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# Publisher's Letter

Vol 56. Issue No. 5 • May 2016

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Editor: P K Chatterjee

Proper selection of Cables & Wires is imperative for reliable and safe functioning of the devices. However, several Indian end-product manufacturers and importers are still indifferent to this very important aspect. Use of poor graded or low capacity cables & wires not only affects smooth functioning of the device but also adds to the worry of the end users owing to increase in risk factors. Many hand held devices like hair dryers or body massagers or even rechargeable flash lights are available with two-pin plugs, which often turn deadly because of improper cabling.

Also, one of the very unsafe practices in the Indian scenario is using two-wire cables for extension sockets offering three-pin facilities. These are manufactured so trickily that it is often difficult to make out the wire type, status and quality as the plug used is a sealed one. When an unaware buyer relies on it believing it to support the earth connection, he/she is often cheated – and at times may even receive electric shocks at high intensity that may be even fatal.

Use of low capacity or quality wires in devices often leads to line heating. First there is burning smell then insulation failure. If the user is careless or unaware of the causes behind the burning smell, he/she is about to pay the price of ignorance or carelessness – and it is quite common in the Indian scenario, where fuse wires are often of higher cross section (which do not blow out as and when required) and circuit breakers are not used considering economy.

Thus, mere rules or specifications are not enough. Considering users' safety all our electrical devices for home use are supposed to be stringently inspected for their current carrying wires' capability and quality. Sudden checks at retail points will also create a force on the device manufacturers.

Do send in your comments at [miyer@charypublications.in](mailto:miyer@charypublications.in)

*Mahadevan*



Mahadevan Iyer

“  
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”

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





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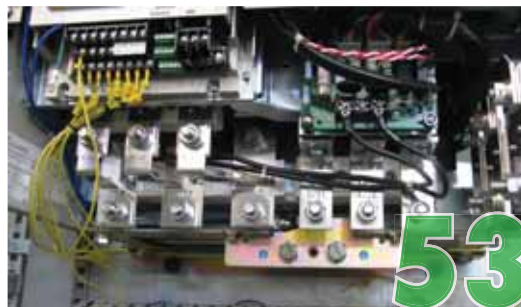


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P K Chatterjee (PK)

“  
*Ceres Power Holdings PLC is manufacturing fuel cells 10 times faster than before, and the company is targeting at reaching fuel cells at every home and business...*”

## Fuel Cells Are Soon Coming To Homes Are On Card

Although of late, stress on rapid development of renewable energy fields – has to a great extent made them surpass the rate of progress of the fuel cell technology, the latter area is also showing quotable improvements. For example, as per the information from the Government of UK; Ceres Power Holdings PLC, the developer of an innovative fuel cell and a globally known player for low cost, next generation fuel cell technology that is used in decentralised energy products that target at: reducing energy costs, lowering CO<sub>2</sub> emissions, increasing efficiency and improving energy security and reliability; has also made a significant breakthrough in building a high-speed production line to scale up manufacturing, with the help of Innovate UK. The Ceres Power Steel Cell features several layers of ceramic on a steel base. It can convert natural gas into a power supply. The high cost of fuel cells has so far been seen as a barrier to their commercialisation. However, the high-speed print line, developed with screen printing business ASM Alternative Energy (ASM AE) – in a project supported by Innovate UK, is breaking new ground.

In the words of James Falla, Chief Operating Officer, Ceres Power, “Fuel cells have been seen as not commercially viable. What our work with ASM AE and Innovate UK has done is – enable us to prove that this technology can be mass manufactured. We can produce at high volume and low cost. Our technology cuts costs and emissions and improves efficiency and reliability. Our vision is for a fuel cell in every home and business.”

The new production line is helping the company in manufacturing its fuel cell at a speed 10 times faster than before. The arrival of cheaper fuel cell technology means power can be generated more efficiently by a business or a home at the local point of use. This means more affordable power for customers, lower emissions and better reliability. Ceres Power has already signed a joint development agreement with Honda to develop fuel cell stacks for a range of power equipment. Talks are on with South Korean boiler manufacturer KD Navien and others. There are other instances too.

Thus, the day is not very far when we are going to use yet another kind of clean energy with its control or management key in our hands.

**Please e-mail me your views at [pkchatterjee@charypublications.in](mailto:pkchatterjee@charypublications.in)**

*P. K. Chatterjee*





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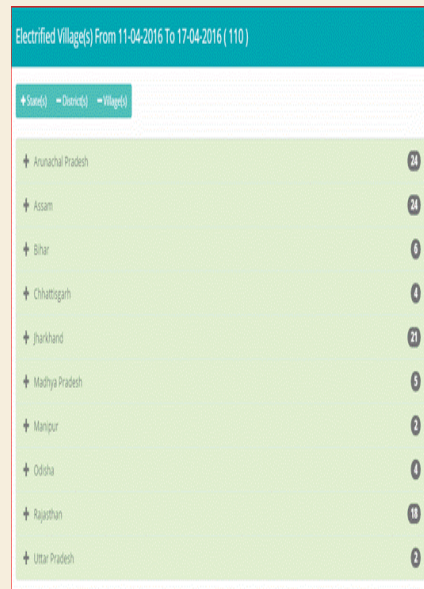
## 110 more villages electrified under Deen Dayal Upadhyaya Yojana

One hundred and ten villages have been electrified across India between April 11 and 17, 2016, under the Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY).

Out of these electrified villages, 24 villages belong to Arunachal Pradesh, 24 in Assam, 21 in Jharkhand, 18 in Rajasthan, 6 in Bihar, 4 in Chhattisgarh, 4 in Odisha, 5 in Madhya Pradesh, 2 in Manipur and 2 in UP.

The Government of India has also decided to electrify the remaining 18,452 non-electrified villages within 1,000 days i.e., by May 1, 2018.

The strategy for electrification consists of squeezing the implementation schedule to 12 months and also dividing the process in 12-stage milestones with defined timelines for monitoring.



So far, 7,343 villages have been electrified. Out of the remaining 10,665 villages due to be electrified, 444 villages are uninhabited. While 7,189 villages will be electrified by the electricity grid, 3,057 villages where grid solutions are out of reach due to geographical barriers will be electrified through off-grid methods, while 419 villages are to be electrified by the respective state governments.

A total of 1,654 villages were electrified between April 2015 and August 2015, while 5,689 additional villages were electrified between August 15, 2015 and April 17, 2016.

Contextually, earlier, Power Minister Piyush Goyal had expressed hope that all the unelectrified villages would be electrified by the end of 2017 and every home would get power by 2018. E1

## NTPC, IIT Kanpur sign MoU for R&D in renewables, automation

State-owned power producer National Thermal Power Corporation (NTPC) has signed a pact with IIT Kanpur for Research and Development (R&D) in areas like renewables, automation and power system engineering.

"NTPC and IIT Kanpur have signed a Memorandum of Understanding (MoU) for research and development in areas of mutual interest like power system engineering, real-time

digital simulations, smart grid, computational sciences, grid connectivity of renewables and micro grids, sensor, robotics and automation in Delhi," according to a company (NTPC) statement.

Joint R&D projects will also be taken up to develop new technologies, processes and products in the field of optimisation as well as efficiency improvements, among others, by the two organisations. The MoU was signed by NTPC-

NETRA Executive Director R K Srivastava and IIT Kanpur, Dean (R&D), Amalendu Chandra.

NTPC had added 2,255 MW capacity in the 2015-16 fiscal, taking its total electricity generation capability to 46,653 MW. The company has set a target of adding 11,900 MW capacity during the current Plan period ending in 2016-17. It is aiming to build generation capacity of 128 GW by 2032, with a lot more emphasis on renewable energy. E1

## Banks, NBFCs support to boost the renewable energy sector

Banks and Non-Banking Financial Companies (NBFCs) sanctioned an amount of Rs 71,201.54 crore to finance renewable energy projects as well as disbursed Rs 29,529.57 crore, against the sanctioned amount since February 2015 (until March 21, 2016), as part of a commitment made by them during RE-INVEST 2015. It may be recalled that during RE-INVEST 2015, 40 major banks and NBFCs, had committed debt funding to renewable energy projects aggregating to more than 78.75 GW for the next five years. Loans sanctioned by these banks and financial institutions for renewable energy projects are 18.63% of commitments made.

Commitments made by banks and NBFCs to finance renewable energy projects, besides agreements with foreign banks and financial institutions to provide low cost, long-term funding are expected to boost the growth of India's renewable energy sector.

The Ministry of New and Renewable Energy had organised its First Renewable Energy Global Investor Meet and Expo (RE-INVEST 2015) from February 15-17, 2015, in New Delhi. RE-INVEST 2015 saw renewable energy capacity commitments of over 283 GW from stakeholders. Further, there was commitment of over 62 GW towards manufacturing of renewable energy equipment in India.

The Ministry of New and Renewable Energy has been receiving monthly status reports on achievements made so far by banks and NBFCs, who had committed to finance bankable renewable energy projects.

The government has set a target to develop 175 GW of renewable energy capacity by 2022. Achieving this target needs a capital outlay of US \$ 160 billion, including equity of US \$ 40 billion. Also, a huge investment is required for transmission and upgradation of infrastructure to utilise power generated through renewable energy sources. As such banks and NBFCs have to play a major role to provide low cost and long-term financing for these projects. E1

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## India finances development of Bhutan's hydro-projects

Indian ambassador to Bhutan Jaideep Sarkar handed over cheques worth Nu 7.7 billion (in Bhutanese currency) to Bhutan's Economic Affairs Minister Lekey Dorji on April 13, to finance hydroelectric projects in the Himalayan kingdom.

Of the total amount, Nu 7.4 billion is for the Mangdechhu Hydroelectric Project Authority and Nu 370 million is for the Punatsangchhu-1 Hydroelectric power project. The economic affairs minister happens to be the chairman of both the hydroelectric

Image Courtesy: Indian Embassy



*Jaideep Sarkar is handing over the cheque to Lekey Dorji...*

power projects. Bhutan's economic affairs minister and the Indian ambassador there – also discussed the progress of ongoing bilateral hydropower projects of Punatsangchhu-1 and Punatsangchhu-2, besides Mangdechhu, which they agreed was satisfactory. They also agreed to work together to ensure that these projects are completed on time. During the last financial year, the Gol released a total of Nu 39.6 billion for the 3 inter-governmental hydropower projects comprising both loans as well as grants.

## Minister to strengthen India-UK collaboration

Union Minister of State (Independent Charge) for Power, Coal, New & Renewable Energy, Piyush Goyal, visited the UK on April 19-20, 2016, to strengthen India-UK collaboration on power and renewable energy. He was accompanied by an official delegation which included the Secretary, Ministry of New and Renewable Energy; Joint Secretary, Ministry of New and Renewable Energy, Director (Technical), IREDA and a nine-member business delegation.

He met officials from UK's Natgrid and the UK Power Network who briefed him about their



functions and capabilities as well as how they could contribute towards enhancing grid stability in India. The minister explained about his plans to increase power generation in India. Goyal discussed enhancing future co-operation between India and UK in the energy sector with Lord Bourne, UK's Minister for Energy and Climate.

He also met Lord Jim O'Neill, Commerce Secretary to the UK Treasury and Nick Hurd, Minister, Department of International Development to discuss about enhancing bilateral relationships in the power sector.

## Indians to get 24x7 affordable and sustainable power by 2019: Piyush Goyal

Union Minister of State (IC) for Coal, Power and New and Renewable Energy Piyush Goyal said that Indians would get 24x7 affordable and sustainable energy by 2019, since Prime Minister Narendra Modi is committed to ensure a better quality of life for every citizen of the country.

"I think this challenge of being able to provide power to every citizen is an opportunity. I am getting fantastic ideas and support from all stakeholders from this sector. Without a challenge people would see affordable, sustainable energy 24x7 by 2019," Goyal said at the India Smart Grid Week 2016 (ISGW) at Manekshaw Centre.

"India is the world's largest market, considering that we are a billion people

looking for a better quality of life. Prime Minister Modi is committed to ensure a better quality of life to every citizen. The poorest of the poor in India should benefit from the technological revolution which the world benefits from," the minister said.

He also added that affordable energy access to every individual in this country is a primary goal which could be achieved with the support of all stakeholders.

Comparing the technological revolution in Sweden with relevance to India, he said that India has the potential to do the same 100 times over.



"With a population of nine million, Sweden is able to do wonders and with a population of 1,200 million which India has, we will do wonders 100 times over," he said

with complete confidence.

India Smart Grid Week (ISGW) 2016 was the second edition of the conference cum exhibition on smart grids and smart cities organised by the India Smart Grid Forum from March 15 to 19. The conference brought together experts in the field of electricity, infotech, communications and smart cities, to discuss challenges as well as opportunities to set up smart grids in India.

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## Siemens Limited starts dispatching GSU transformers to NTPC

Siemens Limited has begun dispatching its largest-ever 'Made in India' single-phase Generator Step-Up (GSU) Transformer of rating 315 MVA, 23.5 kV / 420 kV for installation at National Thermal Power Corporation's (NTPC) Kudgi Super Thermal Power Station in Bijapur district of Karnataka.

Normally, generated voltage is in the range of 11 kV to 24 kV, which is not efficient to transmit power through transmission lines.

Generator Step-Up (GSU) transformer is a special purpose transformer, which is used to step up generator voltage to high voltage (400 to 765 kV), for efficient transmission of generated power to load centres located at long distances. GSU transformers are essential components of



the power station, which once operational, will boost high-capacity power generation for the South Indian states of Karnataka, Andhra Pradesh, Tamil Nadu and Kerala. NTPC has ordered 10 units of these GSU transformers from Siemens.

Dr Harald Griem, Executive Vice President and Head of Energy Management,

Siemens Limited, said, "Siemens Limited has manufactured as well as successfully tested the first single-phase 315 MVA, 420 kV Generator Transformer at its Kalwa factory. The Generator Transformer also successfully underwent short circuit withstand testing in the first attempt, at KEMA Laboratories in the Netherlands, which was also a first for the test lab, in terms of current capacity".

Generator Step-up (GSU) transformers are critical links between generating power stations and transmission networks, often operated day and night at full load.

They function as two-way transformers, where power is received from the grid and feed plant station loads during plant start-up or on generator trip. BT

## BHEL bags EPC order for 50 MW solar photovoltaic power plant

Bharat Heavy Electricals Limited (BHEL) has bagged a prestigious order to set up a 50 MW Solar Photovoltaic (SPV) Power Plant on Engineering, Procurement and Construction (EPC) basis.

Valued at Rs 282 crore, the order to set up the solar power plant at Mandsaur in Madhya Pradesh, has been placed with BHEL by the National Thermal Power Corporation (NTPC) Limited.

The project is scheduled for completion in twelve months. Earlier this year, BHEL had bagged

another EPC order from NTPC under domestic competitive bidding for setting up a 50 MW solar power plant at Anantapur in Andhra Pradesh, which is currently under execution.

BHEL manufactures solar cells and modules at its Electronics Division Unit in Bengaluru, while space-grade solar panels using high efficiency cells and space-grade battery panels are manufactured at its Electronics Systems Division, which is also located in Bengaluru.

BHEL is one of the few companies whose solar business is backed by a dedicated R&D team at the company's Amorphous Silicon Solar Cell Plant (ASSCP) in Gurgaon.

Bharat Heavy Electricals Limited offers EPC solutions for both off-grid and grid-interactive solar photovoltaic power plants.

The company has set up solar power plants in various locations all over India, including the Lakshwadeep Islands, all of which amount to a total of 200 MW. BT

## Suzlon receives order for eleven units of \$97 120m hybrid tower

Suzlon Group has received a turnkey order for a 48.30 MW wind power project from the Indian Oil Corporation Limited (IOCL). The IOCL project consists of 11 units of S97 120 m all-steel hybrid tower and 12 units of S97 90 m tubular tower with rated capacity of 2.1 MW each. It has the potential to provide power to 26,000 households and reduce 0.10 million tonnes of CO<sub>2</sub> emissions per annum.

Located in the districts of Jaisalmer and Jodhpur of Rajasthan, the project is scheduled



Ishwar Mangal, CSO, Suzlon Group

for completion by March 2017. Suzlon will provide comprehensive operation and maintenance for an initial period of ten years.

The company is credited with developing one of the country's largest wind parks in Rajasthan's Jaisalmer district, with installations of more than 1,100 MW.

As on March 2015, Rajasthan's total wind power installations stood at 3,307 MW, out of which 1,569 MW had been contributed by Suzlon.

Suzlon Group Chief Sales Officer Ishwar Mangal said, "Yet another order from Indian Oil Corporation Limited (IOCL) is a testimony of our customer confidence in our technology, which helps us partner with the nation's leading Public Sector Units (PSUs) in their transition to sustainable energy architecture. With our next generation technology, we continue to fulfill growing demand. Suzlon is best positioned to leverage its technological expertise for the Indian terrain. With the ambitious government target of 175 GW by 2022, we are confident that our partnership will reinforce the sustainable development of the country." BT

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## Sterling & Wilson commissions 90 MW solar photovoltaic plant in South Africa

Sterling & Wilson (S&W), a well known global solar EPC with around 1,000 MW of installed solar photovoltaic capacity on the ground, has commissioned its 90 MWp solar photovoltaic power plant in South Africa.

The solar power plant commissioned by S&W has been set up for Solar Capital De Aar (Pty) Ltd, close to De Aar in the Northern Cape region of South Africa. The project is a part of the Department of Energy's (DoE) Renewable Energy Independent Power Producer Procurement Programme (REIPPP).


This Independent Power Producer Procurement Programme has been designed to contribute towards socio-economic and environmentally sustainable growth, as well as stimulate the renewable energy industry in South Africa.

The solar plant will be operational for 20 years and is expected to generate approximately 183,000 MWh of power during its first year.

While installing the solar power plant, Sterling & Wilson employed more than 90% unskilled employees from the local

community. Power generated by the solar photovoltaic plant will be evacuated at 132 kV voltage level.

Sterling & Wilson's scope of work for this project included a turnkey EPC and construction of a 132 kV substation and a 15 km transmission line, including refurbishment of the last 5 km of the line.

Sterling & Wilson will also operate as well as maintain the power plant. The company already does O&M activities for global projects. 

## CMI Limited to supply wires to Indian Railways

CMI Limited, the BSE-listed specialty cable company, has received approval from Indian Railways to supply hard drawn contact wire and catenary wire used in electric traction of trains at 25 kV. Both these wires have tremendous application in Indian Railways, Metros and Dedicated Freight Corridors.

Indian Railways has only 28,000 km of electrified track, out of a total of 67,000 km of track. The rest 39,000 km of track has to be electrified in the near future. Besides this, 7,000 km of dedicated freight corridor will be added in the next five years. Work is already going on in

3,000 km of the Western Freight Corridor as well as the Eastern Freight Corridor, which is expected to be completed in three years.

The cost of these specialised cables is around Rs 12 lakh per kilometre of railway track. CMI Limited is among a handful of manufacturers who have been approved by the Indian Railways to supply these cables.

The total business potential from the supply of these cables to the Indian Railways is Rs 1,000 to 500 crore per annum.



Amit Jain

CMI estimates Rs 100 crore as the potential business accretion from the supply of these cables to Indian Railways in FY 2016-17.

"Indian Railways is one of our biggest customers. With this approval CMI has become approved for the entire range of signalling, telecom, quad cables, indoor signalling and wires for High Voltage Traction on Electrified Tracks. This approval reinforces our confidence that we will be able to maintain our pace of growth in the years to come," CMI Limited's Managing Director Amit Jain said. 

## NALCO and IMIDRO task force to set up smelter and power plant in Iran

National Aluminium Company Limited (NALCO), a Government of India Enterprise as well as the Iranian Mines & Mining Industries Development & Renovation Organisation (IMIDRO) plan to constitute a joint task force to deliberate on the proposed smelter and gas-based power plant at Chabahar Free Trade Zone in Iran.

The task force which will comprise senior executives of NALCO, Directors of Ministry of Industries of the Government of Iran as well as senior executives of the Iranian Aluminium Company (IRALCO), has been given three months to submit its report.

"The project will help NALCO use low cost energy available in Iran to convert its alumina,




Deputy Minister of Iran and Chairman, IMIDRO greeting Dr. Tapan Kumar Chand, CMD, Nalco in Tehran...

which is presently exported to international markets, to aluminium. Aluminium products from the joint venture company are expected to be highly cost competitive combining the

advantages of low cost NALCO alumina and low cost Iranian energy," NALCO CMD Dr Tapan Kumar Chand said.

Dr Chand had visited Iran as part of an Indian business delegation, led by Union Minister for Petroleum and Natural Gas Dharmendra Pradhan.

During this visit, Dr Chand held discussions with Deputy Minister of Industry, Mines & Trade, Government of Iran, IMIDRO Chairman and top officials of the Government of Iran as well as other aluminium companies.

Ownership pattern of the company, project financing, long-term supply of gas and other aspects shall be decided, based on the task force report. 



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## Siemens, Airbus sign deal to develop hybrid electric aircraft propulsion systems

Airbus Group and Siemens have signed a collaboration agreement to jointly develop hybrid electric aircraft propulsion systems.

The Chief Executive Officers of both companies have launched a major joint project towards the electrification of aviation with the goal of demonstrating the technical feasibility of various hybrid / electric propulsion systems by 2020.

Both companies will be making significant contributions into the project and have sourced a team of around 200 employees to advance European leadership in innovation and the development of electrically powered aircraft.



"Electric and electric-hybrid flight represent some of the biggest industrial challenges of our time, aiming at zero-emissions aviation. The progress we have achieved in this arena, together with our industrial and governmental

partners, in only a few years, is breath-taking, culminating in last year's channel crossing of our all-electric E-Fan aircraft. We believe that by 2030 passenger aircraft below 100 seats could be propelled by hybrid propulsion systems, and we are determined to explore this possibility together with world-class partners like Siemens," said CEO of Airbus Group Tom Enders.

"By entering the field of highly innovative aircraft propulsion technology, we're opening a new chapter in E-Mobility. Collaboration with Airbus Group will create new perspectives for our company and open us up even more towards disruptive innovation," said Siemens President and CEO Joe Kaeser. **EI**

## UK-based Witt Ltd to test marine version of its 200-Watt WITT device

The UK-based Witt Limited is making progress in developing a marine version of its 200-Watt 'Whatever Input to Torsion Transfer' (WITT) device for wave tank testing. Contained within a sealed unit, WITT devices utilise a 3D pendulum that drives the transmission system, converting all motion, in any combination of the six degrees of freedom, into a single unidirectional rotation of a flywheel, to generate electricity.

WITT devices harvest chaotic motion, fast, slow or erratic, turning into useable power. A

sealed WITT is resistant to harsh sea environment, and is a 'fit and forget' solution. WITT will harvest power from wave surge and pitch, sway and roll, with no shock load. This offers twice the capacity for wave power conversion than other devices, the company has claimed. It has also secured critical support from global players, Gibbs Gears and Schaeffler to build the 200-Watt WITT device which converts wave motion into electricity.



WITT device inventor and the company's Chief Technology Officer Martin Wickett said, "The WITT's key advantages over other wave energy converters or WECs are that energy is captured from all six degrees of motion. Therefore, it can capture up to 100% more energy from motion than comparable devices. We believe this makes it the optimum technology to be deployed to generate renewable electricity from the sea". **EI**

## GE partners with EETC in order to reinforce Egypt's national grid

General Electric (GE) has signed a contract worth approximately US \$250 million with the Egyptian Electricity Transmission Company (EETC) to provide the company's advanced grid solutions technologies to substations located in Mostathmereen, Beni Suf Industrial, Ismailia East and Temay Alemdeed.

GE North East Africa President & CEO Ayman Khattab said, "We are proud to continue our 30-year partnership with EETC by providing our latest grid technologies to help meet Egypt's continuing and growing energy needs in a more efficient way."

"We are keen to support the government's initiatives in the energy sector in both generation and transmission, in order to offer a more stable

supply of electricity to Egyptian homes," he added further.

These four Gas-Insulated Substations (GIS) will help connect seven gigawatts (GW) of power to the national grid, which is equivalent to the electricity needs of more than 6.5 million Egyptian homes. This will be crucial to reinforce Egypt's network during periods of peak demand. French components make up approximately 50% of the total project scope including the GIS technologies to be installed at the substations that are manufactured and assembled in France.

The project is being executed in a consortium with Rowad Modern Engineering, a leading Egyptian contractor, for the construction work of the substations.

The first phase, which includes the Mostathmereen substation, will be connected to the grid within six months – while the remaining three substations will be completed by the end of 2017.

As part of the contract, GE will also supply a digital data protection system, network management system and telecommunication technologies, which will help connect the substations to the National Energy Control Centre and improve the network's stability.

The installation of GE's Gas-Insulated Substations will offer several solutions for Egypt's grid including smarter networks, condition-based maintenance and greater load control to prevent outages. For over a century, utilities around the world have relied on GE. **EI**

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## ABB wins US\$80 million order to connect new offshore wind farm to the Belgian grid

ABB has won an order worth around US\$80 million from Rentel NV in Belgium to deliver an advanced cable system that will connect the offshore substation at the Rentel windfarm located off the Belgian coastline to the mainland close to Zeebrugge.

"The Rentel windfarm cable link will help bring clean wind power to the people of Belgium. It is another example of ABB technologies that enable the integration of renewable energy and lower the environmental impact, which is an integral element of the

company's next level strategy," said Claudio Facchin, President of ABB's Power Grids Division. The cable system installation will be executed by ABB's new state-of-the-art vessel, which will enhance efficiency and precision of the cable laying operations. The project is scheduled to be commissioned in 2018.

ABB will design, manufacture and install the approximately 40-kilometre long extruded



three-core 220-kilovolt Alternating Current (AC) submarine cable system, which will have a transmission capacity of around 300 megawatts.

The energy transmitted to shore from this windfarm will contribute to a greener power supply in Belgium, capable of providing enough electricity to meet the needs of around 280,000 households.

## Electricity powered Sun Flyer aircraft to fly by middle of the year

Colorado-based Aero Electric Aircraft Corporation's (AEAC) CEO George Bye has announced that his company's fully electricity powered aircraft 'Sun Flyer' will be a breakthrough aircraft for the future of flight training in the USA and around the world.

Bye has also announced that Bloomington Corporation is working with AEAC to set up an infrastructure network of electrical superchargers around the US. "Bloomington is committed to 30 Sun Flyer flight training aircraft, as well. That

brings our total orders to 65 today," Bye has added.

The two-seat Sun Flyer training aircraft is to be certified under Part 21 regulation, which limits its maximum gross weight to 1,654 pounds, and is meant for certifying standard training aircraft. The payload including passengers, pilot and bags, will be 440 pounds.

"Once the Part 23 regulation rewrite is complete, there will be room for electric aircraft



George Bye

certification there, and we plan four and six-seat versions of the aircraft in the future," he continued.

AEAC's proof-of-concept demonstrator has a Slovenian Emrax 100 kilowatt electric engine (130 hp) and South Korean LG chemical batteries capable of powering three hours of flight (that is before additional energy is recovered from its regenerative-energy propeller system and solar wing cells).

## Dutch architect invents piezoelectric gravity device which could generate energy anywhere

Dutch architect Janjaap Ruijssenaars has developed a simple device which generates electrical energy with the help of gravity, and hopes that the invention could lead to new renewable phone chargers or even power household appliances.

Ruijssenaars has worked with scientists from the University of Twente to assess the potential of the method, which relies on principles of piezoelectricity to turn kinetic energy into electrical energy. The system works by perpetually unbalancing a weight at



Janjaap Ruijssenaars

the top of the system to generate energy at the bottom.

"Intuitively, I thought that gravity must have something to offer, given that everything is drawn to earth," explained Ruijssenaars, who is currently trying to patent his invention.

"By unbalancing a weight at the top that is only just stable, using little force, a

large force is created at the bottom at a single point. The idea was that this should yield something," he added.

"Thanks to clever use of gravity, the energy yield from the so-called piezo method,

which converts mechanical pressure into electrical energy, is increased from 20 to 80%," said Theo de Vries, Systems Architect at the University of Twente's Robotics And Mechatronics Group.

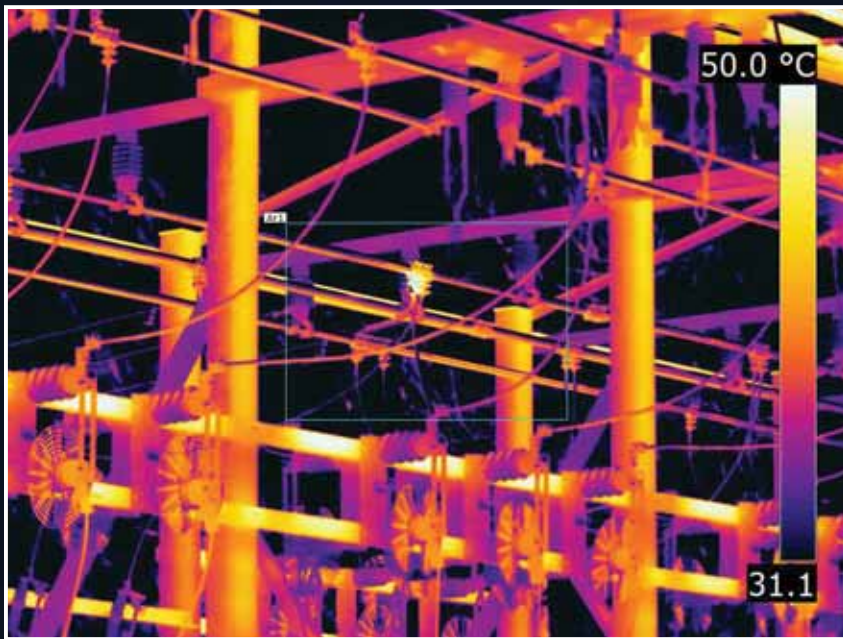
"Ruijssenaars literally turned the method on its head, as a result of which we, as scientists, have started to look at this method in a new light. Everything that is currently offered as mechanical energy will actually be useful, thanks to the invention," Theo added further.

The technology could provide an alternative to solar or wind energy in situations, where such installations are not convenient. The researchers are now working with the architect to develop practical applications.

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### Mukesh Kumar Surana has been appointed as CMD of HPCL



**Mukesh Kumar Surana**

*He has wide exposure in the oil and gas industry spanning over 33 years...*

The Government of India has appointed Mukesh Kumar Surana as Chairman and Managing Director (CMD) of the Hindustan Petroleum Corporation Ltd (HPCL), one of India's leading Fortune 500 companies.

He took over charge from April 01, 2016, from Nishi Vasudeva who has superannuated on March 31, 2016. Prior to taking over as HPCL's CMD, Surana held the position of Chief Executive Officer of Prize Petroleum Company Limited, a wholly owned subsidiary and upstream arm of HPCL, since September 2012.

He is a mechanical engineer, with a Master's degree in Financial Management. Surana has wide exposure in the oil and gas industry spanning

over 33 years, handling various responsibilities including business leadership positions. He has been closely involved in strategy formulation, business process re-engineering, major projects implementation, refinery operations, ERP implementation, besides acquisition as well as management of upstream assets.

He has vast experience in domestic and international Oil & Gas business and is known for his business acumen, innovative ideas and people-centric leadership. In his various roles, he has been able to empower teams to perform and deliver exceptional results through positive engagement and a shared vision. He was a Core Team Member for Corporate wide ERP implementation in HPCL.

### Suzlon Group appoints J P Chalasani as Group CEO



**J P Chalasani**

*After taking up the lead role in Reliance Power, he transformed the company...*

The Suzlon Group has appointed JP Chalasani as its Group CEO. Speaking about the development, Suzlon Group Chairman Tulsi Tanti said, "I am delighted that J P Chalasani has joined the Suzlon family as Group CEO. He has deep and rich experience highly relevant to us and the power sector."

Chalasani is a mechanical engineer, who is widely acclaimed for his project management and people leadership skills. He began his career with the National Thermal Power Corporation (NTPC) and grew up the ranks over the years.

After taking up the lead role in Reliance Power, he transformed the company to make it the largest market cap entity in the private sector. He also led the work to transition BSES from being a power distribution company to a leading infrastructure business company.

Chalasani said, "I have always watched Suzlon closely. I believe its business fundamentals to be strong and that the company, at its core, is a compelling and credible business operation. Suzlon is well positioned to tap the current growth of the renewable energy sector."

### PESB recommends Akhil Joshi as BHEL's Director (Power)



**Akhil Joshi**

*He has been CMD of Bharat Pumps & Compressors Limited since 2013...*

The Public Enterprises Selection Board (PESB) has recommended the name of Akhil Joshi, who is Executive Director of Bharat Heavy Electricals (BHEL), for the post of BHEL Director (Power).

Earlier, Joshi has served as Executive Director of Technology Licensing & Joint Ventures, Mergers & Acquisitions and Member of Management Committee at BHEL.

He has been Chairman and Managing Director of Bharat Pumps & Compressors Limited since 2013.

Joshi began his career in 1979 as a Trainee Engineer with BHEL's Haridwar unit. Joshi has

diverse experience of marketing, project management, technology acquisition and managing equity joint ventures, mergers and acquisitions as well as spares and services functions at BHEL.

While leading business development in certain overseas markets for BHEL, he was instrumental in breakthroughs in crucial market segments in several countries including Cyprus, Egypt, Bangladesh, Iraq, Vietnam and Belarus.

BHEL is an integrated power plant equipment manufacturer and one of the largest engineering and manufacturing company of its kind in India.



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Power Quality Measurement Team with Customer at Solar PV Site



Measurement Setup on CT/PT side

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Image Courtesy: Nano Dimension Ltd.



Highly conductive silver nanoparticle inks for printed electronics...

# New Market To Emerge

A recent report titled 'Conductive Ink Markets 2016-2026: Forecasts, Technologies, Players,' from IDTcchEx states that everything is changing in the conductive inks and pastes market...

Conductive inks find wide application in silicon solar cells, UHF RFID tags, touch screen edge electrodes, automotive, in-mould electronics, e-textiles, 3D antennas, 3D printed electronics, desktop PCB printers, ITO replacement, OLED lighting and others. A recent report titled 'Conductive Ink Markets 2016-2026: Forecasts, Technologies, Players,' from IDTcchEx states that everything is changing in the conductive inks and pastes market.

The conductive inks and pastes market will reach nearly \$1.7b in 2026 at current metal prices. Micro-sized silver conductive pastes will dominate the market, controlling nearly the entire market in 2016. Silver nanoparticles will however become increasingly competitive, finding use in a range for emerging applications sectors to become an \$80m market in 2026. Copper will remain a comparatively immature technology but will achieve

limited success as novel curing systems are installed to open the door to copper ink sales.

The solar panel industry will be 1.5 k tonne market in 2016 for screen-printed firing-type conductive pastes. At the paste level, a new group of suppliers will soon come to dominate this business – whilst at the powder level the users will force through a more diversified supplier base. The touch screen edge electrode market will continue its decline. The linewidth-over-spacing (L/S) has decreased to 20/20, pushing screen printing with standard PTFs beyond its limits and opening the door to photocurable pastes. Etching-based techniques will find additional opportunities as the bezel is further narrowed whilst standard PTFs will retain some share in the low-cost end of the market.

Sensors such as car occupancy sensors, printed piezoresistive sensors and some versions of glucose sensors will remain a

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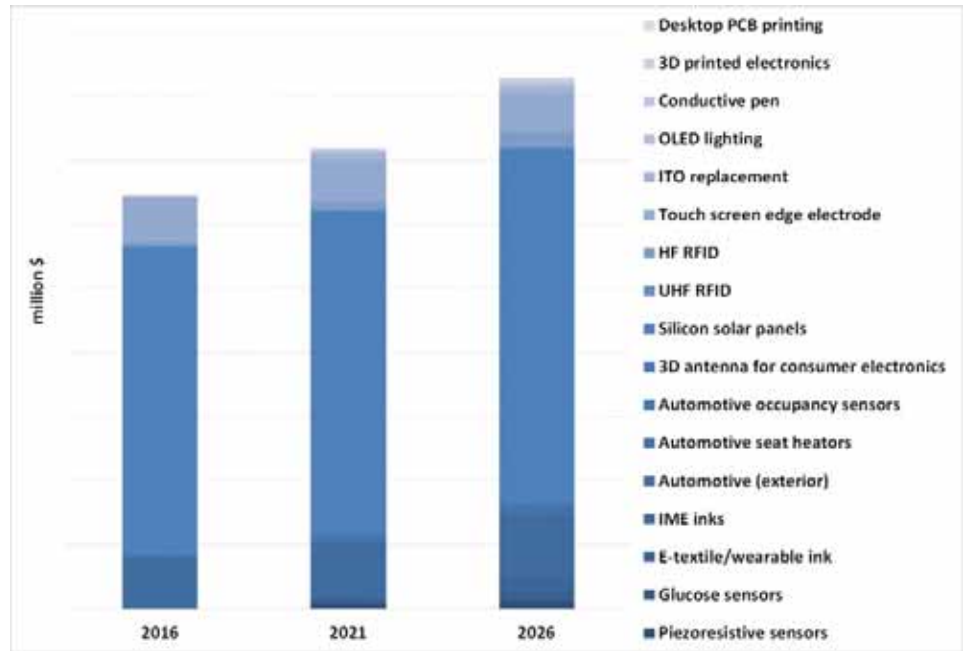
substantial niche market for conductive pastes, as will the automotive sector with its mixed grouping of stagnant traditional and high-growth emerging applications.

HF and UHF RFID antenna markets will grow but will see the relative market share of ink types transform over the coming decade. 3D antennas made using aerosol printing will continue gaining traction.

This approach will compete head-on with MID (Molded Interconnect Devices) techniques – and will become a substantial player in the consumer electronics market.

Metal mesh as an ITO alternative will make slow inroads despite the pending consolidation period in the TCF industry, creating demand for silver nanoparticle used in filling or printing fine lines.

New markets will emerge and create new performance requirements. In-mould electronics will demand inks that can stretch and survive the thermoforming/moulding process. Electronic textiles will require inks that are truly stretchable and withstand repeated washing cycles. 3D printed electronics and desktop PCB printers will need the high



Ten-year market projections for conductive inks...

conductivity and low temperature inks to open vast new prototyping possibilities for 3D printers and circuit designers. All these markets are poised for rapid growth provided technology innovations can satisfy the market pull.

Image Courtesy: IDTechEx



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## BHEL wins DSIJ Award 2015 for the Most Efficient Maharatna PSU

**B**harat Heavy Electricals Limited (BHEL) has been awarded the DSIJ Award 2015 for the Most Efficient Maharatna Public Sector Unit for its superlative performance during fiscal 2014-15.

The award was received by BHEL Chairman & Managing Director Atul Sobti, from Union Minister of State for Tourism & Culture (Independent Charge) and Civil Aviation Mahesh Sharma.

Significantly, BHEL has been conferred this award for the seventh successive year and has been winning this prestigious award since its inception.



*Atul Sobti is receiving the award from Mahesh Sharma...*

BHEL is an integrated power plant equipment manufacturer and one of the largest engineering and manufacturing companies of its kind in India engaged in the design, engineering, manufacture, construction, testing, commissioning and servicing of a wide range of products and services for core sectors of the economy like power, transmission, transportation (railways), renewable energy, oil and Gas, as well as defence, with over

180 product offerings to meet the needs of these sectors. It has been the bedrock of India's heavy electrical equipment industry since its incorporation in 1964. **ET**

## Schneider Electric's Indian MD receives highest French civilian award

**S**chneider Electric India's MD & Country President Anil Chaudhry has received France's highest civilian award, the Chevalier de la Légion d'Honneur (Knight of the Legion of Honour), for his outstanding contributions to French society and strengthening Indo-French relations over a period of 20 years, since the beginning of his career.

The award was conferred upon Chaudhry by the Ambassador of France to India, François Richier, during a ceremony held on Monday, April 18, at the Residence of France, New Delhi. Along with the Ambassador, the evening was graced by officers of French Embassy and officials of the Government of India and Chaudhry's family and colleagues.

Working for over three decades for French business interest in India and in the world, Chaudhry worked significantly in the field of infrastructural



*Anil Chaudhry*

development, climate change, Indo-French economic relations, access to energy as well as skill development.

Receiving the award, Chaudhry said, "It is with great honour that I receive this profound recognition given to me by the French Embassy today. The distinguished history of this award and its long list of eminent awardees leave me humbled and tremendously inspired to live up to the noble principles this award represents."

He added, "I take this opportunity to thank all the people in my life, without whom my achievement would have been impossible. A special thanks to my wife Suman, my daughters, my parents, extended family, friends and my entire Schneider Electric team, business partners as well as colleagues from previous organisations for their constant support at all times. I consider this award as a responsibility given to me to vanguard our countries' great alliance and tirelessly work towards further strengthen this Indo French alliance in all possible ways." **ET**

## Adwen's AD 5-135 gets first Type Certificate issued by DNV GL

**A**dwen's AD 5-135 turbine has obtained the first Type Certificate based on the Guidelines for the Certification of Offshore Wind Turbines, issued by DNV GL.

The AD 5-135 is an evolution of the AD 5-116 of which Adwen has installed 630 MW. It was according to the specific configuration required for Wiking offshore wind farm, Iberdrola's 350 MW project in the Baltic Sea. Among the new features figure the 25-year operating lifetime and the Grid Loss System -- a new smart system which allows energy production for self-consumption in case of temporary loss of grid connection.

"This certification proves that the AD 5-135 is a reliable and robust product that has kept pace with the latest developments in the industry



in terms of design, manufacturing materials and processes, and performance. The fact that it is the first turbine to be certified under the latest standard demonstrates that our technology is at the leading edge of the offshore wind energy industry," Adwen's Chief Technology Officer Maite Basurto said.

"We are pleased to issue the first Type Certificate according to GL 2012 to Adwen for their AD 5-135 turbine. As the development of modern offshore wind turbines is rapidly progressing, the guideline GL 2012 is taking all the latest safety and reliability requirements into account, including updated qualifications for load, mechanical engineering and safety engineering," DNV GL-Energy's Head of Certification Mike Wöbbeking said. **ET**



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**Ab roshan  
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# Outset Of A New Era

INTEGRATED ENERGY PLAZA  
HANNOVER MESSE  
25.-29. April 2016



US President Barack Obama and German Chancellor Angela Merkel opened the Hannover Messe 2016 trade fair. For the first time under the motto 'Integrated Energy,' the Hannover Messe 2016 hosted Energy 2016. Center piece and walk-in showroom of this key theme was the 'Integrated Energy Plaza.' There the entire value chain was shown from energy generation to distribution, storage to energy demand-side management...

Although Hannover trade fair is not a new name to the global technologists, scientists, business communities and other technology enthusiasts; (this year's) Hannover Messe 2016 that ran between 25 to 29<sup>th</sup> April in Hannover, Germany, had an altogether different perspective, and its significance magnified with inclusion of several first-ever-events – including the first-time partnership of the United States and presence of the POTUS Barack Obama in the event in a special role.

U.S. President Barack Obama and German Chancellor Angela Merkel opened the trade fair, where (out of around 5,200 exhibitors) 465 exhibitors from the USA presented their innovations designed to take manufacturing to new digital heights. They shared the arena with a host of German enterprises intent on making Industrie 4.0 (Industry 4.0) a reality by means of cutting-edge mechanical and electrical engineering solutions.

In his inaugural speech, Obama said, "We want to build on the spirit of innovation in the USA." That spirit has been driven by Germany and Hannover Messe, especially over the past 70 years. The U.S. President



added that the USA has now created new production facilities, subsidy schemes and jobs in recent years to help reach this goal.

During his last visit to Germany, POTUS Obama spoke in particular about the Transatlantic Trade and Investment Partnership (TTIP) free trade agreement. He believes that there are too many obstacles restricting trade between the EU and the USA. Different regulations and standards lead to higher costs. Therefore, one of TTIP's aims is to establish harmonised high standards.

In the opening-day walkabout of the fair, POTUS Obama and Chancellor Merkel visited a few selected stalls. Beside promoting the Transatlantic Trade and Investment Partnership, as Obama promoted the USA as a production location for European companies, Merkel gladly took the opportunity to say, "We love competition. But we also like to win."

In her speech, Merkel emphasised that cooperation is essential for the future of industrial production – in a transatlantic partnership. "We in the EU want to lead the way, together with the USA," said the Chancellor, referring above all the development of global communication and IT standards for integrated industry.

So, was the sound historic beginning.

## Theme of the Hannover Messe 2016

The age of Integrated Industry is standing at the door. Energy systems will be digitally controlled. Mature Industrie 4.0 technologies are hitting the market. Thus, Hannover Messe 2016 was determined to drive this development even further – with a record number of examples of concrete applications.

With several leading trade fairs that ran simultaneously, Hannover Messe covered a wide range of themes and exhibits including R&D, industrial automation and IT, industrial supply, production engineering and services, as well as energy and environmental technology. The opportunity to develop new sales leads in other sectors, unique access to new products and technologies and a huge international presence attracted exhibitors and visitors from all over the world.

Industrie 4.0 (Industry 4.0) and Industrial Internet – two concepts predominantly surfaced in the world's leading trade fair for industrial technology. Although closely interrelated, the two concepts embody rather different approaches to integrated industry. In the words of Dr. Jochen Köckler, Member of the Deutsche Messe Managing Board, "Hannover Messe brought together the best of both worlds. The German industry was climbing into the ring with their world-famous engineering prowess, while their U.S. counterparts were flexing their muscles as creators of novel data-based business models. It was a case of 'Industrie 4.0 meets the Industrial Internet'. And Hannover Messe 2016 revealed the potential for common ground between the two approaches."



A portion of the exhibition, where US-based companies presented their innovations...

(Image Courtesy: www.hannovermesse.de)

The second keynote theme at this year's Hannover Messe was intelligent energy systems. Köckler said, "Digitalization is the way forward for the energy sector, just as it is for manufacturing. The smart technologies and solutions needed to make it all happen were on show here in Hannover."

The Internet of Things and Services is moving into the production environment. Industrie 4.0 will be the backbone of tomorrows' production. Considering this, the Deutsche Messe under the auspices of the BMBF and the BMWi and in cooperation with the Industrial Internet Consortium (IIC), the Plattform Industrie 4.0, the VDMA and the ZVEI staged the Forum 'Industrie 4.0 meets the Industrial Internet' at the Hannover Messe 2016, to

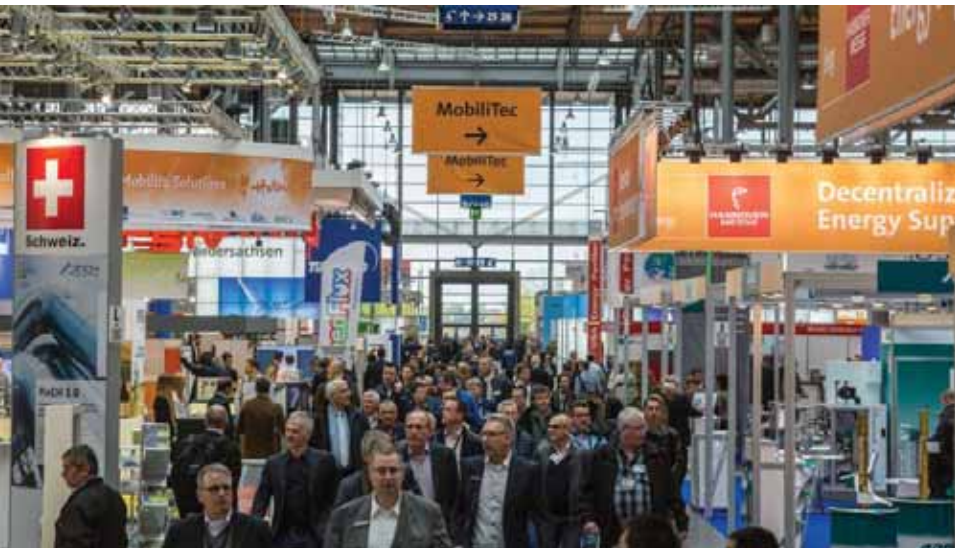


Dr. Jochen Köckler

(Image Courtesy: P K Challenge)

put forward the chances of digitalization of the value added chain.

For the first time under the motto Integrated Energy, the Hannover Messe 2016 hosted Energy 2016. Center piece and walk-in showroom of this key theme was the 'Integrated Energy Plaza.' There the entire value chain was shown from energy generation to distribution, storage up to energy demand-side management. The energy system of the future was brought to life in a modern and interactive way. Major players such as Enercon, Prysmian and Siemens chose to leverage the Integrated Energy Plaza to show off their contributions to future-



(Image Courtesy: www.hannovermesse.de)

Another view of the exhibition where some power companies are displaying their products...

proofing our energy supply. A model provided by the premium sponsor GPJoule illustrated vividly how the system could work. There were also forums for knowledge exchange on Hydrogen (based energy), Fuel Cells and Batteries (storage).

### Participants in the 2016 trade fair

As much as 58% of this year's exhibitors were from outside Germany, with 75 nations represented in all. The top exhibiting nations were Germany, China, the USA, Italy, Turkey and the Netherlands. Almost 650 exhibitors came from China. Next in the ranking was the USA, with 465 – the highest number of U.S. companies ever to participate in a trade show outside North America.

With names like General Electric, Honeywell, Eaton, Microsoft, IBM, AT&T, Cisco and Intel, the official list of American exhibitors reads like a 'who's who' of U.S. industry. Among their ranks were several companies – who have perfected the art of data-driven business – and who demonstrated their mastery of the 'bit and byte' in Hannover. IBM, for instance, showed how it helped John Deere achieve highly customised tractor production. The exhibitor lineup also featured all the big-named U.S. universities and research institutes, among them were the Massachusetts Institute of Technology, the University of California and Georgia Tech University. They showcased a wide array of research initiatives and advances in everything from combating climate change to redefining industrial robots. A section for the young technological enterprises was an added bonus for the visitors.

German enterprises too came forward with full force at this year's show, where visitors could – as a Hannover Messe first – immerse themselves in more than 100 real-world application scenarios for Industrie 4.0 technology, the bulk of which is 'made

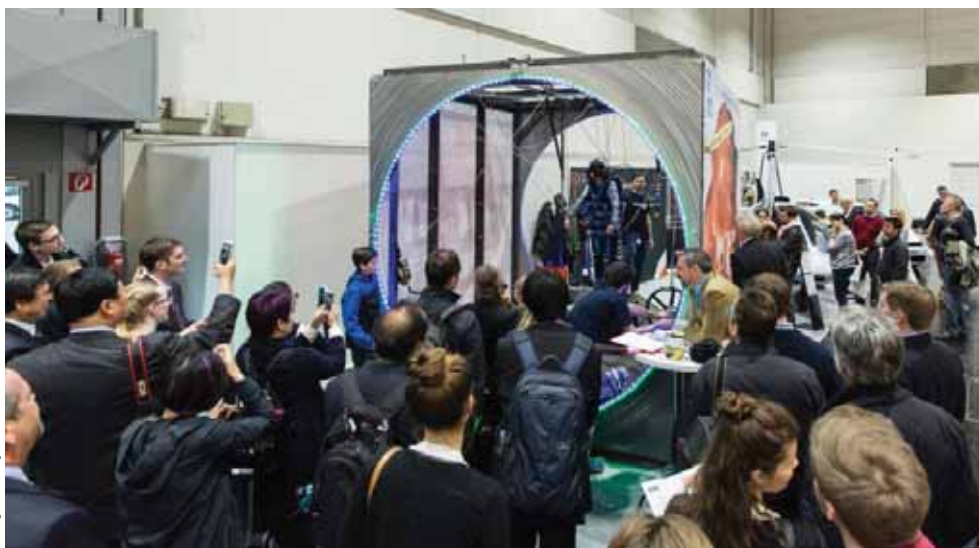
in Germany.' Among them there were smart robots that can navigate factory environments autonomously and production machines that can communicate with human co-workers by means of speech, thus making things easier for them on the job.

Like their U.S. counterparts, German companies were supremely adept at collecting and analysing data, as was made abundantly clear in the new 'Predictive Maintenance 4.0' display. "With predictive maintenance, integrated sensors detect impending faults and trigger maintenance to keep machines operational. It's a bit like humans wearing smart watches that can signal impending health issues and caution their wearers to take it easy. In this sense, predictive maintenance is not just about being able to accumulate the necessary data, but also to assess it in meaningful ways," explained Köckler.

### Energy initiatives of some global majors

Next generation energy systems will include many small, decentralised parts that need to be merged and managed by smart, digital technology. Under the motto 'Integrated Energy,' the Hannover Messe 2016 featured a comprehensive array of solutions for integrating the entire energy production and supply chain, covering everything from generation, transmission, distribution and storage right through to electric vehicle solutions. It also displayed a working model of the energy system of the future.

The challenges of the energy transition are changing. The first phase mainly focused on taking renewable energy out of its market niche and making it one of the supporting pillars of the mainstream. Today, the key area of interest is systemic linking of the many different decentralised structures. Here it's a question of using innovative technologies to create flexibility in the electricity system, intelligently link together different energy consumer sectors, involve new players, and create new business



(Image Courtesy: www.hannovermesse.de)

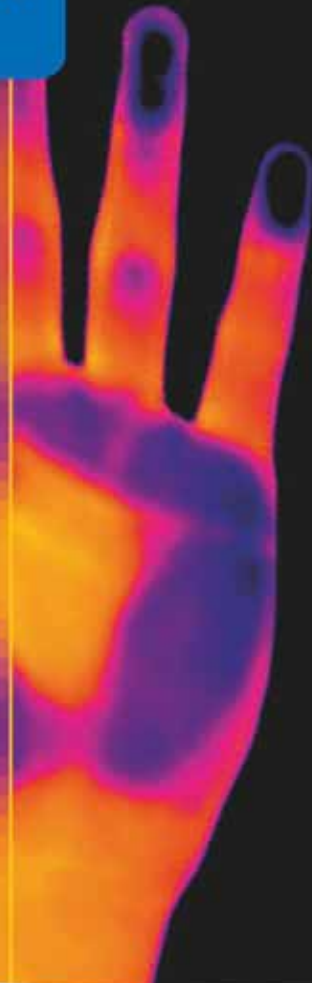
A section for the young technological enterprises was an added bonus for the visitors...

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(Image Courtesy: www.siemens.com)

The world's most powerful man, Barack Obama, visits the largest booth at the Hannover Messe: Siemens in Hall 9. To his right, German Chancellor Angela Merkel, next to Siemens CEO Joe Kaeser and Managing Board member Klaus Helmrich in front of the Automotive Cube...

models for the energy transition of the future with the aid of digitalisation. This is what's meant by the term 'Integrated Energy.' To show what possibilities this opens up, Deutsche Messe and the German Energy Agency (DENA), in partnership with several companies, were presenting the 'Integrated Energy Plaza' at the Hannover Messe

Under the banner 'Ingenuity for life – Driving the Digital Enterprise,' from Hanover's biggest single booth, Siemens offered an overview of the company's extensive portfolio, including an array of innovations in the fields of power distribution, automation and drive technology as well as

industrial software. Their exhibits included the new performance features of the Totally Integrated Automation (TIA) Portal V14 and new versions of the engineering software Comos, process control system Simatic PCS 7 or the simulation software Simit. In the field of energy management, Siemens presented two new series of its moulded case circuit breaker 3VA from the Sentron portfolio in compliance with American standards with UL approval, and the modular multi-channel current measuring system type 7KT PAC1200.

Siemens is paving the way towards industrial digitalization. "To support our customers on their way to attaining Industrie 4.0, no matter what size their company and no matter in which industry, we have undertaken further development of our Digital Enterprise portfolio. We are now in a position to offer them even more and even better solutions to address their needs," explained AG Klaus Helmrich, Member of the Managing Board of Siemens, while speaking at the Hannover Messe.

Schneider Electric participated in different forums like in a Discussion (in German) on intelligent field devices in the context of Industry 4.0; (Smart Grid Forum) How much decentralisation can we handle? Lessons learned from EUREF Micro Smart Grid in Berlin; Energy distribution 4.0 (in German); IEC 61850 und CIM auf dem Weg zum Smart Grid (in German).

Visitors to power management company Eaton's main stand had the opportunity to experience the company's best-in-class industrial process and



(Image Courtesy: www.hannovermesse.de)

There were also forums for knowledge exchange on Hydrogen (based energy), Fuel Cells and Batteries (storage)...

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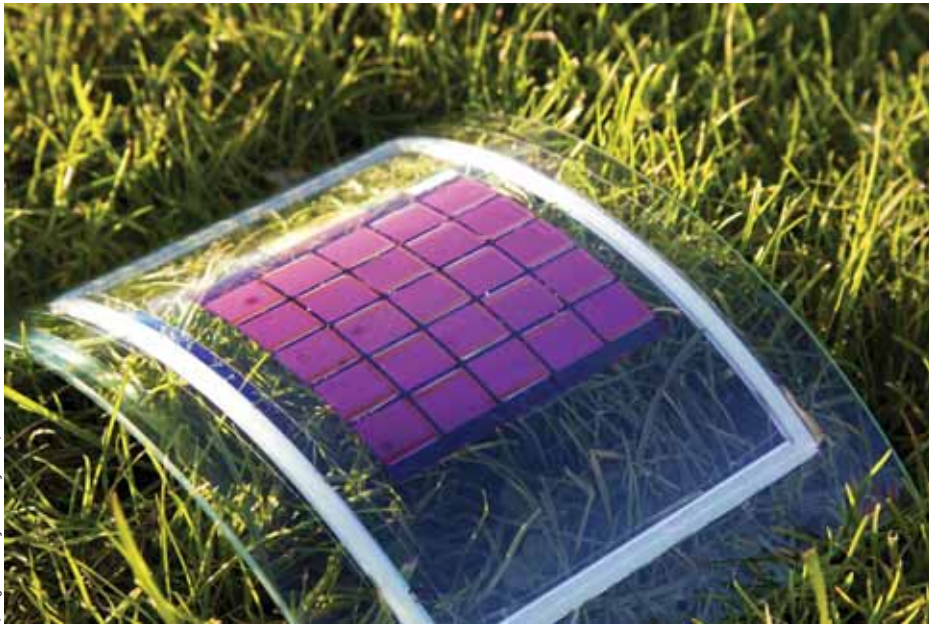


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(Image Courtesy: Wibu Systems)

Flexible and without solvents hazardous to health: The solar cells developed by KIT...

machine control technologies, including electrical and hydraulic power management systems.

They experienced how these could help build intelligent machines and systems that would be more reliable, safer and more efficient while reducing time and cost across the entire manufacturing process. Smart wiring solutions that lay the foundation for Industry 4.0 were also displayed.

### A few new products introduced in the trade fair

Wibu-Systems introduced their new CodeMeter ASIC, the most compact form factor of its CodeMeter product lineup, at this year's Hannover Messe. Manufacturers can solder and embed this component directly onto their PCBs, and deliver software protection, licensing and security features all at once.

This Application-Specific Integrated Circuit (ASIC) is particularly recommended for small devices or embedded boards; medical and measuring devices are among the top areas of application that can benefit immediately from the space saved in their board designs.



(Image Courtesy: Wibu Systems)

New CodeMeter ASIC for PCBs...

Karlsruhe Institute of Technology (KIT) presented innovative technologies for future energy supply, lighting, and lightweight construction. By means of a production concept developed by KIT, battery packs for stationary storage systems can be produced safely, flexibly and at low cost. KIT has also developed a sustainable method for the production of novel organic solar cells: the coating process does not require any substances hazardous to health or the environment. In addition, KIT displayed luminescent coatings for three-dimensional components, a process for preforming textile materials in lightweight construction, and a 3D printing technology for high-performance polymers.

### Parting remark

Hannover Messe 2016 had undoubtedly presented a comprehensive picture of the essential technological transformations that we are going to experience shortly to step into the future human societies. Although I have focused only on a small portion of the energy industry considering our beat and (on) contracting the width of the article, the trade fair has presented innovations for integrated industry from many other segments and sectors, which are future-ready to accelerate embracement of Industrie 4.0 (Industry 4.0 or the fourth industrial revolution) and Industrial Internet.

In the societies of the coming age; as flexible, secure and intuitive production will be essential, there will be equal and parallel necessity for decentralised power generation with proper power mix and storage to sustain the processes. Hannover Messe 2016 successfully included the existing and potential technologies in all those sectors/segments.

Although for common people, Industrie 4.0 and Industrial Internet make no much difference, technically there are several debatable deviations, such as Industrie 4.0 (Industry 4.0) is concerned about German industrial policy, whereas Industrial Internet is about best practices; the former is focused on manufacturing but the latter targets everything; the first one is more hardware focused but the second one is equally focused on both hardware and software. Integration of both needs sincere will and systematic approach. Hannover Messe 2016 has initiated the process, now we have to wait and watch the next steps, i.e., how POTUS Obama's 'build on the spirit of innovation' gel with Chancellor Merkel's 'zeal for winning,' and the entire world is benefitted from the fourth industrial revolution.



**P K Chatterjee**  
Editor  
Electrical India

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# Achieving Energy Efficiency



(Image Courtesy: Wikipedia)

Hillsboro School District headquarters in Hillsboro, Oregon...

Ameresco and Hillsboro School District began work on a nearly \$3.5 million Energy Savings Performance Contract (ESPC) to improve thirteen schools – and increase their operational efficiency. The project is expected to be completed by year-end 2016. Let us see it in details...

We often talk about energy saving related to industries, offices, auditoriums, retail stores, railway or bus stations, airports and homes, however, educational institutes are the places where – although discussed often – practically the matter is generally neglected. But the fact is; whether it is a primary or secondary level school, or a higher level educational institute, where regularly students come to attend classes, a fairly large amount of energy can be saved there with little efforts and modifications.

## The project

In Framingham, which is a town in Middlesex County, Massachusetts, in the United States, such an initiative has been taken up by the energy efficiency and renewable energy company Ameresco, Inc. Ameresco and Hillsboro School District began work on a nearly \$3.5 million Energy Savings Performance Contract (ESPC) to improve thirteen schools – and increase their operational efficiency. Approximately a third of the project cost, \$1.3 million, is funded through Oregon Senate Bill 1149 (SB1149), which is provided by a public-purpose charge from electrical customers to fund K-12 school improvements.

## What's the outcome?

"Partnering with Ameresco under an ESPC has made it possible for us to implement significant energy efficiency upgrades in our schools, and to make improvements to the overall learning environment without an additional burden to our taxpayers. The efficiency upgrades are expected to deliver an estimated \$137,000 in annual cost savings, while improving the comfort of the facilities for our students and staff," said Adam Stewart, Chief Financial Officer, Hillsboro School District.

## What're actually being done?

Some of the energy saving projects include: lighting retrofits; installing CO<sub>2</sub>-based ventilation control; occupancy and daylighting sensors for lighting control; adding variable speed pumps, heating and air conditioning controls upgrades, and retro-commissioning; installation of building automation systems; upgrades to electrical service to increase capacity; installing natural gas water heaters to replace electric water heaters; and identifying district-wide water saving measures.

## What's more?

In addition to enhancing the identified schools, the efficiency measures and upgrades also support the District's sustainability goals. The environmental benefits from implementing the energy efficiency measures include an annual reduction of approximately 790 tons of CO<sub>2</sub> greenhouse gas emissions, which is the equivalent to removing 106 cars from the road or preserving 216 acres of mature trees each year.

## Think a little

As in any field, association with a professional organisation accelerates the mission, when educational institutions tie up with a group or company that is providing service in the field of energy conservation or climate protection, they can benefit a lot.

As education industry is growing fast in India, many multipurpose educational institutions are coming up at different parts of the country on huge chunks of lands, where such type of associations have tremendous potential to lead to many win-win situations.





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## SWG-32/2000R



## PORTABLE CABLE FAULT LOCATOR SYSTEM

### MAIN FEATURES

- Suitable for portable application
- Easy to operate
- Multiple fault location methods included
- 10.4" High-contrast color TDR display
- Improved convenience for operator
- Heavy duty

### Application

SWG - 32/2000R portable cable fault location system is a complex solution for safe, fast and easy locating a faulty place on low and medium underground voltage cables. It includes a powerful high-voltage unit, which has a test, burn and surge generation modules, and a time-domain reflectometer for locating faults on cables.

### Technical specifications

## P-900



### MAIN FEATURES:

- Searching for the underground communication and power cables using inductive method
- Determining the depth of cable location
- Finding the short circuit points in the cables
- Finding the location of underground high-voltage power cables
- Insulation damage using an acoustic method

GENERAL parameter	Value
Supply voltage, V	230+23
Supply voltage frequency, Hz	50+1
Power consumption (max), kVA	20
Dimensions, mm	1115x735x535
Net weight, kg	140
HV-module parameter	
TESTING MODE	
Output DCV range, kV	0 - 32
Output DCI ranges, mA	1 ; 10
BURNING MODE	
Output DCV range, kV	0 - 32
Output DCI ranges, mA	100
SURGE MODE	
Ranges, kV	8x16 ; 32
Surge rate,s	3-15 or single shot
Max output energy, J	2000



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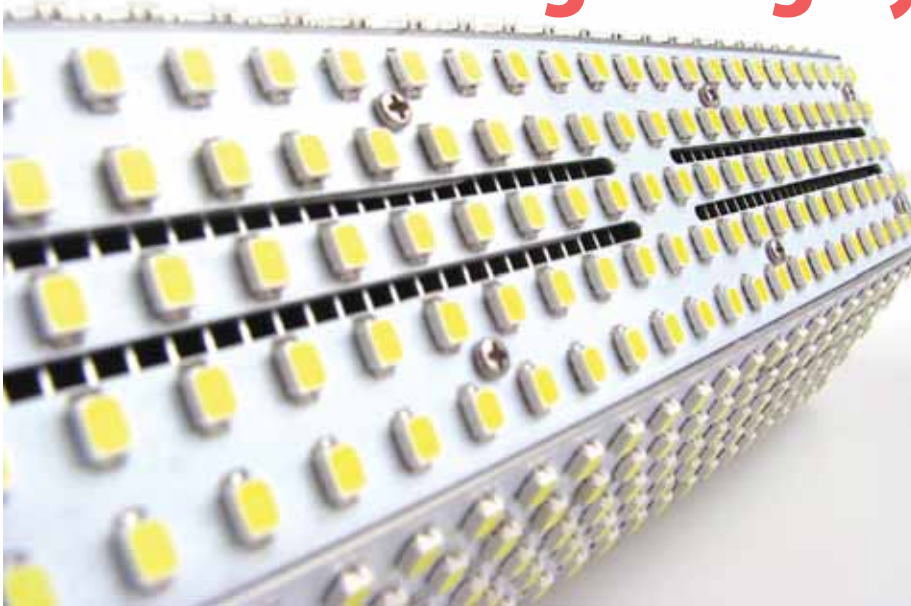
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# LED Retrofits

## Fixtures For Solid State Lighting Systems



Requirements for fixtures have to take into account the flat dispersed nature of LED placements, especially because this factor could influence the successful deployment of such lighting solutions...

**W**ith the advent of solid state lighting technology like LED lamps, the need for lighting fixtures need redefinition. In the case of earlier technologies, requirements for ingress protection and heat dissipation were different. Now, requirements for the lighting fixtures have to take into account the flat dispersed nature of LED placements.

The cost of the lighting fixtures and their efficiency plays a major role in the successful deployment of LED lighting solutions as retrofits/replacements to the conventionally existing lighting systems. Ingress protection, which is essential to protect the lamp, results in temperature build up inside the fixture – due to conduction being the only mode of heat transmission to the environment. This is a design challenge. The other major design challenge is the design the fixtures as retrofits without sacrificing the light transmission (beam distribution) characteristics such as cosine efficiency and batwing efficiency. The effectiveness of heat sinks plays a major role in determining the operating efficiency of the lamp due to the operating temperature. Thus, the lighting fixture affects the performance of the lamp that must be kept in mind during the design.

Light Emitting Diodes (LEDs) are miniature bulbs of directional or pointed beams with UV resistant, weather proof, unbreakable plastic super-lamination. Basically, the mode of building up of a luminaire of large size is through clustering of miniature sources into a lamp. An individual LED gives a maximum output of 1200 lumen. Luminaires are configured out of around 3 to 60 LEDs.

Solid state, opto white semiconductors LEDs in conjunction with solar PV have the potential for wiping off the dependence on kerosene lanterns from the country. It is a continually evolving technology, financially becoming cheaper and is an ideal energy saving solution in the lighting sector as a portable as well as in-situ technology. The energy efficiency of LEDs (laboratory), which was around 100 lumen/W in 2008 went up to 132 lumen/W in 2009 and 231 lumen/W in 2011 and 275 lumen/W in 2016. The field efficiencies are presently around 140 lumen/W. The difference in the laboratory and field conditions is the operating temperature and other test conditions like operating current, etc. CPRI, Bangalore is one of the premier LED lantern and home lighting system testing agency in India.

A major advantage of LED lighting technology is its ability to be integrated into smart grid configurations in the electricity distribution sector because it is a solid state technology and can be digitally controlled for illumination level, on/off operations, etc. The building lighting load and street lighting load when using LED systems would be of much lower electric rating and can also be controlled with ease. It is an ideal solution for a demand side management for minimisation of the grid evening peak created because of lighting loads. Dimming, without drop in energy efficiency is a distinct feature of LED lighting.

The Government of India through the EESL under the Ministry of Power has launched a massive programme to replace conventional CFL and incandescent lamp technologies with LED lamps.



## Challenges in Lighting Accessories

The massive replacement program involves the replacement of conventional lamps by LED lamps. The mechanism is through replacement using the same 230 V AC pin type holder. The challenge here is to make the LED lamp compact and fit into the same old pin type holder. The volume and mass of the LED lamp must confirm to this holder size. This requires innovative designs to ensure that mass and volume are within limits.

While the main thrust of the Indian program is on the 9-10 W LED lamps with pin type holders using 230 V AC, the lighting fixtures and accessories play a critical role in the acceptability and technical performance of larger size fixtures of larger sizes of LED lamps from around 25 W to 100 W to 500 W.

**The outdoor fixtures can be classified as:**

**Fixed configurations:**

- Linear strips
- Lay in Troffers
- Down light
- Wall packs
- Landscape
- Cloud
- Decorative
- Flood lights
- High bay

**Configurations with different degrees of freedom:**

- Track light
- Underwater

**The indoor fixtures can be classified as:**

- Pin type fixture
- Flush
- Pendant
- Recessed fixtures
- Wash down
- Wrap around
- Sensor fixtures (also for outdoor)
- Vapour proof (globe) (also for outdoor)
- Temper proof (also for outdoor)
- Explosion proof (also for outdoor)

## Requirements of Lighting Fixtures

The requirements for the enclosures of lighting fixtures are:

- Lumen distribution
- Ingress protection
- Heat dissipation

The lighting fixtures have an impact on the energy efficiency of the lamp since the fixtures has a role in determining the operating temperature depending on its heat dispersion characteristics.

### Lumen distribution

The light guides of LEDs are generally rectangular to provide cosine beam distribution efficiency of above 60%. The batwing distribution (polar distribution) efficiency must be over 70%.

### Ingress protection

The outdoor LED lighting systems have requirements of IP 65:

- 6- Total protection against dust (no ingress of dust) and complete

protection against contact. It must also satisfy ingress under negative pressure up to 8 hours of air flow.

- 5-Protection against low pressure water jets from all directions. Limited water ingress is permitted. Water (12.5 l/min) at 100 kPa projected by a 6.3 mm nozzle for 3 mins. should not result in ingress.

For indoor LED systems or home LED systems (semi indoor also included) should satisfy IP 22:

- 2- Protection against solid object over 50 mm, e.g., accidental touch by persons.
- 2-Protection against direct water sprays equivalent to 3mm of rainfall/min. for 10 min. up to 15° from the vertical.

Figures 1-12 show the designs of lighting fixtures from those available in the market. The obverse and reverse are shown to indicate the design.

### Heat dissipation

The rate of increase of temperature in the LED is given by:

$$dT/dt = (dQ_{LED\ system}/dt) - (dQ_{sink}/dt) - (dQ_{dispersion}/dt) \quad (1)$$

The heat generation is from the LED system (inclusive of driver) and the heat dispersion is from the heat sink and from thermal dispersion. While the thermal dispersion is a small quantity (15% of the heat generation) the bulk of the heat is to be dispersed through the heat sink. Inadequate or inefficient heat sink will result in rise in temperature which will cause loss of performance as discussed below.

The increase in junction temperature is on account of either excessive generation of heat or inadequate withdrawal of heat.

The heat generation or thermal load ( $q$ ) (W) of the LED emitter/source/engine of electric power input of  $P$  (W) is given by,

$$q = \left[ 1 - \left( \frac{\epsilon_{emitter}}{668.45} \right) \right] P \quad (2)$$

For a typical LED with a lumen efficiency of 100 lumen/W the thermal load is 85% of the input electric power to the emitter (after subtracting of the thermal loss in the driver). Heat sinks must be designed of conditions of higher power and lower lumen efficiency.

The thermal load ( $q$ ) (W) of the driver of rating  $P$  (W) is given by,

$$q = \left[ 1 - (\eta_{driver}) \right] P \quad (3)$$

The driver thermal load is the fraction of the electric power absorbed in the driver as heat which is typically between 2% to 15% of the input electric power.

Inadequacy in the heat sinks in the LED emitter and increase in temperature of the electrolytic capacitors at the output stage of the LED drivers – also lead to increase in junction temperature (over the design temperature).

The fixture design must take into consideration the heat sinking capability. While the material cast aluminium and powder coating affect the heat transfer characteristics, their optimisation is called for to keep in mind not only the structural considerations but also the heat transfer considerations.

Figures 13-15 show the temperature profiles at the reverse (finning area) of the light fixtures after certain lengths of operation.

## Challenges for the Lighting Fixtures

The major challenge for the LED lighting fixtures is the performance under retrofitting. The massive replacement program calls for replacement



Figure 1: Fixture for 9 LED 9 W-obverse...



Figure 2: Fixture for 9 LED 9 W-reverse...



Figure 3: Fixture for 12 LED 24 W-obverse...



Figure 4: Fixture for 12 LED 24 W-reverse...



Figure 5: Fixture for 32 LED 72 W-reverse...



Figure 6: Fixture for 50 LED 100 W-reverse...



Figure 7: Fixture for 44 LED 90 W-obverse...



Figure 8: Fixture for 96 LED 180 W-reverse...



Figure 9: Fixture for 96 LED 180 W-obverse...



Figure 10: Fixture for 96 LED 180 W-reverse...



Figure 11: Fixture for 96 LED 210 W-obverse...



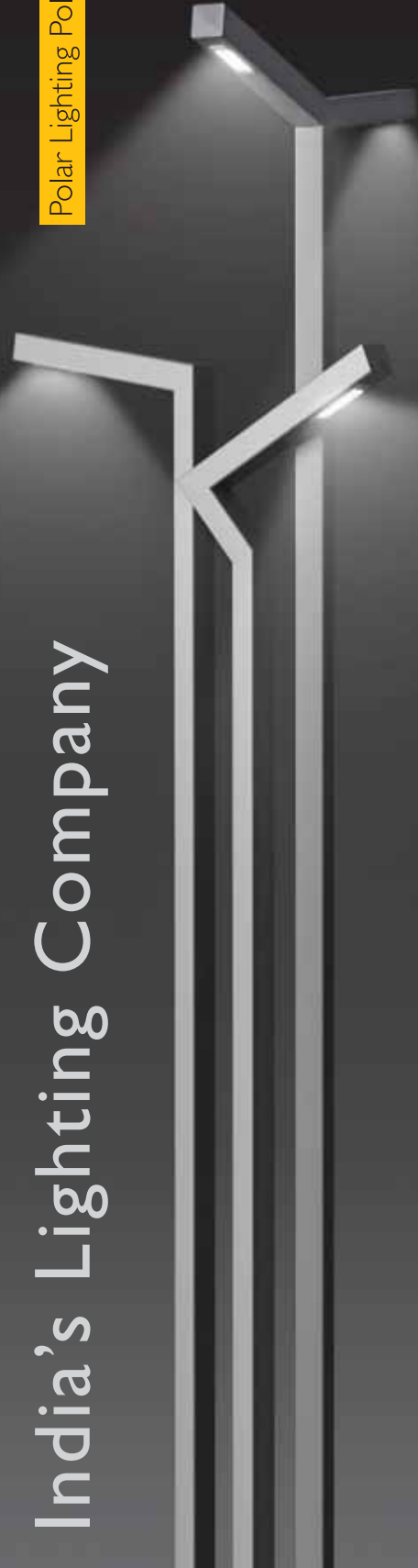
Figure 12: Fixture for 96 LED 210 W-reverse...





# Landscape Solutions

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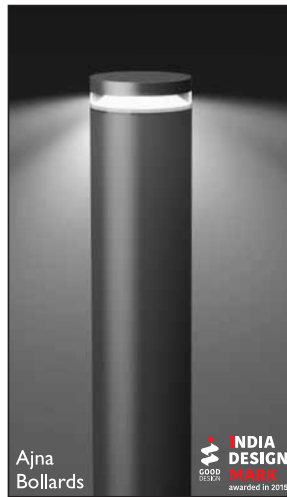


LED Strip



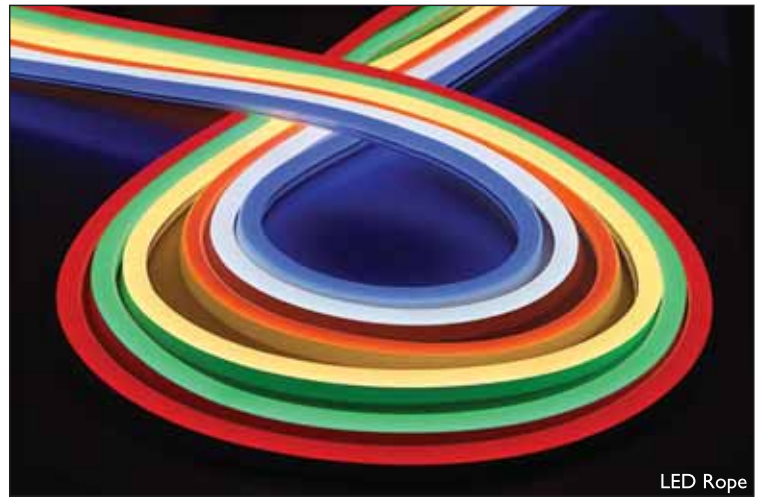
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LED Rope



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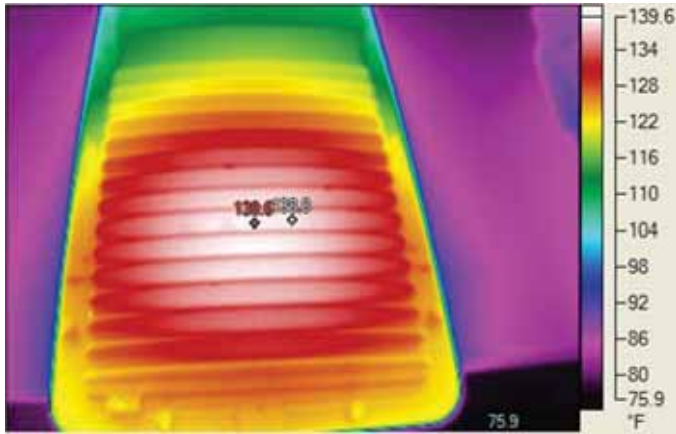


Figure 13: Outside temperature (reverse) of 18 W LED lamp fixture after 5 hours...

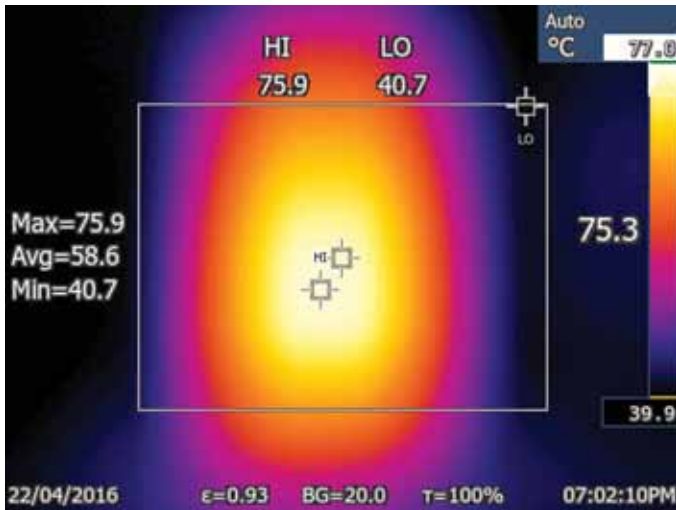


Figure 14: Outside temperature (reverse) of 100 W LED lamp fixture after 2 hours...

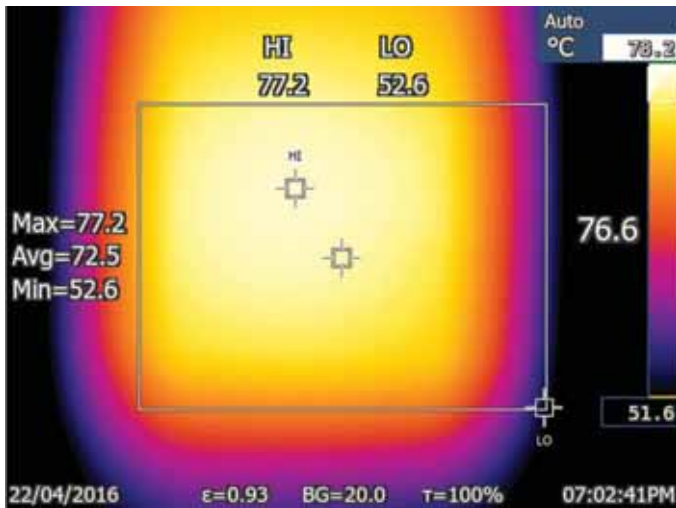


Figure 15: Outside temperature (reverse) of 100 W LED lamp fixture after 2 hours...


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of different types of ballasted and gas filled lamps with LED. The retrofitting calls for placing the new fixture in the place of the same old one. The retrofitting must be accomplished at the maximum efficiency (the performance must be maximum and must not deteriorate after placement of the fixture due to retrofit constraints), minimum cost and minimum displacement of the positional requirements. The ingress protection also results in heat trapping in the system and there will be internal temperature rise in the system. The heat sinking fins do not give uniform temperature conduction in both the x and y directions resulting in temperature concentration as indicated in Figures 14 & 15. This calls for innovative designs such as heat pipes for dispersion of heat from the interior of the fixture to the outside.

### Conclusions

The main conclusions are:

- i. Integration of LED lighting systems with either locally or centrally based SPV into street lighting systems and building lighting systems with intelligence and controllable features, has a fair share of potential as a substitute/retrofit for conventional technologies.
- ii. The LED sector is poised for an increase in its market share from the present 3% to 55% in 2020. The composite growth rate of LED technology may be around 45-55% compared to the present sale unless the scenario is altered by newer more efficient technologies. This calls for efforts at cost reduction through improved designs.
- iii. One of the main deterrents to penetration of LED technology is the capital cost. The cost of the bare LED is over 40% of the system cost. Significant cost reduction is expected in LED costs following the present trends and factors like innovative manufacturing processes, indigenous manufacturing capability and volumes. The lighting fixtures also add to the capital cost as well as affect the performance of LEDs via the temperature and the transmittance efficiency.

The cost of the lighting fixture, their efficiency and their design plays a major role in the successful deployment of LED lighting solutions as retrofits to the conventional systems. The designs have to be configured keeping in mind the constraints of the original lamps to integrate with the lighting system and aesthetics. 



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# UG Cable



Underground cables help in ensuring uninterrupted power supply that are hitherto uncommon in overhead systems. The main hindrance in ensuring uninterrupted power supply through overhead systems is the non-availability of space in developed urban areas...

Electricity plays an important role in the modern society because of its versatility with respect to input energy form. Electricity also offers total environmental, enhancement opportunity as compared to other energy route pattern by the consumer. However, the rapid advancement in the field of electronics and its innumerable applications in residential, commercial, industrial and agricultural sectors, the demands for quality power supply has increased tremendously. The primary requirement of a planning engineer is to give power supply to the consumer in a reliable manner at a minimum cost, taking into consideration the constraints and the criteria such as reliability, economics, environment, society impacts and value of electricity. Therefore, availability of quality power depends on the extent of its requirement by the usage sectors mentioned earlier, the expected degree of reliability etc.

A cable is basically an insulated conductor and is used for underground (UG) transmission and distribution of electricity. Insulation is used to cover the conductor and provides isolation from the surroundings. It should possess high resistance, high dielectric strength, high mechanical strength and long durability.

UG cables are generally used in densely populated areas such as cities and metros, where there are high density of automobiles; high raised commercial, residential buildings and places; where vital installations of uninterrupted power supply such as water supply system, hospitals and IT services, etc. UG cables are also preferred in industries, sub-stations, railways and road crossings, servicing of residential installations and other similar locations.

UG cables help in ensuring uninterrupted power supply, which are hitherto uncommon in the Overhead (OH) system. The main hindrance in ensuring uninterrupted power supply in the OH system is the unavailability of space in developed urban areas. Falling of tree branches on the OH lines and short circuiting of conductors due to heavy winds and gales, rains, accidents due to bare conductors, failure of supporting structures, etc. Although UG cable system at high voltages is expensive than OH line system, the benefits reaped are higher. UG cables system provides high reliability, least interruptions due to line faults and good safety. In addition to this, the  $I^2R$  losses are quite low compared to OH system due to the absence of steel wires. Its



advantages such external protection is provided against mechanical injury, moisture entry and chemical reactions.

## Selection Criteria

The type of cable used at a specific location is determined by the mechanical considerations and the voltage at which it is required to operate. The grade of insulation of the UG cable depends on the voltage levels. Hence, the size of the cable is dependent on the voltage levels. Commonly used UG cables and the basic insulating material structure are appended below:

### Class 1A: PVC Cables

It is a synthetic material and obtained as white odorless tasteless, chemically inert, non-inflammable and insoluble powder. It is chemically combined with plastic compound. Gel is used over the conductor to form the insulation cover. It has a maximum cont. temperature rating of 75°C, dielectric strength of 17 kV/mm and dielectric constant of 5.

### Class 1B: Paper Insulated Lead Cable

It is most popular and highly advantageous as insulating medium due to higher thermal conductivity, dielectric strength, better thermal withstanding capacity capability, low cost and long durability. Paper is dried and impregnated with insulating oil and taped over the conductor. Dielectric strength of this insulator is around 20 kV/mm with a maximum contact temperature of 80°C and dielectric strength is 3.5

### Class 1C: Cross Linked Polyethylene Cable (XLPE)

Specially treated low density polyethylene results in cross linking of carbon atoms and the compound is a new material having extremely high melting point with light weight, small dimension, low dielectric constant and high mechanical strength due to high thermal resistance and very low moisture absorption. These cables can be directly laid on the soil bed and easily worth for voltages up to 33 kV. Depending on the type of cores, the cable is further classified as 1 core, 3 core, and 3 ½ core. Commonly used conductor materials are aluminium and copper. However, aluminium cables are more common because of expensiveness of copper.

The UG cables are classified based on operating voltage levels, as mentioned below.

- L.T. Cable, M.V. Cable, H.T. cable for voltages ranging from 11 kV to 33 kV.
- EHT (Extra High Tension) cable

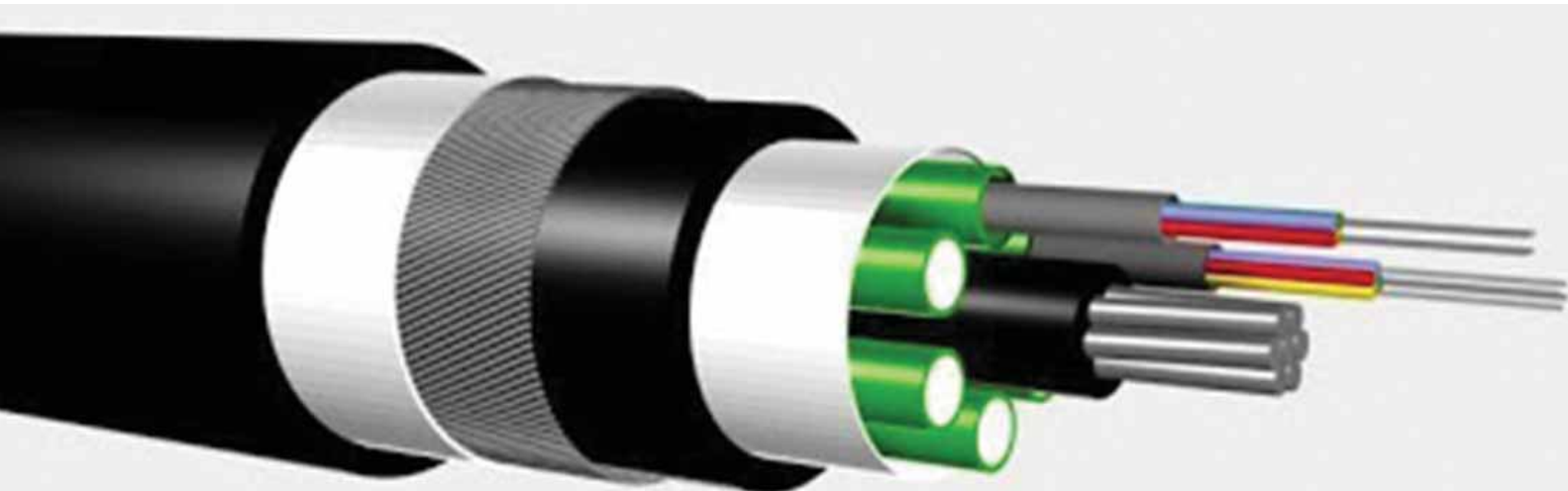
Low Voltage (LV) cables are directly laid in ground and hence, the cheapest, simplest and extensively used method. High Voltage (HV) cables are usually laid on the brick bedding inside trenches, which are



buried at a depth of 0.75-1 m. Additional cables can be laid in the same trench by a minimum clearance of 0.3m between the trench and the cable. The trench is refilled with sand or soil. Details of cable laying conforming to established standards and code of practice is explained below:

## Storage

- i. The cable drums shall be stored on a well-drained, hard surface, so that the drums do not sink in the ground causing rot and damage to the cable drums. Paved surface is preferred, particularly for long term storage.
- ii. The drums shall always be stored on their flanges, and never on their flat.
- iii. Both ends of the cables especially of PILCA cables should be properly sealed to prevent ingress/ absorption of moisture by the insulation during storage.
- iv. Protection from rain and sun is preferable for long term storage for all types of cables. There should also be ventilation between cable drums.
- v. During storage, periodical rolling of drums once in, say, 3 months through 90 degrees shall be done, in the case of paper insulated cables. Rolling shall be done in the direction of the arrow marked on the drum.
- vi. Damaged battens of drums etc., should be replaced as and when it may be necessary.



# Lightning & Surge protection



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TYPE 1 / CLASS I



Lightning Current & Surge Arrester  
TYPE 1+2 / CLASS I+II



Surge Arrester  
TYPE 2 / CLASS II



Surge Arrester  
TYPE 3 / CLASS III



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### Handling

- i. When the cable drums have to be moved over short distances, they should be rolled in the direction of the arrow marked on the drum.
- ii. For manual transportation over long distances, the drum should be mounted on cable drum wheels, strong enough to carry the weight of the drum and pulled by means of ropes. Alternatively, they may be mounted on a trailer or on a suitable mechanical transport.
- iii. For loading into and unloading from vehicles, a crane or a suitable lifting tackle should be used. Small sized cable drums can also be rolled down carefully on a suitable ramp or rails, for unloading, provided no damage is likely to be caused to the cable or to the drum.

### Operating problems with cables

- Cables required high charging current and reactive power for operation. The reactive power is capacity in nature and can affect at lightly loaded conditions due to Ferranti effects of rising of sending end voltage of the cable.
- Flow of charging current causes heating of cables and reduces the lower current capability. Sometimes, higher dielectric loss may further rise in the temperature.
- Switching of cable capacitive current may give rise to over voltages.
- Although the purpose of using OH line and cables being the same, use of UG cables is limited due to large charging current for long distance transmission.
- The insulation required by cable is high, heat dissipation is less than OH lines.

UG cables have greater safety and less interference with communication lines, with better outlook.

The limitations of UG cable are:

- Expensive compared to OH lines
- Difficulty in fault detection
- Restoration of power supply takes longer time during break down.

Precautionary Measures for better reliability and safety:

- For ensuring longer life of the cable, UG cable should never be overloaded for longer duration – and always advisable to restrict the loading to about 70% of the rated capacity.
- Before carrying out maintenance of the UG cable, care should always be taken to discharge the static charges stored in the cable.



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Bangalore



## 4 Major Challenges Necessitating The Need For Intelligent Energy Storage

With the changing demand pattern, the energy supply methodology also needs to transform...

Earlier, electricity has flowed through the grid in one direction – centrally generated, transmitted long distances, then distributed within cities to customers. But, today the world's demand for energy has

changed. We have become more dynamic in terms of where, when and how we consume energy. We want it to

come from renewable sources. We want to be more efficient with what we already have. These changes in both supply and demand present a new set of challenges.

- Our grid infrastructure is aging.
- It lacks intelligence.
- It is generally inflexible in handling the growing demands of consumers in a rapidly accelerating electronic age.
- Energy generated from renewable sources is difficult to integrate since it isn't reliable and doesn't generate when we need it.

The adoption of intelligent energy storage as part of the electricity supply chain solves many of these challenges.

(Source: Demand Energy Networks, Inc.)



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# Selecting Wire & Cable For Solar PV Applications



Photo courtesy: [www.huberstline.com](http://www.huberstline.com)

Cables are extensively used in photovoltaic systems and their management can often be critical for effective functioning. Various standards for cables used for the purpose are also being discussed...

The renewable energy market is growing rapidly. This growth applies to wind energy as well as to solar energy. Due to public interest, a number of governments have decided to support the renewable energy economics with large amounts of subsidies. Thus, even a further increase in this market can be expected. Cable management is one of the most important aspects of the safety and longevity of nearly every photovoltaic (PV) system. This is primarily due to the extensive use of exposed cables in the DC PV array. Since the equipment is installed outdoors on rooftops and in open fields, the electrical conductors must be rated for sunlight resistance and be supported and secured properly. Most electricians are referred to as 'indoor wiremen' and are familiar with installing conductors in conduit, but have little, if any, experience working with exposed cables in power systems. These exposed cable power systems are common in the utility and petroleum industries and there are decades of experience with these types of systems. Since the National Electrical Code (NEC) does not regulate either of these industries, there is little in the NEC to guide these types of installations.

Photovoltaic refers to the direct generation of electricity by solar irradiation. Photovoltaic cells use special semiconductor materials, the most common being silicon, to harness solar energy. When light strikes the cell, some of the solar irradiation is absorbed within the semiconductor material. The energy of the light is now transferred to the semiconductor, knocking electrons loose and allowing them to flow freely and release energy. CSP technologies use mirrors to reflect and concentrate sunlight onto receivers that then collect the solar energy before converting it to heat. The resulting thermal energy is then used to produce electricity through a steam turbine or heat engine that drives a generator.

Currently, three common types of CSP technologies exist: a parabolic trough, a solar power tower, and a solar engine. A parabolic trough is shaped like a half-pipe and is covered with mirrors that are aligned north-south and pivot to follow the sun during daylight. These mirrors concentrate the sun's rays onto heat transfer fluid pipes at 30 to 100 times their normal intensity. The pipes are then used to produce steam to spin a turbine to power a generator. Solar power towers, on the other hand,





generally use thousands of flat sun tracking mirrors called 'heliostats' to concentrate the sun's radiation onto a single tower-mounted receiver, at which point same process as the parabolic trough is applied. The last type of aforementioned CSP technologies is the solar engine, which contains both a solar concentrator and a power conversion unit. The most popular example of a solar engine is the Stirling engine, which uses a sun-tracking mirrored parabolic dish to direct captured heat to a hydrogen gas-filled piston. The piston then drives the engine to produce electricity. Over a twenty-year period, a Stirling engine system can generate over 850 MW of electricity.

Although the sun is an excellent energy source during the day, the method in which solar energy is stored is critical due to the lack of continuous supply. An effective and low-cost way of storing solar power is employing the use of molten salts. Salts have a high specific heat capacity and can deliver heat at temperatures compatible with conventional power systems. Off-grid PV systems traditionally store excess energy with rechargeable batteries. With grid-tied systems, the excess electricity can be sent to the transmission grid and kept track of using net metering programs. Net metering programs give such systems a credit for each megawatt of electricity delivered to the grid. These credits offset electricity provided from the grid when the system cannot meet demand, effectively using the grid as a storage mechanism.

The photovoltaic market is a very specific market. Various national regulations are to be taken into account. The system size can vary from a small home power supply with a nominal power of few kilowatts up to large centralised solar plants in the Gigawatt range. The components used in these systems must be suitable for these specific applications. One common determining factor for all photovoltaic power systems is the outdoor use, which brings along high temperatures and, of course, high UV radiation. Weathering and humidity need to be taken into account, as well. Furthermore, safety and reliability aspects are very important.

### Cable Requirements

Despite being a critical component, wiring for solar panels is rarely discussed. In home solar power systems, there are four components to connect together: the solar panels, the charge controller, the batteries, and the inverter. The charge controller is used to prevent the batteries from overloading; the wires that connect the panel to the charge controlled should be correctly sized to minimize transmission power loss.

Correspondingly, the further away the panels are, the larger the wire gauge should be. The inverter is used to convert the DC power collected by the panels into AC power, which is the most popular form of electricity accepted by appliances. These systems are typically outdoors, so any cable used for this type of application needs to be ultraviolet radiation resistant and suitable for wet locations. For solar tracking panels, the cables used need to be flexible as the panels will be moving along with the sun.

CSP systems have a lot of requirements similar to solar panel. However, in addition to the water and UV resistance, the cables used need to be able to withstand high temperatures.

### Standards for Solar Power Cables

Both the United States-based agency Underwriters Laboratory (UL) and the German-based agency Technischer Überwachungs-Verein (TUV) have approvals specifically for wires used in photovoltaic

applications. UL has two types of approvals for photovoltaic applications: USE-2 and type PV. Originally, the standard approval for photovoltaic applications was USE-2. However, once there was a greater demand for wire for solar power, UL designed the UL type PV approval to meet the needs of such applications better. USE-2 and type PV approvals are similar; however, there are a few differences. PV wire can be used in both grounded and ungrounded PV arrays and is rated +90°C wet and +150°C dry with approvals for 600V, 1000V, and 2000V. Although USE-2 is only suitable for grounded PV arrays per NEC, it has a +90°C wet and dry rating and is only rated for 600 V. In addition to the better temperature and voltage range, type PV wires have better sunlight resistance, low-temperature flexibility, flame resistance, and thicker insulations for additional element protection.

### UL 4703 Standard

In 2005 the American Underwriters Laboratories (UL) published the UL subject 4703 'Photovoltaic Wire.' It covers single-conductor, insulated and integrally or non-integrally jacketed, sunlight resistant, photovoltaic wire in several temperature and voltage ratings for interconnection wiring of grounded and ungrounded photovoltaic power systems.

The standard UL 4703 is based on the service entry cords USE-2 and specifies some additional requirements for photovoltaic cables. The UL standard leaves more freedom for the manufacturer as far as the cable construction and the selection of materials is concerned. One or two insulation layers can be chosen optionally as well as a 'skinned' single layer construction. For two layer construction, as specified in the DKE-document, several combinations of wall thicknesses are allowed in UL 4703. But in each case the total sum of wall thickness will be higher than specified in the German specification (see table 1). Thus, the diameter for the same conductor cross section will be higher that reduces the suitability for several connectors. And the increased need of insulation compound will add to the production cost.

Table 1: Wall thicknesses acc. to UL 4703

Dimension	AWG 10 — AWG 18	AWG 2 — AWG 9
Single layer	1.52mm / 60mils	1.91mm / 75mils
Skinned	1.91 mm / 75mils (1.14mm + 0.76mm)	2.28mm / 90mils (1.52mm + 0.76mm)
Double layer	2.28mm / 90 mils (1.14mm+ 1.14mm)	2.66mm / 105mils (1.52mm+ 1.14mm)

The main focus of UL 4703 is the fire performance. Tests to be performed are the Vertical Flame Test acc. to UL 1581, Section 1060 or optional the flame test VW-1 acc. to UL 1581, Section 1080. Based on RHW-2 the flame test FT-2 acc. to UL 1581, Section 1100 is also required. Therefore, another cable construction will be necessary to meet the UL-requirements.

The new developed solar cable is a single core cable built with a tinned stranded conductor. All materials are halogen free, flame resistant and fire retardant. No corrosive gases will be released in case of fire and the smoke density is low. The insulation and jacket materials are extremely resistant to weathering, UV-radiation and abrasion. The wide temperature range from -50°C to +150°C (fixed installation) enables the use of this cable in extreme weather conditions. Additionally, it is salt water resistant and resistant to acids and alkaline solutions.



The cable is flexible and designed for high mechanical loads. So it is suitable for fixed installation as well as for moving applications without tensile load. It is especially designed for outdoor use, which means direct sun radiation and air humidity, but due to the halogen free flame retardant cross-linked jacket material the cable can also be installed in dry and humid conditions indoors.

### Fire Performance


Although the danger of fire propagation in outdoor applications such as solar plants is not a great risk for the safety of people, a good fire performance is required to protect the technical equipment. The document specifies a flame propagation test on the completed cable according to IEC 60332.1.

### Absence of Halogens

In the case of fire, acids caused by the smoke of halogenated materials are a serious danger for people's health as well as for the function of electric and electronic devices. In former times halogen free cables were required in public areas such as hospitals, airports and other similar structures. But due to the increasing importance of electronics in all areas of everyday life, this quality is increasingly required in industrial premises, too.

As far as for solar cables, this characteristic is especially important for solar power devices on residential buildings. Several tests have to be performed to prove the absence of halogens in solar cables. Electrical

conductivity and pH value of the smoke are to be quantified according to European standard EN 50267-2-2. The content of chlorine and bromine is determined according to EN 50267-2-1 and a special test is developed for the content of fluorine in Annex C of the discussed specification.

There are different standards for solar cables in different countries. The requirements are very high, but they differ due to the various national philosophies in respect to safety and reliability issues as well as market and subvention aspects. The determining factors in this application are external conditions, which do not depend on national laws and can depend only on few local aspects. Therefore, a standard in the future will be established by international market acceptance. Due to the different requirements and philosophies in each individual standard, one cable cannot satisfy both standards at the same time. In order to meet these standards and not to compromise the performance of the cable, one type of cable is needed to satisfy the requirements of the specification and another cable type is needed to satisfy the UL requirements. 



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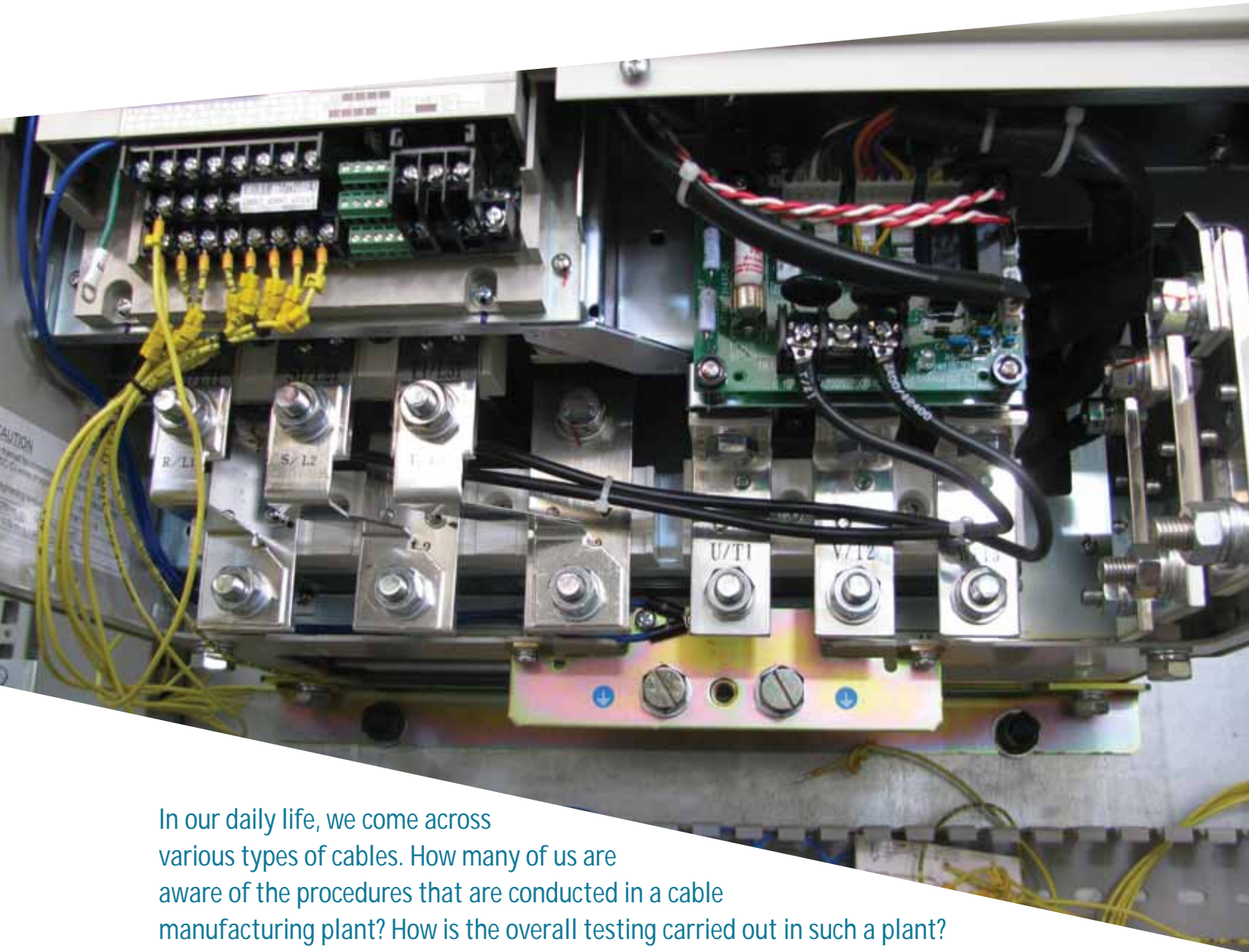
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# Testing Procedure For Cable Manufacturing Plants



In our daily life, we come across various types of cables. How many of us are aware of the procedures that are conducted in a cable manufacturing plant? How is the overall testing carried out in such a plant? Read on...



**A**fter installation and commissioning, all the functions as per individual elements and their interconnected wiring is required to be checked under cold test, i.e., without energisation of any element in the panel or at the machine. After cold test, individual elements and independent test shall be conducted under energised condition.

After this limited interconnected elements shall be checked for its signal exchange and functioning. All inputs and outputs shall be monitored at PLC Input Cards. Similarly, isolating the PLC output terminal Opto card which is an interface between PLC output and actual elements shall be tested. At this stage all the drive parameters shall be uploaded through PC or display keyboard at individual drive. AEF shall be checked for its functioning and DC bus generation as the input supply to the all drives. A simulation test without running the machine is conducted for software program responsible for overall run of the machine. After successful test, whole machine along with Panel are ready for Trial Run.

## System Testing

### Cold test

For check of wiring and interconnection among various elements is to be ensured cautiously with respect to design documents. A separate folder for 'terminal board' drawing has been made with cross reference and with no place for ambiguity. The results are recorded in form of tabulated check list:

Table 1: Tabulation for wiring check list

S. No.	Signal	Name	Designation (terminal board)	TB No.	Colour	Wire No.	Result
1.	Forward select	Run	Main panel & drive panel	T B x 8	Red	811	✓

### Earthing test

Total impedance including cables from any unit point to earthing pit must be below 0.3Ω.

### Energisation of PLC for Input Signal test

Before proceeding, measurement of cold condition resistance between positive (+ve) and negative (-ve) points at all TERMINAL boards is measured & recorded as a Ohmic reference value, to declare healthy conditions.

Table 2: PLC Input Ohmic Record

S. No.	TBX. Terminal Board	TB No. Positive (+ve)	TB No. Negative (-ve)	Ohmic value
1.	TBX 8	1	2	473.0 Ω

Conclusion: Any Ohmic value more than 470 Ω will be considered as healthy and below this needs investigation.

### Measurement of Encoder waveform

With slight rotation of encoder, under flexible coupled condition; the wave of signal A and B with corresponding inverted form are measured at source and receiving end for no loss & deformation of true square wave. In our case, 128 pulses are recorded for every quarter of motion.

### Analog signal drop

Accuracy in drive synchronisation is significant. Few mV signals were issued from the source and a record at receiving end was measured. Variation at both ends was recorded. One sample exercise given and it was repeated for next 11 analog signals. It confirms the selection and usage of screened analog cable is in order.

Table 3: Analog signal transmission error

S. No.	Measurement at source	Measurement at recovering end	Difference	% Error
1.	0.5 mV	0.45mV	0.05mV	10
2	----	-----	-----	-----

### PLC supply energisation

With prompt alertness, all cage PLCs are energised step by step. Checking, for PLC inputs by actual operation of mechanical dogs, stoppers, levers, limit switches, proximity sensors, push buttons, thermostats and pressure switches etc., is done with actual machine operating conditions.

Table 4: PLC Input checking

S. No.	Operating Element	PLC Input	LED	Measured Value
1.	Push Button	I 1.1	Lit	23.7V
..	.....	...	...	....

### Simulation for PLC output devices

Isolating PLC output card/connectors, an external power source with short circuit protection is applied to all PLC triggered output devices. On actuation, its applied effect on indicators, solenoids is recorded for all output signals.

### Test for PLC interface Opto-cards

Disconnect PLC output terminal board cum connectors; and a 24V DC signal (protected by 250 mA) is injected to input of Opto-cards and corresponding output should operate a control relay or an LED indicator at cage station, control desk or a signal transmission to corresponding receiver end at respective terminal board. The exercise is to be repeated for 31x8=248 times as per drawing and each record is to be kept separately.

### Test for emergency P.B. pressings

This is very important to ensure the effect of EMG. P.B. is positive, especially when there are 12 locations of emergencies. EMG. Signal is processed directly by hard wired logic & via PLC, in such a way that even if a wire is opened, the action should be taken as if emergency exists. The record is made & checked in a preventive maintenance schedule.

### Active energy front energisation

Keeping all MCB in off conditions, only 3 phase supply is given to external charging circuit and DC bus is energised and a watch on DC bus voltage is kept. Simultaneously inbuilt fan in LCL filter must be in rotation; else stop charging and connections / fuse etc. are to be checked. The procedure is followed as per the following sequence flow diagram.

### Cage panel testing

3 phase & 415V supply is measured before main's isolating switch. Impedance of R, Y, B line with respect to connected motors should be recorded as reference for healthy condition for motor. The variation must be controlled, by adjusting carbon brush angle and shape. The carbon brush must be under spring pressure. All the carbon bushes & slip ring connection must be clean and tight in an enclosed chamber.

### Take up panel testing

On 3 phase supply energization, start procedure as per following sequence.

### Software Loading

PLC software is developed as per machine and should be uploaded in all PLC units and HMI touch panel including developed screen pages,



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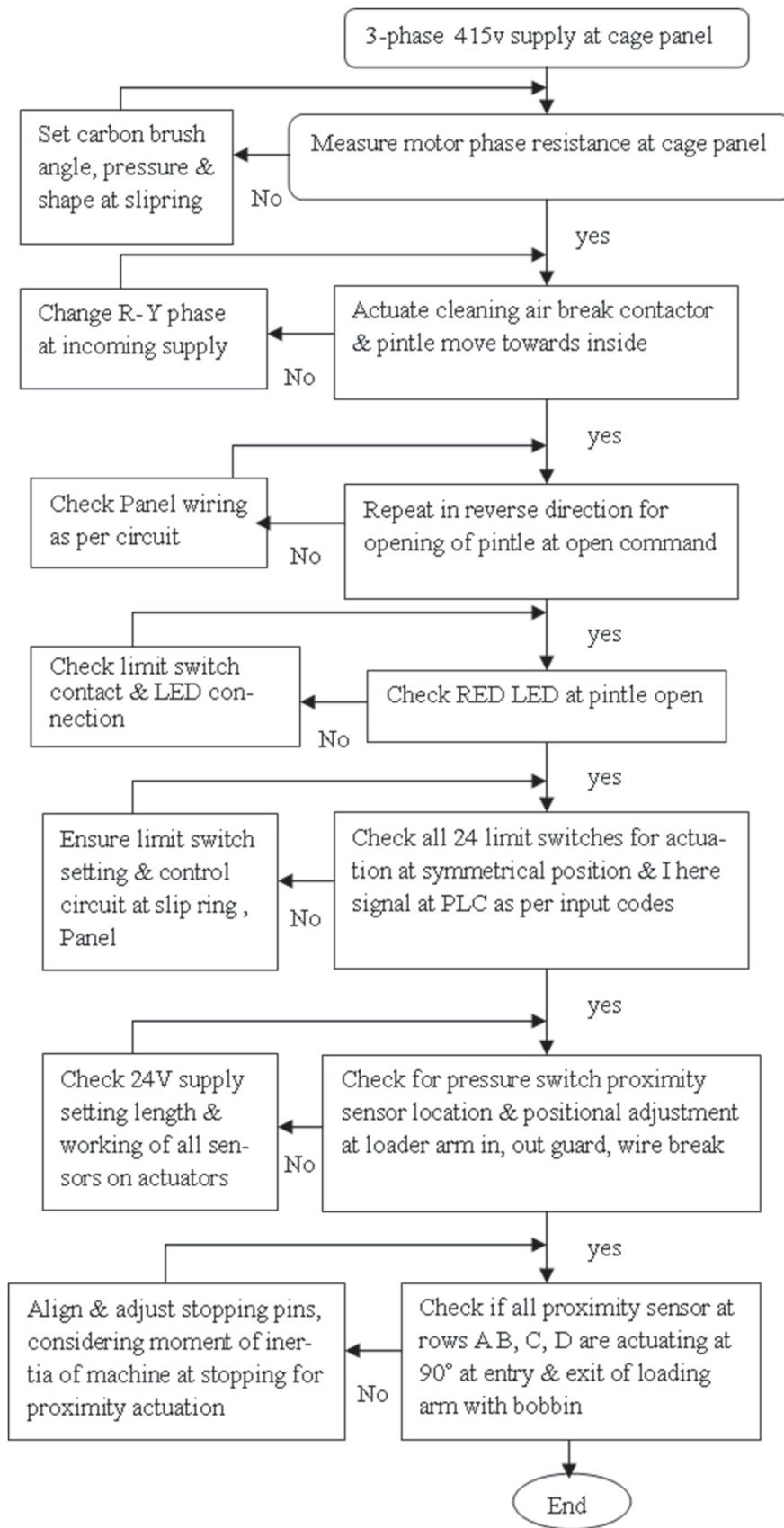


Figure 1: Flowchart for Cage Panel checkup...

data and windows Xp. Drive Wizard and Parameter uploading is required to be done in all Drives.

Active Energy Front Device parameters are loaded for control and performance of DC bus voltage and by bidirectional flow of energy during inversion and conversion processes.

### Software simulation without running of machine

The Input and Output functions for all cages are checked as per PLC I/O list. Following three inputs from main panels to AEF units are to be checked by simulation and its output logics should be noted.

- Request for synchronies with main utility networks (Regeneration).
- Shut down DC bus.
- Run enables/disables for base and block of IGBT.

### Simulation of digital signals (I/O) at main panels

All signals coming from cages to main PLC and command signal from main PLC to cages are simulated for their functions as defined in I/O list. For reference following strings are given.

- Readiness of all cages and Start/stop of all cages.
- Warning when conductor present length target is reached.
- Start/stop of hydraulic pump motor is simulated, especially when line is not running. It is exclusively simulated when any of cage station is selected for same activity.
- Load in progress in all cages.
- Issue of load clearance on station selection request.
- Over all fault signal creation.

### Simulation of message/alarm at Touch panel HMI

All cage faults i.e., by opening left/right guard, Wire break, Pintle opening, Loading arm is not at home, Station select, Drive trap, Panel over heat, No application data entered, Encoders cables faults, Encoders rotation is not getting sensed, Motor over heat, Indexing gear is engaged, Load clearance from main control desk can be displayed in HMI.

Among PC, main PLC (Programmable Logic Controller), HMI (Human Machine Integration), cage 12, 18, 24, 30 and all the 7 drive units. Further Ethernet communication by RJ-45 connection among all units as covered above.

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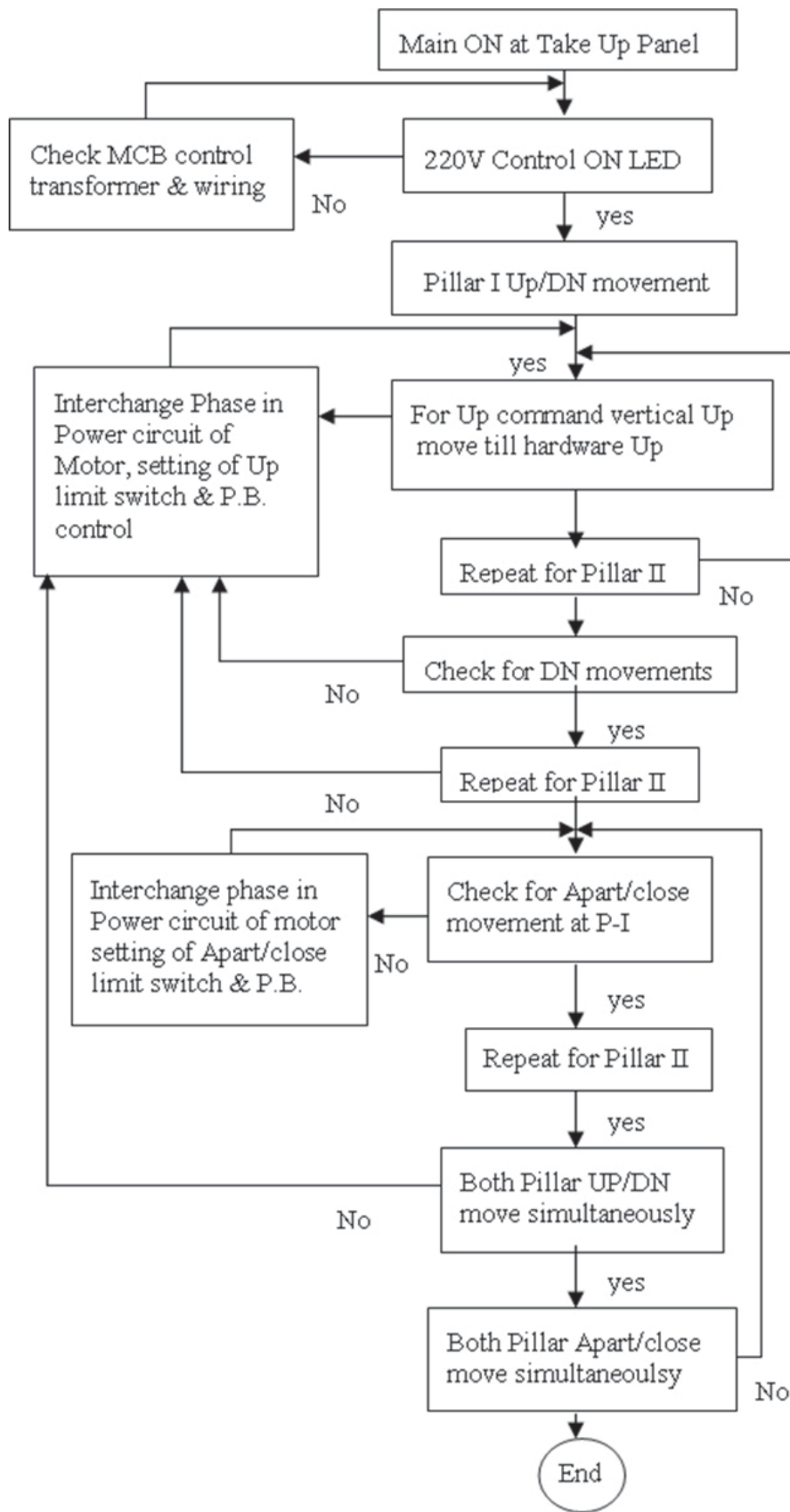


Figure 2 Flow Chart for Take Up Panel Check...

### Auto tuning of drives

Mechanically all motors including all cage, capstan, take-up, auto traverse and motor are un-coupled from machine before proceeding for online tuning.

The actual cable under application is included as a part of motor winding resistance. After entry of motor name plate data like kW, RPM, power factor, supply voltage, number of pole.

Encoder data like pulse per revolution (PPR), gear ratio, direction and alarming conditions are entered as parameter in the drive manual.

The run command is given for auto-tuning and motor winding data, losses at no load, slip, etc., are internally calculated and kept in the drive memory.

### Conclusion

The article discussed various initial checks and examining healthy conditions of all sub-assemblies of main equipments. A cold test check is conducted without energising the equipments for all its inter-connections at terminal boards.

DC bus is especially checked for polarities by feeding say 2V cell. Earth resistance test for both power and screen cable is conducted for satisfying minimum value criteria.

A record of tests is tabulated as reference values at beginning. Low signals like encoder and analog signals are measured for proper reference and mV drop, if any.

AEF panel, take-up panel and other cage panels are energized following their sequence as per flow chart. Software in PLC is uploaded including operating system, and machine. A simulation test without run is conducted for software check.



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# Planning & Decision Making



Could there be a fairly reliable way to forecast future electricity demand by taking into account various variables in order to make economic and technical decisions? Here is an article which looks into a method of doing precisely such a thing...



The economic growth of the country depends on the generation of power and also on the per capita consumption. Therefore, it is necessary to make an advance plan for the future, since the economic growth is crucially dependent on the power sector. The total power generated in India with non-renewables and renewables up to 2014 is shown in Fig.1.

As of now 5GW power is generated from nuclear, 25 GW from oil and gas, 154 GW from coal, 21, GW from wind, 2GW from solar, 41 GW from hydropower, and 7 GW from biomass. The Gujarat Energy Research and Management Institute in Gandhinagar, Gujarat (Reference 1) has suggested that a target of 612 GW (which is about 2.4 times the 2014 capacity) consisting of both non-renewable and renewable generation can be achieved in 10 years, by 2024, as shown in Fig.2.

In this article, we apply the random number theory to project the total expenditure that will be required over a 10 -year period to increase the GW capacity of renewable and non-renewable sources. First, we apply the theory to non-renewable sources. Fig.3 shows the GW power of non-renewable sources in 2014, target in 2014, and increase in power over the 10-year period, and the total assumed expenditure for increase in power in 2024.

	NUCLEAR	OIL-GAS	COAL
GW power in 2014	5GW	25GW	154GW
Target in 2024	12GW	60GW	370GW
Increase in power in the ten-year period	5-12 GW	25-60GW	154-370GW

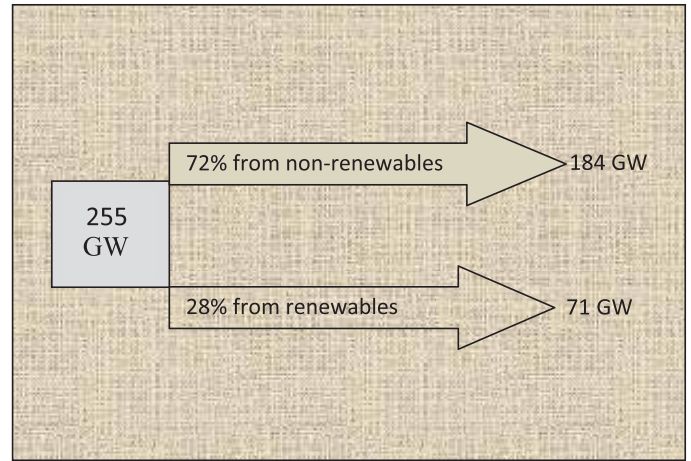


Fig. 1: Power generation capacity in 2014...

	NUCLEAR	OIL-GAS	COAL
Total assumed Expenditure for increase in Power in 2024	Rs-Crores 360000	Rs-Crores 300000	Rs-Crores 5550000

Fig. 2: Projected power generation capacity and total expenditure in 2024 for non-renewable energy sources...

### Random number theory

On an Excel spreadsheet if you type a function '=R AND BETWEEN(1,4)' and say fill 5 spaces in a column you will get the set of

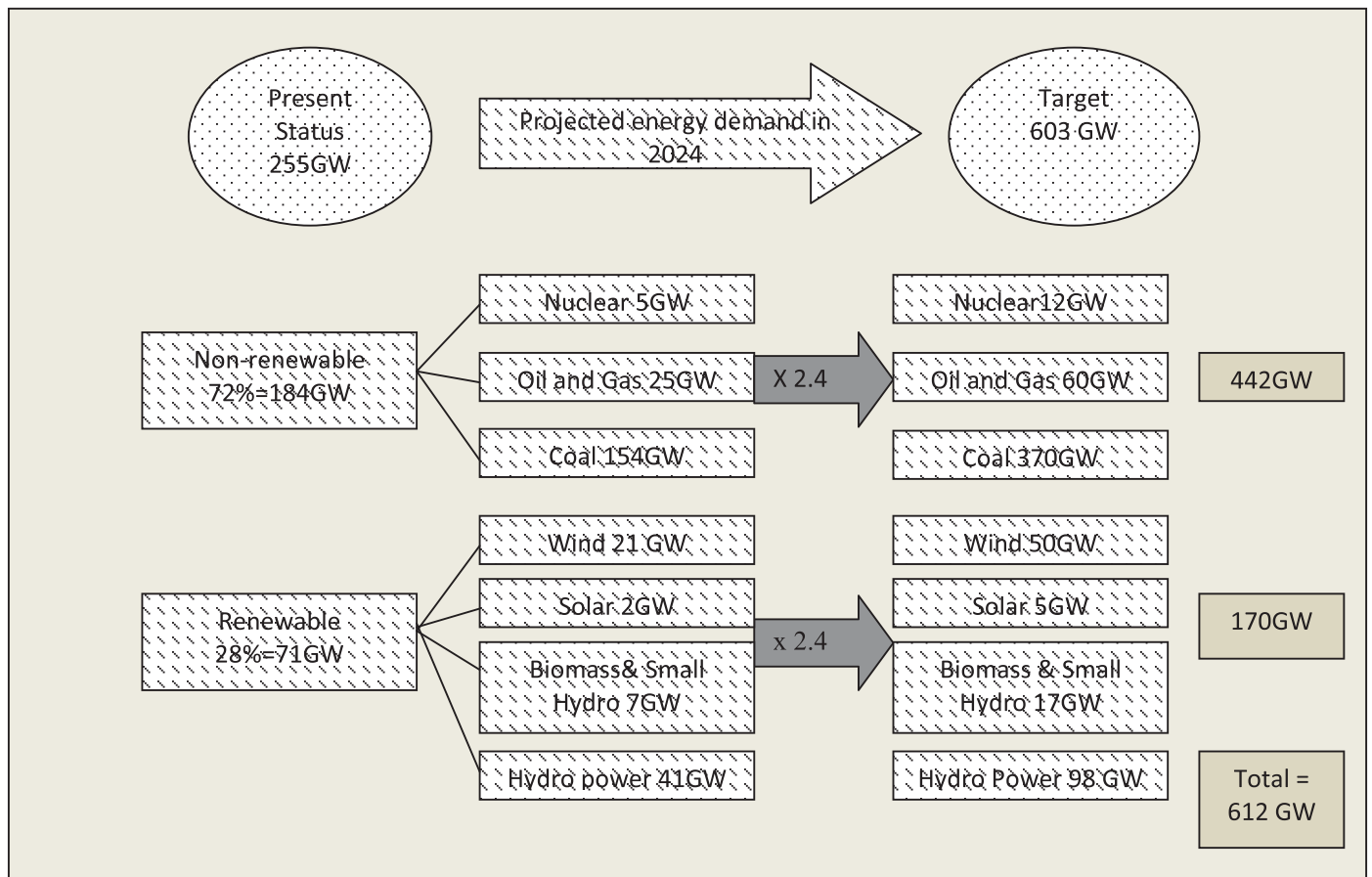


Fig.2 Projected power generation capacity in 2024 (Ref.1)...



numbers, 2,3,4,3,2 or any other which are within the range (1,4). Similarly, for example, the random number table for nuclear power is generated as shown in Fig.4 and the corresponding cost is calculated..

Increase in Nuclear power, 5-12GW R and between (5,12)	Cost per GW, Rs 30000
10	300000
8	240000
7	210000
6	180000
12	360000
8	240000

Fig.4 Random number generation of nuclear power in GW and the corresponding costs...

### Costs for increasing the generation capacity of all non-renewable plants over a ten-year period

The random numbers and corresponding costs are generated for all nonrenewable plants as shown in the previous section. The total costs for all non-renewable generators are then added and arranged in an increasing order of total costs, as shown in Fig.5 (below). It can be observed from Fig.5 that increasing the capacity of non-renewable sources from 201GW to 401

GW in ten years will increase the expenditure on non-renewable sources from Rs 2890000 to Rs 5805000 crores.

### Costs for increasing the generation capacity of all renewable plants over a ten-year period

Fig.6 shows the GW power in 2014 for renewable plants, target in 2024, increase in power over the 10-year period, and the total assumed expenditure for increase in power in 2024.

Next, the random numbers and corresponding costs are generated for all renewable plants as shown in the previous section. The total costs for all renewable generators are then added and arranged in an increasing order of total costs, as shown in Fig.7. It can be observed from Fig.7 that increasing the capacity of non-renewable sources from 305 to 396 GW in ten years will increase the expenditure on renewable sources from Rs 5745000 to Rs 7590000 crores.

### Summary

In this article, we have suggested a planning and decision making method in the power sector for its future demand by using the method of random variables. The method is similar to the method of Monte Carlo analysis but is much simpler. We have assumed the total expenditures over a 10- year period for both renewable and non-renewable generation,

NUCLEAR		OIL-GAS		COAL		Total GW	Total Cost in Crores	Rank
GW	Rs in crores	GW	Rs in crores	GW	Rs in crores			
11	330000	29	145000	161	2415000	201	2890000	1
7	210000	58	290000	177	2655000	242	3155000	2
5	150000	33	165000	193	2895000	231	3210000	3
7	210000	36	180000	212	3180000	255	3570000	4
11	330000	39	195000	212	3180000	262	3705000	5
10	300000	51	255000	212	3180000	273	3735000	6
9	270000	25	125000	234	3510000	268	3905000	7
9	270000	33	165000	249	3735000	291	4170000	8
6	180000	55	275000	251	3765000	312	4220000	9
8	240000	50	250000	271	4065000	329	4555000	10
12	360000	30	150000	270	4050000	312	4560000	11
11	330000	26	130000	284	4260000	321	4720000	12
7	210000	34	170000	301	4515000	342	4895000	13
12	360000	40	200000	291	4365000	343	4925000	14
7	210000	53	265000	312	4680000	372	5155000	15
6	180000	45	225000	326	4890000	377	5295000	16
8	240000	46	230000	325	4875000	379	5345000	17
7	210000	33	165000	341	5115000	381	5490000	18
11	330000	31	155000	343	5145000	385	5630000	19
12	360000	29	145000	346	5190000	387	5695000	20
8	240000	59	295000	350	5250000	417	5785000	21
10	300000	36	180000	355	5325000	401	5805000	22

Fig.5 Projected power generation capacity and total expenditure in 2024 for non-renewable sources...



# 5 Points To Note On India's Nuclear Power Programme

It is quite satisfactory to note that in 2015, under the leadership of Prime Minister Narendra Modi, India has seen major achievements in the field of civil nuclear cooperation...

With a view to making India a power-rich country, beside renewable energy, the Union Government has been emphasizing on developing the nuclear power segment. In Union Budget 2016-17, Rs. 3,000 crore has been earmarked for nuclear power generation. The Union Government is also drawing a comprehensive plan to be implemented in next 15 to 20 years for exploiting nuclear energy. It is quite satisfactory to note that in 2015, under the leadership of Prime Minister Narendra Modi, India has seen major achievements in the field of civil nuclear cooperation. The implementation of the civil nuclear cooperation agreement with the U.S. was put back on course when Prime Minister hosted President Obama in New Delhi between January 25 to 27, 2015.



Source: ANI

A retrospective view of the construction site of the Koodankulam Nuclear Power Plant...

- 1) India has a flourishing and largely indigenous nuclear power programme and expects to have 14.6 GWe nuclear capacity on line by 2024 and 63 GWe by 2032. It aims to supply 25% of electricity from nuclear power by 2050.
- 2) Because India is outside the Nuclear Non-Proliferation Treaty due to its weapons programme, it was for 34 years largely excluded from trade in nuclear plant or materials, which has hampered its development of civil nuclear energy until 2009.
- 3) Due to earlier trade bans and lack of indigenous uranium, India has

- uniquely been developing a nuclear fuel cycle to exploit its reserves of thorium.
- 4) Since 2010, a fundamental incompatibility between India's civil liability law and international conventions limits foreign technology provision.
- 5) India has a vision of becoming a world leader in nuclear technology due to its expertise in fast reactors and thorium fuel cycle.

(\*We acknowledge inputs from World Nuclear Association)



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	Wind	Solar	Biomass	Hydro	geothermal
GW power in 2014	21GW	62 GW	1 GW	41GW	1GW
Target in 2024	203 GW	100GW	17 GW	98 GW	5GW
Increase in Power in the ten-year period	21-203 GW	62-100 GW	1-17 GW	41-98 GW	1-5 GW
Total assumed Expenditure for increase in power in 2024	Rs-Crores 3150000	Rs-Crores 2500000	Rs-Crores 210000	Rs-Crores 2050000	Rs-Crores 100000

Fig. 6: Projected power generation capacity and total expenditure in 2024 renewable sources...

Wind		Solar		Biomass		Hydro		geothermal		GW	Total Rs. Crores
GW	Rs. Crores	GW	Rs. Crores	GW	Rs. Crores	GW	Rs. Crores	GW	Rs. Crores		
										Minimum to Maximum	Rank
166	2490000	62	1550000	14	140000	61	1525000	2	40000	305	5745000
159	2385000	73	1825000	14	140000	70	1750000	1	20000	317	6120000
186	2790000	51	1275000	16	160000	65	1625000	1	20000	319	5870000
162	2430000	65	1625000	15	150000	74	1850000	5	100000	321	6155000
166	2490000	69	1725000	13	130000	70	1750000	4	80000	322	6175000
192	2880000	62	1550000	15	150000	68	1700000	2	40000	339	6320000
176	2640000	68	1700000	17	170000	73	1825000	1	20000	335	6355000
163	2445000	84	2100000	20	200000	61	1525000	5	100000	333	6370000
203	3045000	65	1625000	16	160000	66	1650000	1	20000	351	6500000
189	2835000	64	1600000	16	160000	73	1825000	5	100000	347	6520000
176	2640000	72	1800000	14	140000	78	1950000	1	20000	341	6550000
178	2670000	100	2500000	13	130000	61	1525000	1	20000	353	6845000
201	3015000	69	1725000	17	170000	78	1950000	1	20000	366	6880000
194	2910000	91	2275000	14	140000	62	1550000	1	20000	362	6895000
197	2955000	82	2050000	15	150000	69	1725000	2	40000	365	6920000
173	2595000	89	2225000	15	150000	76	1900000	4	80000	357	6950000
208	3120000	76	1900000	12	120000	70	1750000	4	80000	370	6970000
204	3060000	76	1900000	14	140000	77	1925000	5	100000	376	7125000
204	3060000	88	2200000	11	110000	72	1800000	3	60000	378	7230000
188	2820000	95	2375000	11	110000	81	2025000	5	100000	380	7430000
204	3060000	95	2375000	10	100000	75	1875000	4	80000	388	7490000
201	3015000	96	2400000	19	190000	77	1925000	3	60000	396	7590000

Fig.7: Projected power generation capacity and total expenditure in 2024 for renewable sources.

based on the reported cost of generation as in 2014 for various energy sources. However, the costs of generation, especially for renewable sources are drastically coming down now.

The procedure may accordingly accommodate the current cost of generations of sources to arrive at the correct figure of expenditure. These can be changed easily if the expenditures appear to be excessive, and the random number analysis can be repeated. As the technology grows and matures, the cost of generation especially of renewable sources is likely to come down. The main advantage of random number analysis is that we are able to decide the types of generations and the GW increase in their capacities over a 10-year period depending on the availability of funds, because the increased capacities are ranked from a low initial expenditure to the highest expenditure in the 10-th year. <sup>13</sup>

Reference: 1. "An Innovative solution for power shortage in India" by T. Harinarayana (GERMI, Gandhinagar, Gujarat), Electrical India, Vol.56, No.2, February 2016, pp.24-26.



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# Interview



**Havells India Limited** is a Fast Moving Electrical Goods (FMEG) company with an extremely strong global presence. The company started practising 'Making in India and Powering the World' long before it became India's national slogan. In an exclusive interview with **Electrical India**, Senior Vice President of the company, **A V Jagdish**, is discussing their success strategy with **P K Chatterjee**. Excerpts...

**“We are always committed to delivering quality products...”**

- Q** As one of the leading FMEG manufacturer in India, what are your top priority areas at present?
- A** Our main priority is to provide innovative, high quality and consumer friendly products and surpass our customer expectations.
- Q** What do you consider to be the fastest growing area in the FMEG field?
- A** Our LED business is one of the high-growth areas, from which we expect to yield considerable revenues over the next few years. With the increased government focus and subsidies on LED, the next few years could mark a huge spurt in demand from this segment.
- Q** What kind of emphasis do you give on Research & Development (R&D) of new products?
- A** Over the years, we have enhanced our technological strengths through extensive in-house R&D activities. In 2005, we established a corporate R&D centre to develop technological capabilities for value creation in diverse business areas and provide the next growth engines. This R&D centre has pursued adaptation of the latest technologies for product development and overcoming manufacturing challenges in the business divisions. We have dedicated R&D centers in all our plants and at head office. The centers closely co-operate and work with various departments to provide the best and the latest in the term of technology and design – and aim to develop new products, upgrade existing products and improve productivity.



**Q What are the new products to be launched in 2016?**

**A** We have recently forayed into entry level modular switches with the launch of 'Reo Bliss.' Reo Bliss range of switches represent a unique symbiosis of advanced technology, maximum functionality and exquisite design to match the taste of today's discerning customers – who want the best-in-class product at affordable prices. The product is available at an attractive price of Rs 19 onwards.

**Q How do you manage to maintain the reasonable balance between safety, aesthetics and cost in your offerings?**

**A** Havells clearly understands the importance of its contribution in energy conservation and reducing environmental hazards. Wasting energy is like wasting the resource which can't be recycled, and it will reflect on customer's electricity consumption bill too. Hence, Havells is always keen to deliver products which meet the customer's requirement as well as save on energy.

The dedicated R&D division at Havells is relentlessly engaged in finding ways to bring down energy consumption and ensure optimum utilization of the products. A combination of quality raw material, specially designed manufacturing unit, well trained technicians, scientific design and a strong 'no' to low quality imported parts has helped the company launch innovative products that are guaranteed to deliver high quality, low cost and environment friendly power solutions.

---

Havells clearly understands the importance of its contribution in energy conservation and reducing environmental hazards...

---

**Q What is the idea behind having so many manufacturing locations? How does that help you in business?**

**A** As a manufacturing-oriented organisation that works on the principle of 'Make in India,' we do not focus on productivity alone. We work towards creating harmony between manufacturing output and efficiencies that deliver social, economic and environmental sustainability. We have adopted world-class technology and automation to ensure that we produce our goods efficiently with emphasis on conservation of energy and water in a sustainable manner.

**Q How is your industrial segment growing?**

**A** Our industrial segment is growing at a sound pace given the govt's focused plan to improve the infrastructure, nationwide modernisation, expansion of transmission and distribution network.

**Q Tell me about your CSR activities in India.**

**A** Havells, as a responsible corporate citizen, always tries to contribute for social and environmental causes on a regular basis. For Instance, Havells is providing mid-day meal across 666 government schools in Alwar district, covering 50,000 students per day. Besides this, the company has acquired land for constructing a larger kitchen with all the modern facilities to serve freshly cooked food to 50,000 students in the area.

In FY 2014-15, Havells initiated a sanitation drive in government schools in Alwar district, wherein the company built eco-friendly and hygienic bio-toilets. These toilets have been designed to inculcate hygienic habits in children. The initiative was also taken to address the challenge especially faced by girl children, who would skip school because of the lack of proper toilets.

**Q How Havells is forming its strategy to cope with the changing market scenario?**

**A** At Havells, we are always committed to delivering quality products to our discerning customers, and that eventually becomes the key differentiator in any market. Today, Havells products are known for their quality, premiumness and value for money. We continue to focus on research and development – so that we keep delivering superior products for our customers. Other than that, we keep launching a slew of innovative products for various segments.



# Alpha Wire expands its Coaxial Cable portfolio

New Micro Coax cables are offered in smaller sizes to meet the growing need for signal transmission in confined spaces...


Alpha Wire recently expanded its Coaxial Cable product line under the Alpha Essentials product family to include Micro Coax sizes from 32 AWG to 50 AWG. With the addition of Micro Coax, Alpha Wire now offers Coaxial cable products ranging from 10 AWG to 50 AWG.

The new Micro Coax cable line will be offered as standard constructions and are ideal for customers looking for signal transmission options, especially when designs offer limited space for cable routing. "Alpha's new 50 Ω Micro Coax line will provide customers with the ability to ensure signal integrity within the increasingly small confines that many designers are working with. With an operating temperature range of -70°C up to 200°C, the new micro coax line is ideal for everything from medical endoscopes to industrial inspection applications," says Hillary Riden, Product Specialist at Alpha Wire.

Alpha's Micro Coax cables (32 AWG to 50 AWG) will be in-stock in 100 meter put-ups and available for immediate shipping. The company can also offer our Micro Coax cables in composite and bundled configurations using their Coast Custom capabilities. Create a custom

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# Osram launches Floodlight 20 Maxi LED

The Maxi version with a connected load of 875 watts and 100,000 lumens is suitable for illuminating wide areas...

Osram is expanding its LED floodlight range with a further large construction size in the form of the Floodlight 20 Maxi LED. As a result, the flexible floodlight series is now available in four sizes and with luminaire luminous flux levels from 3,000 to 100,000 lumens. The lens optic ensures precise light control, minimises glare and also achieves best results with quality of light and efficiency.

The Maxi version with a connected load of 875 watts and 100,000 lumens is suitable for illuminating wide areas and designed for mounting heights from 14 metres upwards. Seven different light distribution patterns enable a diversity of applications, e.g., sports locations.

The floodlight provides flicker-free lighting, enabling TV broadcasting in HDTV and super slow motion. The modular design of the floodlight range consists of a housing with electronic control unit, ESD-protected LED module and fixing element, enabling simple installation and maintenance and the upgrading of modules. 

Website: [www.osram.com](http://www.osram.com)



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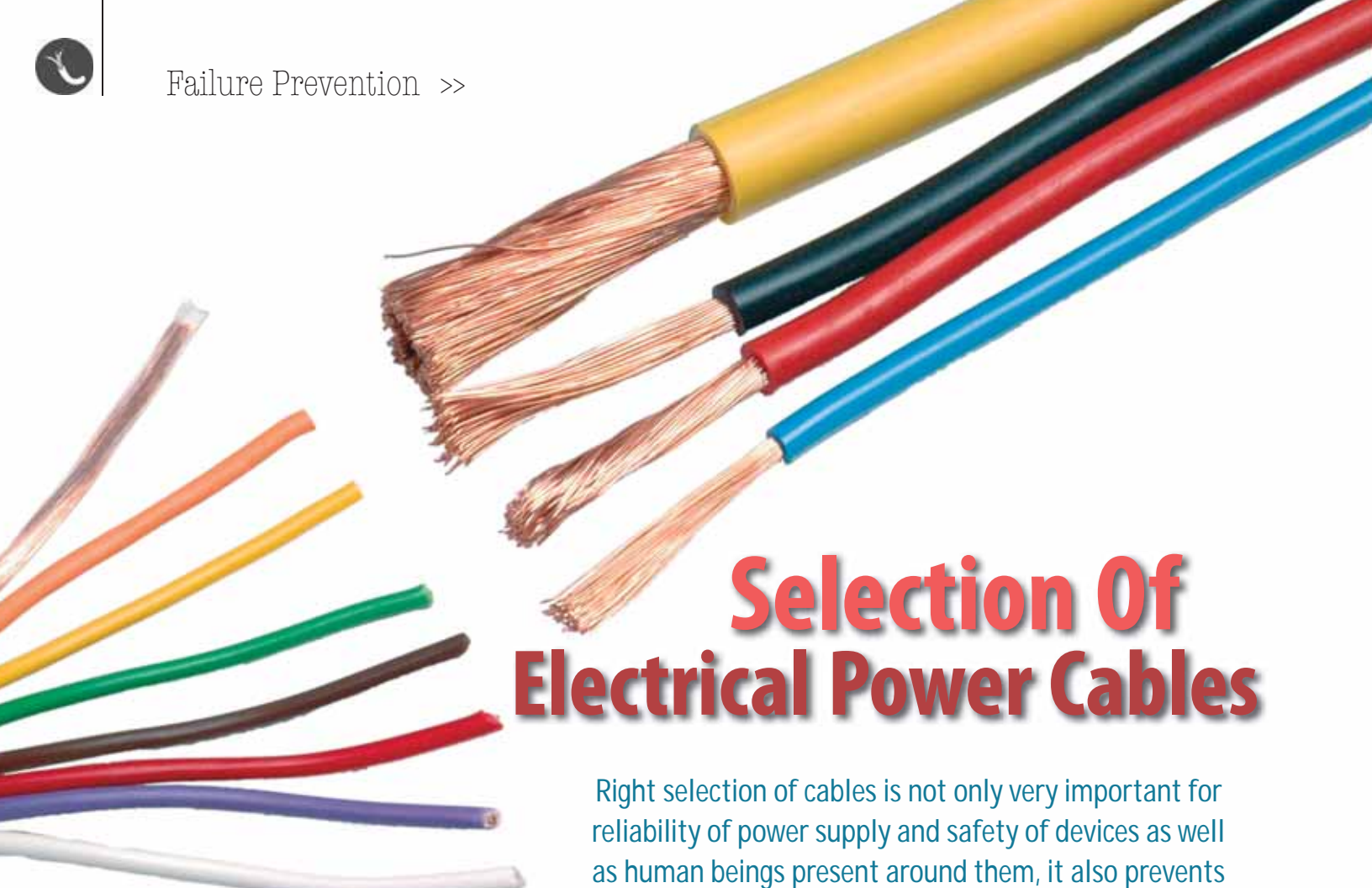
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# Selection Of Electrical Power Cables

Right selection of cables is not only very important for reliability of power supply and safety of devices as well as human beings present around them, it also prevents loss of assets and saves costly business hours...

**E**lectrical cables are the nerves of any electrical network. Cables consist of a huge percentage of capital investment in any electrification project. And, they are the most vulnerable to failures too. Most of the cable failures could be attributed to improper selection. This article aims to address the issue of proper selection of electric power cables.

## Selection Parameters

- i. **Voltage Rating:** This is the rated voltage of the system, in which the cable is to be installed & used. It is also important to know the method of system earthing. The rated voltage of the cable is generally specified as a dual rating (e.g.) 6.6kV (UE)/11kV (E). 'UE' means that the cable can be used for the specified voltage in an unearthed or in a non-effectively earthed system. 'E' means that the cable can be used for the specified voltage in a solidly earthed system. Thus, a cable whose rated voltage is specified as 6.6kV (UE)/11kV (E) can be used either in a 6.6kV unearthed or in a 6.6kV non-effectively earthed system or in an 11kV solidly earthed system.
- ii. **Type of Conductor:** The most generally used conductor in a cable is either Copper or Aluminium. As is known, for the same voltage rating, type, insulation, cross sectional area and method of installation, the continuous current rating, the short time current rating and the per unit length cost of a Copper cable is considerably higher than that of an Aluminium cable.
- iii. **Type of Insulation:** Most of today's cables are insulated either with PVC or with XLPE. Obviously, for the same conductor material, voltage rating, type, insulation, cross sectional area and method of installation, the continuous current rating, the short time current rating and the per unit length cost of an XLPE insulated cable is considerably higher than that of a PVC insulated cable.
- iv. **Type of Cables:** Armoured or Unarmoured Unarmoured cables are used in indoor installations and on above ground installations, such as in cable trays, in pre-built concrete cable trenches, etc. , Armoured cables are mandatory for any underground cable installation. The armour can be a wire or strip made of Galvanised Iron or Aluminium. In many cases, this armour is connected to the plant earthing system, preferably at one end only, generally, the sending end.
- v. **Continuous Current Rating:** The continuous current rating of cables with Aluminium / Copper conductor are available in different cable manufacturer's catalogues. But, it should be noted that the continuous current ratings are given in these catalogues for certain standard conditions of laying. In practice, it is not possible to get or to maintain these standard conditions. Thus, certain rating factors are applied to arrive at the practical continuous current rating.
- vi. **Rating Factors:** The following are the general rating factors to be considered:



- Rating factor for variation in ground temperature or in duct temperature
- Rating factor for variation in ambient temperature
- Rating factor for variation in thermal resistivity of soil
- Group Rating Factor – Vertical Spacing
- Group Rating Factor – Horizontal Spacing

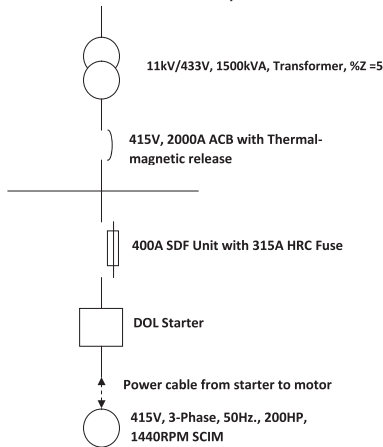
All these rating factors for various conditions are also available in the cable manufacturers' catalogues.

vii. **Voltage Drop:** Cables consist of resistance & reactance. And, thus the current flowing through such an impedance will cause a voltage drop. This drop should not affect the loads connected by the cable. Actual voltage drops in cables are given in V/km/A, in the cable manufacturer's catalogues, for various types of cables. It is also given in Indian Standard IS 1255 (Code of practice for installation and maintenance of power cables up to and including 33 kV rating). One should not only calculate the steady-state voltage drop, but also the acceleration state voltage drop during the starting of large loads. And, it must be ensured that the steady state voltage drop at the load terminals is not more than 10% and the acceleration state voltage drop at the load terminals is not more than 15%.

viii) **Short Circuit Current Withstand:** Any cable's short time current withstand capacity can be calculated using the following formula:  
 $S = [(I \sqrt{t}) / K]$   
 Where, I = Short Circuit Current, in Amperes, t = Duration of Short Circuit, in seconds, K = Adiabatic Constant (= 115 for PVC /Copper, = 143 for XLPE / Copper, = 76 for PVC / Aluminium and = 92 for XLPE / Aluminium)

Note: It is prudent to select the duration (t) judiciously, based on the fault clearing time of the isolating devices provided in the upstream of the cable. It must be ensured that the co-ordinated fault clearing time of the uppermost isolating device is considered for the purpose.

**CASE STUDY:** Now, let us select the power cable for the following case:



Motor Full Load Current:  $(200 \times 0.746 \times 1000) / (\sqrt{3} \times 415 \times 0.8) = 260A$

De-rating factors:

- Ambient Temperature @ 45°C – 0.90
  - Ground Temperature @ 35°C – 0.94
  - Soil Resistivity @ 150°C cm/W – 1.00
  - Depth of Laying @ 75cm – 1.00
  - Grouping factor for horizontal laying, 1 cable laid in isolation – 1.00
  - Grouping Factor for vertical laying, 1 cable laid in isolation – 1.00
- Net De-rating Factor =  $0.90 \times 0.94 \times 1.00 \times 1.00 \times 1.00 \times 1.00 = 0.846$

Continuous current rating of the cable to be selected =  $260/0.846 = 307A$   
 We can select a 3c x 400 sq.mm AYFY Cable, whose continuous current rating is 335A. Secondly, we have to check the voltage drop of this cable. The estimated voltage drop is: 0.22V/km/A. Consider the cable length is about 120m.

During normal running, the voltage drop in the cable would be:  $0.22 \times 0.12 \times 260 = 6.864V$ , which is just 1.65% of the nominal system voltage of 415V. As per IS 325, a motor should be capable of producing rated output even with a voltage drop of 6%. So, it is seen that with this cable, the steady state voltage drop is kept within limits.

Assuming that the starting current of the motor is 6 times its rated current, the voltage drop in the cable during motor starting would be:  $0.22 \times 0.12 \times 6 \times 260 = 41.18V$ , which is about 9.92% of 415V. During acceleration state, a voltage drop of up to 15% is permissible. Hence, with the selected cable, even the acceleration state voltage drop is kept within permissible limits.

Lastly, we have to check the short circuit current withstand capacity of the cable. For this, we have to calculate the magnitude of short circuit current at the terminals of the motor.

For this, the transformer impedance has to be converted to Ohmic value from % value.

$$Z = [5 \times 10 \times (0.433)^2] / 1500 = 0.00625 \text{ ohms}$$

The transformer resistance is 1.42 milliohms.

So, the reactance would be:  $\{(0.00625)^2 - (0.00142)^2\} = 0.00609 \text{ Ohms}$ .

The cable resistance & reactance will be: 0.0778 Ohm/km & 0.0729 Ohm/km;

For 120m cable it will be 0.0093 ohm & 0.0087 ohm respectively.

The total resistance is: 0.0107 Ohm & the total reactance is: 0.0148 Ohm. The total impedance is: 0.0183 Ohm.

The fault current at the motor terminals would be: 13748A.

The short time withstand rating of cable is given by:  $t = (K^2 S^2 / I^2)$ .

K = 76 for PVC Alu.; S = 400 sq.mm; I = 13748A; t = 4.89 seconds.

This cable will withstand this fault current for a duration of 4.89 seconds, whereas the 315A fuse provided in the motor feeder would clear this fault in about 4 milliseconds.

Even if the fuse does not operate, the short circuit release provided in the 2000A ACB, which will be set for 5In (i.e.) 10000A, will trip in about 300 milliseconds.

Hence, the cable will withstand the short-circuit current too till cleared by the fuse or by the ACB release.

Hence, it is established that the 3c x 400 sq.mm AYFY Cable selected is suitable for the application with respect to the continuous current carrying capacity, steady state voltage drop, acceleration state voltage drop & short circuit current withstand.

## Conclusion

The selected cable size is OK for the application.



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# Moving forward with tan-delta high voltage insulation testing



Though recent tan-delta test sets in the market, which are widely used to assess insulation in high-voltage electrical apparatus, combine versatility with convenience, there is room for further improvement...



**M**odern tan-delta (power factor) test sets, particularly those which offer intelligent temperature correction and automatic voltage dependence detection, are a widely used option to assess the condition of insulation in high-voltage electrical apparatus such as transformers, bushings, circuit breakers, cables, lightning arresters and rotating machinery.

Recent test sets of this type combine versatility with convenience and greater ease of use than older models, but there is room for further improvements. It is, interesting to look at some of the latest enhancements and the benefits they provide.

In the user interface, even small improvements could increase operator convenience as well as providing valuable time savings.

Examples of this type of improvement include simplified set-up page layout and the pre-programming of the most commonly used options, such as frequency variation test mode and selecting default test object temperature of 20°C.

As their products become more widely used, instrument manufacturers draw on field experience, particularly when those products incorporate major functional innovations such as intelligent temperature correction.

This lets them refine these novel functions to enhance the accuracy, repeatability and comparability of test results.

Report generation is, an important aspect of the operation of all but the most basic instruments. Data management and report generating software for power instruments has, sometimes had a reputation for being complicated and inflexible.

Much progress has been made to address these issues, with the latest instruments offering facilities for generation of reports in the same convenient formats whether using built-in software or software running on an external PC. Careful selection of defaults by the manufacturer simplifies and speeds the work of report production.

With complex test instruments like high-voltage tan-delta test sets, it's easy to focus on the instrument itself while paying scant attention to test leads and other key accessories. As users point out, these items are just as important as the tester. The test leads, are the essential link between the instrument and the object under test; inferior or damaged test leads not only make life more difficult for the user, they can be a very real safety hazard.

In response to this issue, developments now being seen in the market place include high-voltage test cables with terminations for connection to the test specimen that offer significantly enhanced strength and durability. This means that, even if the termination is dropped from a height – a relatively common occurrence when, for example testing large transformers – the risk of damage is greatly reduced.

Tan-delta testing is increasing in popularity not only in the industrialised nations but also in the emerging economies where the climatic conditions can be particularly demanding.

This presents a challenge for the instrument manufacturers as their products necessarily incorporate high-voltage components yet there is constant pressure from users to minimise size and weight.

The best manufacturers are now successfully addressing this challenge by upgrading their designs and revising their choice of components to ensure that their instruments operate reliably in high-temperature, high-humidity.

Accessories need to be suitable for use in the same demanding



climatic conditions as the instrument itself. This has led to the introduction of improved and more durable high-voltage strobes with rugged connectors and optional extended-reach cables.

Naturally, purchasers of tan-delta test sets like to get the best possible value from their investment and many of them buy accessory kits.

Recently, some of these have become even better value for money by including humidity and temperature probes rather than separate and somewhat less convenient temperature and humidity meters. Oil test cells are also popular accessories.


The latest types offer a convenient option for carrying out informative oil testing on a small scale in the field without the delays inevitably associated with sending the samples to a laboratory for testing.

The best of the new oil test cells can be used at temperatures up to 100 °C and can be heated by a standard oil bath heater. Provided that they contain oil, cells can also handle voltages up to 10 kV.

One final area that frequently receives less attention than it deserves is carrying cases. Many users are moving away from traditional soft carrying cases, possibly because these generate a false sense of security in relation to the level of protection they really offer.

Increasingly, their place is being taken by rigid transport cases that hold the instrument, test leads and accessories.

These cases are inevitably somewhat heavier than soft cases, but the use of modern plastics materials in their construction means that the weight difference has now been greatly reduced without sacrificing the level of protection provided.

It would be easy to dismiss the changes discussed in this article as insignificant and, in comparison with the introduction of a completely new instrument; this would of course be true. Nevertheless, when taken together, these apparently minor changes can make life a lot easier for those who regularly use high-voltage tan-delta test sets in their daily work. 



**Vince Oppedisano**  
Product Manager  
Transformer Testing Range  
Megger, USA



## Statewise Monthly And Cumulative Gross Generation During The Year Vis-À-Vis That During Corresponding Period Previous Year

Region		Actual Generation (MU) during March*			Actual Generation (MU) during April - March*		
		2016	2015	% Growth	2016	2015	% Growth
NR		20067.47	19655.73	2.09	283820.15	286363.15	0.89
	CHANDIGARH						
	DELHI	298.38	549.17	45.67	6206.07	8722.83	28.85
	HARYANA	1252.72	1616.34	22.50	22244.28	28748.61	22.62
	HIMACHAL PRADESH	907.26	1094.76	17.13	27081.13	23319.13	16.13
	JAMMU AND KASHMI	1144.52	1164.38	1.71	15132.44	14485.02	4.47
	PUNJAB	1174.51	1242.05	5.44	23336.52	22960.9	1.64
	RAJASTHAN	4671.66	3954.98	18.12	53937.37	54185.92	0.46
	UTTAR PRADESH	9319.66	8717.94	6.90	111284.56	111901.74	0.55
	UTTARAKHAND	602.04	728.12	17.32	12768.63	11439.22	11.62
	BBMB	696.72	587.99	18.49	11829.15	10599.78	11.60
WR		36994.36	30183.44	22.57	407328.43	367783.4	10.75
	CHHATTISGARH	9174.95	6876.46	33.43	89472.87	79710.57	12.25
	GUJARAT	8885.55	8178.57	8.64	104912.7	105538.54	0.59
	MADHYA PRADESH	8728.37	6245.86	39.75	95755.15	75212.47	27.31
	MAHARASHTRA	10205.49	8882.55	14.89	117187.71	107309.21	9.21
	GOA	0	0		0	12.61	100.00
SR		22500.06	21246.13	5.90	225700.04	215865.4	4.56
	ANDHRA PRADESH	5902.5	4424.46	33.41	58160.1	45245.42	28.54
	TELANGANA	3694.81	3681.86	0.35	36866.68	40901.97	9.87
	KARNATAKA	4332.69	4979.68	12.99	47546.6	50163.29	5.22
	KERALA	592.28	654.2	9.46	6653.49	8034.17	17.19
	TAMIL NADU	7955.61	7505.93	5.99	76245.5	71418.41	6.76
	PUDUCHERRY	22.17	0		227.67	102.14	122.90
	LAKSHADWEEP						
ER		15472.38	14539.28	6.42	172664.62	163018.77	5.92
	BIHAR	2113.78	1850.04	14.26	20815.78	18272.27	13.92
	DVC	2676.79	2189.24	22.27	28029.49	25551.11	9.70
	JHARKHAND	1508.82	1220.66	23.61	15945.24	14621.88	9.05
	ORISSA	5035.53	4598.77	9.50	57205.02	51332.44	11.44
	WEST BENGAL	3961.05	4552.22	12.99	46948.28	49742.02	5.62
	SIKKIM	168.04	128.35	30.92	3548.69	3345.29	6.08
	ANDAMAN NICOBAR	8.37	0		172.12	153.76	11.94
NER		987	651.9	51.40	12627.77	10634.5	18.74
	ARUNACHAL PRADES	49.08	27.1	81.11	1280.24	1109.48	15.39
	ASSAM	395.04	288.8	36.79	4514.03	4299.84	4.98
	MANIPUR	15.83	13.1	20.84	536.68	372.44	44.10
	MEGHALAYA	34.82	37.3	6.65	1035.94	863.15	20.02
	MIZORAM						
	NAGALAND	4.42	3.6	22.78	164.21	165.15	0.57
	TRIPURA	487.81	282	72.98	5096.67	3824.44	33.27
IMPORT		53.85	61.32	12.18	5244.74	5007.74	4.73
	Bhutan (IMP)	53.85	61.32	12.18	5244.74	5007.74	4.73
Grand Total		96075.12	86337.8	11.28	1107385.75	1048672.96	5.60



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# Reliable Cable for Industry

Constant advances in materials, test standards and procedures ensure reliability and predictability...

Many things move in the industry. What is good for production, is a major challenge for cables. Energy chains are often used to protect moving machine cables and hoses from tensile and torsional forces as well as external influences such as impact or welding sparks. Even then, demands on the cables remain enormous!

An energy chain can be described as the umbilical cord of a machine. It supplies a machine part with energy, data and media whilst following its every movement. The degree of movement ranges from simple linear strokes to six-axis robotic applications. For cables to withstand stresses millions of times without core breaks or the 'corkscrew' effect after a few thousand cycles, the material and structure of the cable must be perfectly matched to each other.

## Only long-term tests provide predictable reliability

Experience shows that even highly flexible cables in dynamic use in energy chains often quickly reach their stress limits. Can their service life be predicted? Standard tests performed by VDE, IEC or UL don't offer a clear statement, because only a long-term test in the energy chain itself offers this. Relevant standards use other means that merely simulate the wear regardless of the chain or the chain material, again offering little accuracy for cable lifetime in energy chains.

To be able to predict the service life reliably, the company igus, as a specialist in plastics and cables in motion, operates the largest test lab for cables moving in energy chains in the industry (1,750 square metres). Here, products are tested for their resilience in continuous operation in 58 different test rigs. Since the exact reproduction of the real working conditions

is crucial, test axes are available with different travel distances and accelerations or environmental conditions. For testing large energy chain systems, such as those used in crane facilities, an outdoor test site with a travel distance of up to 240 metres is available. Here components have been successfully tested at 4 m/s and with an additional load of 8 kg/m for a total lifetime of 25,000 km.



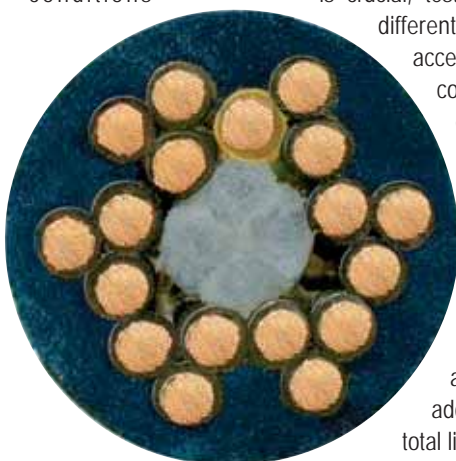
## Simulating application at extreme temperatures in real conditions

Likewise, temperature conditions from -40°C to + 60°C are tested. The specially adapted container, in which these conditions can be simulated, is of vital importance. Unlike standard 'cold winding' tests, in which test cables are wound up on a mandrel and cooled to test in temperature conditions just once, here the cables and chains are put under appropriate test temperatures and realistic motion conditions. They must withstand millions of strokes to prove they will withstand the expected bending stress in a real application. A test is considered passed when no jacket breaks can be detected, and thus proved to have the necessary cold flexibility.

The tests are not always about extreme temperatures. Customer requests are often about cables that must operate reliably at -5°C. Therefore, for the last four years igus has been offering an oil-resistant PVC compound, which has a high abrasion resistance with a wide temperature bandwidth. This is unique in the market, because the usual PVC compounds for chain-suitable cables do not normally meet these requirements. Another benefit is that in more moderate temperatures it is not absolutely necessary to rely on expensive jacket materials such as PUR or TPR.

## Bundle instead of layer

Findings obtained from the ongoing analysis of all tests for more than 25 years have been archived at igus and used for the development of its



www.electricalindia.in




own, ever-growing range of cables. This has led to, among other things, the introduction of stranding in bundles, similar to the concept used in steel cables. In an elaborate bundle stranding process, the cores are stranded in individual bundles with three, four or five wires, which are then again braided with each other into an overall stranded bundle. For large stranded superstructures this is done around a strain relief element. The result is a cable that is durable in motion and suitable for chains because, in contrast to a layer-stranded cable, each of the cores moves similarly in the inner and outer radius with the motion in the energy chain and thereby prevent relative stretching and compression.

In even more extreme movements, cables with a similarly complex cable structure are used. The so-called 'robot cables' are primarily used in industrial robots and must follow very extreme movements, bends and torsions. Special damping elements give the cores the necessary freedom of movement in the interior of the cable. Because, the more twisted the cable is approaching its load limit, the more difficult it becomes for the cable to twist. Special shields and exterior materials also ensure an optimum durability of the cables.

### 1,040 different cables for application in energy chains








The service life of a cable used in an energy chain will depend on a variety of variables that must be considered in the structure and the choice of materials. Thus, the chainflex product family from igus currently offers 1,040 different cables. How long the cables last in a relevant



application can even be calculated by users themselves. This is made possible by the results from the 2 billion test cycles each year in the laboratory, which is incorporated into the igus database. Based on this data, the free online tool on the igus company website can predict the service life of cables. 

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Medium Voltage Cable Terminators	Data Products	Infrastructure Management	Reelcraft	Label for DDr Marks, Laser & Thermal Transfer Printer	Mobile Thermal Printer	Thermal Transfer Printing System	Wire Connectors
							


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## FLIR E-Series thermal imaging camera comes with MSX technology

**F**LIR Exx Series of thermal imagers troubleshoot more efficiently, create detailed reports easier and share images as well as findings faster. These thermal imagers with MSX technology feature a fresh array of imaging, communication, and productivity tools to help users get more work done.


It is ideal for electricians, plant maintenance engineers and technicians for predictive maintenance as well as planned inspections of electrical or mechanical systems, to ensure that they operate at maximum efficiency and safety, with minimal energy consumption. MSX Technology enables users to see numbers, labels and other key visual details not normally apparent in a regular thermal image with an all-in-one thermal picture, which instantly directs them to right where heat issues are present.

Resolutions are as high as 160 × 120 pixels, 240 × 180 pixels and 320 × 240 pixels, with touchscreen control as well as auto orientation incorporated. These imagers have onboard digital camera with picture-in-picture facility. They come with interchangeable lenses and manual focus, with MeterLink connectivity. 

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## Copper Strips offers CNC machined electrical product components

**C**opper Strips (P) Ltd., specialises in the machining of difficult-to-manufacture, performance-critical components from a complete range of both ferrous and non ferrous and including the exotic alloys such as Inconel and Titanium. Machined components range from small components through to rings and casings up to 2m diameter.

The company offers CNC machined precision components of Copper, Steel and Brass etc for various applications. For switchgears, the company supplies fixed and moving contacts; finger contact assemblies; busbars, coil Assemblies; shunt assemblies; flexible connections etc. They have bushing head; offload tap changer; flexible connections; laminated foil & copper braid etc. for transformers. Short circuiting rings, rotor bars, oxygen free copper components, damper bars, commutator segments, bevel gear assembly etc. are also available in their portfolio. 




**For further information:** [www.copperstripsindia.com](http://www.copperstripsindia.com)

## NTL Lemnis launches Pharox Atlas industrial batten

**N**TL Lemnis, the LED Lighting solutions company, has launched a new product 'Pharox Atlas Industrial Batten.' This product is specifically designed to meet the high expectations of industrial spaces. It is an energy efficient replacement for conventional 2 x 36W FTL batten.

This adds on to the LED product range for industrial segment. The twin tube design of the fixture gives a different look to the product and makes it 'one of a kind' in this particular product segment. A beam angle of 120° gives a uniform light distribution across the luminaire and delivers better illumination to the surroundings.

This latest product is designed for multiple applications like Warehouses, Stores, Textile plants, Automobile industry, Indoor Car Parkings, Assembly Lines etc. The aluminium housing of the product provides better heat dissipation, which reduces the lumen depreciation, and gives longer life to the luminaire as well as withstand the acrid industrial environments. 

**For further information:** [www.pharoxglobal.com](http://www.pharoxglobal.com)



## LAPP India launches ÖLFLEX fire survival cables

Lapp India, a 100% subsidiary of the Lapp Group Germany, has launched ÖLFLEX FIRE Survival Cables for circuit integrity application. These cables are passed through C/W/Z fire resistant test and can provide optimum cabling solutions in fire mishaps by maintaining circuit integrity for temperatures up to 950° C, 650° C and 950° C as per application requirements. The inner and outer sheaths of the cables are specially made of halogen free compound which reduces emission of fumes and acid gases in the event of fire.

ÖLFLEX FIRE Survival Cables are designed for major infrastructure installations such as – airports, metro rail, rail terminal, bus terminal etc., along with building and construction management. Rapid urbanization has escalated the need for high rise buildings, malls, modern houses and offices, all of which depend on wires and cables. As a result, the need for installing quality wire and cables is growing.



For further information: E-mail: [info@lappindia.com](mailto:info@lappindia.com)

REDUCTION IN FAILURE RATE OF ELECTRICAL EQUIPMENTS & ENERGY SAVING  
By installing Jindal's Industrial Robot Automatic Voltage Controller

Voltage Variation is a common phenomenon.  
The voltage is generally low during day time and high during night hours



### Advantages

- Reduction in breakdown of electrical equipments upto 80%
- Energy saving upto 5%
- Improvement in power factor and reduction in MDI
- Uniform quality of end product
- Better efficiency of plant due to lesser Breakdown
- Depreciation @80% as per Income Tax Act

### Pay Back

Automatic Voltage Controller (AVC) pay back its cost within 12-24 months depending upon the input voltage variation and working hours of the plant.

### It's a breakthrough in energy conversion

**DATA LOGGER** If you are facing higher breakdown of electrical equipments due to voltage variation, we can provide you the computerised printout of voltage variation at your premises by installing Data Loggers charging normal expenses

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FRP Pole | FRP Enclosure | FRP Ladder | Trefoil Clamps


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## Testo 869 high resolution thermal imager

The newly introduced limited edition high-quality thermal imager Testo 869 is real value for money for engineers and technician contractors who use thermography for routine maintenance purposes.

Real thermography starts at 160 X 120 pixels. The heart of Testo 869 is a high-quality detector with 160 x 120 pixels that makes 19,200 individual temperature measurement points which never miss an anomaly. The smallest temperature differences are made visible thanks to a thermal resolution of less than 120 mK or 0.121 °C. Testo 869 fits well into the user's hand and can be intuitively operated, which allows electrical switching cabinets, to be tested quickly. In switching cabinets, malfunctions are usually preceded by a temperature increase, which Testo 869 not only measures, but also visualises precisely without contact, before it's too late.

The high-quality 160 x 120-pixel detector never misses an overheated contactor, an overloaded cable or an insufficiently tightened clamp. Testo 869 is designed for practical use and is based on the proven product series Testo 870 which was honoured with the German Design Award 2016. In addition, Testo 869 also offers a wide field of view, which is useful particularly for thermography indoors, as spatial conditions restrict the distance it is possible to stand from the measurement object. The standard lens (focus-free 34° lens) quickly records a large image section, and thus allows an ideal overview of the temperature distribution of the entire measurement object. Critical temperature conditions are directly displayed using automatic hot-cold-spot recognition. The pro software for image evaluation on a personal computer is new in this price class. Optionally, thermal images can also be saved directly in the instrument as a JPEG file and sent to the client as documentation. 




**For further information:** [www.testo.in](http://www.testo.in)

## Polar lighting poles from K-Lite

K-Lite surface mounted Polar Lighting Pole, integrated with LED Lighting Module is an exclusive choice of designers for city beautification lighting blended with architectural appeal. It is designed for a complete range of contemporary designs with single arm, double-arm, L-arm, V-Arm, square arm and parallel arm. The pole is engineered to meet adverse conditions and pole sections are duly welded using special grooving techniques and high end MIG/ TIG welding processes.

The control box is integral and built-in with service door, locking arrangement and safety chain. The galvanised pole is coated with epoxy zinc phosphate primer and finished using environmentally stable polyurethane based paint. The pole is supplied with necessary foundation hardware for normal soil condition. Polar Lighting Pole lighting arms are integrated with LED modular lighting system, which is environment-friendly under green lighting category. The LED lighting offers more lumens with lesser power consumption.

The luminaire is IP 68 protected and various models were evaluated by an extensive research and understanding of illumination requirements for urban spaces. Choice of drivers for LED takes into consideration harmonic distortion level (not exceeding 10%) power factor greater than 0.9 and surge protection. The LED modules are individually rated 42 watts. The control gear tray is prewired with terminal connectors, MCB and loop-in loop-out arrangement and located in the control box, integral with the pole. 



**For further information:** [www.klite.in](http://www.klite.in)

## Electrical Test & Measuring Solutions



Turns Ratio Meter



Winding Resistance Meter



Automatic Transformer Observing System



Digital Microhm Meter



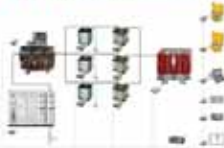
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Static Frequency Converter (EPS)



Automatic Transformer Test System



Cast Resin Standard PT



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Risatti Instruments Italian



STATOR TESTER



Standard CT



SURGE TESTER



DIE CAST ROTOR TESTER

### OUR PRODUCT RANGE

Winding Resistance Meter  
Turns Ratio Meter  
Digital Microhm Meter  
Contact Resistance Meter  
Motor Tester

Standard Current Transformer  
Standard Voltage Transformer  
Transformer Loss Measuring System  
Automatic Transformer Test System  
Rotor Tester

Static Frequency Converter (EPS)  
Mobile EPS  
High Voltage PD Filters  
Coupling Capacitor/ HV Dividers  
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Oil BDV Test Set  
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## Fronius offers a solution for future where 100% of power will be supplied by renewable energy

Fronius Energy Package Powerwall (comprises the Fronius Symo Hybrid Powerwall inverter, the Tesla Powerwall and the Fronius Smart Meter), which has been developed in close cooperation with Tesla Energy. This solution enables users to store photovoltaic electricity, which they have generated themselves, in the Tesla Powerwall. If only a little or no energy at all has been produced from the roof-mounted solar modules, the system owner can call on the stored electricity.




"The storage solution from Fronius and Tesla Energy is particularly attractive for those who want to increase their rate of self-consumption. Being less vulnerable to rising energy costs with the help of a designer storage unit is a big draw for many people," explains Martin Hackl, Head of the Solar Energy division at Fronius. 

For further information: [www.fronius.com](http://www.fronius.com)

## Armacell presents pre-insulated low-smoke pipes for cold applications

Armacell has overhauled its range of pre-insulated copper pipes for air-conditioning applications, adapting it to the current market needs. In a fire, Tubolit Split and Tubolit DuoSplit release only a minimal amount of smoke gases and so make a significant contribution to people's safety in buildings.

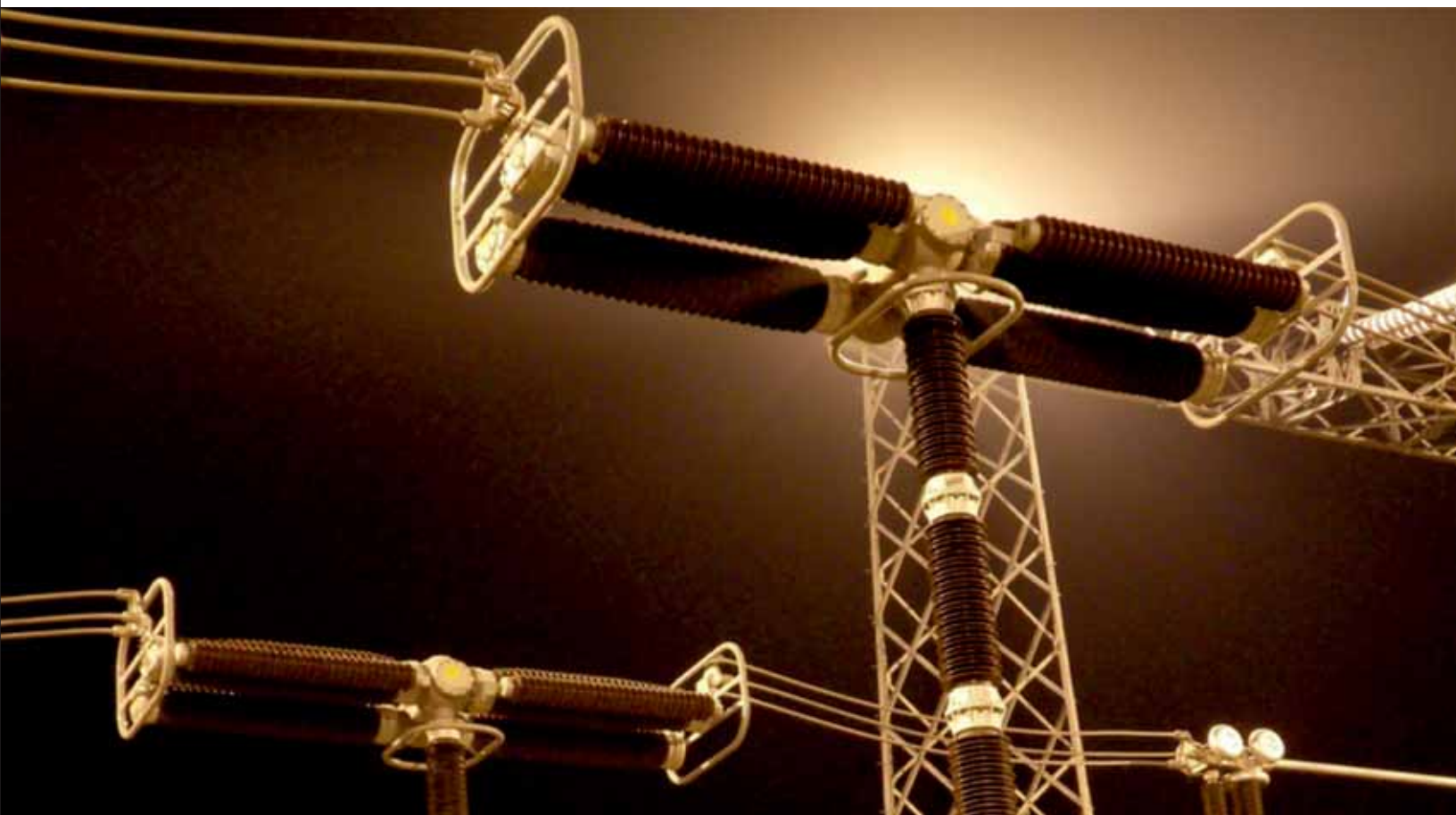


Low-smoke density makes all the difference in a fire. In the event of a fire it is vital that those trapped find escape routes quickly. This is only possible with minimal smoke development. Tubolit Split and Tubolit DuoSplit achieve class CL-s1, d0 in the European fire test. In a fire the pipe insulation develops significantly less smoke than traditional PE products and has been proven to contribute to people's safety in buildings. 

For further information: [www.armacell.com](http://www.armacell.com)



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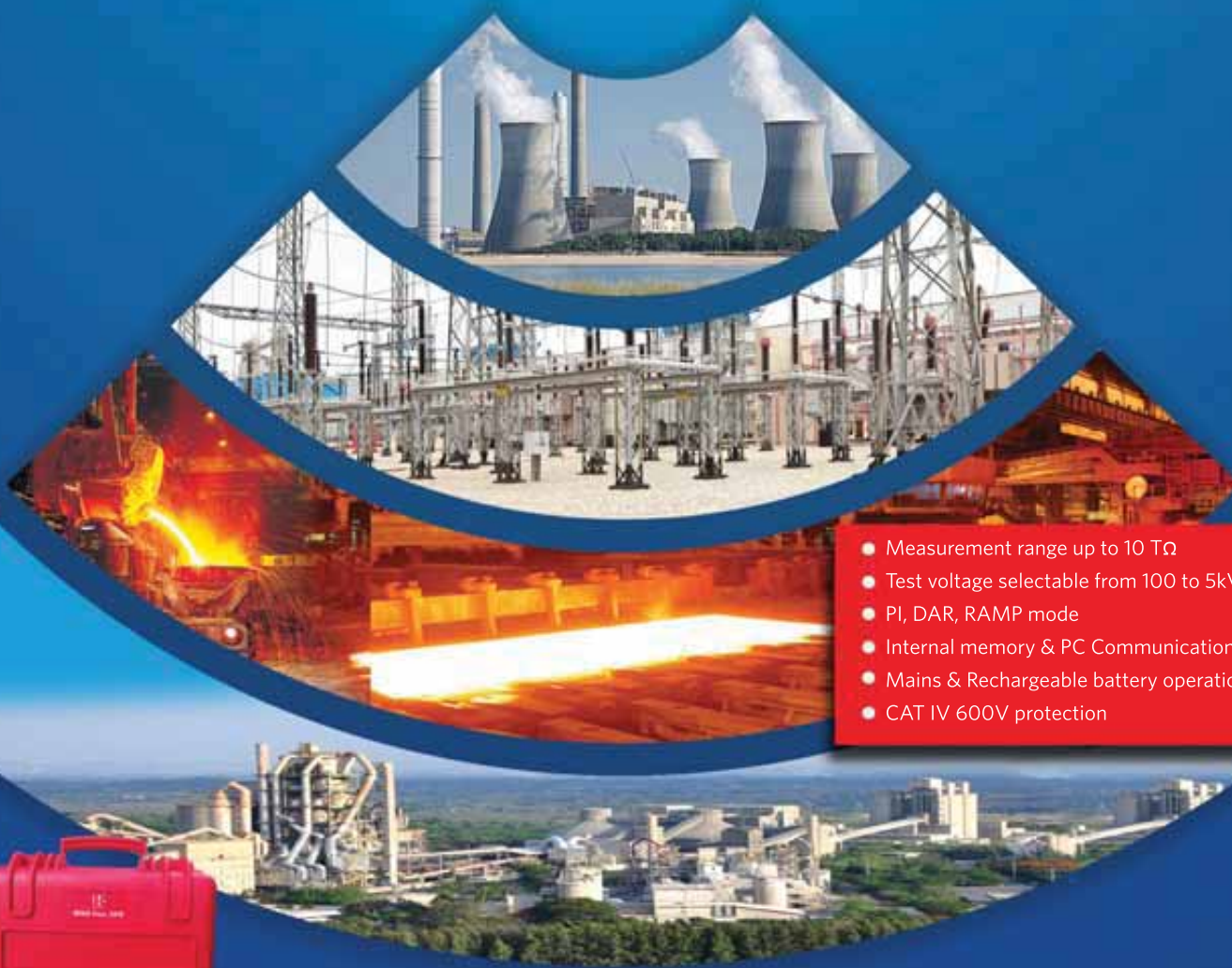
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