

Since 1961

Electrical India

ISSN 0972-3277

India's oldest magazine on power and electrical products industry



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



Transmission Lines in Smart Grid

- Trends in Underground Cables
- Electrical Safety Earthing
- LED Lighting Industry Scenario
- Solar investments in India

Visit us at –

inter solar

connecting solar business | INDIA

11-13 December 2018

Bangalore International Exhibition Centre, Bengaluru



Scan the QR Code to know more about EI Website

The Energy Management System that fosters energy efficiency



Your trusted partner for the continued growth of your business – Larsen & Toubro – presents SmartComm Energy Management System. It enables you to measure and monitor your electrical system, consequently helping you save energy. At the heart of this monitoring system are our digital panel meters, with host of benefits.

Key Features

- SmartComm Energy Management System software
- Meters with Class 1, Class 0.5, 0.5S, Class 0.2, 0.2S accuracy
- Meters with THD and individual harmonics up to 31st
- Direct access to Basic, Power and Energy parameters through front keys
- RS485 or Ethernet communication available
- Analog, Digital inputs and outputs, Data logging options

L&T's metering solutions include:

Single function meters

VAF + PF meters

Energy meters

Dual Source meters

Basic Multifunction meters

Advanced Multifunction meters

MD Controller

Customer Interaction Center (CIC)

BSNL / MTNL (toll free): 1800 233 5858

Reliance (toll free): 1800 200 5858

Tel: 022 6774 5858 Fax: 022 6774 5859

Email: cic@Lntebg.com

Web: www.Lntebg.com

For more information,
just scan the QR code.



Have a safe **Diwali** with Hager devices!



Smart & reliable electrical solutions!

Hager Electro Private Limited
Office No. 504, Pentagon P1,
Magarpatta City, Hadapsar,
Pune-411013 India
Tel: +91 20 41477500
Fax: +91 20 41477510
Toll free no.: 1800 103 5440
hagerwow@hager.co.in
hager.co.in

:hager



German Quality



Hello and welcome once again to *Electrical India*.

India is slated to be one of the fastest growing economies in the world. The economy grew at 8.2% in the April-June quarter of the current fiscal on strong performance of manufacturing and agriculture sectors. It is expected to continue this growth momentum with the range of 8-10% in near future.

This strong economic growth will drive electricity demand in India thanks to rapid urbanisation and industrialisation. The Government of India's focus on attaining 'Power for all' is expected to further fuel the demand for power.

India has the fifth largest power generation capacity in the world and it ranks third globally in terms of electricity production. However, the country, once projected to be the power surplus, is reeling under power shortage. As many as 17 states are reeling under acute power shortage. A shortfall in coal supply has come to afflict scores of power plants in India.

Already under severe power shortage, Maharashtra is now facing another challenge. Coal scarcity is causing low production and loss of units. According to data from the Central Electricity Authority (CEA), as on 1st November, out of the total 15 thermal power plants in the state, 12 were running on coal stocks that would last less than 5 days. Of these, 11 are running on 'supercritical' coal stocks which is less than three days' stock. This demands urgent intervention from the concerned ministries.

In addition, the financial health of Indian DISCOMs has been a cause of concern. According to the CEA report, "Management and financial inefficiency, especially in state power utilities, have adversely affected capacity addition and system improvement programme." The government should ensure effective implementation of the reforms that were announced to improve financial health of the DISCOMs.

Electrical India is entering the 59th golden year of its publishing in January, 2019. To mark this milestone, we are coming up with the Annual Issue of the magazine in December. A voluminous issue of over 200 pages will cover almost all aspects of power and electrical industry featuring detail insights to keep our readers abreast of the latest industry trends. We would like to invite you to voice your opinions on this sector.

Do send me your comments at miyer@charypublications.in

Mahadevan

Publisher & Editor-In-Chief

Directors

Pravita Iyer
Mahadevan Iyer

Publisher & Editor-In-Chief

Mahadevan Iyer
miyer@charypublications.in

Group Editor

Subhajit Roy
subhajit@charypublications.in

Editorial Department

Associate Editor

Supriya Oundhakar
editorial@charypublications.in

Editorial Co-ordinator

Nafisa Kaisar
nafisa@charypublications.in

Advertising Department

Director Advertisement

Pravita Iyer
pravita@charypublications.in

Advertising Manager

Yasmeen Kazi
yasmeen@electricalindia.in

Advertising Executive

Nafisa Khan
adv@electricalindia.in

Design

Nilesh Nimkar
charydesign@charypublications.in

Subscription Department

Priyanka Alugade
sub@charypublications.in

Accounts Department

Dattakumar Barge
Bhakti Thakkar
accounts@charypublications.in

Digital Department

Ronak Parekh
dgmarketing@charypublications.in

Chary Publications Pvt. Ltd.

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

Single Issue: ₹ 100 / Annual Subscription: ₹ 1000

Disclaimer

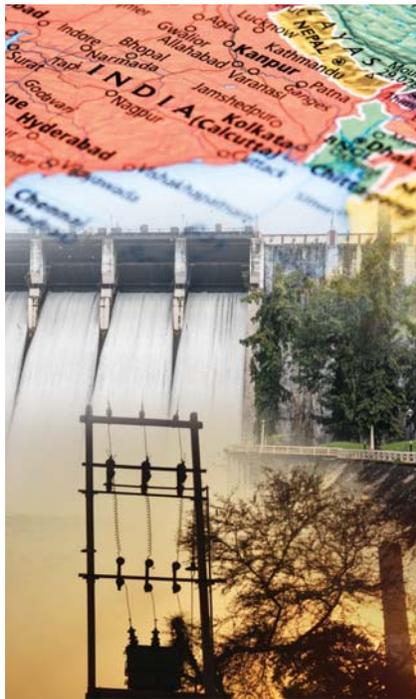
Electrical India does not take responsibility for claims made by advertisers relating to ownership, patents, and use of trademarks, copyrights and such other rights. While all efforts have been made to ensure the accuracy of the information in this magazine, opinions expressed and images are those of the authors, and do not necessarily reflect the views/ collection of the owner, publisher, editor or the editorial team. Electrical India shall not be held responsible/ liable for any consequences; in the event, such claims are found - not to be true. All objections, disputes, differences, claims & proceedings are subject to Mumbai jurisdiction only.

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



SYNTHETIC AND NATURAL ESTER TRANSFORMER FLUIDS

The **MIDEL** family of ester transformer fluids - delivering fire safety and environmental protection to India's power sector.



MIDEL 7131

The world-leading fire safe, biodegradable, synthetic organic transformer fluid, MIDEL 7131 has exceptionally high moisture tolerance, enabling it to extend cellulose insulation life. It is used in a wide range of transformers up to 433kV. Perfectly suited for non-breathing and free-breathing transformers (due to its excellent oxidation stability), MIDEL 7131 offers the ability to safely increase transformer loading or reduce transformer size.



MIDEL eN 1204

MIDEL eN 1204 is a natural ester liquid (rapeseed) with a high fire point that significantly increases fire safety and reduces the need for fire protection equipment. It is sustainably sourced and readily biodegradable, enabling reductions in containment measures. MIDEL eN 1204 has a pour point around 13°C lower than the soya-based natural ester, making it ideal for cooler climates.



MIDEL eN 1215

MIDEL eN 1215 is an excellent dielectric fluid because it has a high fire point, making it demonstrably safer than mineral oil. Environmentally friendly, MIDEL eN 1215 is made from renewable vegetable oil (soya), and is also non-toxic and readily biodegradable. In addition, MIDEL eN 1215 offers superior moisture tolerance and has the potential to increase the lifetime of cellulose based solid insulation, which in turn can extend transformer life.

contents

Vol. 58 | No. 11 | November 2018

ARTICLES

- 26** Transmission Lines in Smart Grid – Geeta Yadav
- 32** Trends in Underground Cables – Munazama Ali
- 38** Electrical Safety Earthing – Dr. Rajesh Arora, Shahrukh Khan, Divyanshu Pal
- 60** LED Lighting Industry Scenario – Anil Valia, Gulab Jha
- 68** Solar investments in India – Subhajit Roy



INTERVIEWS



Betting Smartly on the Smart Grid

Girish Kumar
Managing Director
Sai Electricals

48

FEATURES

- Fast and reliable data exchange with new CAN bus cable from igus. 52
- Going the distance. 56
- FLIR Thermal Imaging Improves Substation Surveys for California Utility. 58
- India's Rooftop Solar Market: High On Opportunities and Loaded With Challenges 66
- Green Solutions from DEIF. 72
- Safety & Reliability in Electrical Installations 78
- Looking Beyond IR-PI Tests for Stator Insulation 82



DEPARTMENTS

- Publisher's Letter 04
- News. 08
- Appointments 20
- Awards 22
- Market Watch 24
- Product Avenue 85
- Environment Matters. 86
- Index to Advertisers. 89



About
94%
Electrical Energy
is converted to
Heat Energy
in Industrial Air Compressors
...which is wasted

Now, harness this
**low grade waste heat for
air-conditioning (HVAC)
or process cooling**

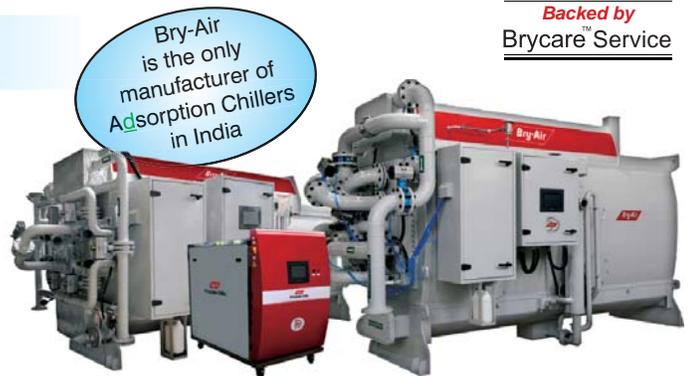


Bry-Air®
Adsorption Chiller
Energysmart Cooling using Waste Heat

Hot water in | **Chilled water out**

Reduce global warming

- Install Heat Recovery Unit to recover 60% to 94% of the waste heat
- Use recovered heat for heating water
- Feed hot water into the Bry-Air Adsorption Chiller
- Get chilled water at 7°C for air-conditioning
- Saves up to 99% electricity on cooling
- Payback period 2.5 years to 4 years



Range 10 kW to 1200 kW (2.8 TR to 341 TR)

Backed by
Brycare™ Service

Bry-Air
is the only
manufacturer of
Adsorption Chillers
in India

Contact today

BRY-AIR (ASIA) PVT. LTD.

419-420, Udyog Vihar, Phase-III, Dist. Gurugram 122016, Haryana, India. • Phone: +91-124-4184444 • E-mail: bryairmarketing@pahwa.com
www.bryair.com

Leaders in Air Treatment ... Worldwide

Govt Launches Award Scheme under *Saubhagya*

RK Singh, Minister of State (IC) for Power and New & Renewable Energy announced an award scheme under Saubhagya to felicitate the DISCOMs or Power Department of the States and their employees for achieving 100 per cent household electrification in their area of operations. Awards would be provided for achieving 100 per cent household electrification at DISCOM or Power Department level of the states. Eight states which have already achieved more than 99 per cent household electrification prior to launch of Saubhagya (Andhra Pradesh, Gujarat, Goa, Haryana, Himachal Pradesh, Kerala, Punjab and Tamil Nadu), are ineligible for participation under the award scheme. All the

remaining States and their Discoms are eligible for the award.

Award will be given in three categories, (i) DISCOMs / Power Departments of Special Category States (which includes seven North Eastern States, Sikkim, J&K and Uttarakhand); (ii) DISCOMs or Power Departments of other than Special Category States (which include Bihar, Chhattisgarh, Jharkhand, Karnataka, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, Telengana, Uttar Pradesh and West Bengal) having more than 5 Lakh un-electrified households and (iii) DISCOMs / Power Departments of other than Special Category States having less than 5 lakh un-electrified households. 

Softbank CEO Masayoshi Son Offers Free Electricity after 25 Years

Chief Executive Officer of Soft Bank Group Masayoshi Son addressed the plenary session of the 2nd Global Renewable Energy Investment Meeting and Expo, (REINVEST- 2018) organised by the Ministry of New and Renewable Energy.



Masayoshi Son, said, "We are no more one nation in this mission, but 121 nations involved in bringing a change. I get involved as the chairman of task force, sharing three outcomes- solar innovation platforms, solar technology centres and finally connecting people with power. Cost of Solar power

The First Assembly of International Solar Alliance (ISA); the 2nd IORA Renewable Energy Ministerial Meeting and the 2nd Global Renewable Energy Investment Meeting and Expo, (REINVEST-2018) held at India Expo Mart, Greater Noida, UP, from 3rd to 5th October 2018. Making a presentation at the occasion Chief Executive Officer, SoftBank Group

generation is much cheaper in India compared to rest of the world. I will give free power from solar power projects after 25 years of PPA to all ISA member countries. We're investing in tech and innovation so that we can harness solar energy efficiently to provide free power to communities across the world." 

GE Power to Deliver India's First Low NOx Boiler Technology for Thermal Plants

GE Power announced that its technology has been selected by NTPC and Tata Chemicals to upgrade two coal-fired boilers in India with low NOx firing system. This is the first installation of this technology in India and it will be implemented at NTPC's 2x490 thermal plant in Dadri, Uttar Pradesh and the 136 TPH Boiler Tata project in Mithapur, Gujarat. GE Power's technology can help reduce NOx generation by up to 40 per cent from current levels in these units.

With more than 170 GW of India's coal-fired fleet operating on sub-critical levels, the implementation of this low NOx boiler technology can help the country reduce its NOx by up to 50 per cent from the current level. GE Power also has the technology to reduce

NOx levels even further by using secondary measures like SCRs (selective catalytic reduction) which together with the low NOx boiler technology can reach reductions of more than 95 per cent.

"This is the first order by any utility or industrial company in India for the firing system modification to reduce the NOx generation at the primary source of combustion boilers," said Andrew DeLeone, Managing Director, GE Power India.

"The success of these projects will benchmark the technology and technical specifications for future low NOx firing system modification in India. GE's state-of-the-art technology can play a major role in making the thermal power plants efficient and environment friendly." 



Supported by



Department of Heavy Industry
Ministry of Heavy Industries & Public Enterprises
Government of India

A MEGA ELECTRICAL EVENT IN MUMBAI DISTRIBUTELEC 2019

DISTRIBUTELEC, IEEMA's large electrical exhibition in Mumbai will bring in Utility, Consumer, Electrical Operational Technology (OT) and IT together. Shape the future of India's power distribution, be there.

Third Edition

distribUELEC

India's only Exhibition on Hi-Tech Power Distribution

4-6 February 2019

Bombay Exhibition Centre, Goregaon East, Mumbai

EXHIBITIONS

CONFERENCES

WORKSHOPS

B2B MEETINGS

Concurrent Expo

buildELEC 2019

A Unique Exposition on Building Electrical Systems

Concurrent Conference

INTELECT

International Conference of Intelligent Electricity

For registration, contact: Mr. Murli Krishna: +919980053992, murlikrishna@ieema.org

For details, log on to: www.distributelec.ieema.org

First Load Of Fly Ash Reaches Pandu Port from NTPC Kahalgaon

The first load of fly ash reached Pandu Port in Assam successfully transporting fly ash from NTPC Kahalgaon in Bihar. NTPC along with team of Inland Waterways Authority of India (IWAI), Ministry of Shipping agreed on the transportation of fly ash



through Inland Waterways to North-East state to be used by Star Cement Limited in cement manufacturing. This endeavour will also establish the water highway route from Kahalgaon to Pandu in Assam via Bangladesh border helping transportation of other goods also. NTPC, Thus, it supports new initiative of

water highways towards nation's growth as well. About 1235 tonne of Fly Ash was loaded at NTPC Kahalgaon and was transported to Pandu Port via Kolkata through National Waterways one and two via IBP (Indo Bangla) rout.

Sustainable fly ash utilisation is one of the key initiative at NTPC. There is a huge demand for fly ash but due to the limitation of transporting it through only railway system, not enough can be utilised. This successful operation will help to enhance and give impetus to the fly ash utilisation.

ⓑ

Suzlon Commissions India's Tallest Hybrid Concrete Tubular Tower

Suzlon Group announced the installation and commissioning of India's tallest Wind Turbine Generator (WTG) with a Hybrid Concrete Tubular (HCT) Tower. The first prototype of S120 - 140m HCT has been commissioned at the Tirunelveli site in Tamil Nadu. J P Chalasani, Group CEO, Suzlon Group said, "The Indian wind energy market is evolving due to the transition to competitive bidding and it has become crucial for us to offer technologically advanced products that are best suited for sites in India and ensure higher return on investment (RoI) to our customers. We continue to invest in R&D with an aim to develop innovative products that reduce the

levelised cost of energy (LCoE). We pioneered the country's first Hybrid Lattice Tubular (HLT) Tower in 2014 and now introduce the country's tallest Hybrid Concrete Tubular Tower." Duncan Koerbel, Chief Technology Officer (CTO), Suzlon Energy, said, "Our R&D efforts are concentrated on innovation across the board, be it in tower technology, blades or control systems with a single point focus on reducing the LCoE. Suzlon does not believe in one size fits all and is providing solutions for the whole country. We are capitalising on tried and tested 2.1 MW platform and manufacturing operations and making it even better with a new 120 meter rotor."

ⓑ

Essar Power Commissions 400 kV Mahan-Sipat Transmission Line

Essar Power has commissioned the 337-km Mahan-Sipat transmission line, the final leg of a 465-km transmission system consisting of three interstate transmission lines that have been built at an investment of Rs 2,400 crore. The 400 kV lines will help Essar Power's 1,200 MW Mahan Thermal Power plant in Madhya Pradesh to evacuate its entire generation. The Mahan-Sipat transmission line is part of the Inter State



Transmission System (ISTS) that has been built by Essar Power Transmission Company Ltd. (EPTCL), an arm of Essar Power. It extends from Mahan in Madhya

Pradesh to the Sipat pooling station in Bilaspur, Chhattisgarh, which is connected to the National Grid. "The commissioning of these transmission lines is a major milestone for Essar Power, and will help us access a nationwide market for the power generated from our Mahan plant. It has also helped establish our presence as a key player in the power transmission sector," said Pradeep Mittal, Executive Vice Chairman, Essar Power Ltd.

Essar's power generation capacity now stands at 3,830 MW across six coal- and gas-fired plants in India and one in Canada.

ⓑ

WHEN POWER CONTINUITY IS CRITICAL TO YOUR BUSINESS, TRUST ON RIELLO UPS.

Your vision for excellence demands an error-free power back up mechanism that sustains aspirations. We provide uninterrupted and high octane UPS solutions that has the potential to cover the power back up needs of diverse industries across the globe. Our technological innovations of advanced UPS solutions ensure global competence for you to become unstoppable in your growth prospects.



Presence and Performance:

- Efficiency upto 97%
- Power Range up to 6400 kVA
- Presence in India for over two decades
- More than 20,000 high capacity UPS installation
- Pan India service network

Riello Power India Pvt. Ltd.

(100% Subsidiary of RPS S.P.A, Italy)

Corporate Office Address: 318, 3rd Floor, Time Tower, MG Road, Gurgaon, Haryana- 122002

Factory Address : Plot No. 213A, Sector -4, IMT Manesar, Gurgaon- 122050.

Web: www.riello-ups.in

CERTIFICATIONS



Bosch Energy and Building Solutions Wins REI 2018 Award

Bosch Energy and Building Solutions was declared the winner of the 'Leading EPC - Solar Rooftop' award on September 17 at the Renewable Energy India Awards 2018. The award recognises excellence and innovation in the Indian solar industry. The awards unveiled industry champions to a global audience on the parameters of excellence and innovation in the renewable energy space. The recognition reflects the company's consistent commitment towards delivering innovative and industry-leading energy solutions.

"Being recognised by Renewable Energy India



Awards 2018 is a validation of our expertise in designing and executing rooftop solar solutions. Our solar and energy efficiency solutions have helped us in actively contributing to their sustainability goals," said Mohandas Mekanapurath - Business Head,

Bosch Energy and Building Solutions India.

Since 2011, Bosch Energy and Building Solutions has enabled more than 180 distinct customers from the commercial and industrial segment in offsetting an equivalent of around 280,000 metric tons of CO₂ emissions through customised energy solutions. 

KEC International Wins New Order of Rs 1,496 crore

KEC International has secured new turnkey order of Rs 1,496 crore in its Transmission & Distribution business in Bangladesh for design, supply and installation of 400 kV Meghnaghat - Madunaghat Double Circuit Transmission Line.

Vimal Kejriwal, MD & CEO, KEC International commented, "We are very happy with the order win in the international market in our core T&D business. With this large order win, Bangladesh is emerging as a major growth driver in the SAARC region. This order



along with the orders announced earlier during the year, reaffirms our confidence in achieving the targeted growth."

KEC International is a global infrastructure Engineering, Procurement and Construction (EPC) major. It has presence in the verticals of Power Transmission and Distribution, Railways, Civil, Solar, Smart Infrastructure, and Cables. Globally, the Company has delivered infrastructure projects in 64 countries. It is the flagship company of the RPG Group. 

GE Wins Engineering Service Provider of the Year Award

Delhi International Airport Limited (DIAL) recognised GE with the 'Engineering Service Provider of the Year' award for the year 2017-2018. The award was given to GE Power's Grid Solutions Services team for providing outstanding services to operate and maintain the power distribution system at Indira Gandhi International Airport (IGIA), Terminal 3 in New Delhi. The winners were recommended by an external independent agency that DIAL had appointed to study the key performance indicators of all their engineering service providers. This is the second consecutive year that GE has received this coveted award from DIAL. The project is being executed by GE T&D India (GETDIL), the listed entity of GE Power's Grid Solutions business

in India. According to Airports Council International (ACI) ASQ 2017 rankings, the IGI Airport ranks number one in the world for airport service quality. With over 63 million passengers flying through the Delhi airport in 2017, it has now surpassed Changi, Incheon and Bangkok airports in terms of passenger growth. It is now among the top 20 busiest airports across the world and the largest in India.

In commenting, Sunil Wadhwa, Managing Director - GETDIL and Regional leader for GE's Grid Solutions in South Asia said, "We are pleased that DIAL is satisfied with our services. Our team has been working 24x7 - for 8 consecutive years now - to ensure uninterrupted power supply for one of the fastest growing airports in the world in terms of passenger traffic." 

Visit India's Largest China Sourcing B2B Show

6th



CHINA MACHINEX™ INDIA 2018

1500+

EXHIBITORS

30,000+

DISPLAY PRODUCTS

Electrical, Power & Energy

Cables & wires		Controls + Switchgears	
Circuit breaker		Insulators	
Connectors		High Voltage Products	
Relays		Pneumatic Tools	
Switches		Smart LED Lighting	
Transformers		Capacitors	
Solar energy panels		Measuring Instruments	

Concurrent Exhibition

6th

CHINA HOMELIFE™

INDIA 2018

www.chinahomelife.in

National Partner

Confederation of Indian Industry

Organised by

ufi **MEORIENT®**
International Exhibition
米奥兰特国际会展

Exhibition Managed by

WINMARK
EXHIBITIONS

17 18 19 December 2018

Show Timings: 10 am - 6 pm

Hall No. 1, 2 & 3, Bombay Exhibition Centre,
W. E. Highway, Goregaon (E), Mumbai.



Register Now For

FREE ENTRY

www.chinamachinex.in

Supporting Associations



Supporting Media Partners



Around The World
In 13 Countries - Taking Place
Every Year



REDEN Solar Completes Refinancing of its Iberian Solar PV Assets

REDEN Solar announced that it successfully completed the refinancing of its Portuguese and Spanish assets, raising a total of €100.5m in the process. This transaction takes the form of a 14-year non-recourse financing arranged by Natixis SA Sucursal en España. It restructures 13 historic loans contracted with five banks and involves around fifty photovoltaic power plants in operation in Portugal and Spain.

Thierry Carcel, President of the REDEN Solar Group, said, "This refinancing operation was largely facilitated



by the international reach of the Natixis Group, which enabled them to coordinate teams in 3 different countries and deal with the broad scope and complexity of the operation. This refinancing not only greatly simplifies the debt structure of our assets, but also improves our economic conditions, and allows us

to generate a significant cash surplus. This, in turn, will enable us to continue to invest in the development and acquisition of new plants in the Iberian Peninsula, in Latin America, as well as in France, where we remain very active." 

HPS to Exhibit at Automation Fair 2018

Hammond Power Solutions (HPS) will be exhibiting for the 8th consecutive year at the Automation Fair event presented by Rockwell Automation. This year's event is being held at the Pennsylvania Convention Center on November 14 and 15 in Philadelphia. The Automation Fair event provides attendees and exhibitors alike with an opportunity to discover advanced manufacturing solutions while gaining expertise in sustainable automation and power control systems. This event also highlights industry forums, technical sessions and demonstration workshops from industry experts.

HPS will be showcasing multiple product lines at this year's Automation Fair event, including a Cast Resin

Transformer, DOE 2016 compliant distribution transformer, as well as a new Encapsulated Transformer for harsh environments. The HPS team will be located in Booth #837, where they will be available to speak with visitors about how transformers and reactors can help with challenges within electrical systems, while improving efficiency, power quality and profitability.

HPS is a North American based company in the designing and manufacturing of standard and custom electrical dry-type and cast resin transformers and reactors. HPS has operations in Canada, United States, Mexico, India and Italy, and is an Encompass Partner with Rockwell Automation in the Americas and EMEA (Europe, Middle East and Africa). 

Toshiba's New Global Brand Identity to Promote Growth and Development

Toshiba Corporation has unveiled a new global brand identity the 'Essence of Toshiba,' a restatement of its abiding purpose and values. The Essence of Toshiba replaces Toshiba's previous group management vision, brand statement and brand tagline. The Essence of Toshiba will be applied across all Toshiba group companies and in all markets, as part of an initiative to harmonise and integrate the group's diverse businesses and operations around the world. As a forward-looking and entrepreneurial Toshiba continues its business transformation, the restated corporate philosophy and new brand identity will provide a strong and consistent framework for all communication. A summation of core management

values and the DNA that has shaped the company for 143 years, the Essence of Toshiba will guide Toshiba in building a sustainable future by focusing on business domains that support modern life and society and creating value with reliable technologies.

The Essence of Toshiba was introduced in-house throughout Toshiba's global organisation on July 1. The scope of the rebranding will be revealed through a global advertising campaign, a refreshed digital and social strategy, along with a full set of branded communications materials and assets. Ichiro Hirata, Toshiba's Corporate Vice President and leader of the Brand Project Team, said, "We believe these strategic moves will help us establish strong foundations for Toshiba's future." 

A NEW LINK BETWEEN PV & GENSET POWER PLANTS

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

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

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



UNIQUE CONTROL SOLUTION FOR PV/GENSET HYBRID PLANTS

- Simple graphical configuration
- Maximised PV penetration
- Minimum genset load requirement
- Spinning reserve demand
- Monitoring and supervision
- Record-time commissioning with DEIF Emulation

SPECIALIST POWER CONTROL SOLUTIONS.



The DEIF Group: Sales, Training & Competence Centres in 16 Key Markets.

DEIF India Pvt. Ltd., 602, Town Centre II, Andheri, Kurla Road, Sakinaka Andheri (East), Mumbai 400 059 MH, India
Tel.: (+91) 22 4245 2000, Fax: (+91) 22 4245 2020, india@deif.com, www.deif.com

Building Energy Inaugurates Largest Solar Photovoltaic Plant

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



Director North America Andrea Braccialarghe, EDF Renewables Distributed Solutions CEO, Jamie Resor, a delegation of the Embassy of Italy represented by Maurizio Greganti, Deputy Chief of Mission, as well as different public authorities at the federal, state

and municipal levels. "Annapolis Solar Park is the seventh renewable energy plant commissioned by Building Energy in the US and it represents for Building Energy the largest PV Solar Project to start operations in the country," said Andrea Braccialarghe, Managing Director North America at Building Energy. 

and municipal levels. "Annapolis Solar Park is the seventh renewable energy plant commissioned by Building Energy in the US and it represents for Building Energy the largest PV Solar Project to start operations in the country," said Andrea Braccialarghe, Managing Director North America at Building Energy. 

Ingeteam Opens New Production Facility for Wind Turbine Components in India

Ingeteam opened a new facility in the vicinity of Chennai to satisfy the demand for wind power converters and control cabinets by both local and international OEMs with operations in India.

Located in the Tamil Nadu region, Ingeteam's new 3,500 m² facility is equipped with state-of-the-art production technology. The production plant in India will manufacture electrical components following the same stringent standards and processes as Ingeteam's other production facilities in Spain, USA and Brazil. The new facility has been specially developed to meet the needs of a promising and demanding market, such as India. This highly efficient as well as cost-

effective production center is based on a modular design and can be easily modified. The production lines are extremely agile, so they can quickly be adapted to meet new client requirements. In addition, the floor space availability will enable Ingeteam to expand the facility on demand. Production at the new facility started in August. Serial production started in October. "With this new plant, we are able to increase our delivery of reliable and quality products to wind turbine manufacturers in India's extremely competitive market. The decision to manufacture locally was marked by the potential of the Indian market," said Ana Goyen, Director of Ingeteam Wind Energy. 

Syrma Technology Opens Up New Electronics Manufacturing Plant in Haryana

Syrma Technology announced the launch of its latest and fifth manufacturing plant at Bawal, located in the Delhi-Mumbai industrial corridor. Built with an investment commitment of USD 10 million in next three years, this new plant is designed to fortify Syrma's market position within the high-demand electronics market in India, including automotive, industrial, aerospace and defence, and healthcare.

The 26,000 square feet facility has initial capacity to assemble over 2,000 square metres of PCBs (Printed Circuit Boards)/annum in class 10,000 SMT (Surface Mount Technology) clean room, which can be expanded up to five times of its present capacity in the next

three years. At its full capacity, the plant will create employment opportunities for over 1,000 people. Syrma, a part of Tandon group, has been an export-oriented business unit for over a decade. Earlier this year, the company announced the setting up of this facility as part of its foray into the domestic market. "With the launch of our new facility, Syrma will be positioned to gain a stronger foothold among domestic electronics manufacturing in India, for India," said Sreeram Srinivasan, Syrma Technology CEO. "As more and more domestic tech-savvy customers crave world-class and smart products, we're excited about bringing our legacy of innovation and quality to more consumers in our home country." 



ISOLGUARD

insulation monitoring device



HOSPITALS

For ungrounded networks



Hakel spol. s.r.o.
Bratři Stefanu 980
500 03 Hradec Králové
Czech Republic
t: + 420 494 942 300
f: + 420 494 942 303
e: info@hakel.cz
w: www.hakel.com



ALLIED POWER SOLUTIONS
(ISO 9001:2008 & UL listed LPS installer)
T - 4, 5 & 6, Third Floor, Pankaj Plaza - 3
I.P. Extn., Patparganj, Delhi - 110 092 (INDIA)
t: +91 11 2224 7322
e: info@alliedpowersolutions.com
w: www.alliedpowersolutions.co
Bengaluru: +91 98869 63195
Kolkata: +91 83348 95599

Surge
Protection
Device



Insulation
Monitoring
Device



ReNew Power Announces Three Strategic Hires

ReNew Power announced the hiring of three senior executives who have joined the organisation in leadership roles. These strategic appointments are in line with the company's continued focus on strengthening its management team.

ReNew announced the appointments of Mayank Bansal as President – Strategy & Operations, Varun Sivaram as Chief Technology Officer, both to be based out of its Gurugram office, as well as Stephen O'Rourke, who has joined as Managing Director, ReNew North America and will be based at the company's recently set up international office in San Francisco, California.

Mayank will be responsible for developing the

current and future strategy of the company and all capital allocation decisions.

As CTO, Varun will be responsible for understanding and integrating new technologies in existing lines of business, identifying new streams of technology enabled opportunities and building a culture of technology innovation within ReNew. Stephen will be driving ReNew's business in the US market, which the company has recently entered. He joins ReNew Power from Capitas Energy where he served as the co-founder and Managing Partner helping them source, advance and sell more than 300MW of mid-stage and greenfield utility scale projects in less than two years. 

Schneider Electric Reinforces its Commitment towards Efficient Power Management

Schneider Electric announced the launch of a host of digitally powered products and solutions to build fault free and future ready facilities in India. Integrated within its EcoStruxure Power digital architecture, the new additions aim at reliable and efficient power management through purpose-built energy management system, utilising analytics to facilitate actionable insights, ensuring near zero downtime due to electrical faults by providing high accuracy and visibility on electrical systems. EcoStruxure Power is part of Schneider Electric's EcoStruxure architecture, an open and interoperable system architecture for building, grid, industry, and

data center customers.

Businesses across today expect improved operational efficiency and a commitment that their facilities will remain operational and compliant with the latest standards and regulations. While technology has made its way into every sector, digitisation of power management still remains an issue.

This gives rise not only to productivity and profitability issues, but also increases safety concerns of the facilities. EcoStruxure Power leverages IoT and digital technologies to support partners in the design and build phase of construction and engineering projects. 

Enel Green Power España Begins Construction of Three Wind Farms in Spain

The three facilities for an overall 128 MW, located in Aragon's Teruel province, are expected to enter into operation by the end of 2019 and, once fully operational, will be able to generate 412 GWh annually. The three projects, part of the overall 540 MW awarded to Enel Green Power España in the Spanish government's May 2017 renewable tender, will involve a total investment of approximately 130 million euros.

Endesa's renewable energy company Enel Green Power España has begun construction of three wind farms for a total capacity of 128 MW in the



municipalities of Muniesa and Alacón, in Aragon's Teruel province. The three projects are the 46.8 MW Muniesa, the 41.4 MW Farlán and the 39.9 MW San Pedro de Alacón wind farms. The new facilities will involve a total

investment of approximately 130 million euros. "With these three projects, we are further expanding our presence in Spain's renewable energy sector and the company is committed to bringing its global expertise and sustainability leadership to the country," said Antonio Cammisecra, Enel's Head of Global Renewable Energy business line, Enel Green Power (EGP). 



HAVELLS

Presenting Next Generation

HIX series & **HIM** series of MCCBs



Wide range of circuit breakers catering to nearly all applications.

- Range: 16A-800A
- High electrical & mechanical life
- SC Breaking Capacity: $I_{cs}=I_{cu}= 20kA$ to 150kA
- Rated Operation Voltage/ Insulation Voltage: 690V / 1000V
- Double break
- Compact size
- Wide range of accessories
- Thermal & Magnetic adjustability

www.havells.com
marketing@havells.com



HAVELLS
CONNECT

Toll Free No.: 1800 11 0303 (Toll Free), 011-4166 0303
(Landline), 1800 103 1313 (All Connections).
For dealer interested in opening new Havells Galaxy Store,
please e-mail at: galaxy@havells.com

*Conditions apply.

Innowatts Appoints Krishnan Kasiviswanathan as Chief Commercial Officer

Innowatts announced the appointment of Krishnan Kasiviswanathan as its Chief Commercial Officer, responsible for the upstream development of its eUtility retail energy platform solution. eUtility, the world's first AI enabled retail enabled solution combines smart meter intel, predictive analytics, and AI to lower energy costs and empower consumers with personalised energy products and services.



Krishnan Kasiviswanathan

In his new role, Krishnan will focus on upstream areas of the eUtility platform including energy forecasting, trading, risk management, and P&L optimisation. "We are excited to have Krishnan leading this important aspect of our growth and development at Innowatts," said Siddhartha Sachdeva. "Currently, upstream activities like these consume the bulk of the cost and risk borne by energy companies and their customers. And, in markets with increasing penetration of renewables, these risk and reliability factors get amplified.

Krishnan's deep expertise and background will help us further strengthen and differentiate our offerings."

Prior to joining Innowatts, Krishnan was the Chief Commercial Officer for Just Energy responsible for gross margin management of a global retail footprint that included US, Canada, UK, Ireland, Germany, and Japan. As part of his role, he oversaw Supply and Trading, Load Forecasting, Product Structuring, and Pricing functions. Prior to Just Energy, Krishnan had held various leadership roles at NRG Energy and Northeast Utilities.

"Being an early adopter of the Innowatts eUtility platform at Just Energy gave me first hand a deep appreciation for the magnitude of quantifiable value that the platform brings to the business. I look forward to helping other utility industry stakeholders streamline and upgrade their operating models by embracing the power of this game-changing platform," said Kasiviswanathan. 

Thor Industries Names Amelia A. Huntington to Board of Directors

Thor Industries, Inc. announced the appointment of Amelia A. Huntington to serve on its Board of Directors effective October 11. Ms. Huntington joins the Board after



concluding a 30-year career in the global energy management and lighting industries, most recently serving as CEO, Philips Lighting America.

"It is an honour to join this world-class team at such an exciting moment for the outdoor recreational vehicle industry," said Ms. Huntington. "Thor is a dynamic and growing company, building North America's premier recreational vehicles and guiding the global industry into the next chapter of outdoor lifestyle, exploration and adventure."

Thor Industries is the world's most innovative outdoor recreational vehicle company. With an unwavering focus on product design and research, Thor continues to attract younger and more diverse consumers and in 2017 manufactured more than

half of North America's entire shipped inventory. In September of this year, Thor announced the pending strategic acquisition of Erwin Hymer Group, Europe's most prestigious and largest manufacturer of RVs with \$2.9 billion in annual revenue, extending Thor's global reach with an unmatched portfolio of brands, diverse products, and an unsurpassed dealer network.

"With Amy's decades of experience and successful track record in corporate leadership and industrial manufacturing, Thor will continue to lead the recreational vehicle industry and be the catalyst to connect more families and friends to the outdoors," said Thor President and CEO Bob Martin.

"Additionally, Amy's history of civic engagement and past affiliation as a board member of the U.S. National Parks New York Harbor Conservancy strategically aligns with our company positioning and passions." 



HAVELLS

More **POWER** and **LESS** energy consumption with Havells **IE2 & IE3** motors



IE2 and IE3 Motors ranging from kW/hp: (0.12-350)/(0.16-470) are accepted worldwide for utilising energy efficiently, so your savings are maximised.

Features:

- All Aluminum Motors come with multi-mount construction and easy change of terminal box position (up to 160 frames)
- 6 Lead Terminal Box • Suitable for standard VFD drives • Low weight-to-output ratio • Better heat dissipation
- Cast iron motors from frame 80 to 355 with good aesthetics and surface finish

Wide range of Motors



Smoke Extraction Motor

Foot Mounted Motor

Flange Motor

Foot cum Flange Motor

Crane Duty Motor

Inverter Duty Motor

Brake Duty Motor

Prima Series

HAVELLS-MOTORS

www.havells.com
marketing@havells.com



HAVELLS
CONNECT

Toll Free No.: 1800 11 0303 (Toll Free), 011-4166 0303 (Landline), 1800 103 1313 (All Connections).
For dealer interested in opening new Havells Galaxy Store, please e-mail at: galaxy@havells.com

*Conditions apply.

Eaton starts accepting applications for annual SOURCE Awards

Power management company Eaton announced the call for entries for the 42nd Annual SOURCE Awards, Eaton's lighting design competition dedicated to celebrating the next generation of lighting professionals and building the pipeline of industry talent.



high-quality designs submitted by talented students and recognising their innovative projects."

The SOURCE Awards competition is open to students currently enrolled in undergraduate or graduate programs in lighting or interior design, architecture, engineering or

University students studying architecture, design, engineering or related disciplines are invited to enter this conceptual design competition focused on furthering the understanding, knowledge and function of lighting as a primary element in design. The deadline to submit entries is February 25, 2019.

"This competition is designed with students in mind. As the future of the lighting design industry, we invite students to feel encouraged to think creatively about overcoming real-world design challenges while gaining practical experience in the process," said Kraig Kasler, President, Eaton's Lighting Division. "We look forward to seeing the

related disciplines. Students are eligible to enter projects based on conceptual lighting designs and will be judged on creativity and how Eaton lighting and controls products are used in conceptual spaces.

Each project will be judged on its own merit and selected entries will earn the distinction of Winner, Honourable Mention or Special Award of Recognition. The winner will receive a \$2,000 award and honourable mention winners will each receive \$500. All winners will receive a crystal trophy, local and national recognition and an invitation to attend a lighting seminar at the SOURCE. **EI**

Sembcorp Energy Bags FICCI Safety Systems Excellence Award

Sembcorp Energy has been conferred platinum award at the seventh edition of the prestigious "FICCI Safety Systems Excellence Award" for the year 2018. SEIL was awarded in the Category of Power (Large units) for initiatives undertaken and practices evolved to maintain safety systems at its supercritical power generation plant in Nellore.



in operation and under-construction spread across seven states. The company's management processes, including its commitment to the environment and sustainability, aim to reflect the robust governance

The award was presented to the Sembcorp team by Santosh Kumar Gangwar, Minister of State for Labour and Employment, Government of India at the 7th National Conference on Excellence in Workplace Safety & Occupational Health & FICCI Safety Systems Excellence Awards for Industry in New Delhi.

Sembcorp is a leading independent power producer (IPP) in India, with a diversified generation portfolio of approximately 4.37 gigawatts' capacity

practices of the Sembcorp group. The company pays strong attention to maintaining and improving Health, Safety and Environment (HSE) behaviour and practice in its day to day operations.

Vipul Tuli, Managing Director of SEIL, said, "Keeping our people safe is our first responsibility, and good business. We are grateful for this award that recognises the efforts of our team to create a safe and secure environment and strong HSE systems. At Sembcorp we are committed to continuously strengthen our safety culture, and every member of our team puts in efforts to walk the talk every day." **EI**



HAVELLS

Install Havells APFC Panel & save money by reducing kVAh



Why pay more due to low Power Factor?

Is there still a difference in kVAh and kWh in your Electricity Bill due to low Power Factor?

Features

- Manufactured with highly precise modern **Amada CNC Machine**
- **11 Tank Process** for corrosion proof powder coating
- Ergonomic, compact and robust design
- Designed with **100% Copper Conductor**
- **Heavy Duty Power Capacitor** for long life
- **Advance C-MOS Technology** based micro processor for intelligent power factor control
- **Air Core Reactor** for extra safety from inrush current
- Provision of top and bottom cable entry
- Automatic temperature control through fans and louvers in panel
- Double side earthing connection

www.havells.com
marketing@havells.com



HAVELLS
CONNECT

Toll Free No.: 1800 11 0303 (Toll Free), 011-4166 0303 (Landline), 1800 103 1313 (All Connections).
For dealer interested in opening new Havells Galaxy Store, please e-mail at: galaxy@havells.com

*Conditions apply.

Wire & Cable Management Market worth \$ 25.26 bn by 2023

According to Marketsandmarkets report, the wire and cable management market is expected to grow from an estimated USD 16.91 billion in 2018 to USD 25.26 billion by 2023 at a CAGR of 8.36 per cent during the forecast period. The market is set to witness growth due to the rising demand from data center and IT facilities and the growing construction sector.

The power cable segment is expected to be the largest segment of the wire and cable management market by cable type in 2018. Power cables are widely used in the power

distribution sector to distribute power and can be installed overhead as well as underground in the industrial, commercial, and residential sectors. High demand for electrification of homes, increased investment in power distribution, and growth in the household sector in developing countries are the key drivers for the growth of the power cable wire and cable management market.

Conduits and trunking are used to protect cables from damage and can be used in almost any location including homes, commercial spaces, and industrial sectors. Rising urban population and need for advanced infrastructure in regions such as Asia Pacific and the Middle East are thrusting the deployment of conduits and trunking system.

In this report, the wire and cable management market has been analysed with respect to five regions, namely, Asia Pacific, North America, Europe, the Middle East & Africa, and South America. Asia Pacific is the largest wire and cable management market, by region, during the forecast period. Rising urbanisation and proliferation of electrification, demand from the construction and mining sectors, growing awareness of energy savings, and supportive government plans are expected to drive the market for wire and cable management in this region.

China, India, and Japan are the leading countries among others which would contribute to the growth of the wire and cable management market in Asia Pacific. 

Image Courtesy: www.mbtstkoudsalg.com



STURDY VOLT

MANUFACTURER OF CRT COILS

UP-TO 36kV CLASS



Both Conventional & Foil winding (Copper / Aluminum).

Comply with IS: 11171 - 1985 & IEC: 60076 standards.

Fully computerized & automated static mixer.

Casting under vacuum.

Epoxy materials both 'H' & 'F' class (Huntsman).



We supply RTCC Panel & Marshalling Boxes (IP55 Certified)

Transmission Lines in Smart Grid

The power flows from power utilities to consumers whereas if wireless sensor networks are added, then the real time price information will also flow from base station to consumers. If the consumer is aware of price of power in peak times, then consumer will act accordingly and regulate his consumption as per price information sent to him.



Picture Courtesy: www.eunighbour.eu

The smart grid is adding smartness to the electric grid by adding smart devices like wireless sensor networks that provide real time information quickly. The smart grid includes adding renewable resources, self-healing, real-time two-way communication between power utilities and consumers etc. The smart grid is divided into four parts as generation, distribution,

transmission and consumer side. The existing power generating stations are thermal power generating station, hydro power generating station, nuclear power generating station etc. The power is transmitted to the consumer in a high voltage level. The power is generated near to sources like rivers, nuclear power plant and far away from consumers. Transmission lines and distribution system connect power generation plant to consumers. The power generated at source is at low voltage and it is stepped up to high voltage and transmitted to consumer where it is stepped down to consumer requirement.

The power flows from power utilities to consumers whereas if wireless sensor networks are added, then the real time price information will also flow from base station to consumers. If the consumer is aware of price of power in peak times, then consumer will act accordingly and regulate his consumption as per price information sent to him. Along with that, if the wireless sensor network added to existing electric grid, then the information of black out is sent to the base station quickly and the issue is resolved quickly. The power will also be directed to the affected houses through another network so that electricity will be available 24*7. The transmission lines are the network of lines that transmit power from base station to consumers. These networks are collection of wires attached to towers. The wireless sensor networks are attached to transmitting line to process the information and inform to control center if there is any situation of black-out. The batteries used in wireless sensor network will get depleted after some time so instead of using standard batteries, fiber optics can be used. The fiber cables or optical ground wires can be used to increase the energy efficiency of the overall smart grid. The transmission lines are divided into three parts based on its design as voltage drop, line loss and transmission efficiency. There are three more types based on transmission line length: short transmission line (up to 50 km, 20 kV), medium transmission line (up to 150 km, 100 kV) and long transmission line (more than 150 km and above 100 kV).

The performance indices of the smart grid are reliability, stability, energy efficiency, robustness, scalability, quality of service (QoS), availability, security of the electric grid. The smart grid based on

communication layer, can be divided into three parts as home area network, neighbourhood area network and wide area network. In home area network, only home appliances are covered, and home automation is applied, whereas in neighborhood area network, all the meters located in the region communicate information to the central controller. Wide Area Network has data collection points.

Smart transmission includes early fault detection and isolation, location recovery and outage detection. These criteria can be fulfilled only by use of wireless sensor network along with transmission lines. These sensors are placed on top of the towers to detect the condition of transmission lines and send real time information even unapproachable location like isolated mountain, hazardous areas etc. These wireless sensors increase the reliability of the overall smart grid. These transmission lines are monitored using WSN and collected parameters like current, voltage, frequency and communication to central monitoring unit at periodic intervals.



**HPS Transformers provide the
POWER TO PERFORM**

Hammond Power Solutions (HPS) excels at designing and manufacturing a broad range of standard products and engineered-to-order solutions to meet your distribution substation needs.

HPS power transformers incorporate cost effective and energy efficient designs with ratings up to 50MVA (ONAN), 138kV Class.

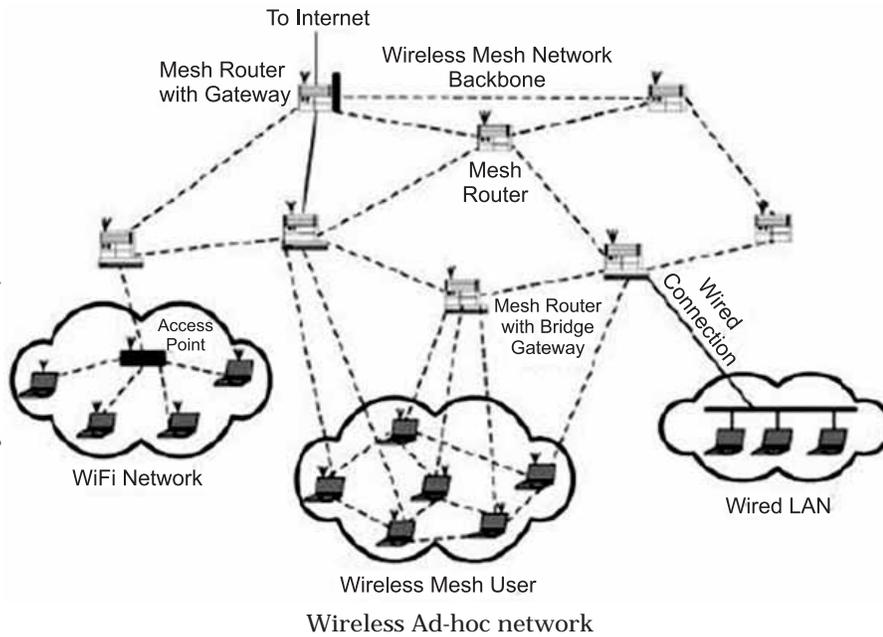
Our product designs meet a wide range of global standards and regulatory compliance including IEC, BIS and IEEE.

Distribution transformers are available from 250-2500 kVA up to 33kV class (as per BIS, IS 1180 standard with Star rated losses).



power to perform 

Picture Courtesy: www.tutorialspoint.com



sent to base station, which will see the whole network in one go in that instant of time. So, in this case, if there is any situation of blackout, then the power is transmitted through another existing nearby network and immediate action has been taken to recover from that situation.

Adding automation to the smart grid includes home automation, automation of transmission line and distribution system. Home automation includes the devices that will control automatically using mobile or any remote devices. The IP address of every electric device connected to the power supply can be recorded and controlled through remote system. The internet of things comes under automating the home devices like opening and closing of doors, lights, home appliances like washing machine, TV, AC etc. The automation of transmission line and distribution systems will reduce theft of electricity, automatic billing process, fault in transmission lines or distribution lines. Self-healing can also be done at transmission and distribution lines if the fault is minimal and the information of fault is sent to power station for recovering the losses.

The overall efficiency of the system is increased as the data flows quickly through internet and connecting to wireless/ mobile devices. 15

There are many existing problems like growing population and demand for energy, global climate change due to use of non-renewable sources for generation of electricity, equipment failure as current electric grid is implemented long ago, sources of electricity are limited, one-way of communication, resilience problems in the existing electric grid.

The smart grid has various components:

- Smart meter,
- Distribution automation,
- Demand response management
- Smart appliances,
- Transmission automation,
- Electric vehicles,
- Electric storage,
- Renewable energy

There are many protocols exist that will send information about transmission lines through wireless optical ground wire (i.e sensor network) to base station quickly using direct transmission, multi-hop transmission, Leach, Pegasus and many more). These towers form a chain network that

transmits powers. These sensors are placed over that towers and collect data. Then the data is merged and send to base station in an efficient way. Leach is clustering protocol that form clusters of towers in an area and then send merged data to main cluster head whereas in Pegasus, chaining is used, and data is transferred to base station from the farthest node through a single chain. There is another approach that collaborates both the protocols and uses both clustering and chaining for transmitting of data quickly. This protocol is the most energy efficient protocol as it uses less energy than both the existing protocols i.e Leach and Pegasus. The clustering is done on area wise dividing the neighborhood area network and then chaining is done on top of it. The clusters send information about an area to cluster heads. Then chaining is done in the cluster heads and farthest cluster head send data to near by cluster head. Then, the whole merged data is



Geeta Yadav
Application Programmer
IBM India Private Limited

www.electricalindia.in

IDENTIFY SOLAR PROBLEMS THERMALLY



FLIR thermal camera helps to:

- Prevent failure before it happens
- Increase revenue
- Increase lifetime & functionality of solar panels

Quality assurance and failure-free operation of the solar panels is a prerequisite for efficient power generation, long life, and a high return on the investment. To ensure this failure free operation, FLIR offers a fast, simple and reliable method to evaluate a solar panel's performance during the production process and after the panel installation. FLIR thermal imaging cameras help scanning solar panels during normal operation and detect anomalies quickly within a short time frame.



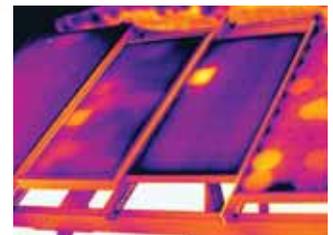
For more details, please call us on: +91-11-4560 3555 or write to us at flirindia@flir.com.hk

FLIR Systems India Pvt. Ltd.

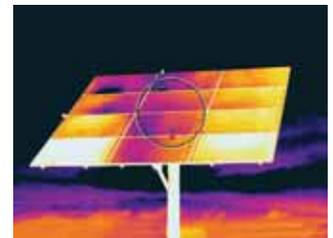
1111, D Mall, Netaji Subhash Place, Pitampura, New Delhi - 110034 | Fax: +91-11-4721 2006

[f/FLIR](#) | [t/FLIR](#) | [y/FLIR](#)

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



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



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

Images for illustrative purposes only.



WWW.FLIR.IN



It is pre-requisite that each and every individual rating of distribution transformer has to be type tested as per IS1180 before dispatch.

Buying non  mark transformer is suicidal as CEIG & Electrical board will not allow to energise the transformer.

Issued in consumer interest by

 **ESENNAR**[®]
TRANSFORMERS

Technically Honest Transformers[™]

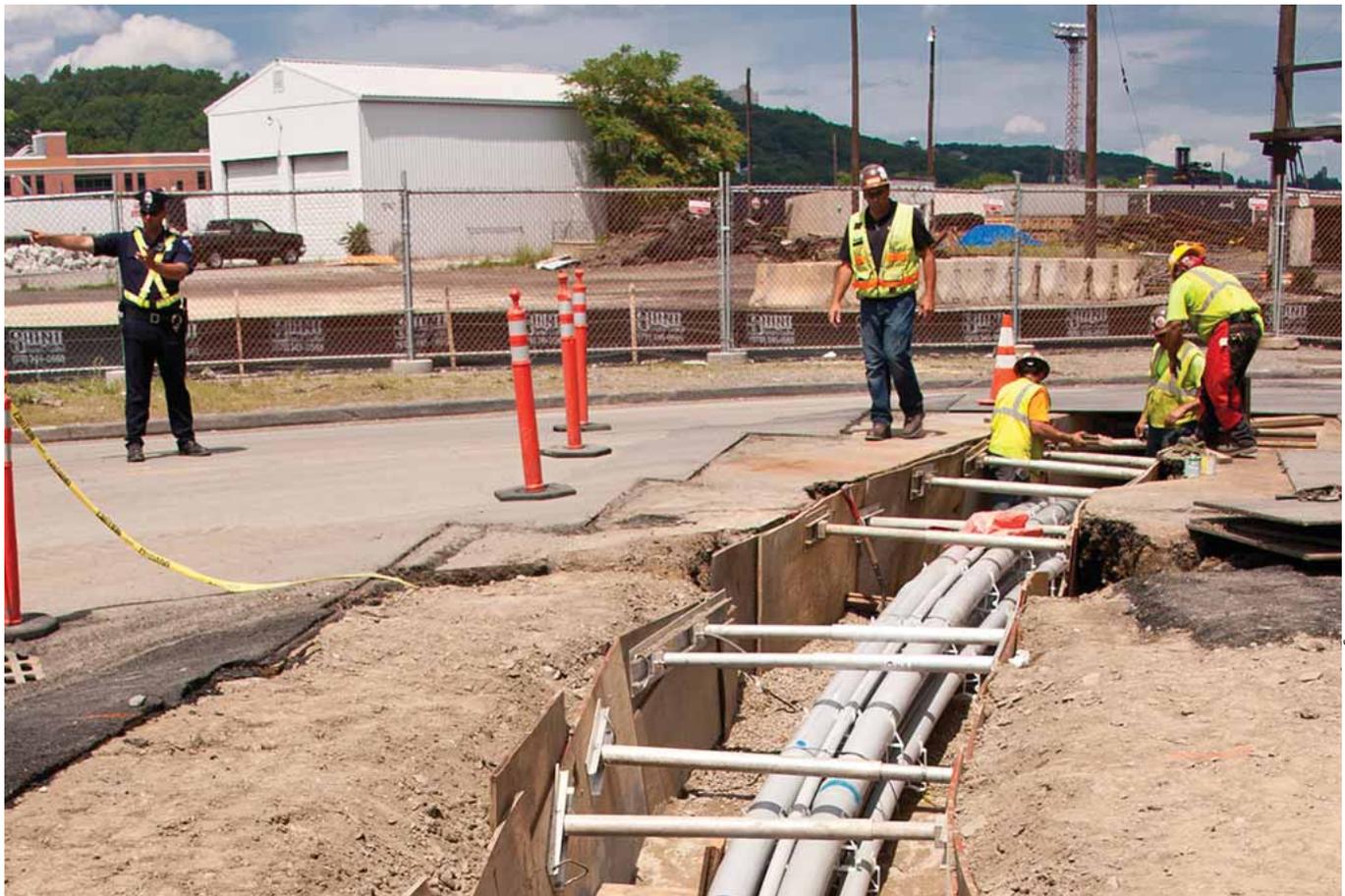
An ISO 9001, ISO 14001 & OHSAS 18001 Certified Company

 mark (BIS 1180 No: CM/L-6300051389)

HYDERABAD | +91 89 78 17 17 17 | marketing@esennar.com

Trends in Underground Cables

The type of underground cable to be used at a particular location is determined by the voltage at which it is required to operate. Underground cables are classified and used at a particular location as per their voltage rating.



Picture Courtesy: www.bondbrothers.com

National Grid, Worcester
115 kV Cable Project

Underground cables are used for power applications for transmission and distribution where it is impracticable, difficult or dangerous to use the overhead line. Such locations may be congested areas where right of way cost would be excessive or local ordinances prohibited overhead lines for reason of safety, or crossing of wide bodies of water

which for various reasons would not permit the overhead crossing. The type of underground cable to be used at a particular location is determined by the voltage at which it is required to operate. Underground cables are classified and used at a particular location as per their voltage rating. Low voltage cables operate at voltage up to 1kv, high voltage cables operate at voltage up to 11kv, super tension cables operate up to 33kv, extra high tension for up to 66kv, super voltage cables for operating voltage beyond 132kv.

Underground cable consists of one central core or number of cores (two, three or four) of tinned stranded copper conductors. Sometimes use of aluminum conductor is also made. Paper or varnished cambric or vulcanised bitumen or impregnated paper are employed for the isolation from each other. A metallic sheath of lead or alloy or aluminum is provided around the insulation to protect it against ingress of moisture. The initial heavy costs the only factor which discourage the use of underground cables for the purpose of transmission and distribution of electrical power.

New Trends in Undergrounding

Over the last few years underground cables are becoming more interesting for higher power rating. Although underground cables are generally more expensive than overhead transmission lines but due to several reasons these are widely preferred today is:

1. Limited space of new and existing substations with no possibility to expand and the necessary right of way for the transmission corridor.
2. Increase customer awareness such as visual impact of transmission line, nature preservation etc.
3. Increased reliability for the transmission grid. This is especially true for the distribution grid as cable connections can be made very reliable, easy to monitor and diagnose and most of all, are not prone to extreme weather events.

Countries which have an almost exclusive medium voltage cable distribution grid, like Singapore and the Netherlands, have a very reliable public power supply within average customer outage rate of less than 30 minutes a year.

Some technical issues that used to be addressed and take care of, such as change within grid as it behaves more capacitive instead of inductive due to increase in high voltage cable connections in the transmission grid; limited transmission capacity present around 1000MVA

Attracting Tomorrow 



TDK Technology Advancing power solutions.

Rare-earth magnets
with high magnetic field strength for wind power generators



Varistors and surge arresters
with high surge capability



EMC filters and sine-wave filters
for currents up to 8 kA

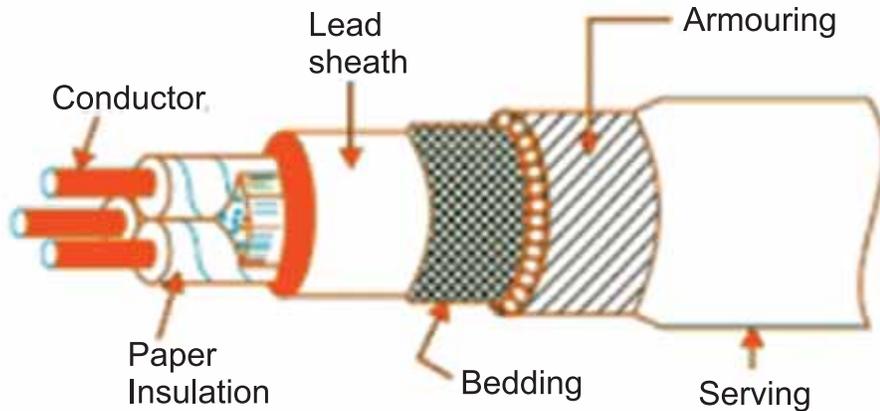


Aluminum electrolytic and film capacitors
for high ripple currents





product.tdk.com/en/industrial



for a single cable compared to overhead line connections; and the reliability of long stretches of such high power of high power transmission cable with many cable joints is point of attention.

Underground electricity cables are typically only used in the US, Europe and Australia. These focus on low medium voltage networks (200V – 20KV). Some countries have achieved in undergrounding between 10 per cent to 20 per cent of their high voltage cables, while other European countries are less than 10 per cent for extra high voltage average is around 2 per cent.

By Voltage

- LT cables: low-tension cables with a maximum capacity of 1000 v.
- HT- cables: High-tension cables with a maximum of 11kv.
- ST cables: Super-tension cables with a rating of between 22kv to 3kv.
- EHT cables: Extra high-tension cables with rating of between 33kv and 66kv.
- Extra super voltage cables: with a maximum voltage rating beyond 132kv.

By Construction

- Belted cables: Maximum

voltage of 11kv.

- Screened cables: Maximum voltage of 66kv.
- Pressure cables: Maximum voltage of more than 66kv.

Technical Issues

- Underground cables need to be insulated against surrounding soil.
- On large lines the methods of electrical and heat insulation become more important.
- For 400kv lines, each conductor needs to be encased in oil filled sleeves.
- Each conductor needed to be placed in a 2m deep trench, resulting in up to 12 trenches for a 400kv line.
- Width of excavation may be anything between 15 and 30m depending on the technology used.

Maintenance

- Underground cables are reported to be more reliable but outages are more difficult to fix, as it is harder to find the fault.
- Routine maintenance of underground cables is much lower in the initial 10 years of operation, maintenance costs can rise steeply thereafter.

- The lifespan of underground is shorter, in some cases it is reported to be half that of overhead cables.

Advantages

- The underground cables have low voltage drop, low chance of developing faults, and hence low maintenance costs.
- Underground cables pose no hazard to low flying aircraft or to wildlife.
- It does not provide any kind of visual pollution most particularly in congested areas.

Disadvantages

- Underground cables are more expensive to manufacture, and their cost may vary depending on the construction as well as the voltage rating.
- Underground cables locations are not always obvious, which can lead to unwary diggers damaging cables or be electrocuted.
- Underground cables are more subjected to damage by ground movements.

Benefits of Underground Cables

- Low maintenance
- Small voltage drops
- Not easy to steal, make illegal connections
- Poses no danger to wildlife or low flying aircrafts
- Suitable for congested areas where overhead lines may be difficult or impossible to install. 15



Munazama Ali

Assistant Professor
Department of Electrical
Engineering, Islamic
University of Science and
Technology, Kashmir

FROM PRINT WORLD TO THE E-WORLD

ELECTRICAL INDIA ENHANCES LIFE WITH ENGINEERING EFFICIENCY

BESIDES MONTHLY
MAGAZINE, TAKE ADVANTAGE
OF THE DIGITAL TECHNOLOGY
& READ **ELECTRICAL INDIA**
MAGAZINE ONLINE, AS WELL AS
WEEKLY E-NEWSLETTER
ON YOUR PC, TABLET OR LAPTOP.

**FOR SUBSCRIPTION PLEASE
CONTACT PRIYANKA ON
022-27777182/8652142057 OR
Email on sub@charypublications.in**

Please turn back for the subscription form.

To Advertise, in Electrical India
newsletter/magazine please
contact YASMEEN on
022 2777 7196 / 9867914216
or email on
yasmeen@electricalindia.in

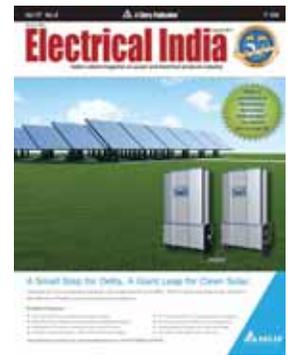
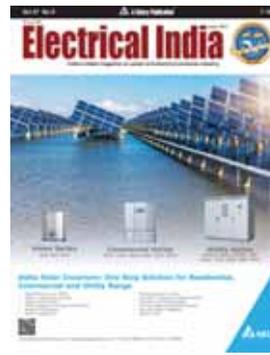
Since 1961

Electrical India

India's oldest magazine on power and electrical products industry

SUBSCRIBE

Since 1961
Electrical India
 India's oldest magazine on power and electrical products industry



Subscription Offers

Sub. Period	No. of Issues	Subscription Type					
		Print		Digital		Print+Digital	
		Actual Rate	You Pay	Actual Rate	You Pay	Actual Rate	You Pay
1 Year	12	1200.00	1000.00	1200.00	1000.00	2400.00	1500.00
2 Years	24	2400.00	1750.00	2400.00	1750.00	4800.00	2625.00
3 Years	36	3600.00	2500.00	3600.00	2500.00	7200.00	3750.00
5 Years	60	6000.00	4000.00	6000.00	4000.00	12000.00	6000.00
E-Newsletter							
1 Year	52	N. A.		365.00		N.A	

PLEASE SELECT MODE OF DISPATCH FOR PRINT EDITION -
 (1). By REGISTERED PARCEL - Rs. 435/- year (2). By COURIER - Rs. 600/- year
KINDLY ADD POSTAGE CHARGES IN SUBSCRIPTION AMOUNT.

Subscription / Renewal Form

To,
 The Subscription in-charge
 ELECTRICAL INDIA
 Email: sub@charypublications.in

Are you a Subscriber,
 Please submit your Subscription no:

Yes, I would like to Subscribe/renew Electrical India / EI e-Newsletter for _____ years at ₹ _____.

PAYMENT DETAILS :

Cheque / DD No. _____ Dated _____ Drawn on Bank _____
 _____ Branch _____ in favour of Chary Publications Pvt. Ltd.

Bank details for NEFT / RTGS / IMPS : Account Name: Chary Publications Pvt. Ltd.

Bank Name: Bank of India Branch: Chembur, Mumbai - 400 071 Account Type: Current Account
 IFSC Code: BKID0000009 Bank A/C Number: 000920110000322 SWIFT CODE :BKIDINBBCHM

Name: _____
 Company: _____ Designation: _____
 Address: _____
 _____ City: _____ Pin: _____
 Telephone: _____ Mobile: _____
 Email: _____
 Signature: _____

Stamp

 **Chary Publications Pvt. Ltd.**

905-906, The Corporate Park, Plot No. 14 & 15, Sector 18, Opp. Sanpada Railway Station, Vashi, Navi Mumbai - 400 703.
 Phones: +91 22 27777 170 / 171 • Email: sub@charypublications.in • Contact : Priyanka Alugade • +91 22 27777182 / +91 8652142057

**Trusting in experience.
Benefitting from innovation.
Perfecting explosion protection.**

Maximum security for hazardous areas:
Pepperl+Fuchs supplies the global process
industry with extremely reliable products and
solutions in the field of explosion protection.
Benefit from a comprehensive portfolio and
pioneering Innovations — paving the way
towards fully networked processes for the
applications of the future.

www.pepperl-fuchs.com



91-80-3352 6000

pa-info@in.pepperl-fuchs.com

Your automation, our passion.

 PEPPERL+FUCHS

Electrical Safety Earthing

The article highlights the importance of earthing with study of different low voltage earthing systems world-wide.



Picture Courtesy: www.integralpower.com.au

The process of transferring the immediate discharge of the electrical energy directly to the earth by the help of the low resistance wire is known as the electrical earthing. The electrical earthing is done by connecting the non-current carrying part of the equipment or neutral of supply system to the ground.

Every building, equipment, power plant, substation facility included in electricity require earth

grounding, either directly or through grounding system. The main objective of doing earthing in electrical network is safety.

But when the neutral for any system is not connected with the earth then it will be known as electrical system without earthing as depicted in fig 1.

Mostly, the galvanised iron is used for the earthing. The earthing provides the simple path to the leakage current and fault current

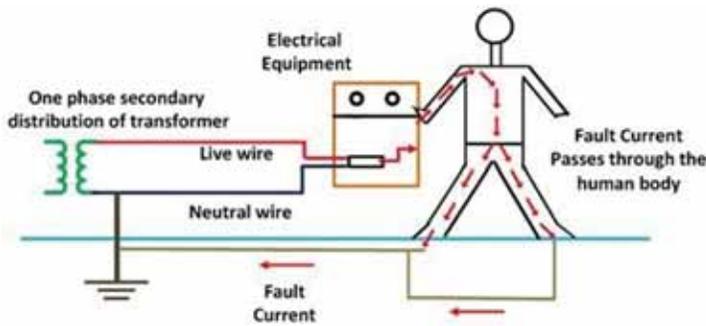


Figure 1: Electrical system without earthing

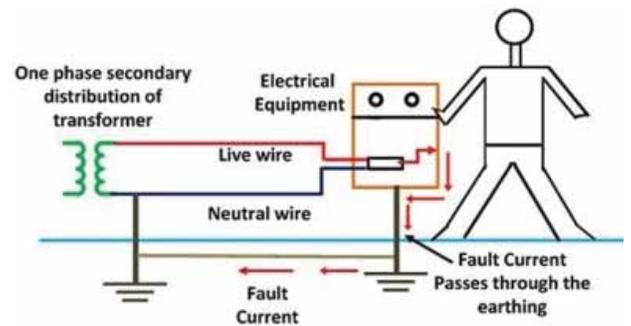


Figure 2: Electrical system with earthing

in the system. The short-circuit current of the equipment passes to the earth which is assumed to have zero potential. Thus, protects the system equipment and personnel working with these equipment from damage as well as shock current as shown in fig 2.

Earthing is not likely to reduce the total magnitude of over voltages produce by lightening or switching surges, it can however mitigate the possibilities of excessive voltage stress on the phase to ground insulation of particular phase.

The system earth resistance should be such that which any fault occurs against which earthing is designed to give protection, the protective gear will operate to make the faulty main or plant harmless. In most cases, such operation involves isolation of the faulty main or plant, for example by circuit breaker or fuses.

Types of Electrical Earthing

The electrical equipment mainly consists of two non-current carrying parts. These parts are neutral of the system or frame or support structure of the electrical equipment. From the earthing of these two

non-current carrying parts of the electrical system, earthing can be classified into two types: Neutral Earthing, and Equipment Earthing.

Neutral Earthing

In neutral earthing, the neutral of the system is directly connected to earth with the help of some metallic conducting wire. The neutral earthing is also called the system earthing. Such type of earthing is mostly provided to the system which has star winding. For example, the neutral earthing is provided in the generator, transformer, motor etc as shown in fig 3.

Equipment Earthing

Such type of earthing is provided to the electrical equipment. The non-current carrying part of the equipment like their metallic frame is connected to the earth by the help of the conducting wire as shown in fig 3. If any fault occurs in the apparatus, the short-circuit current to pass the earth by the help of wire. Thus, protect the system from damage.

Importance or purpose of earthing

- To Protect the workers who regularly come in contact with electrical devices that might give them a shock.

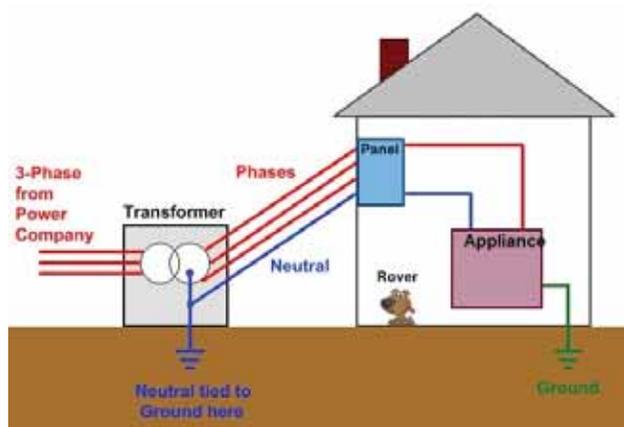


Figure 3: Neutral and equipment earthing

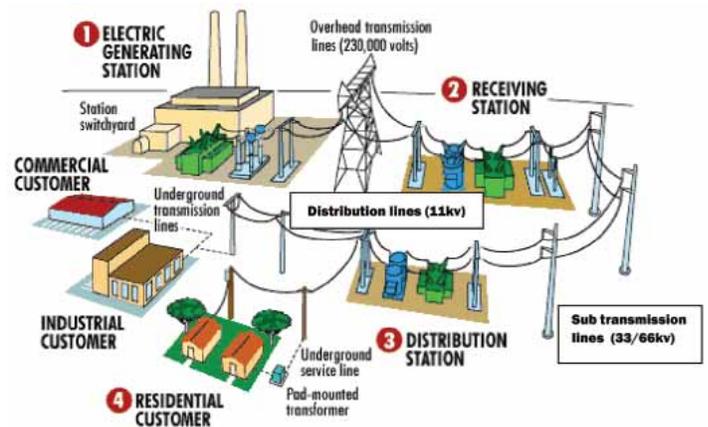


Figure 4: Power System Network

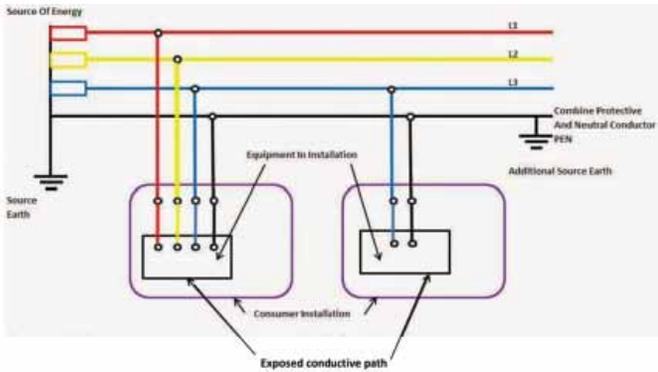


Figure 5: TN-C Earthing System

- To keep the voltage of the device constant in the healthy phase in case of single phase to ground fault.
- A good grounding path which has a low impedance value ensure that faults in the electrical path are cleared quickly. If the faults stay within the system for a long time, they can pose a serious threat to the stability of the system.
- Many modern electronic devices generate a form of 'electrical noise' that can cause damage to the device and reduce its efficiency, unless the device is properly grounded.
- Surge protection device function better with the help of proper grounding.
- Malfunctioning electric devices often leak electricity, which has the potential to start a fire if not redirected safely.

Classification of Earthing System

A low voltage (LV) distribution system may be identified according to its earthing system. These are defined using the five letters T (direct connection to earth), N (neutral), C (combined), S (separate) and I (isolated from earth). The first letter denotes how the transformer neutral (supply source) is earthed while

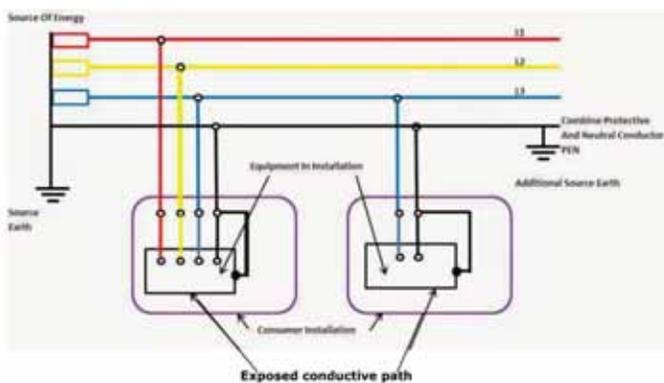


Figure 7: TN-C-S Earthing System

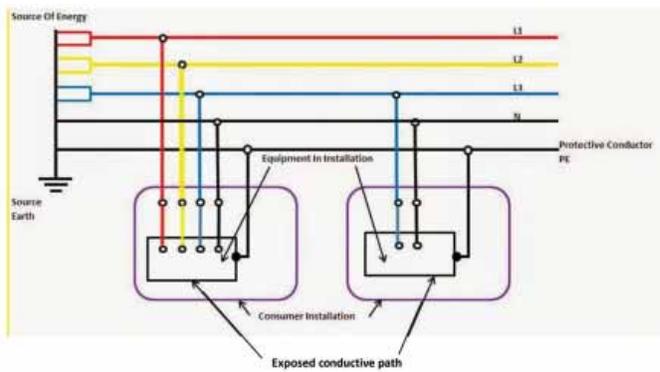


Figure 6: TN-S Earthing System

the second letter denotes how the metal work of an installation (frame) is earthed. The third and fourth letters indicate the functions of neutral and protective conductors respectively. The electrical power network is shown in fig 4.

There are three possible configurations:

- **TN**: Transformer neutral earthed, frame connected to neutral. The TN system includes three sub-systems: TN-C, TN-S and TN-C-S
- **TT**: Transformer neutral earthed and frame earthed.
- **IT**: Unearthed transformer neutral, earthed frame.

TN Earthing System

In a TN earthing system, the supply source (transformer neutral) is directly connected to earth with one or more conductors and all exposed conductive parts of an installation are connected to the neutral or protective earth conductor. The three sub-systems in TN earthing system are described below with their key characteristics.

TN-C Earthing System

TN-C system has the following features:

- Neutral and protective functions are combined in a

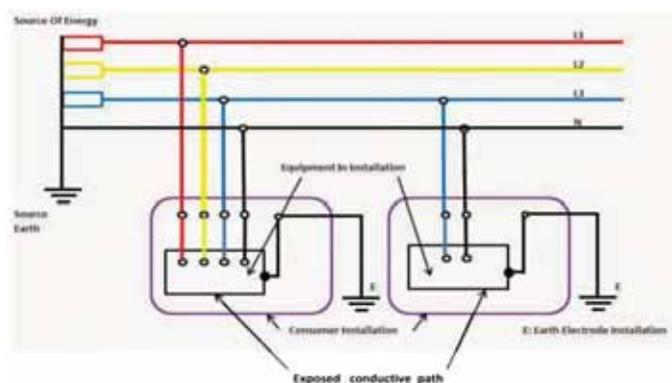


Figure 8: TT Earthing System

Continued on Page 42

ALTANOVA

GROUP

Advanced testing and monitoring solutions

AQUILA



PD SCOPE



FOR

HV & MV CABLES

WORLD CLASS CABLE TESTING & MONITORING SOLUTIONS

Our expertise helps you monitor & maintain your cable's health and makes them last longer.

ALTANOVA, apart from providing FAT consulting & spot testing during operation, also offers for HV & MV cable sequential or simultaneous off-line testing or on-line monitoring at every joint and the terminations of the cable.

Our world class technology easily detects Partial Discharges (PD) and assesses the condition of HV & MV Cable Systems and keeps the degradation processes under effective control.

At **ALTANOVA**, we ensure that you work towards business growth with enough time to do what you should be doing, while we take care of all your Electrical Assets...



Regional Office: C-33, Ground Floor, Sector-2, Noida-201301, Uttar Pradesh, India
Telephone: +91 120 4543853 / 54 / 4222712; **Fax:** +91 120 4574772
Website: www.altanova-group.com, **Email:** info.asia@altanova-group.com

TECHIMP

Safety

Continued from Page 40

single conductor throughout the system. (PEN—Protective Earthed Neutral).

- The supply source is directly connected to earth and all exposed conductive parts of an installation are connected to the PEN conductor as shown in fig 5.

Advantages of TN-C Earthing System

- Earth fault loop impedance of TN-C earthing system is low.
- It does not require earth electrode at site.
- It is economical.

Disadvantages of the TN-C Earthing System

- TNC earthing system is least safe as compared to other earthing systems.
- TN-C system is less effective for Electromagnetic Compatibility (EMC) problems.
- A fault in the LV network may cause touch voltages at other LV customers.

TN-S Earthing System

TN-S system has the following features:

- A TN-S system has separate neutral and protective conductors throughout the system.
- The supply source is directly connected to earth. All exposed conductive parts of an installation are connected to a protective conductor (PE) via the main earthing terminal of the installation as shown in fig 6.

Advantages of TN-S Earthing System

- Earth fault loop impedance is low.
- TN-S is the safest system.
- Electromagnetic interference is low.
- It does not require earth electrode at site.
- TN-S earthing system could work with simple over current protection.

Disadvantages of the TN-S Earthing System

- Low power factor (high inductance of long cable).
- Requires extra equal potential bonding.
- On occurrence of an insulation fault, the short-circuit current is high and may cause damage to equipment or electromagnetic disturbance.

TN-C-S Earthing System

TN-C-S earthing system has the following features:

- Neutral and protective functions are combined in a single conductor in a part of the TN-C-S system. The supply is TN-C and the arrangement in the

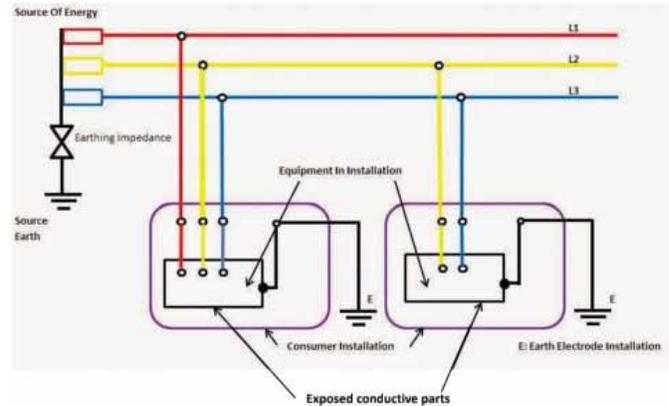


Figure 9: IT Earthing System

installation is TN-S as depicted in fig 7.

- Use of a TN-S downstream from a TN-C.
- All exposed conductive parts of an installation are connected to the PEN conductor via the main earthing terminal and the neutral terminal, these terminals being linked together.

This type of distribution is known also as protective multiple earthing and the PEN conductor is referred to as the combined neutral and earth (CNE) conductor.

The supply system PEN conductor is earthed at several points and an earth electrode may be necessary at or near a consumer's installation.

Advantages of TN-C-S Earthing System

- Safe system
- Less expensive.

Disadvantages of the TN-C-S Earthing System

In the TN-C-S system, the TN-C (4 wires) system must never be used downstream of the TN-S (5 wires) system, since any accidental interruption in the neutral on the upstream part would lead to an interruption in the protective conductor in the downstream part and therefore a danger.

TT Earthing System

In this system, the supply source has a direct connection to earth. All exposed conductive parts of an installation also are connected to an earth electrode that is electrically independent of the source earth as shown in fig 8.

The fault loop impedance is higher, and unless the electrode impedance is very low indeed.

Advantages of TT System

- No risk of failure and suitable for premises where all AC power circuits are residual current device (RCD) protected.

Continued on Page 44

Quality | Safety | Speed



Ramelex Pvt. Ltd, Pune (RPL), established in 1990, is an ISO 9000 and Class "A" registered electrical contracting company.

We manufacture compression type power connectors, equipment connectors, conductor and earth wire accessories and insulator hardware, suitable for aluminium conductors of various types such as AAAC, ACSR and HTLS conductors.

FACILITIES:

NABL Accredited Testing Lab:
Ramelex Testing & Research Institute



R&D Centre Recognized by DSIR
(Govt. of India)

World Class Manufacturing Facilities



CNC Machine

VMC Machine

INNOVATIVE POWER SYSTEM PRODUCTS & SERVICES:

HTLS Hardware and Connectors: Design, development, type testing, manufacturing of HTLS/HPC conductor hardware fitting and accessories, and also for ACSR /AAAC conductor.



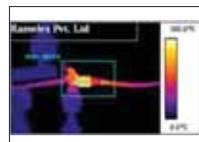
RE-RA/BPA Clamp: Best solution for conductor snapping issues in transmission line (association of RPL & R-INFRA/ADANI)

Transmission Line Tower Stub Strengthening by RPL: Patented technology with patent no. 297450 dated 06/06/2018 ensuring and enhancing the life of line towers, preventing collapsing of towers.



RTV Coating of Insulators: RPL is integration partner of CSL SILICONS, CANADA for RTV COATING of insulators.

EPC Projects: Transmission line and substations on turnkey basis with expertise in project management.



DNA, O&M Services like hot/cold line maintenance, thermography, coronagraphy, PID, string replacement/washing, AMC and energy audit for complete power system upto UHV LEVEL.

Table 1: Comparison of all earthing systems

Earthing System Conditions	TN-C	TN-S	TN-C-S	TT	IT
Earth Fault Loop Impedance (EFLI)	Low	Low	Low	High	Highest
RCD Preference	No	Optional	Optional	Yes	N.A.
Need of Earth Electrode at Site	No	No	Optional	Yes	Yes
PE Conductor Cost	Least	Highest	High	Low	Low
Risk of Broken Neutral	Highest	High	High	No	No
Safety	Least safe	Safest	Safe	Safe	Less safe
Electromagnetic Interference	High	Low	Low	Least	Least
Safety risks	Broken neutral	Broken Neutral	Broken neutral	High loop Impedance (step voltages)	Double fault, over voltage

- Faults in the LV and MV grid do not migrate to other customers in the LV grid.
- Simple earthing of the installation and the easiest to implement.

Disadvantages of the TT Earthing System

- Each customer needs to install and maintain its own ground electrode. Safety and protection depend on the customer, thus complete reliability is not assured.
- High over voltages may occur between all live parts and between live parts and PE conductor.
- Possible overvoltage stress on equipment insulation of the installation.

IT System Earthing

In this system, the supply source is either connected to earth through deliberately introduced high earthing impedance (Impedance earthed IT system) or is isolated from earth. All exposed conductive parts of an installation are connected to an earth electrode as shown in fig 9.

The conductive parts including metal body of the installations are connected to earthed through one or more local earth electrodes. These local electrodes do not have any direct connection to the source.

It is pertinent to mention here that single phase TT system shown in fig 9 is not used in India.

Advantages of IT system

- The main advantages of IT system are:
- It improves the energy availability: this is interesting for applications where a loss of electricity supply can cause a risk to people (in hospitals for example),

or a financial risk (for some process in industry).

- It can also eliminate the risks of fire or explosions in case of insulation fault, as the faulty current is very low.
- It will increase electrical device life time, as faulty current is low, it causes less stress on the equipment.
- Finally, it is possible to do preventive maintenance on the IT installation. Through the permanent insulation monitor device, we can detect insulation drops before they become insulation faults.

Disadvantages of IT system

- This system experience repeated arcing grounds.
- Insulation failure occurs during single phase to ground faults.
- Earth fault protection for unearthed system is difficult.
- Voltage due to lightning surges do not find path to earth.

Comparison of all Earthing Systems

Comparison of all earthing systems based on earth fault loop impedance, RCD preferred, need earth electrode at site, PE conductor cost, etc. has been carried out as mentioned in Table 1.

Brief of earthing system adopted world-wide

- In India LT supply is generally through TN-S system. Neutral is double grounded at distribution transformer, neutral and earth run separately on

Continued on Page 46



YOUR RELIABLE PARTNER FOR ALL CABLES AND CONDUCTORS NEEDS

We are the India's Leading manufacturer of Cables & Conductors. For over 30 Years, we are continuously expanding our presence in Indian and Overseas market to Electricity Boards, Government and Private Power Utilities, Private Contractors & Various EPC Companies. Our Organizational Philosophy is backed by Product Excellence, Customer delight, Technological advancements and an environment friendly approach.

Manufacturer & Exporters of:

- 66 KV XLPE Power Cables
- HT & LT Aerial Bunched Cables
- HT & LT XLPE UG Power Cables
- LT PVC Power & Control Cables
- FR/FRLS/LSZH Cables
- Airdac, Communication and Concentric Cables
- Solar Power Cables
- Bare & Insulated Copper Conductors
- ACSR, AAA, AA, AL59 & HTLS Conductors
- Railway Signalling, Power & Quad Cables



Dynamic Cables Ltd.

(A Govt. Recognised Star Export House) AN ISO 9001:2015 & OHSAS 18001:2007 Certified Company

Registered Office: F-260, Road No.13, V.K.I.Area, Jaipur- 302013, Rajasthan, India

Ph: +91-141-2332388, 2262589, 4042005 | Fax: +91-141-2330182

E-mail: info@dynamiccables.co.in | Website: www.dynamiccables.co.in

— Supporting —



Safety

Continued from Page 44

- distribution overhead line or cables. Additional earth electrode pits are installed at user ends for strengthening earth.
- Most modern homes in Europe have TN-C-S earthing system. The combined neutral and earth occurs between the nearest transformer substation and the service cut-out (the fuse before the meter), separate earth and neutral cores are used in all the internal wiring.
- In the areas of UK where underground power cabling is prevalent, the TN-S system is common.
- In Australia, New Zealand and Israel, the TN-C-S system is in use. However, each customer is must provide a separate connection to earth via a dedicated earth electrode.
- TN-C-S earthing system is used in the USA and Canada whereas France, Italy, Japan uses TT Earthing System.
- TT system is suitable for rural areas because of cost.

Conclusion

From the above information it can be concluded that, if the grounding is not carried out properly, it can cause number of problems like:

- An improper grounding results in higher potential being created in the equipment that can damage equipment and pose safety threat to working personnel.
- It can delay in clearing of faults that will result in insufficient current flow.
- The dangers of a fire caused by leaking electricity are increased exponentially.
- It can cause reduction in the operational efficiency of the machine.

In addition, the choice of earthing system depends on the priority given to many aspects mentioned in table 1 by the relevant distribution company and regulatory authority of county. ⓑ



Divyanshu Pal

Student of Electrical Engineering
Aryabhata Institute of Technology, Delhi



Shahrukh Khan

Student of Electrical Engineering
DPG-ITM Engineering College, Gurugram



Dr. Rajesh Arora

Assistant Manager (Technical)
Delhi Transco Limited

PRINT & DIGITAL

Advertise in our magazine which is available in both print as well as digital medium

WEBSITE

Advertise and get more visibility (hyperlink to your website), increasing hits on your website

E-NEWSLETTER

Advertise to avail the weekly digital blast, being on TOP OF THE MIND of your prospective customers is always a manufacturers desire



Print



Digital



E-Newsletter



Website

Electrical India

56 years of dedicated non stop service to the industry

BRINGING THE POWER INDUSTRY TO YOU SINCE 1961

For Package Deals contact, Ad Department at +91 22 27777170 /71 / Yasmeen +91 22 27777196



Innovative Cable Solutions



EN 50618
CERTIFIED

Over
1,00,000 KMs
Installed

ELECTRON BEAM IRRADIATED SOLAR & WIND MILL CABLES

1.8 KVDC, 120° C OPERATING TEMPERATURE EB-XLPE CABLE

SOLAR CABLES

- EN 50618:2014, TUV 2PFG 1990/05:12 and TUV 2PFG 1169/08.2007 Certified Cables
- Annealed Tinned Flexible Copper
- XLPO Insulation and XLPO Sheath
- Zero halogen Low smoke
- Electron Beam Crossed Linked
- Ultra Violet Rays and Ozone Resistant
- Rated for 1.8 KV DC operation
- Max operating temperature 120° C
- Cables life > 25 Years

Rodent proof cables also available

DC cables with AL Conductor also available

COMMUNICATION CABLES

- RS 485 cables
- Single Mode/Multi Mode Fibre Optic Cables

HT XLPE / LT XLPE CABLES

- 1 KV to 66 KV XLPE Cables
- Single Core cables up to 1000 mm²
- Multi Core cables up to 400 mm²
- Armored or Unarmored type

PVC POWER and CONTROL CABLES

- Power Cables up to 11 KV
- Control Cables up to 61 Cores

WIND MILL CABLES

- Largest Supplier of Wind mill Cables in India
- 1.1 KV LT to 33 KV HT Rubber Flexible Cables for Nacelle Application
- Designed to withstand High Torsion Conditions
- Flexible PCP and FRLS CSP, CPE Sheath options
- Electron Beam or Chemical cross linking options
- Good UV and Ozone Resistance and Fire performance
- Reduced bending radius Aluminium Rubber Insulated cables
- XLPE Insulated 1.1 KV to 33 KV cables
- Medium Voltage Covered Conductors

OUR ESTEEMED CUSTOMERS

APAR INDUSTRIES LTD.(Unit : Uniflex Cables)

12/13, Jyoti Wire House, O. Veera Desai Road, Andheri (West), Mumbai - 400 053

Phone: 022-26740001/2/3 Fax: 022-26740600 Email: info.cable@apar.com Web: www.apar.com



Betting Smartly on the Smart Grid

The need for smart transformers looks more real 5 years down the line. Our products and our online condition monitoring system are aligned with these technological advances... We see ourselves leading the way in transformer data analytics.

Girish Kumar
Managing Director, Sai Electricals

Sai Electricals, a unit of Sai Computers Ltd., is a manufacturer and exporter of transformers and servo voltage stabilisers. Here, in an interview with *Electrical India*, Managing Director of Sai Electricals, Girish Kumar talks about his current business and future roadmap.

What is the range of transformers you manufacture?

There is a very wide range of transformers that we have manufactured – from regular transformers to very specialised ones. We have manufactured transformers from 10 kVA at the lower end to 20 MVA at the higher end up to 33 kV class. There are a variety of specialised transformer products that we have

manufactured for metro rails, Siemens, Amazon, Indian railways etc. In keeping with today's needs of environment and energy preservation we have also developed our latest range of transformers, the 4HD transformers.

Can you explain more about your latest offering, 4HD?

We have quite good experience in transformer manufacturing and maintenance and putting this experience to good use, we have developed 4HD transformers. They are highly efficient which results in energy saving and reduced bills. They are also long-lasting thus have low maintenance cost. They are also highly fire safe, more than the regular transformers.

The key feature of 4HD transformers is that they are environmentally friendly as they do not emit or leak harmful components, unlike other transformers. 4HD transformers find their applications in critical and fire sensitive areas, also in places where there is space criticality as they are compact as well. We have delivered few 4HD transformers already and view it as a promising product for the future.

How unique are your Servo Voltage Stabilisers?

Our servo voltage stabilisers are quite unique, for which we have developed a unique technology for rolling contact type Servo Voltage Stabilisers. We have applied for patent for this technology. This makes our stabilisers very compact. Our Servo voltage stabilisers offer unbalanced voltage control as against the balanced voltage control in other competing products. Not going into too much detail, it is important to note that our product provides stable voltage on all three phases. This is important because a spike in a single phase can cause voltage problems on all three phases, and a slight voltage fluctuation can cause huge damage.

How do you maintain product quality?

Quality is our foremost focus. Our customers think of us when they want quality products and recommend us. We take it very seriously and comply with various certifications such as ISO 9001:2015. We have successfully implemented 5S and Lean Manufacturing. We regularly run quality circle to continuously optimise our process and production and also keep our employees satisfied and aligned with the ultimate goal of manufacturing quality product. An important aspect of quality control and management is removing errors by automating tasks and processes. In the past year, we have enabled software-controlled development. Starting from order release, design, to production and dispatch, everything is planned, monitored and controlled using our in-house developed Plant Management System. We have automated the designing process as well; design of every job is created through software making it optimum in lesser time and lesser iterations. It helps us focus on the manufacturing of quality products and help us keeping our customer happy.

Brief us on your manufacturing capabilities.

We can manufacture transformers between 10 kVA to

20 MVA, upto 33 kV voltage class. In this range, we can cater to almost any need. In terms of number of transformers, we can manufacture 300 transformers in a month of assorted ratings.

We have testing facilities for all routine testing and even for some special tests. We have also invested in latest machinery to increase production and production quality.

How significant is your presence in the export markets?

We supply regularly to various markets globally. Especially in neighbouring countries like Nepal and Myanmar, we have significant presence. South-East Asian countries are also key markets and we are expanding more into them. Outside Asia, we have also been active in African countries like Nigeria, Zambia, Kenya, and Uganda.

Is there any new product in pipeline?

Of course, there are many. We have a very committed team working on various unique offerings for the power sector companies. To mention one on the top of my head is software requirements of monitoring and analysis of power sector data. This can help reduce losses of power and enable efficient

We have automated the designing process as well; design of every job is created through software making it optimum in lesser time and lesser iterations. It helps us focus on the manufacturing of quality products and help us keeping our customer happy.

distribution and utilisation of resources for power companies. There are very few companies, actually none, who can analyse the vast amount of data in a focussed way like we are doing. This will also bring down consumer cost and enable better energy utilisation.

Where do you see your company 5 years from now?

With the technological advances the idea of smart grids is not far-fetched anymore. The need for smart transformers looks more real 5 years down the line. Our products and our online condition monitoring system are aligned with these technological advances. Our experience, learning and perseverance are unmatched. We see ourselves leading the way in transformer data analytics. ❶

inter solar

connecting solar business

| INDIA

10

2009-2018

YEARS OF INTERSOLAR INDIA

India's Most Pioneering Solar Exhibition and Conference
Twice a Year Serving Two Key Markets!

NEW IN BENGALURU, KARNATAKA, INDIA!
BANGALORE INTERNATIONAL EXHIBITION CENTRE

DEC 11-13 2018

www.intersolar.in



- Exhibit in Bengaluru – the capital city of India's Silicon Valley, technology hub and one of the top solar markets!
- Secure your best booth position to connect with more than 17,000 business professionals from more than 55 countries!
- PV meets energy storage and electric mobility – Benefit from cross-sector opportunities!
- Establish new powerful b2b partnerships and get in touch with investors at Intersolar's Buyer Seller Forum!

with special exhibitions

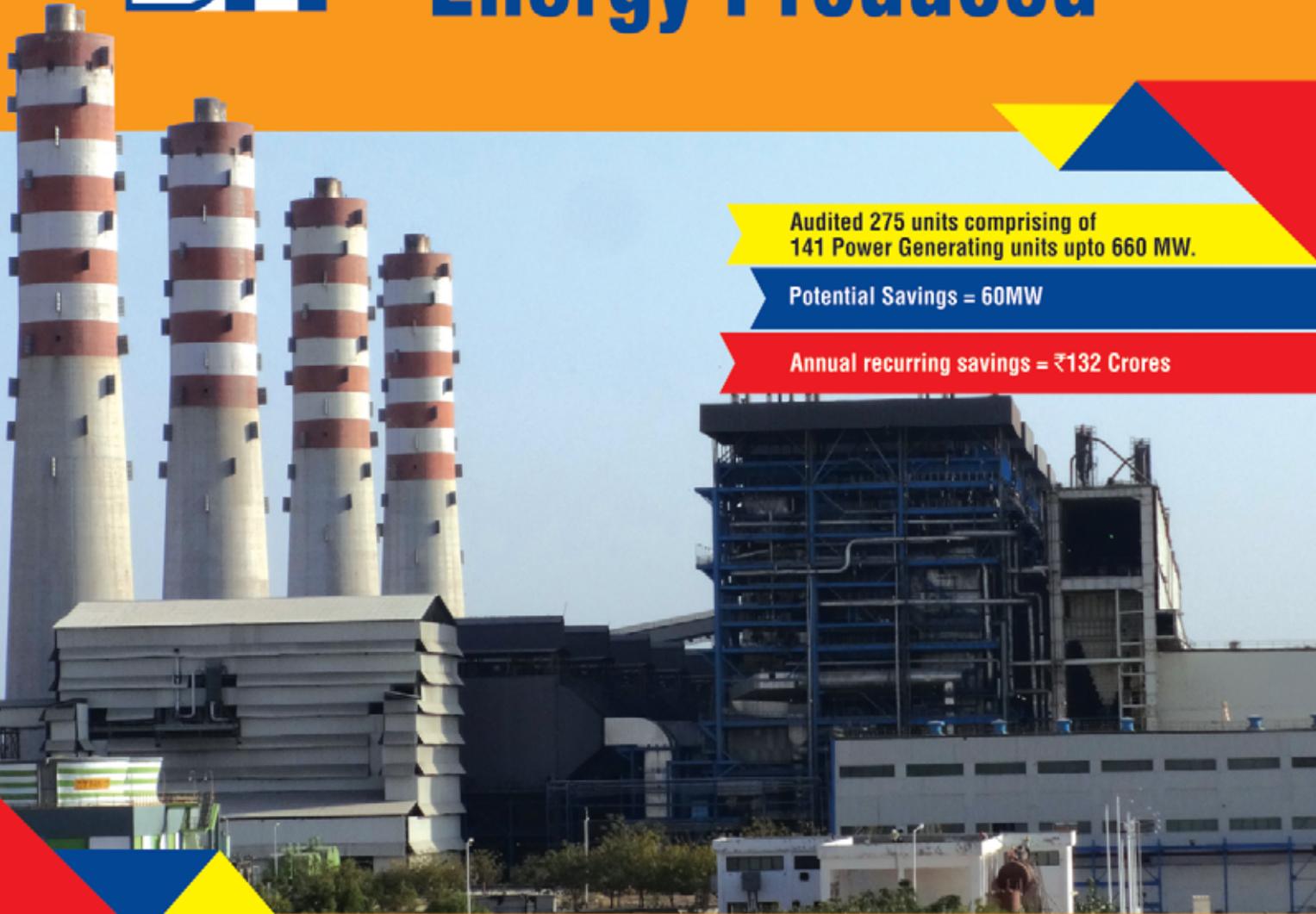
ees
electrical energy storage

**POWER
DRIVE**
| INDIA

GET THE BEST OF THE WEST – SAVE THE DATE FOR:
Intersolar India in Mumbai, April 4-5, 2019



Energy Saved is Energy Produced



Audited 275 units comprising of
141 Power Generating units upto 660 MW.

Potential Savings = 60MW

Annual recurring savings = ₹132 Crores



Energy management services with more than two decades of experience :

- Perform, Achieve and Trade (PAT) Scheme related Measurement & Analysis
- Measurement and Verification (M&V) under ESCO Business Model
- EC Awareness through Walk Through Energy Audits
- Performance Efficiency Testing (PET) of Thermal Power Plants
- Heat and Mass Balance Analysis

ELECTRICAL RESEARCH AND DEVELOPMENT ASSOCIATION

Toll Free No.: 1800 233 2668 | E-mail: bd@erda.org | Web: www.erda.org

Fast and reliable data exchange with new CAN bus cable from igus

New chainflex cable for CAN systems with PVC or PUR outer jacket, approved for Indian market



igus has developed a CAN bus cable for highly dynamic energy chain applications. The cable has EAC and CTP approval, which ensures easy trading in the Russian market.

Bus systems are increasingly being used in automation, as they ensure fast and reliable data exchange, save space and therefore money. To meet these needs, igus has developed a new CAN bus cable for highly dynamic energy chain applications, such as in machine tools. This is available with either highly abrasion-resistant PVC or oil-resistant PUR outer jackets. Both cable options have EAC and CTP approvals, simplifying trade with Indian market.

Demand for Controller Area Network (CAN) systems continues to grow in a bid to standardise data exchange. These ensure seamless networking of electronic systems with each other, such as control units or intelligent sensors. This enables complex systems to be implemented economically, and cross-system diagnostics can be carried out simultaneously across several ECUs. The new CAN bus cable from igus guarantees a high transmission reliability of the data, even with very high stress on the cable during motion, such as when used in an energy chain. The new cost-effective bus cable is available in two outer jacket options - CFBUS.PVC.020 with highly abrasion-resistant PVC or CFBUS.PUR.020 with highly oil-resistant PUR. As with igus cables, the new CAN bus cables were also

tested in the in-house test laboratory, spread over 2,750 square metres. igus claims to be the only manufacturer in the market to offer a 36-month guarantee on its entire cable range. The new cables are used in processing machines and machine tools, as well as in low-temperature applications. To facilitate trade with Russia or EAEU member states both cables have CTP and EAC approval.

Chainflex cables with approvals are reliable and save money

With more than 1,300 types, igus offers the widest range of energy chain cables with the world's most extensive selection with international approvals, including cables with EAC and CTP approval. The EAC certificate is the official proof that the imported machines or components for production equipment comply with the harmonised technical regulations (TR ZU) of the participating countries of the Eurasian Economic Union (EAEU). The CTP standard focuses on the fire behaviour of cables and the flame retardancy of the materials used. The two approvals are intended to simplify business relations. Thanks to the EAC and CTP approvals, companies exporting to Russia or EAEU member states can get their machines and equipment through customs more quickly and start commissioning at the end-customer immediately after re-assembly. Having both EAC and CTP approval, the comprehensive inspection of all regulatory requirements for all components of a production machine is carried out quickly and smoothly. By using certified chainflex cables, companies can save time and money at customs. An additional advantage of both certifications is that new and used machinery and equipment can be moved and sold across the borders within all member states of the Customs Union. Further national certificates of conformity, through GOST-R, TR or GOST-K, are no longer required with EAC and CTP approvals. 

For more information, visit www.igus.in

HEY!

YOUR SEARCH
ENDS HERE



WOULD YOU LIKE

to know more about the HVAC and R (heating, ventilation, air-conditioning and refrigeration) industry.

JUST FLIP OVER AND WE HAVE A
SUBSCRIPTION FORM FOR YOU.

BESIDES MONTHLY
MAGAZINE TAKE
ADVANTAGE OF THE
DIGITAL TECHNOLOGY
& READ COOLING INDIA
MAGAZINE ONLINE, AS
WELL AS FORTNIGHTLY
E-NEWSLETTER ON YOUR
PC, TABLET OR LAPTOP.



PRIYANKA

022-27777182 / 8652142057
sub@charypublications.in



Cooling India

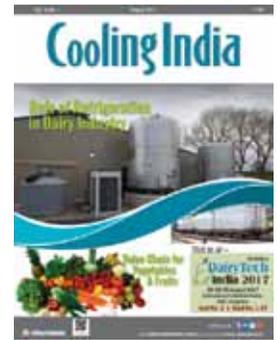
India's foremost Monthly dedicated to the growth of HVACR Industry

YOU CAN ALSO
SUBSCRIBE **ONLINE**
www.coolingindia.in

SUBSCRIBE

Cooling India

India's foremost Monthly dedicated to the growth of HVACR Industry



Subscription Offers

Sub. Period	No. of Issues	Subscription Type					
		Print		Digital		Print+Digital	
		Actual Rate	You Pay	Actual Rate	You Pay	Actual Rate	You Pay
1 Year	12	1200.00	1000.00	1200.00	1000.00	2400.00	1500.00
2 Years	24	2400.00	1750.00	2400.00	1750.00	4800.00	2625.00
3 Years	36	3600.00	2500.00	3600.00	2500.00	7200.00	3750.00
5 Years	60	6000.00	4000.00	6000.00	4000.00	12000.00	6000.00
E-Newsletter							
1 Year	24	N. A.		365.00		N.A	

PLEASE SELECT MODE OF DISPATCH FOR PRINT EDITION -

(1). By REGISTERED PARCEL - Rs. 435/- year (2). By COURIER - Rs. 600/- year

KINDLY ADD POSTAGE CHARGES IN SUBSCRIPTION AMOUNT.

Subscription / Renewal Form

To,
The Subscription in-charge
COOLING INDIA
Email: sub@charypublications.in

Are you a Subscriber,
Please submit your Subscription no:
.....

Yes, I would like to Subscribe/renew Cooling India / CI e-Newsletter for _____ years at ₹_____.

PAYMENT DETAILS :

Cheque / DD No. _____ Dated _____ Drawn on Bank _____
_____ Branch _____ in favour of Chary Publications Pvt. Ltd.

Bank details for NEFT / RTGS / IMPS : Account Name: Chary Publications Pvt. Ltd.

Bank Name: Bank of India Branch: Chembur, Mumbai - 400 071 Account Type: Current Account

IFSC Code: BKID0000009 Bank A/C Number: 000920110000322 SWIFT CODE :BKIDINBBCHM

Name: _____

Company: _____ Designation: _____

Address: _____

_____ City: _____ Pin: _____

Telephone: _____ Mobile: _____

Email: _____

Signature: _____

Stamp

 **Chary Publications Pvt. Ltd.**

905-906, The Corporate Park, Plot No. 14 & 15, Sector 18, Opp. Sanpada Railway Station, Vashi, Navi Mumbai - 400 703.

Phones: +91 22 27777 170 / 171 • Email: sub@charypublications.in • Contact : Priyanka Alugade • +91 22 27777182 / +91 8652142057

igus® has been manufacturing chainflex® cables for e-chains® for 25 years ...

3-year guarantee on all chainflex® cables



Tested: chainflex® lasts or your money back

Unique guarantee for all igus® cables: 36 months or 10 million double strokes (5 million with chainflex® M). Predictable reliability thanks to the industry's largest test laboratory (2,750 m²) for moving cables – with over 700 concurrent tests per year with 2 billion strokes. More information can be found at: igus.in/guarantee



igus® (India) Private Limited
36/1, Sy. No. 17/3, Euro School Road,
Dodda Nekkundi Industrial Area - 2nd Stage
Mahadevapura Post
Bangalore - 560048
Phone +91-80-45127800
Fax +91-80-45127802

● plastics for longer life®

igus®.in

igus.in/all_cable_tests

36 month
guarantee



Going the distance

MONCABLO detects and locates insulation defects along several kilometers of power cable



MONCABLO partial discharge system for power cables

Elia, the transmission system operator in Belgium, is busy completing a large-scale expansion of its high-voltage power grid in Flanders called the Stevin Project. One phase of this project was to add four buried cable circuits, each comprising three 380 kV cables over a distance of 10 kilometers (6.21 miles) between two substations.

Ensuring Reliable Operation

"The Stevin project is critically important for strengthening the high-voltage grid in Belgium," says Pieter Leemans, Elia's Asset Manager for MV and HV cables, "so we must guarantee the functionality and stability of the new cable links. The best way for us to do this is through real-time

monitoring of the dielectric condition."

"Not only did we need a partial discharge (PD) monitoring system to perform a site acceptance test on the high-voltage cable dielectric to be sure that the cable links were PD-free before commissioning," he explains, "we also need the same system to continuously assess PD activity during operation of the entire cable system."

Fact box

MONCABLO

- > Synchronous PD data acquisition at all cable accessories
- > Advanced defect localization along the cable's entire length
- > Integration with third-party sensors and SCADA systems

"We chose OMICRON's MONCABLO solution because it provided the best match for our criteria for a cable monitoring system. Most importantly, we were impressed with OMICRON's flexibility, structured organisation and detailed explanation of how it would meet our system requirements and implementation milestones."

Multiple Monitoring Points

The MONCABLO PD monitoring system was installed on all four 3-phase cable circuits, covering 24 outdoor terminations and 132 buried connections, making a total of 156 monitoring points.

"Each monitoring point has three high-frequency current transformers (HFCTs) to collect PD signals at the grounding connections of each phase, which are connected to a data acquisition unit to pre-process the data," clarifies Mario Sarens, the Elia Project Leader responsible for on-site installation. "Multiple data acquisition units are connected in a daisy chain by a fibre optic cable to a data collection unit, which then sends the data to our central server and SCADA system in Brussels," he adds.



As part of Elia's Stevin project, MONCABLO is monitoring PD activity along 10 km (6.21 miles) of buried cable circuits between the Gezelle and Van Maerlant substations in Flanders.



The cement boxes protect the HFCT sensors and data acquisition unit against ground-water and dust.

Solving Installation Challenges

"The MONCABLO system has a flexible design that was successfully customised to match our cable system layout and special installation requirements," he explains. "For example, the groundwater level is high in this part of Flanders, so we installed the buried monitoring components at the cable joints in sealed cement containers, and the HFCT sensors were immersed in gel to keep them dry and maintain their integrity."

"An additional challenge was how to power the buried monitoring equipment. In the end, we installed a low-voltage power cable alongside the high-voltage cables over their entire length,"

Mario Sarens describes. "This solution was the result of collaboration between OMICRON's and Elia's technical experts to produce the best design for the LV cable that keeps HV interference to a minimum while also ensuring personal safety," he concludes.

Localising Defects

"The MONCABLO system is designed to detect and identify the exact location of PD-related defects along the entire length of each cable," says Pieter Leemans, "but the system can also inform us by e-mail when PD activity exceeds pre-set warning and alarm thresholds. This enables quick, detection-based responses and will help us reduce maintenance needs."

An Intuitive Web Interface

"We can swiftly access stored PD data from any remote location using the MONCABLO software's intuitive web interface," he continues, "we can view the PD status of each monitored accessory as well as real-time and historical trend curves for each phase of every cable circuit."

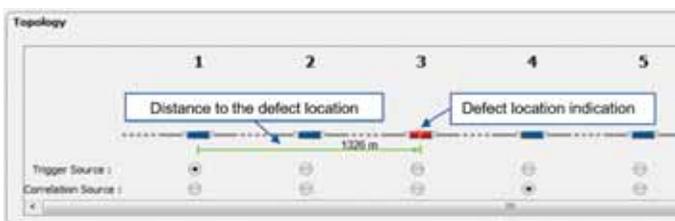
"Various automated features enable us to conveniently evaluate the PD data. OMICRON's unique 3PARD diagram and automatic cluster separation allow us to separate external noise from PD signals and determine the phase of signal origin," he describes.

Correlation with Other Monitoring Data

"As well as PD monitoring, MONCABLO's software can be expanded to cover other parameters, such as verifying the functionality of cross-bond joints and detecting cable sheath faults," says Pieter Leemans. "The data from multiple monitored parameters can be displayed on a single graph for a full insulation diagnosis." E1



MONCABLO's software simultaneously shows the PD status of all monitored cable accessories



A unique, patented technology allows MONCABLO to pinpoint the location of PD defects along the entire length of the cables.

For more information, visit www.omicronenergy.com/moncablo

FLIR Thermal Imaging Improves Substation Surveys for California Utility

Providing each PG&E crew with a thermal imaging camera allows them to immediately see heat anomalies that signal potential danger.



FLIR E95 : This style of handheld thermal imager costs less than the high-definition models needed for intensive inspection work, allowing companies to supply more crews with cameras.

During a routine inspection at a PG&E substation in the San Joaquin Valley, an electrician felt heat blast his face as he passed within five feet of an energised transformer bank. While one would expect a transformer bank to give off some heat, the intensity of it alarmed him. He immediately grabbed a handheld thermal camera from his truck, and within seconds verified that there was a major issue.

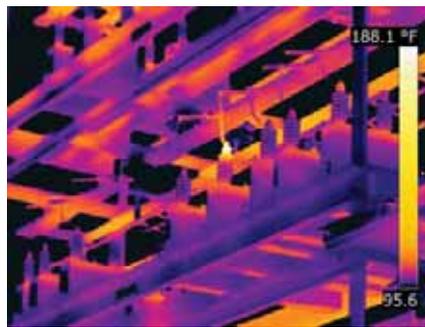
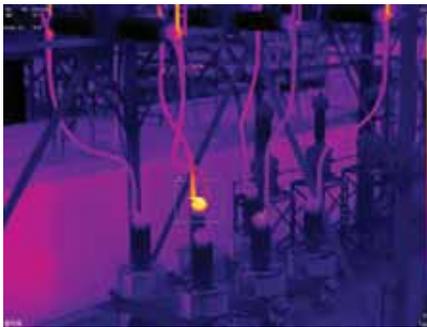
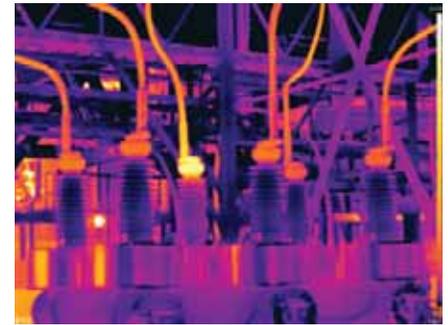
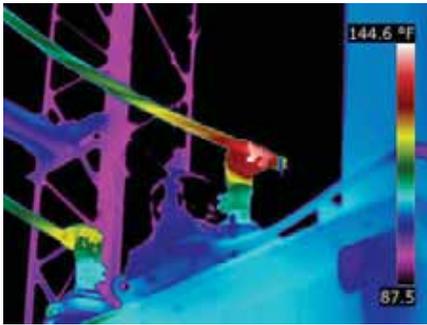
Prevent a Serious Outage

The electrician immediately informed his supervisor, and they shut down the system to investigate. They discovered that there was no oil flow in the transformer. Fortunately, detecting

the problem early helped the utility company and its customers avoid the impact of a serious outage and safety issue. "By catching it in time, we spent only about USD 300,000 to repair that transformer bank. That's a major savings compared to the roughly USD 3 million to replace it, which we would have had to do if it had completely failed and been destroyed," said Ray Friend, supervisor of the substation's maintenance and construction. The repair took about one week with a crew of six – about one-sixth of the time it would have taken waiting for a replacement. Sometimes delivery of this equipment can take months to arrive.

Safety

This has prompted PG&E to add more than 200 new mid-range, pistol grip FLIR thermal imagers to their collection of inspection tools. Friend explained that the purchase was simply a matter of common



sense. Providing each PG&E crew with a thermal imaging camera allows them to immediately see heat anomalies that signal potential danger. "Safety is always the first thing we want to think about," explains Friend. "The crew wants to know if something is operating (within safety parameters) the way we expect it to, whether it's oil-filled equipment or an air switch under load."

An infrared camera allows them to have confidence that the equipment they are working on is safe. PG&E crews now routinely do a quick scan to look for unusual hotspots on a variety of components that may need maintenance. "If you're required to stand at the end of a 16-foot disconnect stick, ready to rip a switch open, you want to be able to trust that the switch is properly adjusted and going to do what it's supposed to. That's what the camera gives us," Friend says.

Efficiency is a Factor

Inspections go much faster with

thermal imagers than they do with more traditional equipment such as IR thermometer guns. That's because temperature guns require scans to be performed close to the target for accuracy, only providing one reading at a time. Plus, they don't produce a picture, making surveys of the many electrical components in a substation a painstaking process. Compare that to the instantaneous images and thousands of detailed measurements one can capture from a safer distance with a thermal camera, and the potential for increased productivity becomes obvious. While PG&E continues to use high-performance FLIR cameras for their more intensive and detailed IR inspections, Friend says the midrange handhelds make it possible for his team to use thermal imaging more frequently on their rounds and on a moment's notice.

"It's simple to operate, there's no rocket science involved, and one can interpret things easily on the screen – all you need to have are a [few] instructions as to what to look

for," he says. "And it is portable and seems to be very rugged. We have them in trucks bouncing around and have had no issues."

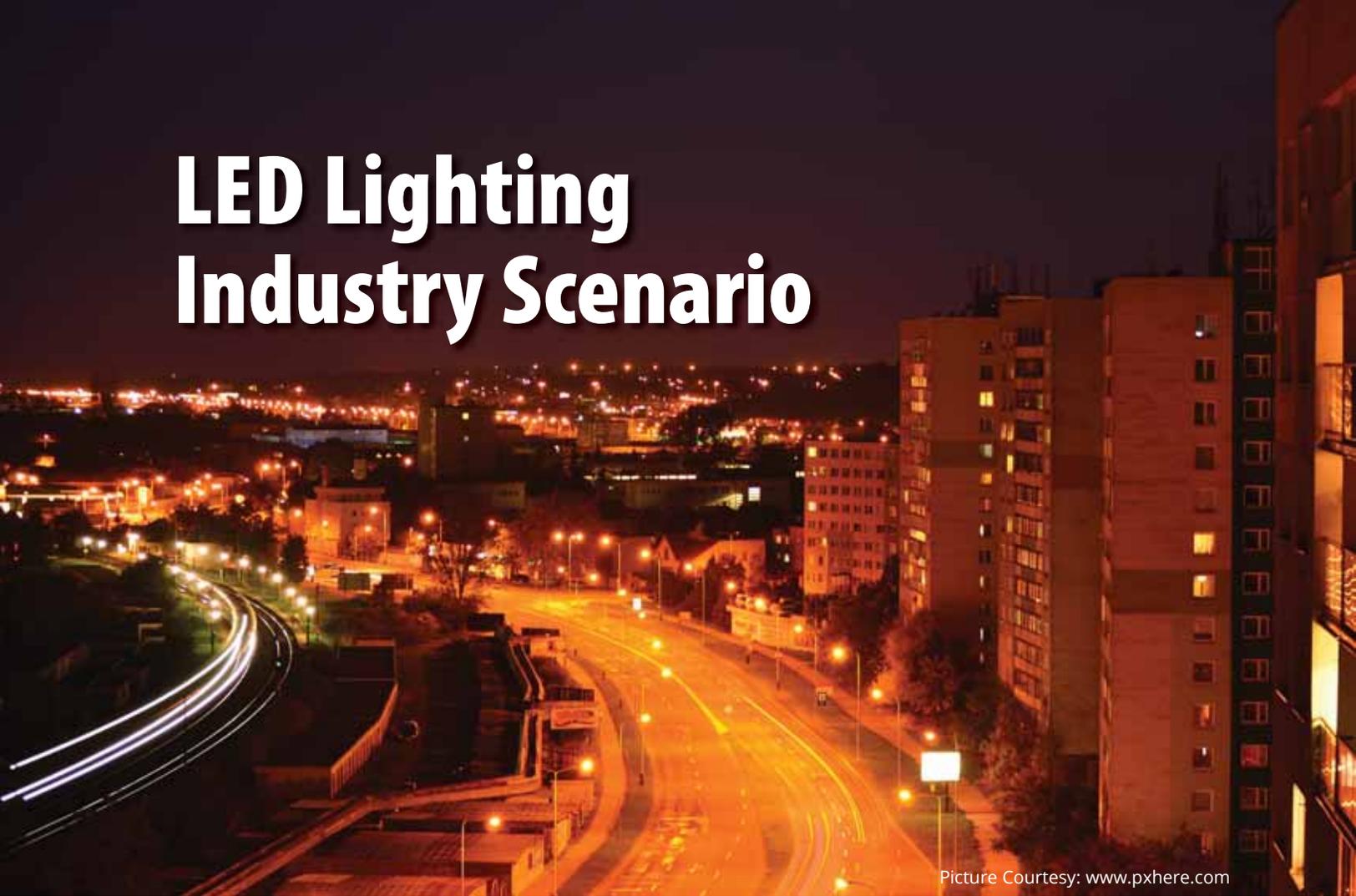
Bottom Line

Across the board, thermal cameras have allowed PG&E inspectors to find issues early. "Normally what they're finding are loose connections, switches out of adjustment, or regulators and breakers that are running too hot. They're also finding oil-filled bushings and other equipment with abnormal temperature differences that indicate a lack of cooling," says Friend. "We're catching them a lot sooner—in time to deal with it properly and safely—long before it fails."

This gives PG&E much better control over a situation, allowing them to more effectively target and plan repairs that help prevent expensive emergencies and shutdowns. With the ability to uncover hidden problems well in advance when they can still be repaired instead of being replaced, Friend feels affordable point-and-shoot IR cameras pay for themselves in no time. He says, "If you can spend a nickel today rather than ten dollars tomorrow, why wouldn't you want to spend it now? It just makes sense operationally and safety-wise." 

For more information, visit www.flir.com

LED Lighting Industry Scenario



Picture Courtesy: www.pxhere.com

The LED will move forward and within lighting technology, make an important contribution to energy conservation and conventional light sources will survive in small niches.

Within a period of just a few years the LED has become the dominant artificial light source and has taken over all the conventional light sources like incandescent bulb, CFL, fluorescent lamps, high pressure sodium lamp and metal halide lamp and also in nearly all fields of lighting applications like residential, commercial, offices, retail, hospitality, industries, roads and now even sports lighting. We have witnessed a disruptive change which has made any previous technology obsolete. How much further will this trend go? What is an LED capable of and what is it

not able to do? The LED will move forward and within lighting technology, make an important contribution to energy conservation and conventional light sources will survive in small niches.

Trends Defining Market Scenario

Unfortunately, the users and lighting industry is so much fascinated with energy saving almost all are neglecting the fact that lighting is for people and not empty space – which ever may be the applications as mentioned above. One side we talk of Human

Centric Lighting and other side we use poor quality – variation in light quality and colour consistency like CCT, use of Full ANSI Box to 5 SDCM (standard deviation of colour matching, also called MacAdam ellipses) poor CRI and so on. In all areas, LEDs are retrofitted with poor quality and less price but resulting energy savings keeping energy managers and utilities happy with saving money but at the cost of quality as required by users. This may not last longer with technological innovations happening at rapid pace which will change the market scenario.

LED Products & Lighting Quality

Being widely used and easy available these LED lights are terribly used with poor products in India and in turns give poor results and hence the industry is looking at drastic changes in term of higher quality. Over the course of 2016 and early 2017, the packaged LED industry has continued the march to specialisation while also pushing to all new levels of light or power output and efficacy. It is an advancement in light quality and spectral power distribution (SPD) that are most exciting when it comes to general lighting applications and even specialty uses such as lighting for health and wellbeing. There is not only great improvement in Lumen at Chip Level but delivered lumen is also improving with right use of thermal management and optics.

LM8, LM79 & TM 21 is implemented to give improved life of LED chip and also the luminaires. Emphasis is given on colour quality and practically all applications are now demanding MacAdam ellipses 3 or less, CRI more than 90 and R9 also 90+. Now TM 30 being out, CRI is getting outdated and being replaced with Rf & Rg. With this trend in other art of the world, users in India too will demand so.

In India, the government has made it compulsory to have BIS certification of all LED lights sold in which is in a way to improve the quality and a minimum standard set so that the consumers get the same quality products bought from any manufacturer or brand. There is already a plan to upgrade the testing methodology and standard by IEC/CIE and in turn BIS will also modify the existing standards.

Technological Innovations

There are lot of new thing currently happening in lighting industry which will change the lighting world



BETTER POWER MEANS BETTER NATION

Install

RELIABLE'S POWER EQUIPMENTS

- AUTOMATIC VOLTAGE STABILIZER FOR L.T. VOLTAGES
- HT AVR (11/22/33KV CLASS)
- TRANSFORMER WITH IN-BUILT AVR (11/22/33KV CLASS)
- ISOLATION TRANSFORMER
- POWER TRANSFORMER
- AC VARIABLE SUPPLY



INTRODUCING IGBT RECTIFIER

- RELIABLE
- ADVANCED TECHNOLOGY
- MORE EFFICIENT
- FLAWLESS PERFORMANCE




- ELECTRICITY SAVING
- PLATING TIME SAVING
- FAST AUTOMATION
- COMPACT SIZE
- LESS WEIGHT

Reliable Power Systems

Regd. Office : 43D, HSIIDC, Sector-31, Faridabad-121003 (Haryana) INDIA. Phone : (O) +91-129-2273512 Telefax : +91-129-4047870
Works : Plot No. 4, Gali No. 5 (W), Sarupur Indl. Area, Faridabad-121004
E-mail : info@reliable.net.in, rps.arunsharma@gmail.com

Website : www.reliable.net.in / www.reliablepowersystem.com



PIONEER IN SILICONE RUBBER PRODUCTS IN INDIA



Our Product Range Includes Silicone Transparent Platinum Cured Tubings

- Silicone rubber tubes (ITI Approved) • Transparent tubings • Silicone connector • Industrial tapes
- LED Gaskets • Nozzle • Silicone caps • Silicone washers • Inflatable gaskets • Cords • Strips
- Squares • Profile • Sections • Gaskets • Cables • O rings • Oil seals • Sponges • Sheets
- Autoclave Gaskets • Corona Treater Sleeves • Braided Hoses • Viton Rubber
- Also available as per drawings / specifications.



SOLUTIONS IN SILICONE



AN ISO 9001:2015 CERTIFIED

C1/55, GIDC Phase-2, Dediyanan, Mehsana-384002, Guj. INDIA.
Phone: +91-2762-224814 / 224240 / 224239
Sales Head: +91-97277 38001 | Sales Dep.: +91-99250 28109
Email: info@sevitsil.com, sevitsil@gmail.com



Picture Courtesy: www.ledvance.com

Human Centric Lighting

we see today.

- New Raw Material

With further research in Metallurgy, several new materials are ready to be used for example a raw material to change the lighting industry includes Nobel prize recipient Shuji Nakamura, whose violet LED use a base of gallium nitride as against sapphire to render better colours, product longevity and efficiency. Another material such as graphene that are making entry with a big bang.

- Driverless technology

LED lights comes with driver but the current trend is that some companies are introducing products which run on mains means with built in driver or without separate driver. The trend will be to use low voltage DC grid for applications like Home lighting and avoiding use of driver.

- Lighting Control

Till date we have seen dimming of various light sources like

bulb CFL, Fluorescent lamps etc, with dimmers, 0-10V and DALI. Then with DMX LED colour changing lighting in indoor and outdoor architectural lighting applications is possible.

Now with the use of LEDs in different applications, the control system has to come out from the so-called box and has become wireless remote control. Today Smart Lighting Technology uses platforms like Bluetooth, BLE, BLE Mesh, Zigbee, and Wi Fi. These technologies are user friendly with flexibility and of course, it is affordable as compared to wired systems.

- Lighting Connectivity

Currently, smart and connectivity is the latest buzz word around the corner and across the globe. Same thing is happening in lighting technology too and it will bring in the futuristic technologies ahead of the schedule. Lights will be controlled remotely or via voice. One will have

complete control on the function and application of lights. These features will make the lights an integral part of the smart homes, smart city and so on. Connectivity and digitalisation allows for new forms of work, leading to more personalised working hours, new flexible working methods and variable work locations. This transition brings new challenges in creating optimum conditions for users that increase well-being and inspire top performance.

Technologies are Power over Ethernet (POE), IoT (Internet of Things), Visible Lighting Control (VLC), LiFi etc. Each has its own hardware and software and will rule the lighting industry.

- Human Centric Lighting (HCL) Light has a great effect on humans. Not only does it allow us to see. Light stimulates us and influences our moods and activity levels. With continuous research on the effect of lights on the human behaviour and body metabolism study are in progress on effects of lights, wave spectrum and how the certain colors of lights effect the moods, productivity and more importantly the health of the person working under the lights. Human Centric Lighting solutions can support the human circadian rhythm, enhance concentration, prevent sleeping disorders and improve our overall well-being.

The new use of light is made possible because of the new knowledge on the biological effects of light, and because of recent

innovations in lighting technology. With the introduction of LEDs, or Light Emitting Diodes, tuneable white light can be achieved in an energy-efficient manner, which is easy to control with advanced control systems. New, smart, connected lighting systems create endless possibilities with better user control.

Tunable-white lighting is one of the biggest trends in applications like commercial lighting, hospitality lighting, educational institutes and hospitals. LED developers have taken a serious grip on the photo-biological research being produced by university departments and other groups. We know more about the way that humans function than ever before and you

might say that it is fortunate for the LED community that the science appears to support a practical technology that is perfectly suited to LED exploitation.

The reality is that tunable light will soon become as common as dimming. There are varying degrees of quality. People will begin to encounter HCL more, and they will soon come to expect it in the spaces where they spend prolonged amounts of time. That means new construction will soon demand this option in the design and specification stage. Also, retrofit opportunities must be available to existing buildings.

The end goal for a facility's lighting, new or old, should be that it fades into the background in

such a way that the built environment feels just as visually comfortable as the lighting in our natural environments — with abilities to simulate the daily transitions outside within the indoor space. And in the moments where manual adjustment is needed, the system can be optimised and altered to suit the specific task at hand.

Opportunities

Lighting industry in India has generated a lot of opportunity. LED lights have massively entered into residential, commercial, streetlight and yard lighting but still it has to go long way. In industrial lighting, still it has not entered the way it has changed the LED lights usages



Frontec
Heat Shrink

Jointing Kits, End Terminations and Tap-Off Connectors for LT, 11K and 33 KV



Clockwise From Top Left:

1. Frontec Silicon MVT
2. Frontec Porcelain MVT
3. Frontec Termination Installed at Gateway Towers
4. Frontec MV Tapoff
5. Frontec End Termination








Frontec
Heat Shrink

Since
1987

Type Tested at
CPRI

Certified with
ISO



Frontec manufactures Heat Shrink items from the granules stage. Some of the products in our range are:

MV TERMINATIONS

MV STRAIGHT JOINTS

MV TEE CONNECTORS

HEAT SHRINK TUBING

HEAT SHRINK COMPONENTS

0-9711361331 ; 0124-651331 ; mail@frontec.co.in ; www.frontec.co.in

Frontec Heat Shrink
Making reliable "connections" since 1987

Frontec Technologies Pvt Ltd
Khandua Road PO Narasinghpur
Bargarh 752 004, Orissa, INDIA



with lighting industry should come together and start cluster-based products for LED, drivers and other components as an individually they will not be able to stand in fast changing lighting industry. They should work cohesively and go for mass production of components or finished products and supply across the globe.

In near future, the lighting industry will move toward digitalisation so the sector should be ready to adapt to new technologies and integrate their products and services. Further, lighting industry should also be ready to offer the solutions to customers instead of just selling their products. They will have to offer complete solutions right from design to installation and commissioning of lighting products and systems to end users.

Outlook for the Sector 2018-19

India LED lighting market is projected to grow at a CAGR of 25 to 30 per cent in value terms during 2018-2022 on account of increasing government initiatives to boost LED adoption and growing awareness regarding lower power consumption of LED lighting products.

As per market research and Elcoma, the LED lighting market in India is expected to reach to INR 220 billion by the year 2020. If we talk in term of contribution, then 30 per cent is from commercial segment, 20 per cent from residential, 30 per cent street lighting and 20 per cent from industrial lighting.

According to a Press Information Bureau (PIB) announcement, by

in other sectors and therefore, there is a big scope in industrial application. With wireless Smart Lighting, LED industry can improve its profitability as compared to selling standard products like bulb and down lights. By entering into Human Centric Lighting for various sectors like offices, hospitality, educational institutes as well as healthcare industry can gain. With new technologies like POE LiFi, VLC, the lighting to smart city lighting, smart mall or retail lighting and so on and also collaboration with IT sectors, data & technology share and transfer, etc. This is the right time to invest in these technologies to be ready for the future.

Challenges

Currently, poor quality raw material and finished products are sold in the market to consumers at cheap prices but these products are spoiling the market and ill effects on the consumer well-being on long-term basis which is unvisible now.

The sector is facing a biggest challenge of manufacturing of raw material like LED chip, its packaging driver components, optics and diffusers, etc locally in India.

Currently, approximately 60 to 70 per cent of raw material is imported and final assembly is locally done in India. This is not 'Make in India'. Due to dependency on the imports the raw material quality, consistency in supply etc are sometimes difficult to manage. Frequent changes in the government policies also hampering the implementation of the manufacturing plan and setback for many companies. India has a huge potential to become a manufacturing hub for entire LED supply chain but need high capital investment. The government needs to roll out industry friendly policies and schemes to encourage such investments. The combined efforts will only work for 'Make in India' program successful.

Year 2018 - 2019 is very crucial year for Indian lighting industry as lot of new smart and wireless technologies will enter Indian Lighting Industry in a big way.

Lighting industry should invest in R&D, and manufacturing some of these technologies or some components locally in India for various applications. Small scales manufacturer who are associated

2019, 770 million LED bulbs and 35 million LED streetlights will be deployed to replace conventional lights. Under the DeenDayal Upadhyaya Gram Jyoti Yojana (DDUGJY), 27.3 million LED bulbs have to be distributed to BPL households. Over 2.1 million conventional streetlights have already been replaced with LED streetlights across the country under the Street Lighting National Programme (SLNP).

LED Lighting Education & Skill Development

Lighting professionals are not expert in Electronics and Electronics professionals have no knowledge about lighting. This is creating huge gap in technology reaching to end customers. LED lighting industry needs to focus on training the new talent for the industry as there is scarcity of quality manpower at all levels to drive the lighting business. There should be regular training internally and externally on products, technologies, soft skills and so on.

This calls for skill development centres which is needed more not only at manufacturing level but installation and commissioning level as well as maintenance level for technicians. Similarly, education for electrical consultant, architects and interior designers, application engineers, marketing persons, traders and so on different types of training courses are required which can be termed as midcareer education to learn about new technology for various applications. For this various associations in Electronics, electrical, lighting, utilities and other such fields should take initiative to create several training centres in all the states in India. The teaching material and training the teachers will be the hurdle besides investment in premises, training workshop, testing equipment and so on. ⓑ



Anil Valia

Lighting Designer & Educator,
Ex-Vice President & Founder Member
ISLE, MIES Emeritus (USA)

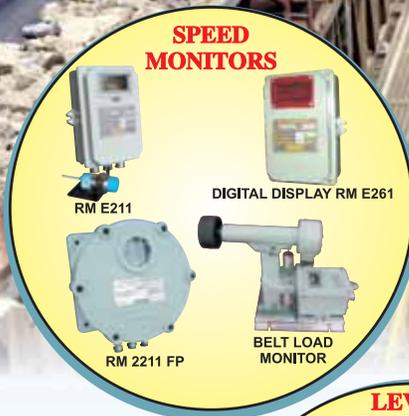


Gulab Jha

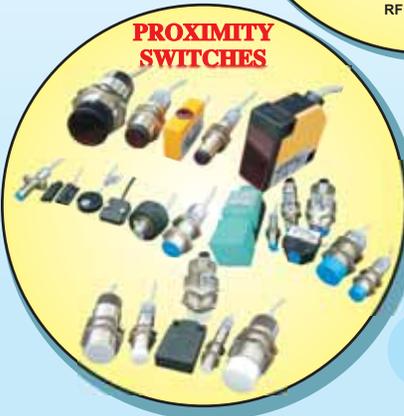
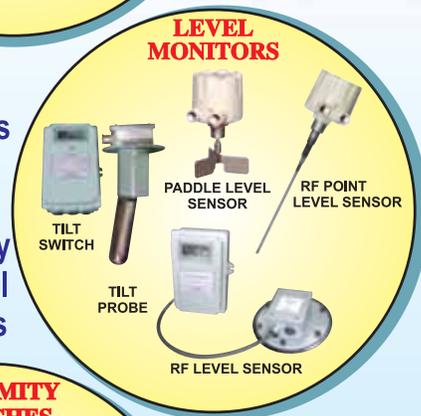
Lighting Consultant

JAYASHREE
ELECTRON
AN ISO 9001-2008 COMPANY

Conveying Safety for Bulk Material Handling Plants



Jayashree Safety Switches for monitoring conveyor safety in Bulk material handling plants



Making in India for more than 35 Years

JAYASHREE ELECTRON PVT. LTD.

Works : EL-34, 'J' Block, MIDC Bhosari, Pune - 411 026.

Tel. : 020- 27130529, 27130295

E-mail : sales@jayashree.co.in

Website : www.jayashree.co.in

India's Rooftop Solar Market: High On Opportunities and Loaded With Challenges



© Simon Kraus

Net metering was introduced in India as a measure to make rooftop solar more accessible and economical for electricity consumers. However, implementation across many states have been slow due to various challenges, more particularly DISCOMS fear of losing premier C&I customers. The rooftop capacity therefore has barely crossed 2.5 per cent of the 40 per cent of the national solar target. However, the segment is expected to pick up momentum with the launch of the Sustainable Rooftop Implementation for Solar Transfiguration of India (SRISTI) scheme which addresses DISCOMS' concerns.

With electrically powered gadgets becoming an essential part of everyone's life universal access to electricity has become a necessity as never before in India. Simultaneously power prices are rising and more and more cities are choking alarmingly with pollution. Clean solar energy has the great advantage of being put to use both as a small decentralised power generator of few tens of watts and as a mega centralised power plants.

Commercial and Industrial rooftop solar market has been rising over the last two years, driven by the huge savings energy cost and the availability of attractive financial models. Low cost financing from

multilateral agencies like the World Bank, Asian Development Bank, KfW etc are also helping the market growth. The C&I segment has accounted for close to 70 per cent of the total rooftop solar installations. However, the market potential still remains hugely under exploited. Among the serious constraints are:

- DISCOMS' disinterest for fear of losing high tariff paying C&I customers which helps them in offsetting the social burden of offering cheap or free power to agricultural sector.
- Metering policies of states: many lack clarity and they are not aligned across the states.
- Serious issues like the possibility of abrupt downward revision of tariff orders looms large.

Experts from the industry, policy makers and market researchers will share their experience and views and suggest the ways to accelerate the market during three rooftop conference sessions at Intersolar India on December 11-13 in Bangalore. Andrew Hines, Co-founder of CleanMax Solar will give a mid-term outlook for rooftop PV in India. Ryan Cook Senior Consultant at Meister Consultants Group will talk about residential market push through PV-rooftop demand aggregation. R.K. Jain, Addl. General Manager (Solar) at Solar Energy Corporation of India will talk about the successes and constraints of the rooftop solar growth in India. Afterwards Anuvrat Joshi, India Business Development Director at Cleantech Solar Energy (India) Pvt. Ltd. will address key trends, opportunities and challenges in adoption and scaling of industrial solar. Furthermore, in a session organised by swissnex India, experts from Switzerland will showcase proven BIPV technologies and applications for more energy efficient buildings, innovative rooftop structures, and sustainable Greentech solutions. 

For more information, visit www.intersolar.in

Solutions that fuel progress



Robust electrical and automation systems are the backbone of economic growth and social progress. Your industrial unit must be safeguarded against inconvenient, unwanted breakdowns, while maintaining productivity and efficiency of a high order. This can be done through monitoring, modernisation and upgrade.

Larsen & Toubro offers a comprehensive modernisation and upgrade plan for your electrical and automation system. It includes monitoring and system study to improve power quality, foster better energy management, enhance system reliability and augment safety. L&T also implements the initiatives recommended, and can undertake retrofit and upgrade of critical equipment with minimum shutdown time and at optimum cost.

To modernise your system and maximise your productivity, contact us today.

Customer Interaction Centre (CIC)
 BSNL/MTNL (Toll free): 1800 233 5858
 Reliance (Toll free): 1800 200 5858 Tel: +91 22 6774 5858
 E-mail: cic@Lntebg.com www.Lntebg.com



Solar investments in India

Profitable yet risky



Picture Courtesy: www.shubz.in

Solar investments can be put at risk by climatic factors, inappropriate component selection and poor handling and installation quality: Study

By *Subhajit Roy*, Group Editor

Endowed with vast and viable solar energy potential, India is making significant strides towards becoming a global solar superpower. Now the country has geared up to achieve its ambitious 100 GW of solar energy capacity by 2022 and has already installed solar capacity of 23.12 GW till July this year.

In a written reply to the Rajya Sabha, Power and New and Renewable Energy Minister R K Singh said, "The Ministry of New and Renewable Energy (MNRE) has planned a detailed trajectory so as to meet the target of 100 GW by 2022. A capacity of 23.12 GW was already installed up to July 2018. Projects of around 10 GW are

Picture Courtesy: PI Berlin



Corrosion caused by humidity and salt in the air can reduce the performance of plants in the long term.

under implementation and tenders for additional 24.4 GW have been issued."

Also, the favourable policies have led to record-low tariffs for adding solar power generation and today solar power costs even lesser than thermal. However, the 'profitable yet risky' for project developers and investors in photovoltaics (PV), reveals to a study by PI

Berlin, a German technical advisory firm.

PI Berlin analysed six projects in India in collaboration with the MNRE and two state-run organisations, the National Institute of Solar Energy (NISE) and the Solar Energy Corporation of India (SECI) between 3-14 July 2017. These plants were chosen based on India-specific environmental factors: various climates, modules and mounting structures, and state-wise solar capacity.

"While large-scale projects of over 100 MW are now common, the investment risks caused by the climate, poor installation, and lack of proper maintenance is on the rise," PI Berlin said in a statement.

The Climatic Factors

In most regions of the world, solar PV projects are primarily affected by a few climatic stress factors, such as salt in the air, high UV radiation, high humidity, heat, sand or strong winds. But, according to Asier Ukar, Senior Consultant at PI Berlin, in many parts of India, PV projects often face a large number of these

Solutions For A Wired World



Ring Main Unit

Bimetallic terminals for connecting power cables with aluminium conductors to copper terminals and bus bars on equipments are made by STI. A bimetallic terminal consists of copper palm integrated to an aluminium barrel by process of friction welding. Aluminium conductors of a power cable is connected to bimetallic terminal inside the aluminium barrel and secured by compression (crimping) tools. Bimetallic terminals eliminate burn out of copper terminals crimped to aluminium conductors. To bushing of Ring Main Units (RMUs) and to copper bus bars.

Ask For **Calter Bimetals** & Compliment With Range Of **Calter Tools** For A **Secure Connection**



Recently completed project in South Gujarat

Successfully Supplying To Major Utilities **Without Any Failures** Across The Globe For The **Last 7 Years!!**

Find full range of products on : www.calter.com
or you can call us : 022 6153 2425

Picture Courtesy: PI Berlin



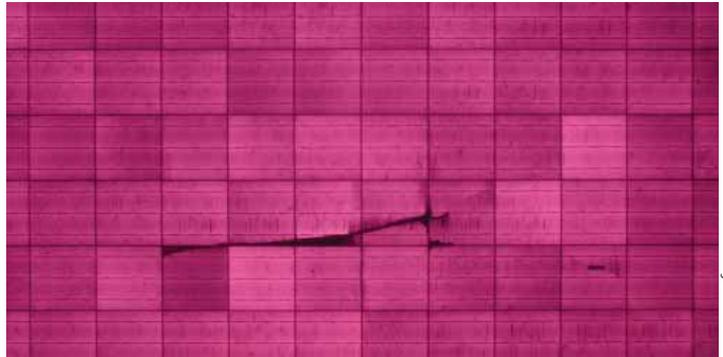
Signs of improper handling, such as footprints on modules, suggest operational errors.

factors at the same time. Citing an example, he said, "In Rajasthan in particular – which is an especially lucrative place for PV projects due to the high level of solar radiation – PV modules and other system components have to battle against many climatic stress factors at once."

To avoid outages, investors and project developers need to ensure that PV projects are designed appropriately from the outset. "For instance, earthing connections made from aluminium or featuring suitable coatings will not corrode as easily in soil with a high salt content," says Ukar. "In addition, India has some of the highest solar irradiation rates in the world but that can also lead to faster component degradation."

Price over quality!

In July this year, solar tariffs once again matched the record-low rate of Rs 2.44/unit in the latest auction. Such fall of tariffs puts pressure on the profitability and long-term viability of projects. According to Ukar, "The price pressures... frequently



Picture Courtesy: PI Berlin

Cell fractures often develop during the production or transportation of modules and are easy to detect.

means that little attention is paid to PV module quality."

For example, PI Berlin observed faulty electrical joints and delamination in several PV projects. "Defects like these could be avoided before and during production of the PV modules," suggests Ukar. "PV modules were observed at all sites with cracked cells that were likely caused during transport, installation and maintenance. These defects could have been prevented if the PV modules were handled proficiently."

He adds that investments are jeopardised as much by defects in the field as they are by lack of clarity in contracts. Contracts with EPCs and O&M companies often contain short and vaguely worded guarantees.

According to Ukar, regular monitoring of performance and operational data would improve predictive maintenance and increase system availability. For instance, while cleaning PV modules twice a month during the monsoon season may not be necessary, this process must be performed more frequently during dry periods.

Conclusion

"The Indian market is a double-edged sword," states Ukar "although India has excellent levels of solar radiation, investments can be put at risk by climatic factors, inappropriate component selection and poor handling and installation quality. In order to obtain the highest possible rates of return from PV projects, steps need to be taken to ensure that high-quality components and the proper assurance processes are put in place."

The study concluded that affordable practical steps could be taken to mitigate these risks in spite of the current price pressures.

www.electricalindia.in



Picture Courtesy: PI Berlin

Although India is a profitable market for large PV investment projects, the environmental conditions expose the plants to a number of risks.



Gujarat's Renewable Energy Achievements and Impacts

Source	Installed Capacity	Savings of Conventional Energy
Wind	5755 MW	11.51 Million Ton of CO ₂ emission avoided. 8.056 Million Ton of Coal saved.
Solar	1707 MW	2.729 Million Ton of CO ₂ emission avoided. 1.91 Million Ton of Coal saved.
Biomass	51.2 MW	149.13 Thousand Ton of CO ₂ emission avoided. 124.27 Thousand Ton of Coal saved.
Biogas	17910 cum	107460 LPG cylinder saved. 57312 Ton of organic manure produce.
Solar Water Heater	11.13 Million liters	77986 Ton of CO ₂ emission avoided. 54209 Ton of Coal saved. 78.47 Million Units electricity saved.

*Data of 31ST August 2018



Climate Change Department
Government of Gujarat



GEDA
ગુજરાત ઊર્જા વિકાસ એજન્સી
GUJARAT ENERGY DEVELOPMENT AGENCY
geda.gujarat.gov.in

Green Solutions from DEIF

Central to DEIF's vision to be the preferred global supplier of green, safe and reliable energy control solutions, DEIF is committed to actively engaging in and supporting sustainable environmental policy by developing and supplying cleantech products and intelligent power management.



Climate change effects world over have resulted in transition of focus from using black to green energy solutions. Not only so, people also want to introduce a mix of green in their existing portfolio with multiple green energy sources.

Central to DEIF's vision to be the preferred global supplier of green, safe and reliable energy control solutions, DEIF is committed to actively engaging in and supporting sustainable environmental policy by developing and supplying cleantech products and intelligent power management. DEIF's goal is to help make the world a little greener every time DEIF implements its solution. Reflecting the accelerating switch of the worldwide energy system

towards more renewable and sustainable energy practices, DEIF's progressive strategies and product development focus intensely on wind power, hybrid Solar, hydropower and biogas.

Aiming also to act in an ethically responsible way across all business segments, including conventional power generation, all DEIF products and solutions are developed in accordance with DEIF's green vision. DEIF develops energy efficient products and solutions that reduce fuel consumption, maintenance intervals, thus, cutting harmful emissions and costs. As a means to combat climate change, conserve natural resources and meet the challenges of global population growth, we are

continuously looking for ways to increase the performance and efficiency of our partners' installations. 20 per cent of DEIF's more than 500 highly skilled employees work in R&D in its pursuit of excellence, consistently mapping new ways in power control technology.

A DEIF solution is a greener choice because it means optimised operation: life extensions and other advanced technologies make our customers' assets more valuable and operationally more efficient. DEIF solutions being cost-effective balance economy and conserve the environment as they are highly efficient.

Extracting more out of the Sun



DEIF's Automatic Sustainable Controller (ASC) is a solution that provides integrated solution for systems with utility, diesel and solar power source. The system provides an interface between the

diesel or gas genset and solar with or without presence of utility power - a solution that enables a client to share the load between solar PV cell and diesel or gas genset with maximum solar penetration, thus, resulting in maximised savings even during utility failure. Using solar for the additional period of the year can make that period also further green and help maximise the project's overall return on investment. DEIF's solar solution will thus, prove to be a boon to India's evolving solar sector.

Capturing the Wind

Every product in DEIF's Wind Power Technology division is contributing to a greener world. Its products do not only contribute but also optimise. Thus, the control systems of DEIF Wind Power

Technology are constantly subject to optimisation of the energy generated by the wind turbines.

Flexible and reliable control solutions being the strength, the company delivers everything from complete turnkey solutions to individual components.

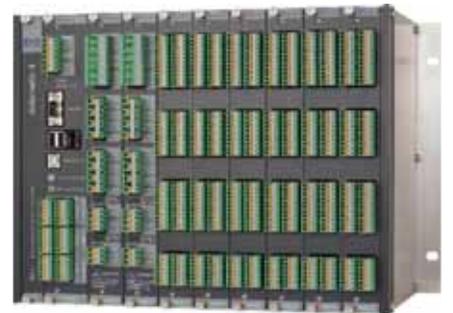
DEIF continuously strives to improve the performance of the wind turbines and makes necessary upgrades to the application and embedded software. Customer also benefits by receiving free software updates in future as well.

DEIF's wind turbine control systems are not only suitable for new installations but also can be used for retrofitting existing wind turbines to give clients numerous key benefits.

Harnessing Hydro Power

Hydroelectric power plants are

installed to capture energy from the flowing water and turned into electricity. Delomatic 4 (DM-4) Hydro-controlled plants offer fully automated control for stable optimised operation and require less maintenance and fewer man hours. Compatible with all types of turbines, the Delomatic 4 Hydro is flexible and easy to adapt with simple parameter settings. Critical functions such as speed governing, generator protections and synchronising are fully integrated with password-protected features for maximum security.



The advantages to DEIF's Delomatic solution go beyond savings, wiring, construction, engineering and maintenance. It is also a flexible solution equally suited for new installations and retrofits, designed to control hydro turbine generators ranging from 2 kW to 20MW along with its auxiliary equipment.

Making the Most Out of Waste Gas



Regardless if gas is bio, natural, landfill or other, DEIF's control solutions will enable to convert it into energy. Irrespective of size of application, type and make of gas



Advanced Graphical Interface, AGI 400



AWC 500



Thyristor Control Module, TCM-2



Wind Sensor Static, WSS

Retrofit package

Green Energy

engine or turbine, DEIF's standard controllers are extremely flexible and will accommodate most of client's needs. But DEIF is also happy to develop completely unique solutions designed exclusively for client's specific application. DEIF's product DM 400 Gas is suitable for total engine control and protection whereas Automatic Genset Controller - AGC-4 Gas is suitable for power management and CHP applications. Installing DEIF solution benefits through increased operational availability of the system and enhanced cost saving by not having to pay to dispose the waste.

Transforming black to green

Equipped with features and functionalities such as fuel optimisation, load dependent start or stop, asynchronous load sharing, DEIF's Automatic Genset Controller - AGC-4 is the most comprehensive and flexible power management and protection unit in the diesel segment. The innovative solution gives a client a critical market advantage that ultimately helps him or her produce more green power at the lowest possible cost.

Internally Green

DEIF A/S is ISO 14001:2004 certified for Environmental Management Systems. DEIF A/S also has been approved by Lloyd's

Register Quality Assurance with the environmental scope as "The environmental aspects in relation to the processes, facilities and buildings for administration, development and manufacturing of control & instrumentation products."

The green focus at DEIF is not only related to product solutions but also to its internal processes as well. Internally, DEIF's focus on carbon-neutral heating and cooling; the DEIF Group's headquarters in Skive, Denmark, features advanced green energy system includes a carbon neutral Aqua Thermal Storage System: storing ground water at constant temperatures in underground wells, the system heats and cools the buildings and has an indefinite lifespan.

DEIF's CHP plant cuts emissions - a micro CHP plant generating power for DEIF's buildings, naturally equipped with DEIF controllers, helps keep our CO₂ emissions low. DEIF wants to prevent pollution and reduce negative environmental impact by encouraging all employees to have a high environmental awareness in every relevant decision taken in the company, especially in its processes and production. The company wants to have a common green mind-set.

DEIF A/S is part of the CO₂ neutral website initiative. The

carbon emissions from both the website and the users of the site are offset through the building of new renewable energy sources, various CO₂ reducing projects, and through purchasing certified CO₂ offsets cleared by relevant government institutions and bodies.

The DEIF website is hosted on Hostnordics servers. As part of Hostnordics green IT strategy to minimise power consumption to take pressure off the environment.

DEIF's printed marketing material is carbon compensated according to ClimateCalc (Cert. no. CC-000033/DK). The paper used for printing is FSC certified (Forest Stewardship Council) implying that the paper comes from well managed forests that provide environmental, social and economic benefits. The printed matter also carries NORDIC ECOLABEL stamp that evaluates a product's impact on the environment throughout the whole life cycle.

DEIF has done its part in all aspects of product life cycle, now it is client's turn to make a commitment towards green energy and safe environment. DEIF can help a client achieve green energy goals. Backed by local support team, choosing DEIF implies reliable and fast on-site service and support. 

For more information, visit india@deif.in

Visibility defines a long term impression

Media does the first entry to opening your door in the mind of your clients

Advertise in **Electrical India**

Contact Yasmeen at +91 22 27777 7196 / +91 9867914216



THE IMPOSSIBLE IS OFTEN

THE TASKS UNTRIED

BESIDES BI-MONTHLY MAGAZINE TAKE ADVANTAGE OF THE DIGITAL TECHNOLOGY & READ **LIGHTING INDIA** MAGAZINE ONLINE, AS WELL AS FORTNIGHTLY E-NEWSLETTER ON YOUR PC, TABLET OR LAPTOP.

To **Subscribe** & Be Updated
Please fill the form (P.T.O.)

PLEASE TURN BACK FOR THE SUBSCRIPTION FORM.

Come Join us in endeavour to bring the lighting industry to you, on the most read media platform of **LIGHTING INDIA**.

"WE TRAVEL AROUND THE WORLD TO GET NEWS, PRODUCTS & PROJECTS FOR YOU, SO THAT YOU CAN KEEP PACE WITH THE REST OF THE WORLD "



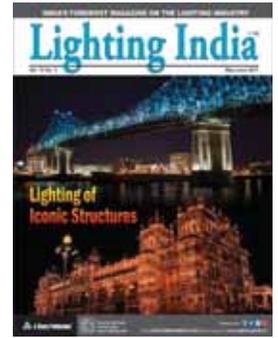
CHARY PUBLICATIONS PVT LTD.

905-906, THE CORPORATE PARK PLOT NO. 14 & 15, SECTOR - 18, OPP. SANPADA RAILWAY STATION, VASHI, NAVI MUMBAI - 400 703. FOR SUBSCRIPTION PLEASE CONTACT PRIYANKA ON 022-2777182/8652142057 OR EMAIL ON sub@charypublications.in

Read and advertise in India's foremost magazine on **LIGHTING INDUSTRY**.

SUBSCRIBE

Lighting India



Subscription Offers

Sub. Period	No. of Issues	Subscription Type					
		Print		Digital		Print+Digital	
		Actual Rate	You Pay	Actual Rate	You Pay	Actual Rate	You Pay
1 Year	6	750.00		750.00		1500.00	1125.00
2 Years	12	1500.00	1350.00	1500.00	1350.00	3000.00	2025.00
3 Years	18	2250.00	2000.00	2250.00	2000.00	4500.00	3000.00
5 Years	30	3750.00	3000.00	3750.00	3000.00	7500.00	4500.00
E-Newsletter							
1 Year	24	N. A.		365.00		N.A	

MAGAZINE WILL BE SENT BY REGISTER PARCEL --Rs.220/YEAR

KINDLY ADD POSTAGE CHARGES IN SUBSCRIPTION AMOUNT

Subscription / Renewal Form

To,
The Subscription in-charge
LIGHTING INDIA
Email: sub@charypublications.in

Are you a Subscriber,
Please submit your Subscription no:

Yes, I would like to Subscribe/renew Lighting India / LI e-Newsletter for _____ years at ₹_____.

PAYMENT DETAILS :

Cheque / DD No. _____ Dated _____ Drawn on Bank _____
_____ Branch _____ in favour of Chary Publications Pvt. Ltd.

Bank details for NEFT / RTGS / IMPS : Account Name: Chary Publications Pvt. Ltd.

Bank Name: Bank of India Branch: Chembur, Mumbai - 400 071 Account Type: Current Account

IFSC Code: BKID0000009 Bank A/C Number: 000920110000322 SWIFT CODE :BKIDINBBCHM

Name: _____

Company: _____ Designation: _____

Address: _____

_____ City: _____ Pin: _____

Telephone: _____ Mobile: _____

Email: _____

Signature: _____

Stamp

 **Chary Publications Pvt. Ltd.**

905-906, The Corporate Park, Plot No. 14 & 15, Sector 18, Opp. Sanpada Railway Station, Vashi, Navi Mumbai - 400 703.

Phones: +91 22 27777 170 / 171 • Email: sub@charypublications.in • Contact : Priyanka Alugade • +91 22 27777182 / +91 8652142057



**STILL USING
INSULATION
TAPE FOR WIRE
CONNECTIONS?**

Switch to WAGO 221

**COMPACT SPLICING CONNECTORS
For All Wire Types**



- Nominal current: 32 A
- Nominal Voltage: 450 V
- Can be used for higher temperatures:
 - Continuous service temperature:
max. 105 °C
 - Ambient operating temperature:
max. 85 °C (T85)

EASY • FAST • SAFE

Safety & Reliability in Electrical Installations

This article covers two devices i.e. Highly Immunised RCCBs (Hi RCCBs) and Over Voltage Protection, which if used can provide better safety and reliability for the users.

With the advent of increased industrialisation and increased demand for housing, technology advancement is taking place at an extremely fast pace. This has not only led to an increase in demand for electricity, but also has demanded an increase in the requirement for safety and reliability of electrical systems.

In our day-to-day lives, electricity has become an integral aspect. We cannot imagine a life without electricity. In today's times when more and more electronic devices are being used in households, the demands on the quality of supply has increased. There is also a considerable increase in the awareness on the correct use of electricity. However, it is observed that more and more organisations as well as people focus on the energy saving aspect of electricity and very few focus on the safety and reliability of the electric supply.

The basic safety aspects are covered by the IS or IEC standards and most of the reputed manufacturers are following these standards to meet the basic needs of safety and reliability. However,

with the increased use of electronic devices in many cases, the basic safety devices do not operate due to the properties of the electronic devices used and the properties of the safety device.

This article covers two devices i.e. Highly Immunised RCCBs (Hi RCCBs) and Over Voltage Protection, which if used can provide better safety and reliability for the users.

Hi RCCBs (Highly Immunised RCCBs)

There is an increased awareness amongst the users on the use of RCCBs in electrical installations. As per NEC 2011 the use of RCCBs is recommended at all sub distribution levels and hence there is a steady increase in India on the use of Residual Current Devices (RCD) in most of the electrical installations. However, it may so happen that in some cases the Residual Current Device may not trip during a genuine earth fault or may cause nuisance tripping when there is no Earth Fault. Such cases compromise the safety and reliability of the electrical installation. To avoid this kind of situations it is recommended to

use Hi (Highly Immunised) RCCBs.

Increased use of semi-conductors in electronic instruments in commercial application such as computers, printer, photocopiers and other non-linear loads and in industrial applications such as Variable Frequency Drives, thyristors, inverters, speed controllers have increased problems of pulsated DC currents, harmonics and transients in electrical networks. These electrical disturbances (pulsated DC currents, harmonics and transients) distorts the pure sine waveform of alternating current and lowers the overall power quality. RCCB being a very sensitive device may trip due to these electrical disturbances in the system, which deforms/distort the sine wave.

These disturbances can be due to:

- External disturbance - High voltage network disturbance, natural lightning
- Internal disturbances - Harmonics - non-linear loads like VFD, electronic loads
- Pulsated DC currents - Thyristors, SMPS, electronic loads

- Switching surges – switching of induction motors, transformers

IEC 61008 defines RCCB as per following class:

- Class AC - for normal AC supply networks with no harmonics
- Class A - for disturbed AC supply networks having pulsated DC currents
- Class B - for pure DC networks

Effect of network disturbances of working of RCCBs - Pulsated DC currents

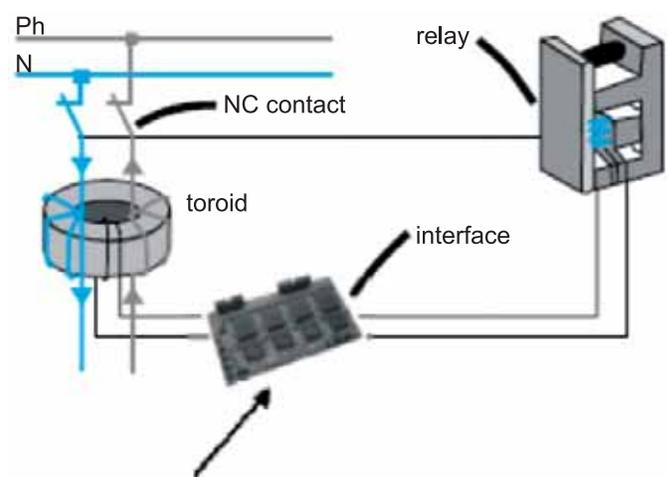
Electrical networks feeding power to devices like SMPS, thyristors, dimmers, VFDs, power electronics etc. would generate pulsated DC components in the leakage currents. As per Faraday's law, the rate change of flux generated at the core due to the leakage current with pulsated DC components is not proportional to the magnitude of the leakage current. The tripping relay then would not have sufficient power to trip the RCCB, thereby compromising on safety. This phenomenon is known as "Blinding" of RCCBs.

Harmonics

In a normal alternating current power system, the voltage varies sinusoidally at a specific frequency, 50 hertz for India. When a linear electrical load is connected to the system, it draws a sinusoidal current at the same frequency as the voltage (though usually not in phase with the voltage).

When a non-linear load, such as a rectifier, is connected to the system, it draws a current that is not necessarily sinusoidal. The current waveform can become quite complex, depending on the type of load and its interaction with other components of the system. It is possible to decompose it into a series of simple sinusoidal waveforms, with each waveform having a frequency which is an integer multiple of fundamental frequency. These current waveforms which have frequency which is integer multiple of main power frequency current is known as harmonic current. Some common examples of non-linear loads include common office equipment such as computers and printers, and also variable speed drives.

These high frequency harmonic current negatively affects the performance of RCCBs. Harmonic current increases the impedance of the secondary circuit (given by $X_L = 2 \pi fL$) of the RCCB CBCT. This increase



Special filter circuit to take care of pulsated DC currents, harmonics and transients is shown above

in impedance of secondary circuit hampers the power transfer to the tripping relay. It leads to non-tripping of RCCBs which is also known as "Blinding" of RCCBs.

Transients

Transient over voltages, when present in a network generally exceeds the insulation voltage of an installation. This leads to momentary puncture of the insulation, thereby generating leakage current, causing nuisance tripping of AC class RCDs. AC class RCDs cannot differentiate between a transient and permanent leakage current.

Effects of electronic loads on RCCBs

Electronic devices like computers, printers, copiers, medical equipment like x-ray machines, to comply with EMC directives, are equipped with interference filters. These interference filters generate permanent leakage current to the tune of 1.5 mA. When a few such loads are connected in a network, the summation of the leakage currents may cross the tripping threshold, and trip the AC class RCD. The risk is high when the installed RCD is AC class with sensitivity of 30 mA.

Effect of harmonic filters on RCCBs

Harmonics generated and circulating in the networks is harmful and needs to be eliminated by employing filtering condensers between phase / neutral & earth, i.e. Harmonic filters. This is essential to facilitate proper functioning of other equipment's connected in the network.

AC class RCDs installed in such networks cannot differentiate between a high frequency harmonic leakage current bypassed to the earth and a normal

Table 2: The common loads in commercial and industrial application which generate pulsated DC components or harmonics.

Disturbance	Nuisance Tripping	Blinding	Load Factors
50Hz Constant Leakage Current	⚠		Charged Cables
HF Transient Leakage Currents / Equipped with Filters	⚠	⚠	Electronic Ballasts, SMPS, Dimmers, Power Electronic Equipment
Leakage Current with Pulsated DC Components		⚠	DC Motors, SMPS, Variable Speed Drives
Devices with interference filters for EMC Compliance	⚠		Computers, Printers, X Ray Machines, Medical Equipment
Lighting Surges	⚠		Natural Lighting
Switching Surges	⚠		Motors, Transformers, Neon Lights

50 HZ leakage current and trips. In summary, electrical disturbance in power supply interferes with the operation of RCCBs connected to network. These disturbances have following effects on the working of RCDs:

Nuisance Tripping

- RCCB may trip without a genuine earth leakage.
- Continuity of supply is affected, though no compromise in people's safety.

Blinding

- RCCB may not trip on a genuine earth leakage
- People's safety is no longer guaranteed In both above cases, either continuity of supply or people's safety is compromised which is not desirable.

Hi RCCB which can withstand the disturbances which causes nuisance tripping or blinding in normal (Class AC & Class A) RCCBs.

Hi RCCBs have following design features which make it superior than Class A or AC RCCBs for electrically disturbed networks:

- Specially designed torrid which solves the problem of non-activation of relay in case of leakage of pulsated DC current.
- Electronic filter circuits for treatment of tripping signals to improve the performance compared to standard RCCBs.
- Improved tripping band of 80 - 100% of rated sensitivity which is much narrower than a normal class AC RCCBs (50-100%).

Hi (High Immunity) RCCBs provides reliable earth leakage protection in electrically disturbed networks (electrical networks having pulsated DC components, harmonics and switching transients).

Comparison of Hi RCCBs with Class A & Class AC RCCBs generally available

Table 1 shows the comparison between Class AC, Class A and Hi RCCBs.

RCCB Type	Suitable for Electrical Networks with		
	Pulsated DC Current	Harmonics	Switching Surges
Class AC RCCB	No	No	No
Class A RCCB	Yes	No	No
Hi RCCB	Yes	Yes	Yes

Class A RCCB may not work satisfactorily in electrical networks disturbed by harmonics & switching transients and may give nuisance tripping.

Hi (High Immunity) RCCBs are suitable for earth leakage protection in electrically disturbed networks (electrical networks having pulsated DC components, harmonics & switching transients).

Hi RCCBs employs special filter circuits to avoid "nuisance tripping" (tripping without any genuine fault) and ensure tripping on genuine earth faults (avoids blinding).

Various disturbances causing nuisance tripping or blinding

Table 2 shows the common loads in commercial and industrial application which generate pulsated DC components or harmonics. 



Huzefa Poonawala

Head Marketing
Hager Electro Pvt. Ltd.



Bringing **POWER** to India's Electrical Installations

Customer Support
 India Service Center
 IEC Safe Products
 Local Fulfillment



KYORITSU
Quality and reliability is our tradition



NEW PRODUCTS

World fastest measurement speed (0.5 sec.)
 PI BAR USB
Low Voltage 1kV Insulation Tester
 KEW 3552BT

World's fastest 200ms interval for leakage current measurement
Unprecedented for Logger!
 KEW 5050

KYORITSU OFFER

let us know you & Get! Exciting Gift!
 Visit URL & fill form
www.kew-ltd.co.in/kco

Multimeters | Clamp Meters | Insulation Testers | Earth Testers | Loop/PSC/RCD Testers | Portable Appliance Tester | Multi Function Testers | Power Meters | Loggers | Sensors

MEET US AT

MACHMA EXPO-2018
 Ludhiana | stall no : A13

WIRELESS EXPO
 Vizag | Stall no : A15

GULF POWER 2018
 Ahmedabad | Stall no : 10

FECON ELECTRICITY EXPO
 Aurangabad | Stall no : 25

Elektrotec 2019
 Coimbatore | Stall no: B160

dis tribu ELEC
 India's only Exhibition on Hi-Tech Power Distribution
 Mumbai | Stall no : H4C43

India Service Centre
 write to: service@kew-india.co.in

KYORITSU
Quality and reliability is our tradition
Kyoritsu KEW India Instruments Pvt. Ltd.
info.ei@kew-india.co.in www.kew-ltd.co.in

TRINITY TOUCH

Product Program



Interface Modules



TRISOLAR



Analog Timers

Flexible Conduits

The Power in Cable Management

- Non-Metallic Conduits & Fittings
- Metallic Conduits & Fittings



Cable Glands

- Nickel Plated Brass-Normal
- Nickel Plated Brass-EMC
- Polyamide



With Wide Clamping Range



Product Program



Wiring Ducts



DIN Rails



TRIBOX



TRIMAT

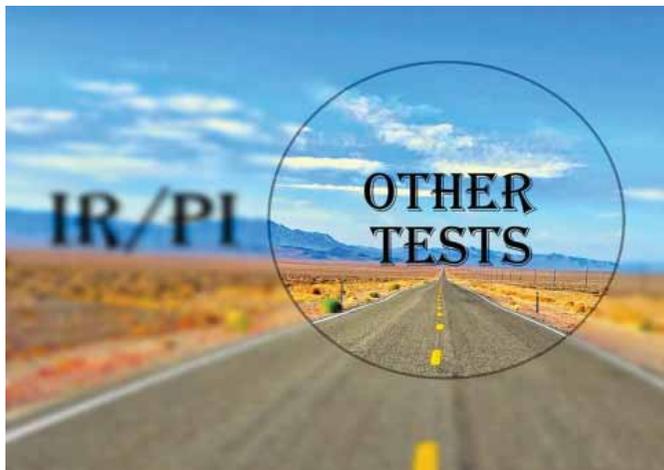
SIMPLY SOLUTIONS

Trinity Touch Pvt. Ltd.
www.trinitytouch.com

Corporate Office
 Delhi: D-10, Defence Colony, New Delhi 110024 India
 Tel: +91.11.71200900 Fax: +91.11.71200998
 E-mail: ms@trinitytouch.com

Looking Beyond IR-PI Tests for Stator Insulation

Insulation Resistance and Polarisation Index has been around since 1970 or earlier. It is most practised diagnostic or troubleshooting test. However, is it still relevant today?



Insulation Resistance (IR) is a measure of quality of the insulation – resistance offered to flow of current through it. So, $IR = V/I$ as measured directly by a Mega-ohmmeter (not multimeter). However, insulation has capacitance and resistive model, by virtue of which, the leakage current is not a steady value. It comprises of conduction current, absorption current, capacitive current (see Graph: Charging Current Components), which causes total current to drop in non-linear fashion, as time progresses. This implies that IR values increase as we continue to charge with steady DC voltage.

The measurement value after 1 min, and corrected to 40°C, has been accepted worldwide as the IR value.

This resistance offered by insulation depends upon geometry - length of path and cross-section area and/or its property (volume resistivity - $\rho l/A$). So, any change in these properties, will affect the IR. For instance, mechanical damage that can cause cracks or pores and expose the insulation to impurities like moisture ingress through such cracks. Other reason could be chemical damage/corrosion or maybe temperature that causes the material to change its structure. It can also be comprehended that such

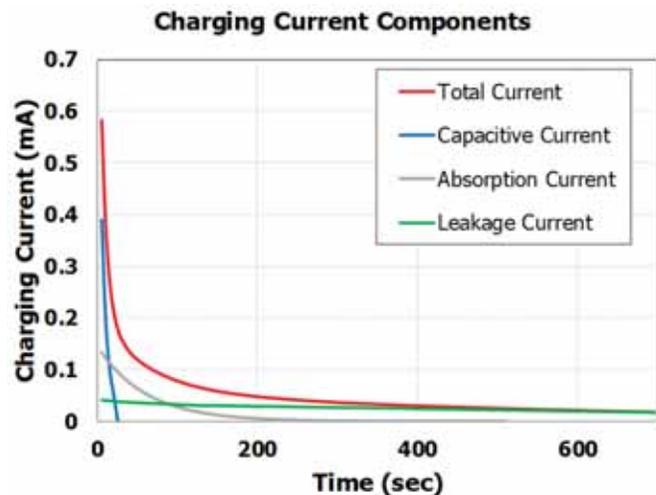
changes could be gradual and take a long period of time e.g. change in structure due to temperature. Such changes will only worsen as time progresses (irreversible harm). Low IR can also be due to sudden phenomena, viz., insulation being cut (irreversible harm) or flood water (reversible).

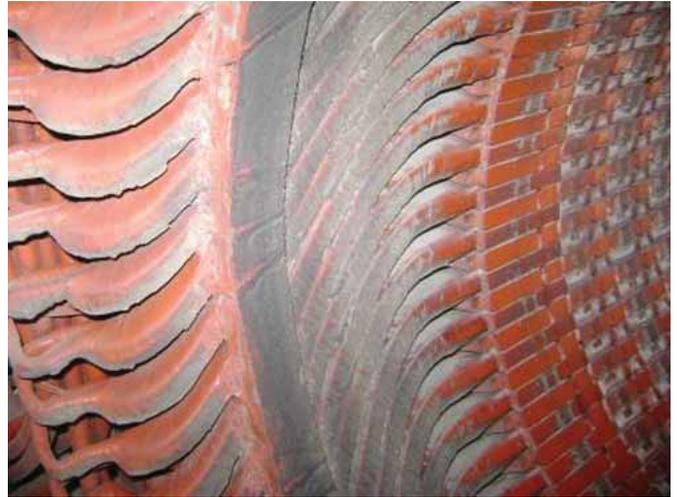
The above rationale has rendered $IR = 0$ MOhm, as an easy troubleshooting tool to determine whether an insulation has flashed (phase to earth fault).

Similarly, Polarisation Index $PI = IR_{10\text{ min}} / IR_{1\text{ min}}$, is a measure of how the IR value varies with time. If there is excessive contamination or high amount of moisture, the conductance current and leakage currents (especially along surface of stator overhangs) are expected to be high. This implies that the IR value, for wet (contaminated) insulation will be low (little rise) with time, as compared to a dry insulation system (significant rise). So, for dry system $PI > 2$ which is acceptable limit as per IEEE 43:2013, whereas for a wet system $PI < 2$, which is not acceptable.

So why should we look beyond IR-PI?

Removal of humidity or moisture often results in





Dry carbonised dust along stator

reduction in conductance and surface leakage currents, which causes PI values to improve. Maintenance managers are seen to be so passionate about this test that they have subjected a good insulation system to excessive heating, simply because PI values were less than 2.

Remember, leakage current in an insulation will actually increase, if the electrons gain sufficient energy to jump the valence gap and break covalent bonds. So, IR will actually start decreasing due to increase in temperature. Some of these effects could also be irreversible in nature.

The standard IEEE 43 clearly states that

1. PI value should not be referred to as a parameter of significance when $IR > 5 \text{ GOhm}$. Yet many overhauling vendors/maintenance employees have been penalised for not being able to improve the PI values > 2 , even when IR values exceed 10 GOhm.
2. PI is not applicable for machines where the copper is exposed to atmosphere (eg. Dc armatures, LT motors/exciters that have enamel coated round wire conductors, turbo-rotors of large alternators etc.)

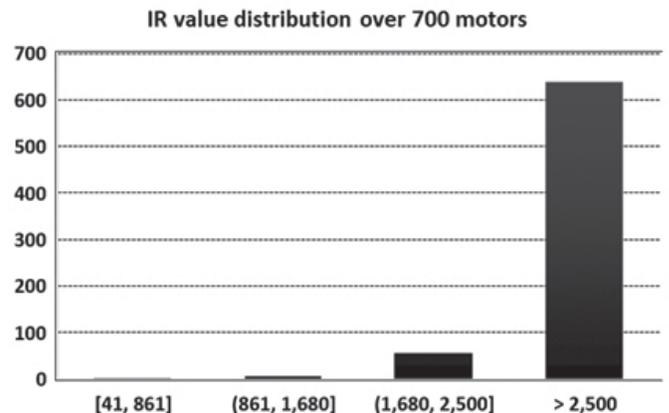
How do you interpret IR values? If your technician reports that the IR value is 3000 MOhm (say nearly similar for each phase), do you refer to IEEE 43:2013 table of acceptable values and since $IR \gg 100 \text{ MOhm}$, conclude that the stator is in good condition. Add to that $PI > 2$, so perfect! Well, it may come as a rude shock that this is the most incorrect way to analyse results. Just check the below case:

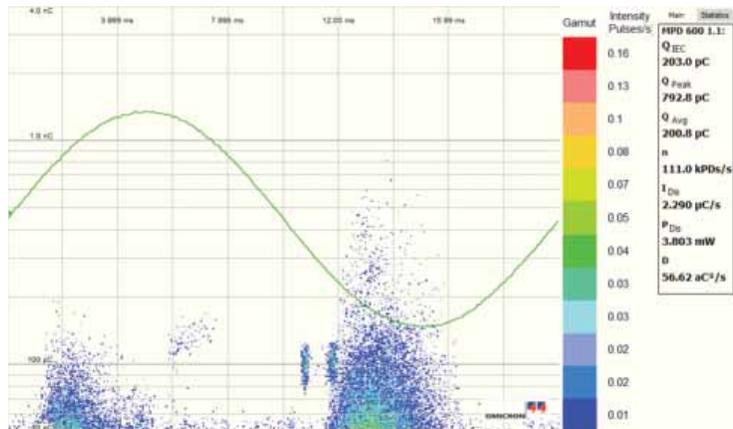
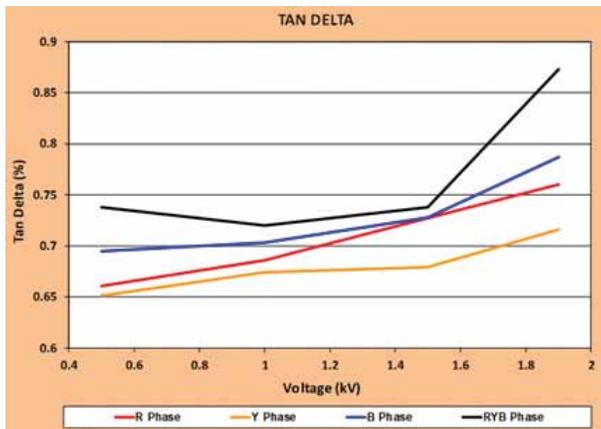
6034 hp, 6000 V, 502 A, 1481 rpm, Class F insulation

system, 2,000 manufactured Boiler Feed Pump motor. Test Voltage: 2500 V Values are corrected to 40°C

Phase	IR 1min (MΩ)	IR 10min (MΩ)	PI
U	2840	13600	4.79
V	2900	14000	4.83
W	3500	16500	4.71
UVW	1140	5570	4.89

IR and PI tests were primarily developed at a time when Class B thermoplastic insulation like bitumen was largely used. These were hygroscopic and would absorb moisture leading to great degradation. Subsequently, insulation material technology has improved greatly to modern day epoxy-mica resin-based Class F thermosetting system, further enhanced by processes like VPI. In this system, conductance current=0. They are non-hygroscopic. Below is statistical distribution of IR values of 700 motors sampled over last few years. The modern-day insulation yields IR values $> 1 \text{ GOhm}$. In fact, in most cases above 10 GOhm. One cannot expect these values to drop to 100 MOhm before ringing any





alarm. A more appropriate method is to maintain log of IR values (from such spot tests) and trend them.

So what tests should one look at?

A) To start with many agencies are now looking at discharge currents. This discharging current or the re-absorption current is measured. Such a current is independent of surface leakage current

- a. **Dielectric Discharge (DD) Test:** This is a test introduced by Megger. The DD or dielectric discharge is the value of this discharging current after 1 min divided by the product of applied voltage (during charging for 30 min) and capacitance of the insulation. Low DD values imply good system. High DD values implies problem with insulation.

- b. **Charge Discharge Test:** This test is offered by Power Electronical and is based on research paper "Dielectric Test Methods for Rotating Machine Stator Insulation Inspection" – R. Goffeaux, B. Comte, B. Fruth, IEEE Transaction, Electrical Insulation and Dielectric Phenomena, Oct. 1998. Annual Report. Conference. The insulation is charged for 15 to 20 minutes (so one can still measure IR/PI values) and then discharged through known external resistor. Discharging current (or depolarisation current) curve with time is then subjected to non-linear regression to get back the parameters (a₁, a₂, a₃, τ₁, τ₂, τ₃ in equation below) that helps to derive the insulation model.

$$I_{\text{depol}} = I_0 + a_1 \cdot e^{-(t/\tau_1)} + a_2 \cdot e^{-(t/\tau_2)} + a_3 \cdot e^{-(t/\tau_3)}$$

These are then used to determine

- **Conduction Index (CI):** Defines the global state of insulation and insulation condition linked to slow polarisation mechanisms

- **Ageing Factor (A):** This determines the general ageing/degradation
- **Normalised Discharge Resistance (RCdch)** – defined by IEEE 43, lower than 2000 values signifies lack of curing, thermal ageing, moisture absorption in bulk wall of insulation.

This method is similar to the PDC technique used for transformer monitoring or IRC (Isothermal Relaxation Current) technique used in cable testing.

- B) To also look actively into ac tests that give more insights into insulation, which the dc test like IR/PI will not give. These include
 - a. Tan Delta and Capacitance Test (IEEE 286:2000 or upcoming IEC 60034-27-3)
 - b. Partial Discharge Test using PRPD analysis. (IEC 60270, IEC 60034-27)

These tests can be used in conjunction with IR and PI to give a much more insightful analysis. For example, the extent of air-spaces in insulation volume (through tip-up in tan delta and capacitance variation with voltage rise), the condition of resin cure, delamination between tape layers, looseness of coils in slots, presence of partial discharge – its characteristic, severity, location and potential to damage the insulation, aging status besides a more reliable assessment of contamination and moisture.

Such, holistic approach is any time better than relying on just two parameters (IR and PI), especially when it empowers decision makers with a more credible data to take important decisions on whether to continue running the motor for next 'n' years or to plan for overhauling. This in turn helps in better budget planning and avoiding costly unplanned downtimes.

Ameet Choughule, Power Electronical, Nashik

TwinCAT IoT Communicator

The TwinCAT IoT Communicator makes it easy for PLCs to communicate with mobile devices by connecting the TwinCAT controller directly and securely to a messaging service through TLS encryption. For smartphone and tablet users, the associated IoT Communicator App ensures that process data can be represented on all mobile devices in a clear overview. Alarms are sent to the device as push messages.

The TwinCAT 3 IoT Communicator exchanges data using a publish/subscribe mechanism. Since no special firewall settings are needed, integration into an existing IT network is easy. Information is exchanged via a message broker that uses the standardised MQTT protocol and acts as a central messaging service in a cloud or local network. A



The TwinCAT IoT Communicator software and the IoT Communicator App provide convenient and secure access to process data via mobile end devices.

high level of communication security is guaranteed by proven TLS encryption (up to version 1.2).

Transmitted process data can be displayed on mobile devices using the IoT Communicator App, which is available for both Android and iOS operating systems. The IoT Communicator App also incorporates an integrated QR code scanner to facilitate entry of

access data for communication between the broker and individual users. The TwinCAT IoT Communicator simplifies the transmission of push messages. It offers a number of advantages over conventional e-mail and SMS messages by visualizing live data, variables and status values. This makes the IoT Communicator an ideal addition to the related TwinCAT IoT and TwinCAT Analytics software products.

For more details, visit: www.beckhoff.com

CITIZEN METALLOYS LTD.

An ISO 9001:2015, ISO 14001:2015 & BS OHSAS 18001 Company
Govt. Recg. Star Export House



www.citizenmetalloys.com



COPPER COMPONENTS

COPPER FLAT / BUS BARS

Cross Section area upto 5000 sq.mm.

COPPER ROD - (Round, Square, Hexagon)

Size: Diameter 3 mm to 115 mm

COPPER PROFILE / SECTIONS

Wide range of profiles & sections developed like J,C,L,Z sections etc. and also can develop as per customer requirements.



Processes :

Cutting, Punching, Bending, Plating, Coating, Sleeving, Turning, Tapping, Twisting, Milling, Drilling, Stud Fixing, Forging, Forming, Ultrasonic Welding and specialized in Cold Forming.

Manufacturer of
**World Class Quality,
Oxygen Free**
**& ETP Grade
High Conductivity
Copper**

EXPORTS TO 40+ COUNTRIES

“AWARDED FOR
EXPORT EXCELLENCE -
STAR PERFORMER
FOR FIVE CONSECUTIVE YEARS
FROM EEPIC”

Registered Office:

808, Sukh Sagar Complex, Nr. Hotel Fortune Landmark, Usmanpura, Ahmedabad - 380 013, Gujarat, INDIA.

Tel: +91 79 2755 0272 | 2755 0227 | e-mail: info@citizenmetalloys.com | sales@citizenmetalloys.com

www.citizenmetalloys.com



Kyoritsu launches new insulation testers

Kyoritsu launches 1KV Insulation testers with PI/DAR + Bluetooth/Memory. In our endeavour to provide the best in measurement,



Kyoritsu has following three models available.

- KEW3551: Standard model
- KEW3552: With memory function
- KEW3552BT: With memory and Bluetooth communication functions

Key features of KEW 3552 BT:

- World's fastest measurement speed (0.5 sec.)
- Resistance test (50/100/125/250/500/1000 V) Six ranges available for insulation
- Insulation measurement up to 40GΩ
- Diagnostic Insulation Test: PI, DAR

Other Features of 3552:

- Short-circuit current upto 1.5mA
- Continuity test available 40.00/400.0/4000Ω
- It comes Standard with a carry case and test

leads with remote control switch.

- Large display with bar graph indication and backlight
- Live voltage warning
- Safety standard IEC61010 CATIII 600V/CAT IV 300V IEC61557-1,2,4
- EMC standard: IEC61326-1,-2-2 IEC60529
- IP 40
- Bluetooth communication function available on (KEW 3552BT)
- Memory function available (Kew 3552/3552BT)
- Clock available on (Kew 3552/3552BT)
- Auto power off
- Automatically discharges electric charges stored in capacitive circuit when measurement is finished.
- Voltage measurement AC /DC auto detection.
- Zero Ω adjustment function
- With elapsed time display
- Illuminance sensor Detect ambient brightness and automatically turn on off light.
- Hold Function available
- Low battery indication

For more details, Email: info.ei@kew-india.co.in

KUSAM-MECO Digital High Voltage Insulation Tester

KUSAM-MECO has introduced a new digital high voltage insulation resistance tester with polarisation index and dielectric absorption ratio having output voltage range from 500V ~ 10KV; Model KM 6213A IN.

The KM 6213A IN has new added features with a low consumption high performance processor. It displays results much faster and has more advanced features. It has automatic polarization index and dielectric absorption ratio calculations.

Results are displayed on the high contrast LCD. It's convenient mounting angle makes it more readable for most users, in diverse working conditions. It has large LCD display with timer. It can stop the test automatically and switch the tester off automatically. It has very low power consumption. It has colour coded terminals and test leads.

The KM 6213A IN is portable, tough and rugged and can sustain industrial environment handling, it



can test at voltage from as low as 500V upto as high as 10000V, adjustable with a 500V step. This insulation tester is lightweight, robust and compact size. It has auto-stop, EnerSave and is a non-destructive tester.

It is used to test insulation resistance on Ceramic insulators, between Busbars, open circuit of contactors connections, insulating materials. It is mainly used for periodic measurements to ensure that user and equipment are safe.

The new PI and DAR features are useful to schedule maintenance. The user keeps records of the PI and DAR results and can analyse these results over time.

It operates on 8 x C size 1.5V alkaline battery. It indicates low battery while in use. It has auto-off function which increases life of battery. Weight is approximately 3.6 kgs. It is supplied with test leads and operator's manual.

For more details, visit: www.kusam-meco.co.in

“Limiting global warming to 1.5°C is not an impossible task”



Picture Courtesy: www.pixabay.com

Limiting global warming to 1.5-degree C is not an impossible task, but would need global greenhouse gas emission to fall by about 45 per cent from 2010 levels by 2030, reaching 'net zero' around 2050, reveals a new report by the Intergovernmental Panel on Climate Change (IPCC).

“Limiting warming to 1.5-degree C is possible within the laws of chemistry and physics but doing so would require unprecedented changes,” said Jim Skea, Co-Chair of IPCC Working Group III. IPCC is the leading world body for assessing the science related to climate change, its impacts and potential future risks, and possible response options.

With clear benefits to people and natural ecosystems, limiting global warming to 1.5-degree C compared to 2-degree C could go hand in hand with ensuring a more sustainable and equitable society,



Limiting global warming to 1.5-degree C compared with 2-degree C would reduce challenging impacts on ecosystems, human health and well-being, making it easier to achieve the United Nations Sustainable Development Goals.

Priyadarshi Shukla, Co-Chair of IPCC Working Group III.

the Special Report on Global Warming of 1.5-degree C by the IPCC released recently in Incheon, Korea said.

Ninety-one authors and review editors from 40 countries prepared the IPCC report in response to an invitation from the United Nations Framework Convention on Climate Change (UNFCCC) when it adopted the Paris Agreement in 2015.

“With more than 6,000 scientific references cited and the dedicated contribution of thousands of expert and government reviewers worldwide, this important report testifies to the breadth and policy relevance of the IPCC,” said Hoesung Lee, Chair of the IPCC.

Panmao Zhai, Co-Chair of IPCC Working Group I stated: “One of the key messages that comes out very strongly from this report is that we are already seeing the consequences of 1-degree C of global warming through more extreme weather, rising sea levels and diminishing Arctic sea ice, among other changes.”

The report highlights a number of climate change impacts that could be avoided by limiting global warming to 1.5-degree C compared to 2-degree C, or more. For example, by 2100, global sea level rise would be 10 cm lower with global warming of 1.5-degree C compared to 2-degree C. The likelihood of an Arctic Ocean free of sea ice in summer would be once per century with global warming of 1.5-degree C, compared with at least once per decade with 2-degree C. Coral reefs would decline by 70-90 per cent with global warming of 1.5-degree C, whereas virtually all (> 99 per cent) would be lost with 2-degree C.

“Every extra bit of warming matters, especially since warming of 1.5-degree C or higher increases the risk associated with long-lasting or irreversible changes, such as the loss of some ecosystems,” said Hans-Otto Pörtner, Co-Chair of IPCC Working Group II.

Limiting global warming would also give people

and ecosystems more room to adapt and remain below relevant risk thresholds, added Pörtner. The report also examines pathways available to limit warming to 1.5-degree C, what it would take to achieve them and what the consequences could be. "The good news is that some of the kinds of actions that would be needed to limit global warming to 1.5-degree C are already underway around the world, but they would need to accelerate," said Valerie Masson-Delmotte, Co-Chair of Working Group I.

The report said that allowing the global temperature to temporarily exceed or 'overshoot' 1.5-degree C would mean a greater reliance on techniques that remove CO2 from the air to return global temperature to below 1.5-degree C by 2100. The effectiveness of such techniques is unproven at large scale and some may carry significant risks for sustainable development, the report notes.

"Limiting global warming to 1.5-degree C compared with 2-degree C would reduce challenging impacts on ecosystems, human health and well-being, making it easier to achieve the United Nations Sustainable Development Goals," said Priyadarshi Shukla, Co-Chair of IPCC Working Group III.

The decisions we make today are critical in ensuring a safe and sustainable world for everyone, both now and in the future, said Debra Roberts, Co-Chair of IPCC Working Group II. "This report gives policymakers and practitioners the information they need to make decisions that tackle climate change while considering local context and people's needs. The next few years are probably the most important in our history," she said.



With more than 6,000 scientific references cited and the dedicated contribution of thousands of expert and government reviewers worldwide, this important report testifies to the breadth and policy relevance of the IPCC. **Hoesung Lee**, Chair of the IPCC.

The report was prepared under the scientific leadership of all three IPCC working groups. Working Group I assesses the physical science basis of climate change; Working Group II addresses impacts, adaptation and vulnerability; and Working Group III deals with the mitigation of climate change.

The Paris Agreement adopted by 195 nations at the 21st Conference of the Parties to the UNFCCC in December 2015 included the aim of strengthening the global response to the threat of climate change by "holding the increase in the global average temperature to well below 2-degree C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5-degree C above pre-industrial levels."

As part of the decision to adopt the Paris Agreement, the IPCC was invited to produce, in 2018, a Special Report on global warming of 1.5-degree C above pre-industrial levels and related global greenhouse gas emission pathways. The IPCC accepted the invitation, adding that the Special Report would look at these issues in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty.

Global Warming of 1.5-degree C is the first in a series of Special Reports to be produced in the IPCC's Sixth Assessment Cycle. Next year the IPCC will release the Special Report on the Ocean and Cryosphere in a Changing Climate, and Climate Change and Land, which looks at how climate change affects land use.

The Summary for Policymakers (SPM) presents the key findings of the Special Report, based on the assessment of the available scientific, technical and socio-economic literature relevant to global warming of 1.5-degree C.

The report would be a key scientific input into the Katowice Climate Change Conference in Poland in December, when governments review the Paris Agreement to tackle climate change. 

(Source: IPCC)



Key Highlights

Global warming should be limited to 1.5C rather than 2C to ensure the impacts of climate change.

By 2100, global sea level rise would be 10 cm lower with global warming of 1.5C compared to 2C

Coral reefs would decline by 70-90% with warming of 1.5C, compared to more than 99% with 2C.

To limit warming to 1.5C, net emissions of carbon dioxide would need to fall by about 45% from 2010 levels by 2030, reaching "net zero" around 2050.

TwinCAT IoT Communicator

The TwinCAT IoT Communicator makes it easy for PLCs to communicate with mobile devices by connecting the TwinCAT controller directly and securely to a messaging service through TLS encryption. For smartphone and tablet users, the associated IoT Communicator App ensures that process data can be represented on all mobile devices in a clear overview. Alarms are sent to the device as push messages.

The TwinCAT 3 IoT Communicator exchanges data using a publish/subscribe mechanism. Since no special firewall settings are needed, integration into an existing IT network is easy. Information is exchanged via a message broker that uses the standardised MQTT protocol and acts as a central messaging service in a cloud or local network. A



The TwinCAT IoT Communicator software and the IoT Communicator App provide convenient and secure access to process data via mobile end devices.

high level of communication security is guaranteed by proven TLS encryption (up to version 1.2).

Transmitted process data can be displayed on mobile devices using the IoT Communicator App, which is available for both Android and iOS operating systems. The IoT Communicator App also incorporates an integrated QR code scanner to facilitate entry of

access data for communication between the broker and individual users. The TwinCAT IoT Communicator simplifies the transmission of push messages. It offers a number of advantages over conventional e-mail and SMS messages by visualizing live data, variables and status values. This makes the IoT Communicator an ideal addition to the related TwinCAT IoT and TwinCAT Analytics software products.

For more details, visit: www.beckhoff.com

CITIZEN METALLOYS LTD.

An ISO 9001:2015, ISO 14001:2015 & BS OHSAS 18001 Company
Govt. Recg. Star Export House



www.citizenmetalloys.com



COPPER COMPONENTS

COPPER FLAT / BUS BARS

Cross Section area upto 5000 sq.mm.

COPPER ROD - (Round, Square, Hexagon)

Size: Diameter 3 mm to 115 mm

COPPER PROFILE / SECTIONS

Wide range of profiles & sections developed like J,C,L,Z sections etc. and also can develop as per customer requirements.



Processes :

Cutting, Punching, Bending, Plating, Coating, Sleeving, Turning, Tapping, Twisting, Milling, Drilling, Stud Fixing, Forging, Forming, Ultrasonic Welding and specialized in Cold Forming.

Manufacturer of
**World Class Quality,
Oxygen Free
& ETP Grade
High Conductivity
Copper**

EXPORTS TO 40+ COUNTRIES

“AWARDED FOR
EXPORT EXCELLENCE -
STAR PERFORMER
FOR FIVE CONSECUTIVE YEARS
FROM EEPIC”

Registered Office:

808, Sukh Sagar Complex, Nr. Hotel Fortune Landmark, Usmanpura, Ahmedabad - 380 013, Gujarat, INDIA.

Tel: +91 79 2755 0272 | 2755 0227 | e-mail: info@citizenmetalloys.com | sales@citizenmetalloys.com

www.citizenmetalloys.com



Kyoritsu launches new insulation testers

Kyoritsu launches 1KV Insulation testers with PI/DAR + Bluetooth/Memory. In our endeavour to provide the best in measurement,



Kyoritsu has following three models available.

- KEW3551: Standard model
- KEW3552: With memory function
- KEW3552BT: With memory and Bluetooth communication functions

Key features of KEW 3552 BT:

- World's fastest measurement speed (0.5 sec.)
- Resistance test (50/100/125/250/500/1000 V) Six ranges available for insulation
- Insulation measurement up to 40GΩ
- Diagnostic Insulation Test: PI, DAR

Other Features of 3552:

- Short-circuit current upto 1.5mA
- Continuity test available 40.00/400.0/4000Ω
- It comes Standard with a carry case and test

leads with remote control switch.

- Large display with bar graph indication and backlight
- Live voltage warning
- Safety standard IEC61010 CATIII 600V/CAT IV 300V IEC61557-1,2,4
- EMC standard: IEC61326-1,-2-2 IEC60529
- IP 40
- Bluetooth communication function available on (KEW 3552BT)
- Memory function available (Kew 3552/3552BT)
- Clock available on (Kew 3552/3552BT)
- Auto power off
- Automatically discharges electric charges stored in capacitive circuit when measurement is finished.
- Voltage measurement AC /DC auto detection.
- Zero Ω adjustment function
- With elapsed time display
- Illuminance sensor Detect ambient brightness and automatically turn on off light.
- Hold Function available
- Low battery indication

For more details, Email: info.ei@kew-india.co.in

KUSAM-MECO Digital High Voltage Insulation Tester

KUSAM-MECO has introduced a new digital high voltage insulation resistance tester with polarisation index and dielectric absorption ratio having output voltage range from 500V ~ 10KV; Model KM 6213A IN.

The KM 6213A IN has new added features with a low consumption high performance processor. It displays results much faster and has more advanced features. It has automatic polarization index and dielectric absorption ratio calculations.

Results are displayed on the high contrast LCD. It's convenient mounting angle makes it more readable for most users, in diverse working conditions. It has large LCD display with timer. It can stop the test automatically and switch the tester off automatically. It has very low power consumption. It has colour coded terminals and test leads.

The KM 6213A IN is portable, tough and rugged and can sustain industrial environment handling, it



can test at voltage from as low as 500V upto as high as 10000V, adjustable with a 500V step. This insulation tester is lightweight, robust and compact size. It has auto-stop, EnerSave and is a non-destructive tester.

It is used to test insulation resistance on Ceramic insulators, between Busbars, open circuit of contactors connections, insulating materials. It is mainly used for periodic measurements to ensure that user and equipment are safe.

The new PI and DAR features are useful to schedule maintenance. The user keeps records of the PI and DAR results and can analyse these results over time.

It operates on 8 x C size 1.5V alkaline battery. It indicates low battery while in use. It has auto-off function which increases life of battery. Weight is approximately 3.6 kgs. It is supplied with test leads and operator's manual.

For more details, visit: www.kusam-meco.co.in

Since 1961
Electrical India
 India's oldest magazine on power and electrical products industry
 invites you to our stall at

Third Edition
distribUELEC
 India's only Exhibition on Hi-Tech Power Distribution
4-6 February 2019
 Bombay Exhibition Centre, Goregaon East, Mumbai

Your presence will surely be of great pleasure to us ...



REDUCE FAILURE RATE OF ELECTRICAL EQUIPMENTS

&

SAVE ENERGY

by installing
JINDAL'S INDUSTRIAL ROBOT AUTOMATIC VOLTAGE CONTROLLER
 A breakthrough in energy conservation

5 Years Guarantee



CAPACITY : 30 TO 100 KVA CAPACITY : 150 TO 3000 KVA

GENERAL TREND OF VOLTAGE DURING DAY TIME

09:00 HRS - 12:00 HRS	12:00 HRS - 14:00 HRS	14:00 HRS - 18:00 HRS	18:00 HRS - 22:00 HRS	22:00 HRS - 00:00 HRS	00:00 HRS - 05:00 HRS
340V-400V	400V-440V	390V-400V	400V-430V	400V-470V	400V-450V
Lunch Hours	Lunch Hours	Peak Hours Restriction	Peak Hours Restriction		

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

JINDAL ELECTRIC & MACHINERY CORPORATION
 C-57, Focal Point, Ludhiana (India) Tel : +91-161-2670250, 2676890, 2676968 Mobile : 98140 84948, 98142 28100
 E-mail : jeme@jindalelectric.com Website : www.jindalelectric.com

Company Name	Page No.
Allied Power Solutions	17
Apar Industries Ltd. (Unit: Uniflex Cables)	47
Bry Air (Asia) Pvt. Ltd.	7
Calter Ltd_STI Industries	69
China Machinex India 2018	13
Citizen Metalloys Ltd.	85
DEIF India Pvt. Ltd.	15
Dynamic Cables Pvt. Ltd.	45
EPCOS AG	33
Electrical Research & Development Association	51
Esannar Transformers Pvt. Ltd.	30, 31
Flir Systems India Pvt. Ltd.	29
Frontier Technologies Pvt. Ltd.	63
Gujarat Energy Development Agency	71
Hager Electro Pvt. Ltd.	3
Hammond Power Solutions Inc.	27
Havells India Ltd.	19, 21, 23
IEEMA (DistribUElec)	9
igus India Pvt. Ltd.	55
InPhase Power Technologies Pvt. Ltd.	BC
InterSolar 2018	50
ISA Advance Instruments (I) Pvt. Ltd.	41
Jayashree Electron Pvt. Ltd.	65
Jindal Electric & Machineries Corp.	89
Kyoritsu Kew India Instruments Pvt. Ltd.	81
Larsen & Toubro Ltd.	IFC, 67
M&I India Materials India Pvt. Ltd.	5
Nextgen Equipment Pvt. Ltd.	90
Omicron Energy Solutions Pvt. Ltd.	IBC
Pepperl+Fuchs (India) Pvt. Ltd.	37
Ramelex Pvt. Ltd.	43
Reliable Power Systems	61
Riello Power India Pvt. Ltd.	11
Sonya Insulators	89
Sturdy Volt (P) Ltd.	25
Suresh Enterprises	61
Trinity Touch Pvt. Ltd.	81
WAGO Pvt. Ltd.	77

Sonya INSULATORS
 SINCE-1960

Manufacturer of Technical / Industrial Ceramics
 711, Anil Road, Ahmedabad-380 025. (India)
 E-mail : info@sonyaceramics.com
 Website : www.sonyaceramics.com



Now Exporting to More than **45+** Countries including USA & Europe

Products:

- > Steatite
- > Cordierite
- > Porcelain
- > High Alumina

NEXT GEN
EQUIPMENTS PVT. LTD.

ISO 9001-2015 Certified Company

Electrical Test & Measuring Solutions

Raytech
SWITZERLAND

M/s Raytech GmbH, Switzerland

Mis Epro Gallsbach GmbH, Austria
epro

ETL
PRÜFTECHNIK
ETL Prüftechnik, Germany



Digital Micro Ohm Meter



Contact Resistance Meter 200A



Turns Ratio Meter



Winding Resistance Meter



Current Transformer Tester



Standard CT



Automatic Transformer Test System



Cast Resin Standard PT



Battery Analyzer



75 KV AC High Voltage Test Set



Automatic Portable HV Tester

Our Product Range

- Winding Resistance Meter
- Turns Ratio Meter
- Digital Micro OHM Meter
- Contact Resistance Meter
- Current Transformer Tester
- Standard Current Transformer
- Standard Voltage Transformer
- Transformer Loss Measuring System
- Automatic Transformer Test-System
- Online DGA
- Static Frequency Converter (EPS)
- Mobile EPS
- High Voltage-PD-Filters
- Coupling Capacitor / HV Dividers
- Online PD Test-System
- Oil BDV Test Set
- AC HV Test Set
- AC / DC HV Test Set
- Battery Analyzer

Corporate Office : 35-B, Ashiana Duplex, Tandalja Vaodara - 390012, Gujarat

Ph : +91 9979888269, +91 9374904404, +91 9811004404 E-mail : info@ngepl.com Website : www.ngepl.com



The lightest protection test set and calibrator

Our 3-phase test set **CMC 430** is the newest member of the CMC family and combines its outstanding performance as a relay tester and calibrator with hybrid measurement and recording facilities. Its lightweight and rugged design ensures excellent portability. Appropriate software tools also allow numerous applications from quick manual testing to distributed scheme tests which makes the CMC 430 a highly flexible solution.

Discover our new CMC family member.

www.omicronenergy.com/newCMC430

OMICRON 

RNI No.: 6226/1961 • Licence to post without prepayment
WPP Licence No. NMR/TECH/WPP-15/NM/2018
Postal Registration No. NMB/183/2018-2020

ASTRA

Active Harmonic Filter
"Best Power Quality Solution"



Multi-level Inverter

Filtering Upto 61st Order

High Filtering Efficiency

Made in India

Made for India

- * Available from 380 to 690 Voltage, 30 to 630 Amps * 3-Level Topology * Extremely Efficient * Low Losses *
- * Hybrid Compensation * Handles Floating grid * Auto Voltage Stabilization * Eliminate Grid Resonance *
- * Dual Quad core DSP Processor 4.4 GHz * Inbuilt Cloud Connectivity * Smart Operation Mode *

Applications: Steel, Cement, Textile, Railways, Process, Automotive and other manufacturing Industries

Powerful Performance - Latest Technology - Economical Price

sales@inphase.in
+91 9632421402
www.inphase.in

