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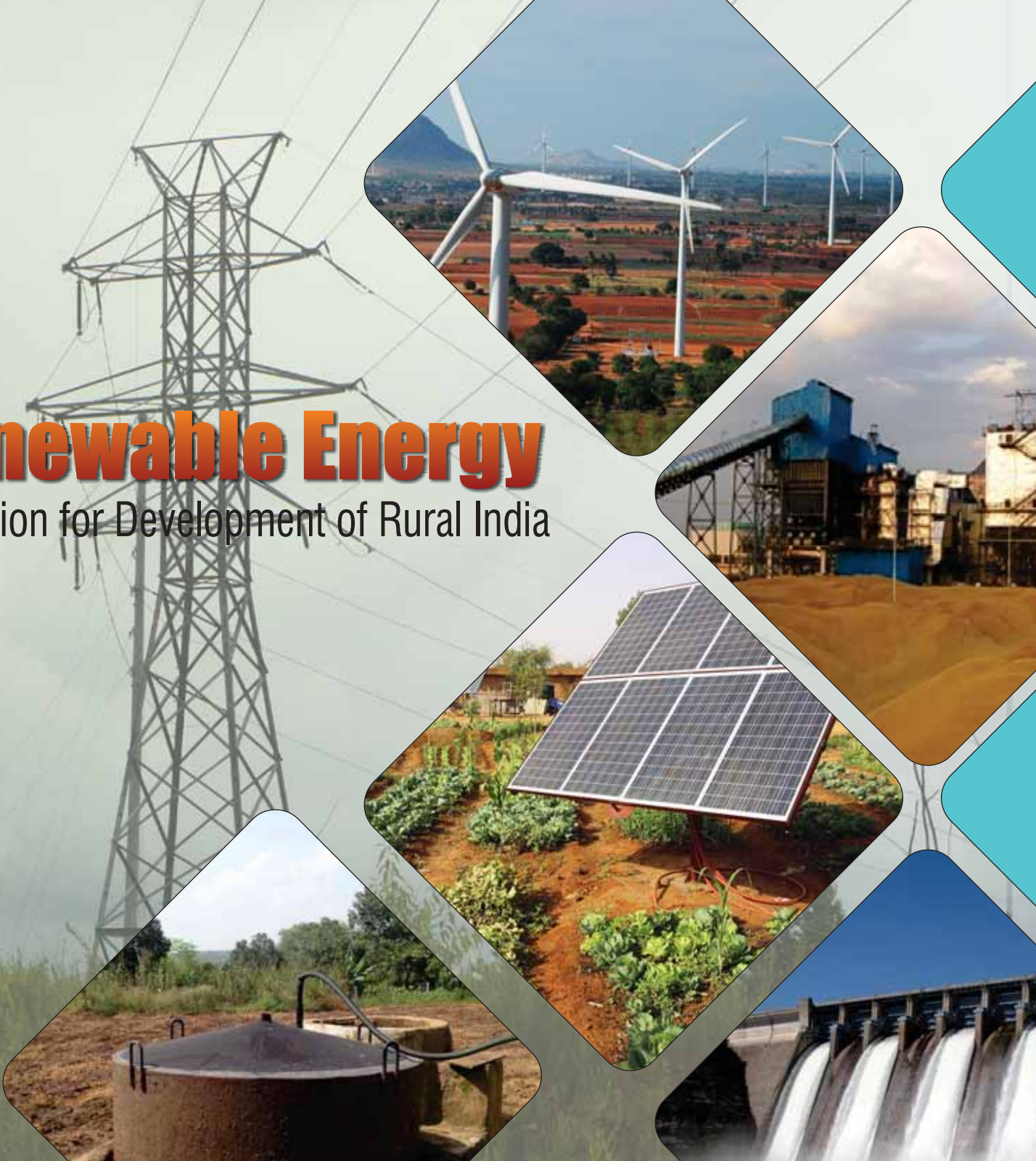
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# Publisher's Letter

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## Directors

Pravita Iyer  
Mahadevan Iyer

## Publisher

Mahadevan Iyer

## Editor-In-Chief

Mahadevan Iyer  
[miyer@charypublications.in](mailto:miyer@charypublications.in)

## Editor

P K Chatterjee  
[pkchatterjee@charypublications.in](mailto:pkchatterjee@charypublications.in)

## Editorial Co-ordinator

Nafisa Kaisar  
[nafisa@charypublications.in](mailto:nafisa@charypublications.in)

## Advertising Department

### Director Advertisement

Pravita Iyer  
[pravita@charypublications.in](mailto:pravita@charypublications.in)

### Advertising Manager

Yasmeen Kazi  
[yasmeen@electricalindia.in](mailto:yasmeen@electricalindia.in)

### Design

Nilesh Nimkar  
[charydesign@charypublications.in](mailto:charydesign@charypublications.in)

### Subscription Department

Nafisa Khan  
[sub@charypublications.in](mailto:sub@charypublications.in)

### Accounts

Dattakumar Barge  
[accounts@charypublications.in](mailto:accounts@charypublications.in)

### Response Department

Sonali Pugaonkar  
[mktg@charypublications.in](mailto:mktg@charypublications.in)

Electrical India is also available online on [www.electricalindia.in](http://www.electricalindia.in). For online enquiries contact: Priya Dubey  
[dgmarketing@charypublicaitons.in](mailto:dgmarketing@charypublicaitons.in)

## OFFICE ADDRESS

### Editorial, Subscription and Advertisement:

201, Premalaya, Next to Cafe Coffee Day, Opp. Telecom Factory, Deonar, Mumbai - 400 088.

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Mahadevan Iyer

“  
***It is quite satisfactory to note that in 2015, 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.

Since then, the Administrative Arrangement for implementing the agreement has been signed, and the India Nuclear Insurance Pool has been set up to implement the understanding on civil nuclear liability.

Commercial negotiations between NPCIL and Westinghouse for construction of 6 units of the AP-1000 reactor at Mithi Virdi, Gujarat are on course for finalization. Civil nuclear cooperations with Russia and France have also been taken forward. During Prime Minister's visit to France in April 2015, a MoU between L&T and Areva (aimed at cost reduction by increasing localisation for the Jaitapur project in Maharashtra) was signed. During Prime Minister's visit to Russia, a Joint Programme of Action for Localization of Manufacturing in India for Russian-designed Nuclear Power Plants was signed. At least 12 reactor units will be built with Russian collaboration. The fuel supply arrangements with Canada, Kazakhstan and Australia will bolster energy security by supporting the expansion of nuclear power in India.

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

*Mahadevan*

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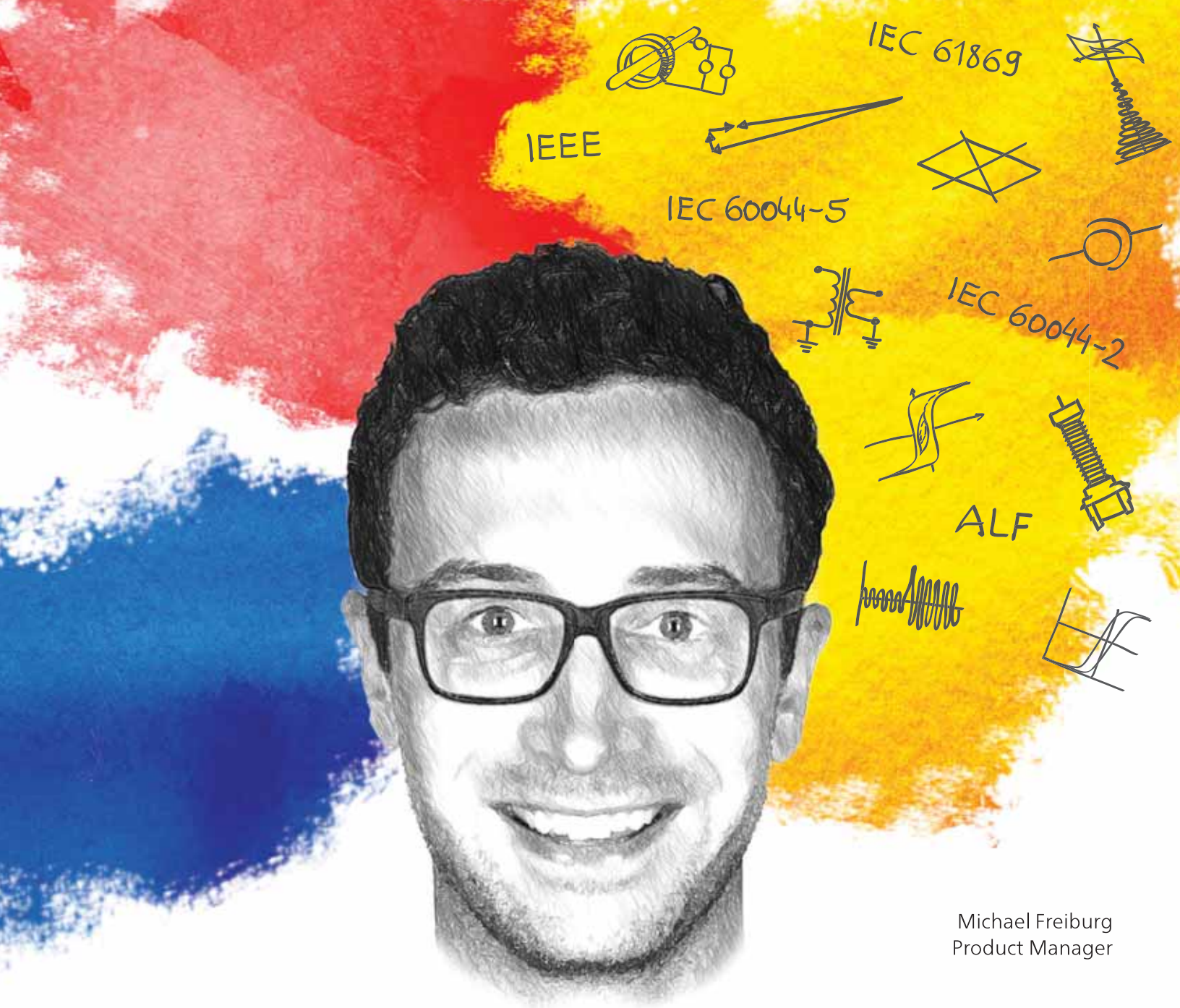
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P K Chatterjee (PK)

“  
***Overall financial viability of the sector is expected to increase as new investments will flow in the sector with facilitated ease of doing business...***”

## Budget 2016-17: My Observations

A country cannot prosper unless and until its rural economy grows. It is quite cheering that our finance minister has paid complete attention on this fact while drafting the Union Budget 2016-17. Also, the Government is committed to achieve 100% village electrification by 1<sup>st</sup> May, 2018. ₹ 8,500 crore has been provided for Deendayal Upadhyaya Gram Jyoti Yojna and Integrated Power Development Schemes. So, obviously there will be a great change in the rural economy leading to enhanced standard of living and better life style for the rural population.

Business brings growth of wealth, however, our education system has by far been instrumental in making people look for jobs only. It is obvious if entrepreneurship is not encouraged in the country, employment cannot grow. As an addition to its several firsts, through this budget the government proposes to provide entrepreneurship education. This sort of education and training will be provided in 2200 colleges, 300 schools, 500 Government ITIs and 50 vocational training centres. I feel, it is an encouraging step for our young generation.

Connectivity through Internet or telecom is important but that does not replace the need for physical movement. According to the proposed budget an allocation of ₹ 55,000 crore has been made for Roads and Highways. This will be further topped up by additional ₹ 15,000 crore to be raised by NHA through bonds. There is no doubt that this will in a much better way connect the remote places with the trade and facility centres, which are mostly located in the urban areas. Thus, ease of transportation will instill a new life in the rural areas. It will also ease the transportation of the bulk materials for power projects to extremely difficult-to-reach places.

Thus, the budget is packed with multi-dimensional growth strategies. However, as several things are interconnected, execution of each and every project needs to be managed very tactfully and efficiently. Delay at one place may cause cost escalation elsewhere. Hope the union ministry keeps vigilant eyes on that.

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

*P. K. Chatterjee*





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## Budget 2016-17: Reactions From Industries

On 29<sup>th</sup> February, 2016, Union Finance Minister, Arun Jaitley has presented the Union Budget 2016-17. Although overall the industry has a mixed reaction on the budget, focus on uplifting the rural economy has gained a good weightage this time. Thus, it is expected that rural electrification will speed up, however the proposal to provide 100% village electrification by May 1, 2018 seems a bit tough from the implementation point of view. Let us now see the reactions of some industry leaders.



We welcome the focus of the budget on rural, social & skill development, making it an inclusive budget – as also steps which have been proposed to simplify tax laws and improve ease of doing business. We also welcome the increased investments in railways & highways and hope that the government

acts upon rationalizing corporate tax & interest rates to encourage private sector spending.

– **Sunil Mathur**, MD & CEO, Siemens Ltd



The Government has tried to keep a healthy balance between inclusive growth and fiscal consolidation amidst global volatility and additional burden on account of the 7<sup>th</sup> pay commission, OROP. With an important focus on digitation, the government has shown good intent in keeping up the momentum

of the 'Make in India' and 'Digital India' Missions. The government has shifted its focus from large cities to rural areas showing a clear intent to uplift those who belong to the bottom of the pyramid, especially the agricultural sector and focus on creating skilled labour.

The effort to incentivize the 'Make in India' programme by way of domestic value adding in the Electronics Manufacturing Systems segment is a step in the positive direction as is the removing of custom duties. This augurs well for us as majority of the spending in our industry is on imported ESDM Electronic System Design & Manufacturing items.

From a taxation standpoint, lowering of Corporate IT Tax for companies not exceeding Rs. 5 crore turnover to 25% plus surcharge is a positive move as it offers incentives to SMEs and SMBs in the country to focus on their growth. Another proposal that will benefit the country and stimulate start-ups on the growth trajectory is the amendments to the taxation for new manufacturing companies incorporated after 1st March 2016 as they will now have the option to be taxed at 25% plus surcharge and cess – provided they do not claim profit linked to investment.

– **Sunil Khanna**, President and MD, Emerson Network Power, India (Also, Vice Chairman of CII Maharashtra Council)



We welcome this budget as it is positive and growth oriented with a clear view to uplift the rural economy.

The budget will result in major change in the sectors of agriculture and farmer welfare, rural development, infrastructure, social sector development and manufacturing among others. This

is expected to result in increased employment, boost to entrepreneurship, better healthcare system and increased ease of doing business, all of which are pivotal to growth of the economy.

I congratulate the finance minister for taking definitive steps to address concerns of the global slowdown. Spurring rural development, focus on job creation and increasing consumer demand and exports are steps in the right direction for the Indian economy. The finance minister has maintained the fiscal discipline path by setting the fiscal deficit target of 3.5% in FY17.

The budget also reiterates the mission and vision of the government to achieve long term self-sufficiency and sustainability, create the necessary support infrastructure and enhance the nation's literacy rate.

On renewable energy specifically, as part of rural development, the government continues on its plan to providing 100% electrification by 1st May, 2018. This poses incredible opportunity for the renewable sector and to boost rural economy. At the same time, coal cess has been doubled to Rs. 400/tonne, thereby, creating the resources to achieve 30-35% carbon emissions reduction target outlined by India at COP21 this year and also 175GW renewables target by 2022.

Further, government commitment to improve grid infrastructure is reflected in the proposed additional depreciation for the plant and machinery acquired, installed for transmission activity.

The excise duty reduction from 12.5 to 6% on materials used for parts and sub-parts of rotor blades for wind operated electricity generators is a positive move. However, the government should review the increase in excise duty of unsaturated Polyester Resin (polyester based infusion resin and hand layup resin), Hardeners/Hardener for adhesive resin, Vinyl Ester Adhesive (VEA) and Epoxy Resin used for manufacture of rotor blades. Also, the imposition of service tax on freight charges incurred for transport of goods by sea will adversely impact the competitiveness of Wind turbine manufacturing in India and hence the finance minister should also review the same.

We hope the government will reconsider the Accelerated Depreciation (AD) limit which has been reduced from 80% to 40% effective FY18. We wish to reiterate that the Accelerated Depreciation limit of 80% should continue till 2022, aligned to the government target of 175GW renewables by 2022 and to boost manufacturing under the Make in India vision.

– **Tulsi Tanti**, Chairman and Managing Director, Suzlon Group



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This budget signifies correcting and working towards some basic priorities in terms of providing more power and support to our internal growth engine. The government has shown a clear intent on revitalizing agriculture, infrastructure, skill development and higher education sectors. This bodes

well for creating a highly skilled labour force to drive the 'Make in India' mission in the country.

The deployment of Massive Open Online Courses to promote Entrepreneurship Education and Training will help Indian youth connect with mentors and credit markets. It is an encouraging move aimed at promoting entrepreneurial spirit, especially among youth from rural areas.

Amendments in the Companies Act and the 'Stand up India' scheme will boost the entrepreneurial ecosystem. Most importantly, the government has indeed offered unique opportunities to Start-ups, categorizing them as critical partners to the 'Make in India' programme. The proposed 100% tax deduction for new startups for the first three years, along with the speedy registration mechanism is quite noteworthy.

– **Bhavin Turakhia**, CEO and Cofounder, Directi



The budget has a number of positives in it – though in some cases they are 'baby steps':

- Focus on rural skills development and improvement of rural digital literacy
- Incenting the creation of domestic IP, driving domestic innovation

- Creating a favourable environment for startups
- Focus on infrastructure outlays
- Continuing the 'Make in India' focus with a few more specific 'catalysts' announced in the budget
- wThe focus on 'Quality of Education' as a specific initiative

As always though, the devil is in the implementation of these schemes. It is good to see a mention of review of program effectiveness as one of the goals in the budget, but till we see that followed up religiously it is hard to give it credence.

– **Partha Iyengar** - VP & Gartner Fellow, Country Manager Research (India), Gartner



It is pleasing to see the Government sticking to its fiscal deficit target as it will give a boost to the overall economy. Changes in customs and excise duty rates for capital goods sector is an encouraging sign for industrial growth – as it will help reduce costs and improve competitiveness of domestic

industry. The proposal to provide 100% village electrification by May 1, 2018, is indeed very welcome as it in line with the Nation's overall vision to provide 24X7 electricity. This will also create headroom for energy efficiency such as use of LED will be vital in achieving the Nation's vision.

– **V. P. Mahendru**, Chairman, Eon Electric



It's a positive budget as neither import duties nor vat has been tweaked. Increase rural spending and exemption on house rent will improve housing sector and thereby giving a boost to steel consumption. As steel users apex body SUFI would have liked if issues pertaining to MIP, Safeguard duties and

BIS were addressed in this budget and some relief was given to users of steel as the protection for Steel Plants has been given which was also necessary. The Govt. has to strike a fair balance between the legitimate needs of steel user industry as well as steel producers.

– **Rajevee Vyas**, Director of Steel Users Federation of India (SUFI)



The overall Union budget 2016-2017 is an optimistic step by the government for entire e-commerce and start-ups industry. We welcome the recent developments and applaud the government's decision to support start-ups by increasing limit for 44AD from 1 crore to 2 crore, this will help start-ups

to efficiently focus on work rather taxations.

– **Chirag Haria**, CEO of Aarogyam Energy Jewellery



This budget has laid down the roadmap for taking India to double digit growth. We not only see a clear direction in which the economy is going to be steered but also the key milestones that we need to cross on the way. There are several positives not just for the industry but for every section of society. FICCI

compliments the Finance Minister for his foresight and for presenting a highly progressive and visionary budget anchored on reforms in an array of areas.

– **Dr. Jyotsna Suri**, President, FICCI

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## Hitachi India displayed its latest products at ELECRAMA



Hitachi Hi-Rel Power Electronics successfully participated at Elecrama 2016, 12th International show of Electrical & Industrial Electronics Industry, the biggest showcase of the world of electricity for electrical and allied products, held at the Bangalore International Exhibition Centre (BIEC) from 13 to 17th February 2016.


Companies today look upon Hitachi Hi-Rel Power Electronics as a significant

contributor in the business of 'Power Electronics Solutions'. From product design to service standards, everything that happens at Hitachi Hi-Rel Power Electronics is intuitively inspired from the expectations and experiences of its valued customers.

There was an overwhelming response at Hitachi Hi-Rel Power Electronics Booth (H3M7 in Hall 3B) with visitors crowded from all across India and other parts of the world, which was truly showcasing a 'Powerhouse' with range of power electronics products display includes UPS and variable frequency drives & automation products.

Some of the key attractions in the stall were: Industrial UPS - i4et model (20 kVA

rating with live demonstration), i4+t model (60 kVA rating) and i6e model (200 kVA rating) UPS; Enterprise UPS - HM33 series model (160 kVA rating with live demonstration) and HS11 series model IT Power Online UPS; and Variable Frequency Drives & Automation Products – NE S1 model (4 KW & 1.5 KW) & WJ 200 model (5.5 KW & 0.7 KW rating) Low Voltage VFDs, high performance micro PLCs along with live demonstration of Low Voltage VFD for solar pump application.

Elecrama 2016 was a grand success for Hitachi Hi-Rel Power Electronics and certainly for the whole Indian Power Electronics Industry. Hitachi Hi-Rel Power Electronics team thank all the visitors who visited the booth. 


## T&M instruments manufacturer CEM to enter India

CEM, a well known manufacturer of advanced Testing & Measuring (T&M) instruments, is entering in the Indian market. CEM India is a joint venture with an Indian company and shall be headed by Vikram Bhansali, who has more than 20 years of experience in the field.

Vikram shared how their range of Borescopes and Thermal imagers will

revolutionise the preventive maintenance practices in India.

The futuristic instrument manufacturing company is planning to invest in educating and equipping the maintenance teams to get in-depth understanding of these new maintenance practices, which involve use of highly precision and high quality instruments.

"The real challenge was to draw a balance between the Value for Money mindset of Indian consumer and the technology we wanted to provide," says Vikram Bhansali. "However, the 3 in-house R&D centres have worked for months to work out the magic for us. We want to be the leaders in India replicating the success stories in European and North American markets." 


## SCOPE won best product award in overall category at ELECRAMA 2016

SCOPE T&M Pvt. Ltd. has launched its indigenously developed, Wireless Surge Arrester Leakage Current Analyzer – model SA 30i+, in ELECRAMA 2016 and grabbed the best product award as best overall product developed by an Indian or an overseas exhibitor. SA 30i+, the Wireless Leakage Current Analyzer from SCOPE is a state-of-the-art, on-line test system for Residual Life Assessment of Metal Oxide Surge Arresters.

The instrument measures and directly displays the values of Total Leakage Current and Third Harmonic Resistive

Leakage Current. It provides system harmonic compensation as per IEC 60099-5-B2. It also provides Corrected Resistive Leakage Current after applying correction factors for change in system voltage & temperature. This can be pre-loaded with the LA identity details (LA Identification, Type, Serial Number, Location, Rated Voltage etc.) and tests conducted on the same ID of the arresters are saved under the same folder. Trend analysis software, SAData picks up this data and stores them in a similar fashion on a PC. This analysis software enables the user to take a

decision to repair/replace the arresters considering safety limits.

SA 30i+ is designed to work under the hostile electrostatic noise found in live EHV switch yards up to 765 kV. The main focus of this product is to provide wireless CT for leakage current measurement and wireless field probe for system harmonic measurement to ensure human safety. Mainly the field probe has to be raised up to the base of arrester. If the probe is raised above the base, dangerous voltage can appear on the probe and may be harmful to the person testing the arrester. 

## PGCIL's CMD visits ABB stall during 'Make in India' event


IS Jha, Chairman and Managing Director (CMD), Power Grid Corporation of India Ltd. (PGCIL) visited the ABB stall at Make in India week in Mumbai.

In the event, ABB showcased various projects and technologies at their stall including an 800 kV HVDC transformer model, High Voltage DC technology and the world's first truly collaborative dual armed YuMi robot.



(L2R) SK Mishra, Sanjeev Sharma, Pitamber Shivnani, IS Jha and YK Sehgal...

"ABB has always been one of our trusted partners. We have a long-standing association and have executed several path-breaking projects together. We count on them for new technologies," said IS Jha, CMD, PGCIL.

"PGCIL and ABB have been a significant catalyst in shaping the 'Make in India' story for the power sector," said S Sharma, CEO & MD, ABB India Limited. 

## Suzlon opens new Blade Science Center in Vejle

Suzlon Group, the world's fifth largest wind turbine supplier, has opened its new Blade Science Center in Vejle, Denmark. The center is dedicated to accelerating Suzlon's vision to become a leader in technology in the wind industry.

The new center will be focused on developing the best blades and control systems in the industry, and integrating Suzlon's aerodynamic, loads and new structures research across the company.

Dr. Thomas Buhl has joined Suzlon as Vice President to lead Suzlon's Blade Science Center. From the Technical University of Denmark (DTU) Wind Energy,

Dr. Buhl has more than 15 years of experience in aerodynamics and blade structures, and has demonstrated strong leadership throughout his career.

At his last assignment, Dr. Buhl was heading the Section for Wind Turbine Structures at DTU Wind Energy where he managed a large group of scientists and engineers with a focus on mechanical design and loads, composite structures and structural optimisation.

Tulsi Tanti, Chairman, Suzlon Group, said, "The new blade centre is aligned to our vision of being the technology leader in the global wind sector. Innovation is at the

core of Suzlon's DNA, and I am confident the new blade center will give further impetus to our research and development efforts. We believe a new wave of innovation is required to unlock the true potential of renewable energy, to lower Levelised Cost of Energy (LCoE), and take the game to a new level. Technology will be the key enabler to achieve this. Denmark is the birthplace of wind technology and we will leverage the experience and expertise of the talent pool there in our innovation efforts as we develop our next generation of turbines." Today, the group has its operations in 33 countries. 

## Delta showed Smart Solutions in Elecrama 2016

During Elecrama 2016, Delta India Electronics has announced in, the expansion of its R&D and manufacturing operations with new facilities in Bangalore and Hosur respectively, in line with its long-term plans to harness the country's significant long-term growth potential.

Delta India plans to develop smart energy management solutions with industry-leading energy efficiency at its new R&D centre, which is expected to create up to 500 engineering jobs within the next 3 years.


Within the next 10 years, Delta's new factory in Hosur will create up to 20,000 jobs for the manufacturing of power electronics, renewable energy and automation solutions.



*At some of Delta's production lines, SCARA DRS40L series robot arm solutions are applied to conduct tracking, positioning and glue pasting for power supply boards and produce around 24.8 million pieces per year...*

James Ng, Chairman of Delta Electronics (Thailand), parent company of Delta India, said, "Delta recognizes the potential of India to become a powerhouse in manufacturing and its need for high energy efficiency, which is one of Delta's core competences.

We believe our new R&D centre in Bangalore will be instrumental in the creation of innovative and energy-efficient technologies that will support the realization of national initiatives such as 'Make in India' and 'Digital India.' Delta was one of the multinational companies invited by Mr. Narendra Modi, to the opening event of 'Digital India' in July 2015."

"We expect the Hosur factory to eventually become Delta's biggest manufacturing base in India. At ELECRAMA 2016, we exhibit for the first time in India, our entire portfolio of smart solutions with industry-leading energy efficiency for a wide range of sectors such as green energy generation, industrial automation, telecom and even agriculture," he added. 

# Cable Test Van

## Compact City



## Loaded with SFX 40

The SFX 40 is a multi-functional system for testing up to 40 kV, prelocation and pinpointing cable faults in low and medium voltage networks up to 32 kV.

### About SebaKMT

SebaKMT is the world's leading developer and manufacturer of measurement equipment for diagnosing the condition of cable networks and locating faults.

From SebaKMT, you can always expect a constantly improved degree of reliability through research and innovation.

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## BPC Engineering commissions a CHP plant




*The CHP plant runs on the natural gas producing 1.2 kW of thermal energy per kW of power...*

BPC Engineering has completed a project for mini CHP plant installation in Nysh village, Sakhalin Region. The plant consists of a 600-kW ENEX 600 power system and a UT-65 heat recovery system with 0.75 MW of thermal output as the main source of heat supply.

Two hot-water boilers, 0.42 MW each, supply additional thermal energy during peak demand. The equipment is arranged in a single building located in the territory of the village. Within the framework of the project BPC Engineering manufactured the ENEX power system and performed equipment supply, installation supervision and the commissioning of the mini CHP plant.

The installation of the new CHP plant was motivated by laying a new gas pipeline to the village. The plant replaced an outdated diesel power plant that was the reason for multiple outages in the remote community. The Customer –

Nogliksk District Administration – chose ENEX power system as being the most reliable, efficient and proven equipment in the conditions of the Far East.

The CHP plant runs on the natural gas producing 1.2 kW of thermal energy per 1kW of power. Modular design of the power system comprising 3x 200-kW microturbine modules ensures high load flexibility for daily peaks. Each module is serviced independently allowing for the continuous operation of the plant. Highly automated ENEX power systems do not require constant presence of technical personnel with maintenance intervals of 8,000 hours. 

## Actis reduces its stake in Energuate

Actis, a private equity firm investing exclusively in Africa, Asia and Latin America, has sold its 92% stake in Energuate, Guatemala's largest electricity network, to IC Power, a wholly-owned subsidiary of New York Stock Exchange-listed Kenon Holdings. IC Power paid US\$265 million for the purchase of Actis' stake, and will assume gross debt of the Energuate business of approximately US\$289 million.


Energuate includes two electricity distribution companies in Guatemala that provide services to 1.6 million customers across 100,000 km<sup>2</sup> covering 10 million

people, representing 60% of Guatemala's energy distribution market.

The Energuate group also includes two smaller businesses; an electricity trading company that provides services to corporate clients and a transmission company that operates 31 km of transmission lines and eight sub-stations.

The transaction reflects the success of Actis' proven, replicable strategy of acquiring and enhancing energy distribution businesses in high growth markets. Under Actis' management, Energuate added over 230,000 customers from May 2011 to date.

Since first investing in Energuate, Actis has worked closely with the management team to enhance customer service through investing and upgrading payment locations and introducing on-site billing. It has also worked with local communities on social programmes and improving safety and customer tariffs related to usage.

From 2011, the main quality indicators measuring average outage frequency and average outage duration have decreased, each, by 50% boosting the Customer Satisfaction Index as measured by the Commission for Regional Electricity Integration (CIER) by 32.2% between 2012 and 2014. 

## Ken Gen enhances hydro generation


Kenya's main power producer, KenGen, has enhanced output from hydro with the current heavy rains filling up the country's major generating dams at the Seven Forks in Eastern Kenya. Energy planners say all the dams in the cascade have attained their spilling levels while the main Masinga Dam is still two metres

to spilling at 1054.32 Meters Above Sea Level (MASL).

The water levels at Kiambere, which is the lowest dam in the cascade, stood at 700.23 MASL.

It is spilling 46 cubic meters (or 46 million litres) per second. At Masinga, the highest dam level is attained when the

water reaches full supply level of 1,056.5 masl, beyond which the dam spills.

Ken Gen MD & CEO, Albert Mugo said increased inflows to the Seven Forks will raise contribution from the hydro mode of generation and lead to an optimum mix, adding that KenGen's other power generating units were operating normally. 

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C<sup>3</sup> Technology: Common Height, Common Depth and Common Door Cutout Facility with **Common accessories** for entire range.

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Range: 630A - 4000A

No. of Frames: 3

Execution: 3P & 4P

Breaking Capacity: 50/65/75/100kA

Version: Fixed / Drawout

Operation: Manual / Electrical

Features: Circuit Breaker

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- Common height, depth and panel door cutout

- Plug in type, common front accessible accessories
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Features: Microprocessor release

- LSI / LSIG, LCD display optional
- Fault history record & display
- Breaker terminal temperature display per phase
- Metering : V, I, PF, Hz, kVA, kWh & Max demand
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- Password protected
- Fault indication LED
- Communication through RS-485



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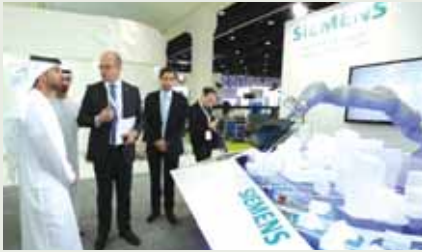
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## UAE's Minister talks to Siemens on digitalization technology




A (background) view of the Siemens stall in World Future Energy Summit 2016...

Eng. Suhail Mohamed Faraj Al Mazrouei, UAE Minister of Energy, was welcomed by Dietmar Siersdorfer, CEO, Siemens UAE and Middle East, to the Siemens

exhibition stand at the World Future Energy Summit in Abu Dhabi to discuss ways of achieving energy efficiency driven by digitalization technology.

Siemens 360° Digitalization Tour, which demonstrates digitalization as a key driver of sustainability in the Middle East, showed how the manufacturing, infrastructure and energy sectors could be enhanced by Siemens digitalization technology to increase efficiency, maximise profitability and build a smarter, leaner, better-connected and more sustainable environment.

Siemens believes digitalization can be further applied to achieve efficiencies that aid the UAE's sustainability targets of Vision 2021, including increasing the share of clean energy contribution to 24% of total power generation, and mitigating the effects of climate change through preventative measures such as CO<sub>2</sub> reduction.

Siemens has committed to developing a digital culture across all of its businesses, viewing its infrastructure solutions as a solid foundation on which to build a connected, smart and digitalized network for a sustainable future. 

## Scotland's ageing population is at an increasing risk of electrical danger

According to a recent report; Age Safe Scotland: Electrical Safety in an Ageing Population - by the charity, Electrical Safety First; the vast majority of older people in Scotland want to stay in their own homes but unsafe electrics can make that a risky business. With 78% of their homes in disrepair (and 58% requiring a critical repair), Scotland's ageing population is at increasing electrical danger.


Around two thirds of domestic fires in Scotland arise from electricity – with many

caused by electrical products - and older people are much more vulnerable to injury from electrical fires than other age groups.

These older people or residents or inhabitants also tend to be owner-occupiers (72%), living in homes built before 1982 that often lack important electrical safety features.

Critically, Scotland's quality standards for social housing and the private rented sector don't apply to people who own the home that they live in.

The personal cost of electrical accidents can't be calculated but Electrical Safety First found that injuries caused by an electrical fault costs Scottish tax-payers around £8.9M each year.

However, a third of this (£3M) is spent on older adults – who only represent 18% of the total population. To put this in perspective, the average cost of a hospital admission for someone over 65 is comparable to the weekly cost of 28 people living in a care home. 

## WHP: possibly even hotter than solar

According to Alphabet Energy – well known in thermoelectrics for Waste Heat to Power (WHP) and Heat is Power – the trade association for the WHP industry, in the USA, solar and wind have made excellent progress in paving the way for a low-carbon path, but both are limited by low capacity factors resulting from their intermittent nature, producing power only when the sun shines or the wind blows.

Waste heat to power is the process of converting exhaust heat into electricity without additional fuel or emissions. Regardless of time of day or wind speed

and direction, energy-intensive industries, such as oil & gas operations, industrial manufacturing and transportation, operate around the clock, year-round, and produce enough waste heat to generate over 15 GW of electricity per year, according to ICF and Oak Ridge National Laboratory.

While WHP is an emerging technology – and installed capacity is not yet on par with that of solar and wind, estimates show that to generate nearly 52,000 GWh of electricity, it takes 22.7 GW of solar compared to only 6.5 GW of WHP due to WHP's much greater capacity factor.

“WHP could have as big an impact on carbon reduction as solar, but much more quickly. Waste heat from furnaces, engines, flares, compressor stations and vehicle tailpipes is abundant throughout the US industrial sector and on our highways. With a much higher capacity factor than wind and solar, the U.S. industrial sector could convert its waste heat into over 120,000 GWh of clean electricity per year. That's enough electricity to power Norway for an entire year,” said Matt Scullin, Founder and CEO, Alphabet Energy. 



\*Condition apply.

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## V Keshanakurthi becomes CFO of RattanIndia Power Limited



**V Keshanakurthi**

*He will oversee corporate finance, accounting, investor relations and financial strategies for the company...*

**R**attanIndia Power Limited, formerly known as Indiabulls Power Limited, a company promoted by Rajiv Rattan who cofounded Indiabulls Group in 1999, has appointed Venugopal Keshanakurthi as the Chief Financial Officer with immediate effect.

The decision was taken in a board meeting held on 12th February 2016.

Keshanakurthi will oversee corporate finance, accounting, investor relations and financial strategies for the company. He will be directly reporting to the Chairman of the company – Rajiv Rattan.

Keshanakurthi has around 27 years of rich and diverse experience in finance and fund

raising. Prior to joining RattanIndia Power, he was associated with GVK group as Director and Chief Financial Officer. Before that he had worked with Adani Power Ltd. for over a decade.

In July 2014, the power and infrastructure businesses were split from Indiabulls and rebranded as RattanIndia under the chairmanship of Rajiv Rattan. Today, it is one of India's foremost diversified conglomerates with businesses spread over Real Estate, Financial Services, Securities and Power. It has installed and achieved a fully operational capacity of 1,620 MW across Amravati and Nasik thermal power plants in Maharashtra, which will be ramping up to 2700 MW by end of year 2017.

## Brüderl takes over as Managing Director for EMEA



**Georg Brüderl**

*He will lead Richardson RFPD's strategic growth and business development initiatives for the entire EMEA region...*

**R**ichardson RFPD, a global electronic component distributor with specialization in RF and wireless, energy management and industrial IoT, has appointed Georg Brüderl as Managing Director for EMEA, filling a new role for the company.

Georg will lead Richardson RFPD's strategic growth and business development initiatives for the entire EMEA region, including the continued expansion of local field sales teams by adding specialized technical sales and experienced support resources.

"Georg brings a vast amount of industry experience that aligns with our strategic business plan," said Rafael Salmi, President of Richardson RFPD.

"Europe is a hotbed of opportunity for RF and wireless product design, particularly with new innovations and applications emerging in automotive, aerospace and defence and other industrial markets. We're pleased to have Georg onboard to grow and expand our EMEA business by supporting the needs of current customers and identifying future growth opportunities," he added.

## President nominates A Kumar for the Board of NTPC Limited



**Aniruddha Kumar**

*He began his career with NTPC Limited., where he worked at Singrauli Thermal Power Station from 1984 to 1987...*

**T**he President of India has nominated Aniruddha Kumar, Joint Secretary (Thermal), Ministry of Power on the Board of NTPC Limited. Kumar has been appointed on the Board of NTPC w.e.f. 25th February 2016.

He is a 1987 batch, Indian Revenue Services Officer. He completed his graduation in Electrical Engineering with honours from Aligarh Muslim University in 1984 and Graduation in Law from Delhi University in 1995.

He began his career with NTPC, where he worked at Singrauli Thermal Power Station from 1984 to 1987. Thereafter, he joined Indian Revenue Service in 1987 – and during his

illustrious career of more than 30 years, he has served in various key departments like Tax Policy Wing of Deptt. of Revenue, Ministry of Finance, Various positions in Income Tax Department, Ministry of Urban Development (2005 to 2009), Ministry of Science and Technology (2009 to 2010) and Principal Commissioner of Income Tax in Agra.

Kumar has travelled extensively all over the world as a member of Indian delegations in various conferences and meetings.

Before taking over the charge of Joint Secretary (Thermal), he was Joint Secretary (Hydro) in the Ministry of Power.



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# Borealis receives European Plastics Innovation Awards

*For the Best Lightweight Innovation Award, Borealis was recognised together with Treofan for their cooperation in creating the thinnest polypropylene capacitor film, down to 1.9 µm...*

*Wolfram Stadlbauer, Senior Application Marketing Manager, Marketing and New Business Development Borealis, (left) and Dr. Karl Heinz Kochem, Head of Innovation Capacitor Films, Treofan, (right) with the Best Lightweight Innovation Award... © Plastics Europe*


**B**orealis, a leading provider of innovative solutions in the fields of polyolefins, base chemicals and fertilizers, has received two European Plastics Innovation Awards: the New Surfaces for Plastic Parts Award for the Daplen EE112AE lightweight primerless paintable Thermoplastic Olefin (TPO) compound and the Best Lightweight Innovation Award for their cooperation with film manufacturer, Treofan, in creating the thinnest polypropylene capacitor film yet.

In 2015, European Plastics Converters (EuPC), Plastics Europe and the Society of Plastics Engineers (SPE) launched their European Innovation Awards competition to acknowledge the work of companies in the plastics industry value chain that have developed a new idea, method, product or technology that responds to a societal need while respecting the three Ps of Sustainability (People, Planet, Profit). The awards were recently presented in Brussels, Belgium.

For the Best Lightweight Innovation Award, Borealis was recognised together with Treofan, a global leader in Biaxially Oriented Polypropylene (BOPP) films, for their cooperation in creating the thinnest polypropylene capacitor film, down to 1.9 µm. This film was made with Borclean HC310BF, a high crystallinity, super pure homo-polypropylene with a novel molecular design that enables the production of ultra-thin, metallisable dielectrical film for dry capacitors with increased thermal stability.

Polypropylene capacitor films are used in the production of dry, metalized capacitors for a variety of applications, but specifically in automotive applications for hybrid and electric motor systems, there is a need for high thermal stability and low volume in order to save space and reduce costs for the cooling systems. Thus, extremely thin films with a high level of thermal and electrical resistance are needed.

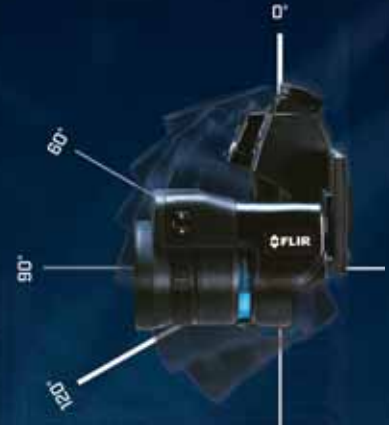
Treofan is developing these ultra-thin capacitor films with a high level of thickness homogeneity, electrical field stressability, low energy losses and very good mechanical characteristics using the Borealis Borclean super pure, high isotactic polypropylene homopolymer with a novel polymer design. The thinness of the film enables the capacitor producer to develop much smaller systems with the same electrical capacity. Treofan and Borealis are planning to further improve these films by further reducing thickness to increase volume efficiency, thermal resistance and voltage levels.

"We are very proud to receive these awards for projects in two of our application areas. This is a result of hard work and determination within our company but also of strong cooperation with our partners in the value chain, further emphasizing our Value Creation through Innovation strategy and our commitment to sustainable plastic solutions. We look forward to continuing and enhancing these partnerships for more innovations to come," comments Maurits van Tol, Borealis Vice President Innovation and Technology. 

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A310pt



A310f

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The World's Sixth Sense™





# Advance Energy Efficient Transformers Testing



*To prove that the transformer meets customer's specifications and design expectations, the transformer has to go through different testing procedures in manufacturer premises...*



Electric transformers become a part and partial of all Modern industries, Smart manufacturing Industries, Automation Industries, Textile, Refrigeration, all Multi National Co as well as all process Industries. without transformer one can not Imagine their growth of over all Empire or Industries . No one can connect their Machine directly with National grid /power supply .or work directly on High Tension line or connect Equipments directly with Electrical Supply.

### What is transformer?

“The transformer is static part of apparatus by means of which an electrical power is transformed from one A.C circuit to another with the desired change in voltage and current, without any change in frequency”

Transformer manufacturer Offer Wide range of sophisticated High quality industrial grade single and three phase electrical transformers .with

- A Grade Quality having 97-99 % Efficiency,
- B Grade 90-95 % and
- C grade less than 85 % Efficiency as per demand of Customer at reasonable prices.



The various range of products are Single-phase, Three-phase, Isolation transformers, Distribution transformers, Drive isolation transformers, Autotransformers, Motor-starting autotransformers, line reactors, Epoxy coated transformers. K-factor rated transformers, low temperature rise, low electromagnetic field



emission transformers, Electrostatic shielded transformers, Special voltage transformers, and Epoxy sealed transformers. And widely popular Dry-type transformers with long and trouble-free life.

Transformers are designed according to the required international standards such as DIN/VDE / IEC or IS. Furthermore, they fulfill all climatic, environmental and fire protection requirements. Basic surge level, the environmental protection requirements are taken into account in the design of Cast Resin Transformers. So customer should aware about which Types of transformer testing is necessary for his applications .

#### Tests done at Factory

- Type Tests
- Routine Tests
- Special Tests

#### Tests done at Site

- Pre Commissioning Tests
- Periodic/Condition Monitoring Tests
- Emergency Tests

### Type test of transformer

To prove that the transformer meets customer’s specifications and design expectations, the transformer has to go through different testing procedures in manufacturer premises. Some **transformer tests** are carried out for confirming the basic design expectation of that transformer. These tests are done mainly in a prototype unit not in all manufactured units in a lot. **Type test of transformer** confirms main and basic design criteria of a production lot.

### Routine tests of transformer

**Routine tests of transformer** are mainly for confirming operational performance of individual unit in a production lot. Routine tests are carried out on every unit manufactured.

### Special tests of transformer

**Special tests of transformer** are done as per customer requirement to obtain information useful to the user during operation or maintenance of the transformer.

### Pre commissioning test of transformer

In addition to these, the transformer also goes through some other tests, performed on it, before actual commissioning of the transformer at site. The **transformer testing** performed before commissioning the transformer at site is called pre commissioning test of transformer. These tests are done to assess the condition of





transformer after installation and compare the test results of all the low voltage tests with the factory test reports.

### Type tests of transformer includes

- Transformer winding resistance measurement
- Transformer ratio test
- Transformer vector group test
- Measurement of impedance voltage/short circuit impedance (principal tap) and I<sub>0</sub> and loss (Short circuit test)
- Measurement of no load loss and current (Open circuit test)
- Measurement of insulation resistance
- Dielectric tests of transformer
- Temperature rise test of Transformer
- Tests on on-load tap-changer
- Vacuum tests on tank and radiators

### Routine tests of transformer

- Transformer winding resistance measurement
- Transformer ratio test
- Transformer vector group test
- Measurement of impedance voltage/short circuit impedance (principal tap) and I<sub>0</sub> and loss (Short circuit test)
- Measurement of no load loss and current (Open circuit test)
- Measurement of insulation resistance
- Dielectric tests of transformer

### Tests on on-load tap-changer :

Oil pressure test on transformer to check against leakages past joints and gaskets. That means Routine tests of transformer include all the type tests except temperature rise and vacuum tests. The oil pressure test on transformer to check against leakages past joints and gaskets is included.

### Special Tests of transformer include:

- Dielectric Tests
- Measurement of zero-sequence impedance of three-phase transformers
- Short-Circuit Test
- Measurement of acoustic noise level
- Measurement of the harmonics of the no-load current
- Measurement of the power taken by the fans and oil pumps
- Tests on bought out components / accessories such as buchholz relay, temperature indicators, pressure relief devices, oil preservation system etc.

**Standard used:** IS 2026, IS 11171, IS 12012

Reference standards: IS 2026-5

IEC 60076-5

IEEE Std C57.12.90 (1999),

IEEE Std C57.12.00 (2000)

Purpose: To verify the integrity for stresses, primarily mechanical, developed when a short-circuit current flows through the transformer.

### TESTS PERFORMED For 1ϕ Transformers:

**Following Routine test on transformers as per IS-2026.**

- Resistance Test
- Insulation Resistance Test (MEGGER).
- No load test
- (Open ckt test)Short Circuit test. (Full Load Test).
- High Voltage Test.
- Temperature Rise.
- Vibration Test.
- Customer specific test.

### Conclusion

Transformer manufacturer Offer Wide range of sophisticated High quality industrial grade single and three phase electrical transformers if customer asked for lower price Transformer they suffer after few years so always use energy efficient transformer. Ⓢ



**D A Suthar**  
Chief Project Executive  
Advance Magnetronics



## A Cost-Efficient Solution For Cities

**A**BB will deliver in partnership with Volvo Buses automated fast charging equipment for Namur's public transport system. This is ABB's second project with Volvo Buses.

Eleven new Volvo electric hybrid buses will run within a new zero-emissions zone in the city center. The new bus system is planned to be operational by the end of 2016. ABB's scope of contract also includes switchgear and a service contract.

Instead of returning the buses to a depot to connect to an individual charger, the buses will be recharged within a few minutes when stopped at the end station. This set-up allows the buses to have a smaller, lighter battery pack which increases passenger capacity. An additional benefit is that the buses are able to run more routes.

"Cities around the world are increasing their urban e-mobility

investments to reduce congestion and improve air quality," said Pekka Tiitinen, President of ABB's Discrete Automation and Motion division. "Combining our e-mobility technology portfolio with partners like Volvo is a key element of our Next Level strategy and improves the commuting of bus clients and lowers cost for municipal transport companies."

"Electric bus systems are a cost-efficient solution for cities to reduce the problems of poor air quality and noise. Together with ABB, Volvo has a complete and competitive offer for cities around the world that want to switch to a sustainable public transport system," said Håkan Agnevall, President Volvo Buses.



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# RENEWABLE ENERGY



*The continuous threat of increasing the fossil fuels cost and its availability questions the security of continuous energy supply – and it also threatens the economic growth locally and globally...*



Indian economy depends on development of many sectors like industry, agriculture, transport etc. and these sectors demand primary need of energy. The energy demand from these sectors has been increasing abundantly since 1950's. It is necessary to supply the energy demanded by these sectors to increase their growth rate to achieve better economic standard. Unfortunately, major part of the energy supplied to the Indian sectors is dependent on the fossil fuels such as oil, gases and coal.

Due to the continuous threat of increasing the fossil fuels cost and its availability questions the security of continuous energy supply and it also threatens the economic growth locally and globally.

It is well known that the supply of fossil fuels to Indian sectors is not easy task because of its cost and non-availability. It is also known that India is a great importer of fossil fuels. India holds fourth rank of importer of oil and the sixth largest importer of petroleum products globally. So, there is continuous oscillation of fuel price and thereby variation in the Indian market at major sectors.

Hence, it is very much essential to utilize the available renewable energy sources as much as possible because India has the capability to produce trillions of Megawatts form renewable energy such as solar, wind, hydro, biomass etc. But the installed capacity of renewable energy in India is only 28% of total installed capacity and the remaining 78% from Non-renewable energy sources.

If the renewable energy is harnessed efficiently form available sources especially from solar, wind and hydro can reduces the usage of fossil fuels. This reduction leads to strengthen the economic status of India globally. The utilization of renewable sources not only raises the economic rate, but also avoids the carbon emission from fossil fuels. The increasing usage of renewable resources can lead to reduce India's dependence on expensive importing fossil fuels.

### Ministry Of New and Renewable Energy (MNRE)

The government of India has established integrated agencies in the development of renewable energy sector like MNRE. This ministry was established in 1992 as the Ministry of Non-Conventional Energy Sources and it was renamed as MNRE in October 2006.

The MNRE has successfully deployed the capacity of 26.3GW of grid-based, off-grid capacity of 787.53 MW and 8846 villages were electrified under the scheme of Remote village electrification as on October 2012.

Ministry of New and Renewable Energy has the specialized technical institutions across the country such as Solar Energy Centre (SEC) in Haryana, Centre for Wind Energy Technology (C-WET) in Chennai, The Sardar Swaran Singh National Institute of Renewable Energy (SSS-NIRE) in Punjab and Alternate Hydro Energy Centre in Indian Institute of Technology-Roorkee.

More number of projects is in progress financed by these institutions headed by MNRE. This agency also distributes the loans and fund assist to renewable projects through specialized financial institution "Indian Renewable Energy Development Agency" (IREDA).

### Investment And Financial Assistance

The government of India has also established "Make in India" to attract the corporate companies to invest in renewable energy development and it also offers full exemption of excise duty of solar tempered glass, machineries and equipment back sheet and EVA sheet, flat copper wire which are used in manufacture of solar photovoltaic (PV) cells/modules. Foreign Direct Investment (FDI) up to 100% is permitted under the automatic route for renewable energy generation and distribution projects subject to provisions of The Electricity Act, 2003. The MNRE also furnishes central financial assistance to build small/micro hydro projects both in the public and private sectors. It provides the 400 fellowship for students and researchers from graduate to Doctorate level.

The various mode of support is also provided to state governments for the selection of new potential sites, including surveys, the preparation of detailed project reports and the renovation and modernization of old projects. State Electricity Regulatory Commissions in Tamil Nadu, Andhra Pradesh, Madhya Pradesh, Haryana, Maharashtra, Punjab, Rajasthan, Gujarat, Kerala, Orissa and West Bengal have announced preferential tariffs for purchase of power from wind power projects.

### Solar Energy - An Overview

Solar energy starts with the thermonuclear fusion reactions occurring in the sun. It represents as an entire electromagnetic radiation (visible light, infrared, ultraviolet, x-rays, and radio waves)

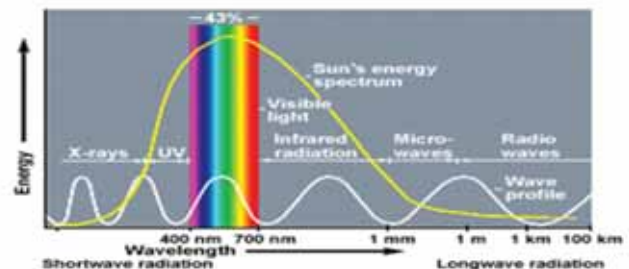


Figure 1 Spectrum of electromagnetic radiation...

as shown in Figure 1. This energy consists of radiant light and heat energy from the sun.

Because of the demand for electric energy and environmental issues such as pollution and an issue of global warming, renewable energy sources such as sun, wind, bio fuels and etc. are considered as an option for generating clean energy technologies. Among them, sun power is the most important one because of its availability and relatively easy way to handle.

### PV Cells

A PV array is the solar "generator" working based on the principle of "photovoltaic effect". The photovoltaic effect is the way in which PV cells create electricity from the energy residing in photons of sunlight. When sunlight hits a PV cell, the cell absorbs



some of the photons and the photons' energy is transferred to an electron in the semiconductor material. With the energy from the photon, the electron can escape its usual position in the semiconductor atom to become part of the current in an electrical circuit as shown in Figure 2.

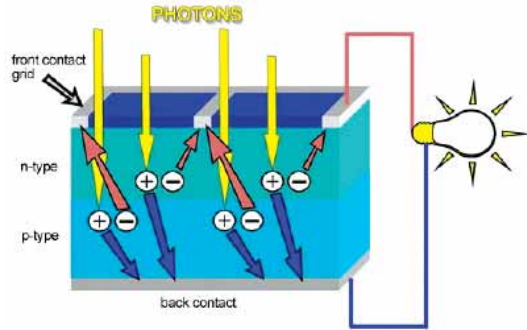


Figure 2 Principle of PV cell...

Most of the PV cells are manufactured based on solar technologies (Figure 3) like crystalline silicon or thin-film. Crystalline silicon modules can be fashioned from either mono-crystalline, poly-crystalline silicon. Thin-film is a term encompassing a range of different technologies, including amorphous silicon, and a host of variations using other semiconductors like cadmium telluride or CIGS (copper indium gallium di-selenide).




Solar cell technology	Characteristics
 Monocrystalline	Structure: Formed from single crystal of silicon Typical Module Efficiency: 13% - 20%
 Polycrystalline	Structure: Formed from multiple crystals of silicon Typical Module Efficiency: 14% - 16%
 Thinfilm	Structure: Formed from amorphous silicon Typical Module Efficiency: 6% - 12%

Figure 3 Solar cell technology...

PV array still have relatively low conversion efficiency because of variations in irradiation, temperature and load. The PV array has a particular operating point that can supply the maximum power to the load which is generally called maximum power point which varies according to the solar irradiance and the cell temperature. Therefore, maximum power point tracking (MPPT) of the solar array is essential in a PV system. To increase the efficiency of PV system, the

maximum power point has to be tracked. A view of location of solar cell is given in Figure 4.



Figure 4 Location of Solar cell...

### Solar-electric System

A solar-electric system consists of PV array and other components, such as MPPT charge controllers, inverters, and batteries. The components required depends on type of solar system. The various solar electric systems are:

#### 1. PV-Direct Systems

These are the simplest form of solar-electric systems, with the PV array and the load. The batteries are absent since power is supplied to the load when the sun is shining. One example is water pumping as shown in Figure 5.



Figure 5 Water pumping with solar system...

#### 2. Off-Grid Systems: (Stand Alone System)

It can be used in remote locations where there is no utility service; off-grid solar-electric systems can work anywhere. These systems operate independently from the grid to provide all of a household's electricity.

These systems require a battery bank to store the solar electricity for use during night time or cloudy weather, an inverter to convert the DC PV

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array power to AC for use with AC household appliances as given in Figure 6.

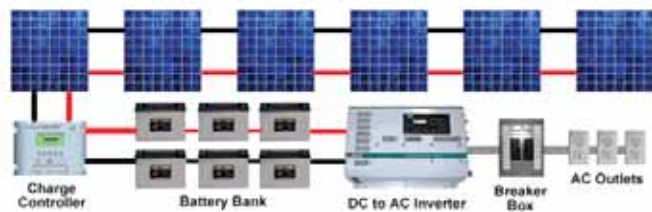


Figure 6 Off-grid system...

### 3. Grid-Tied Systems With Battery Backup

This type is similar to an off-grid system in design and components, but adds the utility grid, which reduces the need for the system to provide all the energy all the time.

### 4. Grid-Tied Systems

These most common PV systems are also known as grid-tied system. They generate solar electricity and route it to the loads and to the electric utility grid. This type of System consists of the PV array, converter, inverter, and required electrical safety gear as shown in Figure 7.

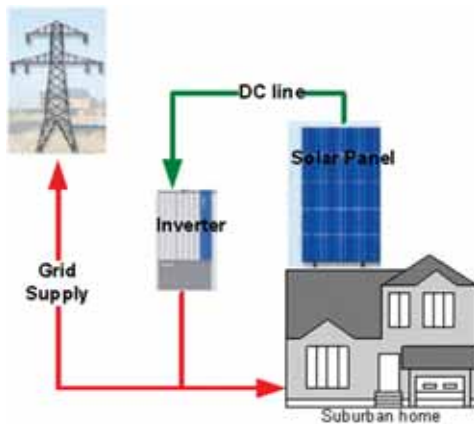


Figure 7 Grid-tied system...

### Utilization Status Of Renewable Energy

The installed capacity of renewable energy connected to grid in India is around 33.8GW as on December 2014. The total of 66% is from wind energy system, 4.6% from Solar Photovoltaic system and remaining

Sources	Installed capacity (MW)
Wind	22,465.03
Solar	3,062.68
Small hydro	3,990.83
Biomass	1,365.20
Bagasse cogeneration	2,800.35
Waste to power	107.58
Total installed	33,791.74

from small hydro unit, Biomass, power from waste and others.

The utilization of wind energy placed top order of 66% compared to other sources. India ranked fifth in the generation of power from Wind energy in the world which is mainly from various states: Tamilnadu, Maharashtra, Gujarat, Karnataka, Rajasthan etc in which maximum of Tamilnadu provides around 7162.18 MW.


### Tentative Target

The Ministry of New and Renewable Energy (MNRE) have aimed to attain around 175GW by the year 2022 across the country. The breakup of region wise target is given in the table.

### Conclusion

Region	Solar power (MW)	Wind power (MW)	Small hydro power (MW)	Biomass (MW)
Southern	26531	28200	1675	2612
Northern	31120	8600	2450	4149
Western	28410	22600	125	2875
Eastern	12237		135	244
North-Eastern	1205		615	
Overall	99533	60000	5000	10000

The implementation of renewable power generations are increasing rapidly because of their merits compared with fossil fuel-based generation. The equipment cost of wind energy system fallen dramatically owing to technological innovation, increasing manufacturing scale and experience curve gains. Similarly, cost of solar modules has also reduced by almost 80% since 2008. The price of wind turbine has fallen by more than 25% during the same period. The continuous utilization of renewable energy sources in India leads to achieve the aim of MNRE to generate 175GW of power by 2022. This impact will meet the major demand of electricity in India by renewable energy. Hence the dependent of fossil-fuel is rapidly decreased and this will strengthen the economic standard of India in future.



**Dr (Mrs) P. Valsalal**  
Associate Professor  
Dept of Electrical and Electronics  
Engineering Anna University

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(Autonomous Society under Ministry of Power, Govt. of India)  
Prof. Sir C.V. Raman Road, Sadashivanagar PO,  
PB. No.: 8066, Bangalore - 560 080, INDIA  
Ph: +91-80-2360 2329 Fax: +91-80-2360 1213  
E-mail: hegde@cpri.in / kamala@cpri.in / shyamr@cpri.in /  
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# Aspects Of Loss Reduction

Though Distribution Transformer (DT) technical loss reduction can also be achieved through replacement of the DTs altogether, the cost of new DTs do not justify the savings from loss reduction...



**P**ower Distribution in India is facing severe challenges. Predominant among them are high network failure rates, technical losses, PQ issues, customer dissatisfaction and high costs for asset upgrade & maintenance. Distribution Transformer (DT) is a key asset of the distribution network. Among the installed 4 Million DTs in India (as per CEA statistics) 6-8 lakhs DTs fail every year resulting in high financial losses. The losses in DTs can be primarily attributed to the following reasons:

- The DTs are very old and have exceeded their operational life but are still being used
- Operations and Maintenance (O&M) of the DTs and other network assets is not followed as a rigorous and robust practice
- Utilities, especially Public Discoms and Franchisees, have limited budget for network upgradation and maintenance
- Losses due to poor standard of equipment.

Further, technical losses in DTs occur because of the physical nature of the equipment and infrastructure of the power systems, i.e.,  $I^2R$  or copper loss – in the conductor cables, transformers, switches, etc. High Technical Losses (No Load & Load losses) persist in DTs of all major utilities across India – and their losses are very high when compared to the ideal losses for the same capacity.

### DT Loss reduction through 'active' repairs

#### What is active repair?

Currently the most prevalent form of maintenance that takes place in Indian utilities is a breakdown repair during a fault occurrence. Across all major distribution utilities including private players, DTs are repaired when they fail or get damaged.

However, considering the high technical losses on DTs, which are much greater than the ideal loss levels, DT repairs happening only at the time of breakdown/failure results in huge loss of energy.

Active repairs is a method through which DTs can be repaired even before a breakdown/failure incidence occurs, to significantly bring down the high technical losses (No Load and Load) to near ideal levels.

Active repairs involve augmentation or replacement of the active materials in a DT – Core and Winding, depending on the condition and design of the DT.

Depending on the No Load and Full Load

losses, DTs can be categorised under 6 permutations and combinations, which drives the 3 types of active repairs.

6 DT categories are derived using Lower Threshold (P1) of 20% and Upper Threshold (P2) of 40%, for both No Load and Full Load loss levels (i.e., the existing loss levels compared to P1 and P2 above the Ideal loss levels), which have been arrived at in consultation with various DT experts and manufacturers.

Against each case, an action has been mapped from 5 unique actions. For Case 1, where the No Load and Full Load losses are both within 20% of Ideal loss levels, any active repairs, though can help reduce the technical losses further, are generally not economically viable.

For case 6, where both No Load and Full Load losses exceed 40% than the Ideal loss levels, any attempt to bring down these technical losses through active repairs may not be effective. In such cases, entire DT replacement may be the only viable option.

For any of the technical losses (No Load or Full Load) ranging in the 20% to 40% bracket from Ideal loss levels (Case 2 to 5), above mentioned active repair type and corresponding action can help bring down the respective technical losses to near Ideal loss levels.

Though DT technical loss reduction can also be achieved through replacement of the DTs altogether, the cost of new DTs do not justify the savings from loss reduction.

Especially in the scenario where utilities generally have limited CAPEX and other operational budget, benefits from technical loss reduction through active repairs of DTs outweigh its cost many times over.

### Types of active repairs

Aside from normal maintenance activities, the following two types of active repairs can be useful for upgrading transformers:

- Core Augmentation
- Winding Augmentation/ Replacement

Core or Winding augmentation is an approach to increase a transformer's useful life. At the same time, it also improves its no load and load loss characteristics. Augmenting a transformer means upgrading the transformer by adding more cooling methods to fulfill the growing energy requirements. DTs can be modified to take increased load potential by maximising the efficiency at which excess heat

is dissipated from the main core and windings.

Upgrading a transformer instead of purchasing a new unit is more cost effective, it minimises disruptions to site operations and increases expected useful working life as well.

### Business case for active repair

As per our study of one power distribution utility in India, which has over 4.5 lakhs consumer connections, 2,800 DTs across various capacities from 10kVA to 630kVA, aged from very recent procurements to as old as 1927. Most of the DTs are of 200kVA followed up 315kVA and 100kVA capacities.

Based on No Load and Full Load loss data availability of good set of DTs (some around 10% DTs) and other key parameters like downtime losses, loading of DTs and power purchase cost growth rate it is observed that existing technical losses of DTs is very high when compared to the Ideal losses for the same capacity. For 200KVA capacity DTs, which forms 50% of total DTs, the difference in total Technical losses from ideal values is more than 0.6 units per hour per DT. For some other capacities, the losses are as high as 1.63 units per hour. This results in staggering INR 21.12 Cr technical loss on DTs every year for the utility, despite being one of good managed and lower AT&C loss utilities.

If active repairs on DTs are done for this utility based on the guidelines mentioned in Section 2.1, Gross opportunity (savings from technical loss reduction) for the utility comes to INR 91.5 Cr, in a period of 10 years.

Against these, the cost of Active repairs (including cost of one-time Health Diagnostics, regular preventive maintenance, periodic oil change and filtering, future breakdown repairs, installation and transportation of DTs etc.) is estimated to approx. INR 21.1 Cr, which results in a Net savings opportunity of INR 70.4 Cr.

Even after considering a Finance cost of INR 7.96 Cr to fund the active repairs, the Net additional profitability is INR 62.5 Cr for the utility, with a ROI of 150% and Payback period of 2.74 Years.

This case is however still limited considering the 10 years timeframe considered for the utility. For other utilities with continued business perpetuity, like the state Discoms, the business case can be much bigger and much more attractive. The financing for such Energy Efficiency intervention can likely come through some form of programmatic financing.




Case	Existing No Load loss above Ideal No Load Loss	Existing Full Load loss above Ideal Full Load Loss	Active Repair Type	Active Repair Action
1	< 20%	< 20%	-	No Work required
2	< 20%	> 20%	1	Only Winding Replacement
3	> 20%	< 20%	2	Only Core Material Addition (With limited winding augmentation)
4	> 20%	Between 20% and 40%	3	Winding Replacement + Core Material Addition
5	Between 20% and 40%	> 40%	3	Winding Replacement + Core Material Addition
6	> 40%	> 40%	-	DT Replacement

### Need for integrated player in DT management

Given the scenario, it is likely that a third party with capabilities in transformer maintenance and repairs, energy management and finance could play a significant role in the management of DTs going forward. This could be a Managed Service Provider (or MSP) who is a dedicated third party company (it can be a DT manufacturer or service provider), procuring and managing Distribution Transformers for a utility based on agreed Service Level Agreements (SLAs). This MSP can help restore the technical losses to near Ideal levels and add huge value in terms of loss reduction savings and manage DT assets with best practices.

### Benefits

- Single agency ownership across life cycle of DT Management (from Procurement, O&M, Repairs, Scrapping etc.)
- Defined and agreed upon SLAs, and payments tied to performance of MSP. Some key parameters and its commitment by MSP are mentioned below:
  - To maintain technical losses for all DTs within maximum 10% of ideal loss levels
  - To ensure timely replacement / repair happens from inventory in case of any failure/breakdown
  - Reduction in DT Failure/Breakdown Rate
  - Regular maintenance
  - Detailed reporting of DTs maintained, DTs repaired, etc.

- Reduce and maintain no load and load losses for all DTs within maximum 10% of Ideal loss levels
- To ensure a minimum DT failure/breakdown rate (for e.g., within 2% in our business case with a utility)
- Regular maintenance, oil change and timely repairs
- Additionally, MSP could also support functional uptime of other assets tied to DT like Energy Meters, Capacitor Banking etc. Detailed reporting of DTs maintained, DTs repaired, etc. by MSP. 

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# Innovative Measures For Energy Management In India

Globally, the energy demand is very acute and to meet the requirement, every nation has to take energy efficient measures to stand before the world...





Energy is one of the most fundamental parts of our universe. Energy has come to be known as a 'strategic commodity' and any uncertainty about its supply can threaten the functioning of the entire economy, particularly in developing economies. India's substantial and sustained economic growth is placing enormous demand on its energy resources.

The total installed capacity in India is 281,423 MW (as on Nov 2015) as shown in figure 1. The major energy source contributor is still coal. The growth rate of installed capacity was 4.55% which was less in comparison to the previous year (2014-15). The growth rate of renewable energy sources was approximately 13% out of which the wind energy gets the major share (65%) followed by biomass and small hydro power shown in figure 2. Tamil Nadu had the highest installed capacity of grid connected renewable power (8070.26 MW) followed by Maharashtra (5630.20 MW) and Gujarat (4430.20 MW), mainly on account of wind power.

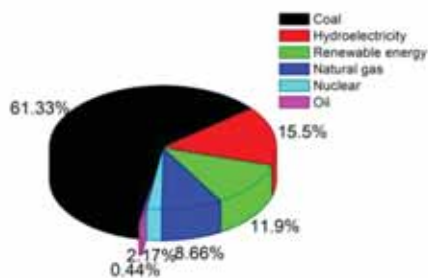


Fig.1: Installed capacity of energy...

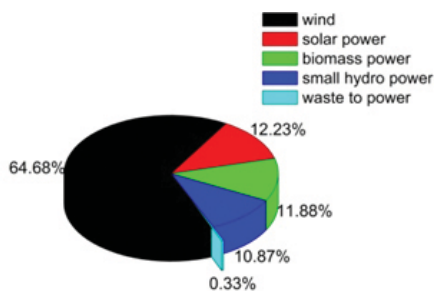


Fig.2: Renewable energy contribution...

India's energy consumption is growing faster than that of world's energy. However the domestic energy supplies are not growing at the same pace owing to host of factors including fuel unavailability, delays in clearances, project delays and inadequate innovative technologies.

This has resulted in increased reliance on energy imports. At present, Indian industries are facing many challenges major being rising inflation, unreliable grid power and increasing energy costs. The energy costs contribute near about 10-20% of the total cost of the product. Reduction in the energy cost by energy management can be key solution in optimizing cost and enhancing competitiveness.

**Measures for energy management**

**(a) Supply Side Measures**

**(i) Increased Use of renewable energy sources**

In recent times, renewable energy has gained a lot of attention as an alternative energy source. For many organizations, investing in renewable energy is not only, for long term advantages on savings but also for sustainability perspective.

In case of power, renewable energy and open access procurement of power are increasingly becoming favorable options for companies who are looking beyond grid power for meeting their energy needs.

This is evident by the increasing share of renewable as a percentage of installed capacity. As already stated, the cost competitiveness of wind energy has already been established in some states like Tamil Nadu, Gujarat, Maharashtra, Rajasthan and Karnataka.

The solar power installed capacity has shown substantial growth in India in the last three years with over 2000 MW installed until October 2015. Over 70 per cent of these installed units are concentrated in Gujarat and Rajasthan. Solar power costs have seen a sharp decline in the last few years. The solar module prices have reduced by around 75 per cent over the past five years owing to innovation contributing to lower manufacturing and processing costs. The solar power prices in

India, based on the auction prices conducted by different states in the last three years, have decreased by more than 45 per cent. This makes it competitive with the prevailing marginal power tariffs for certain consumer categories in some states – especially the highest slab residential, industrial and commercial category of power consumers. The retail tariffs of these segments are already upwards of INR 7-8 per unit at the margin and would be even higher if one were to take a levelized view (long-term cost).

With solar prices approaching grid parity, solar power is expected to make significant contributions to incremental demand. This has been realized by many companies and they are exploring the solar rooftop option (factoring the likely parity and the 'green energy' aspects of solar power). One important benefit of solar rooftop power over other sources of power is that power can be generated at the point of consumption and hence, avoids the significant network and distribution losses. The advantages of solar rooftop power are:

- reduces the dependency on grid power and provides long term reliable power source
- can mitigate requirement of expensive fuels like diesel to some extent
  - Additional Generation Based Incentives (GBI) in for domestic consumers
  - Low gestation time

Most of the states allow consumers with high power requirement to go for open access procurement of power. In this arrangement, industrial and commercial consumers can meet entire or a part of their power demand from other sources such as power exchanges, captives and IPPs. This option can be cost effective in states where power supply is intermittent and consumers use diesel



Fig. 3(a): Roof top Solar system...



Fig. 3(b): Wind Power Plant...





generators, grid power prices are high and open access charges and cross subsidy surcharge are not so high.

## b. Demand side measures

The low reliability in energy supply cause steep increase in fuel prices and increase in power demand charges, which in turn pursue organization to take measures on demand side.

Demand side measures refer to interventions deployed to reduce consumption or manage peak energy demand. Thus, demand side measures help organizations to deliver same or better output with lower energy consumption. These measures typically include enhancing process efficiency, equipment rightsizing, reducing wastage and managing the peak demand.

### i. Demand Side Management

In a manufacturing facility, for a given production capacity, the processes, technology and equipments are key determinants of the energy requirement. In most of the cases, equipment and technology in plants would be old and obsolete. There is less emphasis on energy efficiency of the processes or equipment as long as the plant is meeting its production targets. To evaluate and implement demand side measures, management needs to be aware of energy consumption of specific processes and equipments and their efficiencies. A robust energy audit is necessary to help understand these aspects. In an Energy Audit process, the auditor identifies the energy systems and measures the energy input and output for each system. Additionally, heat loss and equipment condition are also assessed either through observation or through usage of advanced monitoring equipments.

Measurements can be extended to certain specific duration to unearth patterns in energy consumption. Such patterns can provide pertinent insights on deviations in energy consumption and can also point to behaviors leading to more than required energy consumption. An Energy Audit report will typically provide understanding on energy consumption, utilization and wastage of energy systems and mostly will also contain impact of improvements in it. Thereafter, the management needs to evaluate energy efficiency interventions on the basis of aspects such as new technologies available, change in

processes, replacement of equipments, resizing of equipments, process timings and relook at the layout. Important aspects are assessment of initial investment, energy savings, and returns over lifecycle and risk to business continuity in order to prioritize the implementation of interventions.

In case of buildings, lighting and cooling/heating equipment account for majority of the energy consumptions. Energy saving in lighting is the easiest to achieve through installation of energy saving devices such as CFL and LED lights.

However, interventions for reducing energy consumption in heating and cooling equipment require an approach similar to the one deployed for manufacturing facilities. The approach includes assessment of energy efficiency, condition of the equipment and fine tuning of temperature control devices. It may also include changing staff behavior to adopt best practices for maintaining building temperature.

### ii. Peak Demand Management


Peak demand describes a period in which power demand is higher than the average demand. Some states have implemented time-of-day tariff for industrial category consumers. Thus, it becomes important to manage energy demand during these periods. Comprehensive evaluation of energy consumption and criticality of each of the energy intensive operations are needed to manage the peak demand at the plant and can result in cost reduction. Employee training Change in employee behavior is one of the most important aspect in achieving energy efficiency goals. Sensitizing employees with energy efficiency practices can help them in proactively embracing the practices, and help organizations in soliciting required support and commitment in implementing energy efficiency initiatives. Organizations should also incentivize employees for highlighting suggestions related to energy efficiency improvement and implementing them. By encouraging energy efficient practices, an employer can not only differentiate itself as a responsible employer but also can enhance its brand image among clients /consumers.

## Measures by the government

The government should frame a policy to implement the energy efficiency solutions in the

country. The integrated energy policy (2008) of government commented that a unit of energy saved is greater than a unit of energy produced since it saves on losses related to production, transportation and distribution. The law of energy conservation (2010) should be enforced strictly to save energy. Further, government should provide energy efficient targets to the core production sectors annually.

## Conclusion

Globally, the energy demand is very acute and to meet the requirement, every nation has to take energy efficient measures to stand before the world. Further, for India to sustain internationally optimal utilization of energy is must as we stand third in the world in Co2 emitting list. For industries, enhancing energy efficiency could be a very effective way of reducing their energy cost and contributing to the national goal of reducing carbon emissions. Thus, besides evaluating the impact of energy efficiency measures only in monetary terms, organizations need to include environmental benefits. 



**Dr. Vikramaditya Dave**  
Department of Electrical Engineering,  
College of Technology and  
Engineering,  
Maharana Pratap University of  
Agriculture & Technology, Udaipur



**Dr. Sujit Kumar**  
Department of Electrical Engineering,  
College of Technology and  
Engineering,  
Maharana Pratap University of  
Agriculture & Technology, Udaipur

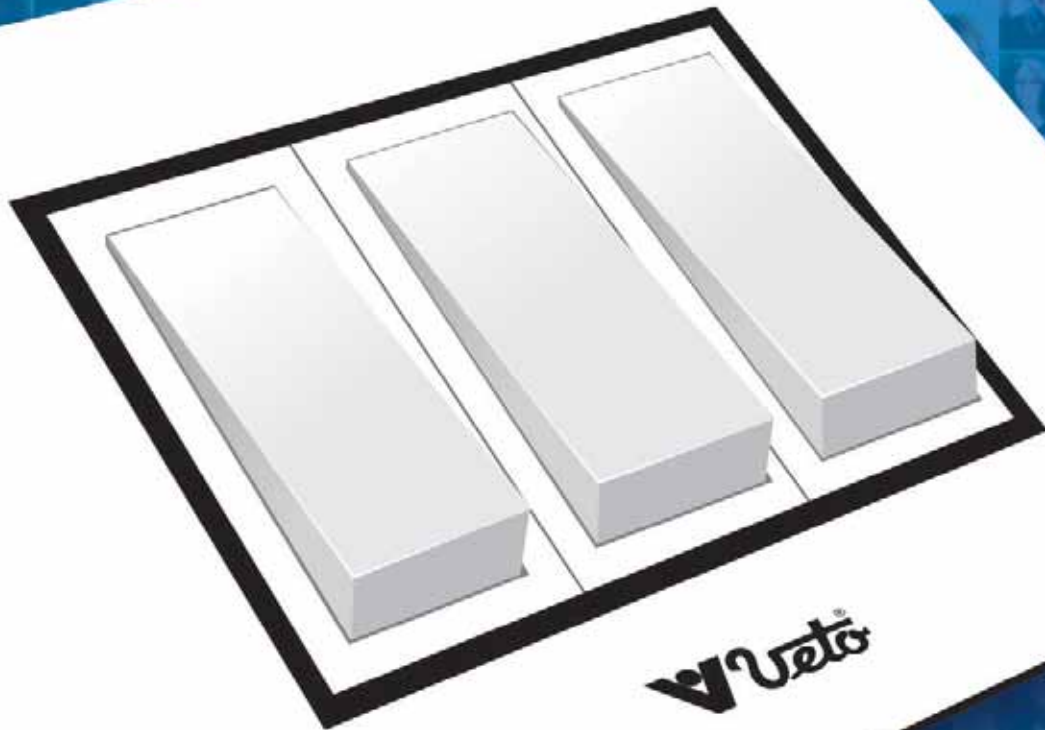
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# Interview

Gupta Power Infrastructure Ltd (GPIL), the flagship company of JRG Group specialises in cables and conductors with its own EPC division for turnkey projects. In an exclusive interview with **Electrical India**, **Abhishek Gupta**, **Director** of the company is delivering a briefing on various aspects of their business to **PK Chatterjee**. Excerpts...

**“Cable manufacturers are now focusing on eco-friendly power cables...”**



### **How is the demand for cables and conductors growing in India?**

The electric wire and cable industry in India is growing at a steady rate and is expected to post a CAGR of 16% during 2014-19. Government is working towards upgradation and modernization of T&D networks to cope with the rising demand for electricity and this will boost the market growth. As per 12<sup>th</sup> Plan, total of 42,59,183 kms (HT & LT) of cable and conductors is required during the plan period.

### **What are the new trends being seen in this segment?**

According to the United Nations Environment Program (UNEP) Report, last year, in the developing countries, there was an investment around \$131 Billion in the renewable energy segment, which was up 36% compared to the earlier year. In this, India's contribution was \$7.4 billion, which is expected to grow rapidly in the coming years.

Inline with our Prime Minister Modi's 2022 target of 160 GW of renewable energy, Indian & global players are entering this field with solutions and products to tap this market of Rs 6 lacs crores. The Indian government is laying great emphasis on solar power generation and simultaneously pushing for retro-fitting of current streetlights and indoor lamps with LED lights to conserve on power consumption.

Now, cable manufacturers are focusing on eco-friendly power cables with their properties including flame retardance, lower emission of poisonous fumes, non-corrosiveness and halogen-free wires.

### **What are the new demands from today's quality conscious buyers?**

Customers want precision products that are also good for the society. We are trying to manufacture the best possible quality to meet their demands.

### **Is competition truly pushing up the quality of the finished products or leading towards using raw materials of inferior quality?**

Of course not, inferior quality is never accepted by any of the customers – because these are electricity related products, hence no one want to take unwanted risks.

### **As your EPC Division is doing exceptionally well, please tell us something about this division?**

We have our own EPC wing offering single window turnkey solutions to power infrastructure projects. This division undertakes a wide range of works in underground as well as overhead segments both in distribution and transmission class. At present the division is executing massive projects for distribution system strengthening. The EPC Division is a huge success and gradually adding value & recognition to the company. It goes without saying about the prowess of our EPC division being the single largest integrated power solution provider in the country.

### **What are the specialties of your RHINO cables?**

Rhino Wires and Cables are produced from 100% purest copper under Copper Max technology, and PVC used for insulation is compounded on highly specialized machine. The world class drawing, bunching machines from Germany, finest extruder and automatic coiler, packaging machines are used in plants to manufacture Rhino Wires and Cables. We have all domestic and international certification for standards and quality like BIS, ISO9001, ISO14001, OHSAS18001, CE, UL to meet the demands of customers.

### **Please tell me in short about GPIL's new product line RHINO LED lights?**

GPIL is launching world class LED lighting with superior features using state-of-the-art technology for its domestic and international customers. We have planned to offer a large range of indoor, outdoor and industrial LED lights. Our lights have high lumen output, high CRI, UV protection, ROHS compliance, environmental friendliness, UL compliance and 50,000 hours of life. We are setting up a world-class testing and R&D lab to ensure superior design and superb quality.

### **How is your focus on quality from manufacturing to product shipping?**

As I said earlier, quality always comes first, but delivery as per agreed deadlines is also important. Secondly, with our traditional products becoming commodities, lean and agile logistics is increasingly playing a major role. For this, we are manufacturing in three strategic locations – Bhubaneswar, Kashipur and Chennai – and we are therefore able to cater to our customers across India. By being near to the ports, we are cutting on transit time for our export shipments. There have been recent instances wherein we airlifted the material for adhering to our delivery commitment to our global clients.

### **To what extent are you prepared to supply customized products to the buyers?**

We are already open for the customized products, as is quite evident from the fact that we are supplying from East to West with vast difference in their requirements, applications, standards and usage conditions. Every customer has got his own PQR. We comply to these and the same then becomes a checklist for our quality control function.

### **Please tell me in short about GPIL's role in improving power transmission and distribution in India?**

We are proud to say that we are electrifying the Nation by being one of the largest suppliers of Transmission line Conductors to the PGCIL – and we are also supplying cable and conductors to all the TRANSCOs and DESCOs to almost all the state utilities.

We haven't stopped over there, we have started contributing to nation in Greener way by using our R&D and innovation, we are manufacturing and supplying HTLS Conductors by having a tie up with Mercury Cable, US in one of the variant's HVCR, and in the process of installing 5 MW solar plant to cater to the needs of our own electricity consumption.

### **What are the financial challenges that GPIL is facing while dealing in the domestic market?**

The main challenges are fund availability and payment on time. Along with those, stringent financial obligations like EMD, BG, price variations and inspection notifications are playing the main role in decision making. At the end of the day, business cycle is highly dependent upon cash flow cycle.

### **What's your message to the potential customers?**

We have not grown in a single day, but we have been continually learning in our journey of more than 50 years along with our customers. We are moving towards automation by installing state-of-the-art machines, which produce precision products. Using advanced software products along with value engineering from 'inquiry generation to delivery,' we are there to support you with 'quality and best possible delivery schedules.' Once a customer of Gupta power means – we will be lifelong partner of your success story.



# Three New World Records

*The turnkey Düsseldorf power plant sets three new records in world-wide comparison. During the test run before acceptance, unit 'Fortuna' achieved a maximum electrical net output of 603.8 megawatts (MW), which is a new record for a combined cycle plant of this type in a single-shaft configuration...*



*Combined cycle power plant at the location Lausward in Düsseldorf... (Source: Siemens)*

Unit 'Fortuna' was handed over to the customer 19 days ahead of the date set in the contract. The project on the bank of the Rhine was additionally a huge success with regard to occupational safety for everyone involved. More than two million hours of work in total were performed without a single accident. Because of the plant's close proximity to the downtown area of the city, special importance was attached to minimum emissions, optical integration into the cityscape, and lowest achievable noise levels: On the opposite shore of the Rhine, across from the plant, the noise level is less than 25 decibels – quieter than a whisper.

Siemens handed over the combined cycle power plant equipped with a Siemens H-class gas turbine at the Lausward location in the Düsseldorf (Germany) harbour area to the customer and operator, the utility company Stadtwerke Düsseldorf AG. The turnkey plant sets three new records in world-wide comparison. During the test run before acceptance, unit 'Fortuna' achieved a maximum electrical net output of 603.8 megawatts (MW), which is a new record for a combined cycle plant of this type in a single-shaft configuration. A new world record of around 61.5% for net power-generating efficiency was also achieved, enabling Siemens to beat its own efficiency record of 60.75% set in May 2011 at the Ulrich Hartmann power plant located in Irsching in the south of Germany.

The high efficiency level makes the power plant especially environmentally friendly. In addition, unit 'Fortuna' can also deliver up to around 300 MW for the district heating system of Düsseldorf – a further international peak value for a power plant equipped with only one gas and steam turbine. This boosts the plant's fuel utilization up to 85%, while reducing CO2 emissions to a mere 230 gram per kilowatt-hour.

The increase in the capacity and efficiency levels is the result of consistent ongoing developments, for example in the design of components, in the materials used, in the overall construction of the plant, and in the perfect interworking of all plant components. "We optimised the power plant to enable it to be ideally positioned in one of the world's most demanding power markets. Together with the Stadtwerke Düsseldorf, we are therefore very pleased that this plant sets the new efficiency world record," stated Willi Meixner, CEO of the Power and Gas Division within Siemens AG.

The gas turbine can run at full load in less than 25 minutes after a hot start, enabling it to also be used as a backup for renewables-based power production.

This flexibility supports the operator in efforts to achieve economical operations in a challenging environment for conventional power plants.

# Lightning & Surge protection



Lightning Current Arrester  
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



Surge Arrester + EMC/EMI  
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Coaxial Surge Arrester



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# Rishabh CTs

## A Technological Excellence



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*Rishabh is having the complete basket of low tension current transformers manufactured in a world class CT manufacturing setup consisting of an automatic testing facility for all CTs with a printed Test Certificate...*



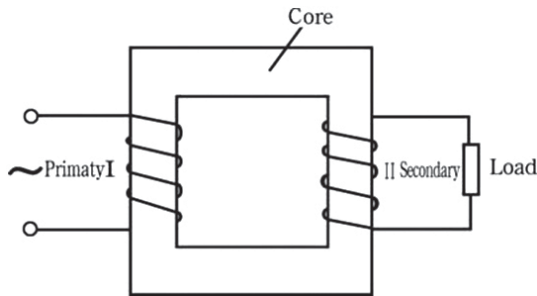
### CT Basics

Measurement of energy flow is extremely important to monitor and protect the power system. Current Transformer is widely used for this purpose.

It becomes practically impossible for any measuring instrument to handle the high current values and hence Current Transformer comes as a handy solution. Current transformer produces a reduced current accurately proportional to the current in the circuit, which can be conveniently connected to measuring and recording instruments. A current transformer isolates the measuring instruments from very high voltage in the monitored circuit.

Engineers often tend to think of a current transformer as an ideal device. Hence let's have a look at ideal CT.

### Ideal Current Transformer



$$a = \frac{n_1}{n_2} = \frac{V_1}{V_2} = \frac{I_2}{I_1}$$

- where:
- a = turns ratio of transformer
  - $n_1$  = number of turns on primary
  - $n_2$  = number of turns on secondary
  - $V_1$  = primary voltage
  - $V_2$  = secondary voltage
  - $I_1$  = primary current
  - $I_2$  = secondary current

An ideal current transformer would proportionally scale down the value of the power system current to a useable known value. Second, the scale-down output should faithfully reproduce the power system current waveform. An ideal current transformer should perform these two tasks over the range of a few amps up through ten thousands amps. The ideal current transformer should be able to meet these requirements. In reality, a current transformer has limitations.

Today's current transformer hasn't changed since it was developed. A current transformer consists of the following components:

- A laminated steel core
- A secondary winding around the core
- Insulating material

When current travels through a current carrying device, such as a cable or bus duct it develops a magnetic field at right angles to the flow of current. The strength of the magnetic field varies as the current magnitude changes during all operating conditions. As learnt in transformer theory, when a magnetic field strikes a wire, it will cause a current to flow in the wire. By using the strength of the magnetic field and knowing the turns ratio, we can obtain a value of current that is useable for meters, relays and other current sensing devices.

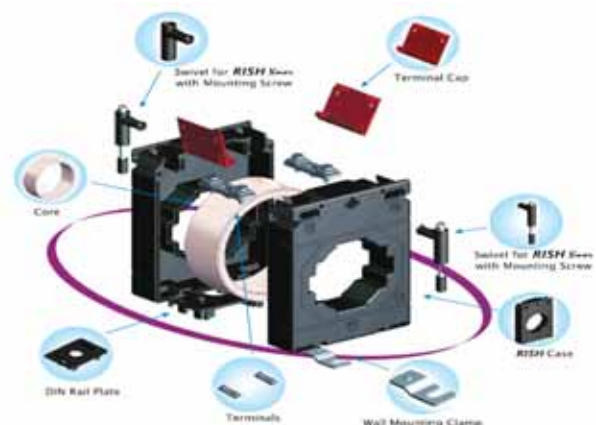
In order to scale a value of high current flowing in a conductor, the engineer needs to introduce a specific number of uniformly distributed turns of wire around the core to scale down the system current. This will ensure that the output current is always proportional to the current flowing in the conductor. The current carrying conductor is referred to as a primary or P1 and the ends of the wire surrounding the core are referred to as a secondary or S1 and S2 for single winding current transformer.

In the past, there were two main values of secondary current typically used in measuring current. In India and most of Asian countries and also in the United States, engineers typically use a 5-amp output. Other countries have adopted a 1-amp output.

### Application

RISHABH Current Transformers are manufactured to meet indoor or internal devices for Switch gear, Distribution Systems, Generator Sets and Control Panels. Rishabh CTs are intended for supplying measuring instruments and protection circuits of electrical power devices with a maximum operating voltage of 0.72KV and frequency of 50Hz or 60Hz. These Current Transformers are supplied in Ring/Rectangular/Split core type in a wide range of ratios and accuracies with Primary current ranging from 1A up to 7500A and with Secondary current of 5A and 1A.

### CT Assembly







Accuracy of CT depends on the magnetic performance of the steel core. Hence we can call it as a heart of CT. Torridly wound cores with high permeability and low loss are used to optimize performance and physical size of the transformers. High grade insulation is used to insulate between the windings and the core and between winding layers.

Maximum mechanical and electrical performance is achieved by distributing all windings evenly around periphery of core.

The casing of the CTs is made with UL 94 V-0 approved 10% glass filled Polycarbonate material having self-extinguishing and non-drip feature that provides an excellent mechanical / fire protective body & look and long term dielectric performance.

## CT Selection

Factors to be considered while selection of the current transformer.

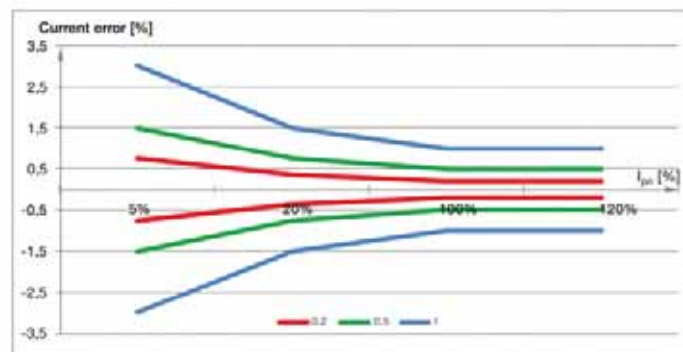
- **Primary Current** :- The nominal value of the primary current ( $I_{pn}$ ) should be selected from the offered series range of available types to provide the closest match with the expected primary current of the system. All low voltage transformers manufactured by Rishabh have an extended rating of 120% which makes conversion possible within a range 20% higher than the rated value.

- **Secondary Current** :- Secondary current ( $I_{sn}$ ) is to adapt to the system found on the secondary side of the transformer. 5A and 1A are the standardized secondary current values. Primary current/secondary current ( $I_{pn}/I_{sn}$ ) is the standard transformation ratio.
- **Power** – the transformer load :- The total load (VA) that will be connected to the secondary side of the transformer should be considered, including the load from the connected device as well as losses on connection leads and terminals. According to standard IEC 60044-1 the current and phase errors of the transformer should not exceed values specified in below given table at any secondary load in the range from 25% to 100% of the rated load.
- **Dimensions**:- Internal and external dimensions of the transformer should be specified to ensure the possibility to install the transformer on the current circuit and that it can be accommodated in the planned locations.
- **Accuracy class** to obtain satisfactory measurement accuracy :- In case of metering CTs with accuracy class 0.2, 0.5, 1 or 3, CT has to be accurate from 5% to 120% of the rated primary current and CTs with accuracy class 0.2S and 0.5S, it has to be accurate from 1% to 120% of the rated primary current at 25% and 100% of the rated burden at specified power factor.

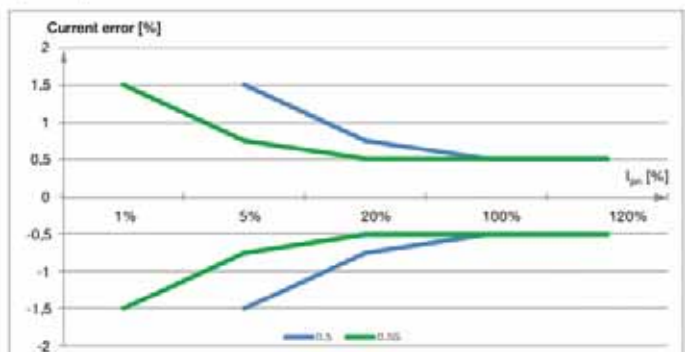
Accuracy Class	+/- Percentage Current (ratio) error at Percentage of Rated Current Shown Below					+/- Phase Displacements at percentage of rated current Shown below									
						In Minutes					In centiradian				
						1	5	20	100	120	1	5	20	100	120
0.1	NA	0.4	0.2	0.1	0.1	NA	15	8	5	5	NA	0.45	0.24	0.15	0.15
0.2S	0.75	0.35	0.2	0.2	0.2	30	15	10	10	10	0.9	0.45	0.3	0.3	0.3
0.2	NA	0.75	0.35	0.2	0.2	NA	30	15	10	10	NA	0.9	0.45	0.3	0.3
0.5S	1.5	0.75	0.5	0.5	0.5	90	45	30	30	30	2.7	1.35	0.9	0.9	0.9
0.5	NA	1.5	0.75	0.5	0.5	NA	90	45	30	30	NA	2.7	1.35	0.9	0.9
1	NA	3	1.5	1	1	NA	180	90	60	60	NA	5.4	2.7	1.8	1.8
3	NA	NA	NA	3	3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5	NA	NA	NA	5	5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Fig. 1. Accuracy class characteristics:

a) classes 0.2; 0.5; 1



b) comparison of classes 0.5 and 0.5S



## Product Range for Nuclear\Power

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6 OPzS	300
6 OPzS	420
7 OPzS	490
6 OPzS	600
8 OPzS	800
10 OPzS	1000
12 OPzS	1500
16 OPzS	2000
20 OPzS	2500
24 OPzS	3000

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Patent applied for - terminal bush design to eliminate cell cover bulging and crack due to plate growth which is a normal failure mode.

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### Factors Affecting CT Prices

Selection CT VA burden and accuracy class should be according to the actual requirement of the application wherein the CT is going to be installed. Selecting higher VA or Class than necessary usually results in a higher cost. The cost generally increases as the CT internal diameter increases. 1A secondary CTs are usually more expensive than 5A CTs.

### Instrument Security Factor (FS)

In order to protect the instruments and meters from being damaged by high currents during fault conditions, a metering core must be saturated typically between 5 and 20 times the rated currents. The rated instrument security factor (FS) indicates the over current as a multiple of the rated current at which the metering core will saturate. It is thus limiting the secondary current to FS times the rated current. ISF for Rishabh CTs are designed to 5 or less than 5. The safety of the metering equipment is greatest when Rishabh CTs are used.

### CT Testing

Each and every CT is tested in accordance with IEC 60044-1 or IS-2705 for ratio errors and phase angle errors with microprocessor based automatic transformer test set (Omicron make CT Analyzer) with facilities for automatic printout of test results. Test comparisons are made with standard traceable NPL to validate ratio accuracy performance for all CTs. For protection class CT the performance is verified by excitation measurements.

### Test Set up Photo used in Rishabh with Test Certificate supplied with each CT...



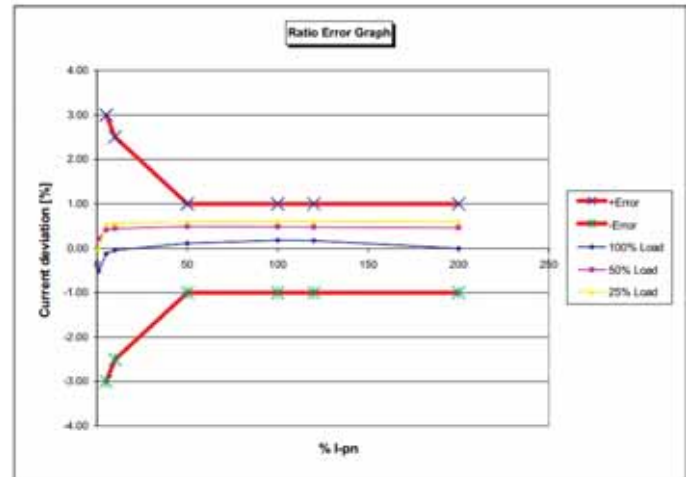
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### TEST CERTIFICATE

General test information:		Date/Time: 2014-03-19, 07:30:21 PM
Test device: CT-Analyzer	Device Serial No: K0551P	
RESULT: OK	CT Serial No: 14/03/9	
Used test settings:		
I <sub>pn</sub> : 200.0 A	Location:	Object:
I <sub>sn</sub> : 5.0 A	Company: Cummins	Manufacturer: Rishabh
Rated burden: 5.0 VA / 0.8	Country: India	Type: Xmer 45/21
Operating burden: 5.0 VA / 0.8	Station:	Core number:
Applied standard: IEC 60044-1	Feeder/Bay:	Tap:
Core type (PM): M	Phase:	Optional:
Class: 1	IEC-ID:	
FS: 5.0	test (cph): 120 %	
50.0 Hz	max. Rd: 0.073 Ω	

Current ratio error in % at % of rated current								
VA/CoilPhi	1	5	10	20	50	100	120	200
5 VA 0.8	-0.514	-0.128	-0.029	0.032	0.111	0.177	0.173	0.460
2.5 VA 1	0.213	0.414	0.446	0.467	0.489	0.484	0.477	0.460
1.25 VA 1		0.532	0.561	0.579	0.596	0.602	0.601	0.594
1 VA 1		0.555	0.584	0.601	0.618	0.625	0.624	0.615
VA/								

Phase displacement in [min] at % rated current								
VA/CoilPhi	1	5	10	20	50	100	120	200
5 VA 0.8	24.860	15.570	12.634	10.294	8.428	1.378	0.370	
2.5 VA 1	33.329	21.026	18.062	15.615	13.116	10.129	9.041	7.580
1.25 VA 1		15.643	13.504	11.661	9.750	8.217	7.661	5.782
1 VA 1		14.760	12.566	10.819	9.035	7.729	7.240	5.525
VA/								



### Metering Class CTs

In general the following applies :

#### Accuracy class requirements:

- 0.1 or 0.2 for precision measurements.
- 0.5 for High grade Killowatt-hour meters.
- 1.0 for commercial grade killowatt-hour meters.
- 1 or 3 for general industrial measurements.
- 3 or 5 for approximate measurements.

#### Burden requirements:

- Ammeter : 1.0 VA.
- Current coil of Watt/var meter : 1.5 VA.
- Current coil of energy meter : 2.0 VA.
- Current coil of PF indicator : 2.5 VA.
- Current coil of Tri-vector meter : 3.0 VA.

# Tested: 27 million times twisted ... from stock



Test 3105



chainflex® robot fibre optic cable CFROBOT5.501 +++ Glass fibre cable survives more than 27 million cycles at  $\pm 180^\circ/\text{m}$  torsion +++ chainflex® lasts +++ Proved in test no. 3105 +++ online calculable +++ Test information and details: [igus.in/chainflexTest3105](http://igus.in/chainflexTest3105)

# Tested: 41 million strokes ... from stock



Test 2233



chainflex® control cable CF5.10.25 +++ Has withstood more than 41 million strokes at a 25% smaller test radius +++ chainflex® lasts +++ Proved in test no. 2233 +++ online calculable +++ Test information and details: [igus.in/chainflexTest2233](http://igus.in/chainflexTest2233)

# Tested: 76 million strokes ... from stock



Test 3089



chainflex® bus cable CFBUS.044 +++ Has withstood more than 76 million strokes in the running endurance test +++ chainflex® lasts +++ Proved in test no. 3089 +++ online calculable +++ Test information and details: [igus.in/chainflexTest3089](http://igus.in/chainflexTest3089)

# Tested: 97 million strokes ... from stock



Test 4009



chainflex® thermal compensation cable CFTHERMO.K.001 +++ Lasts more than 97 million strokes at a 48 mm radius +++ chainflex® lasts +++ Proved in test no. 4009 +++ online calculable +++ Test information and details: [igus.in/chainflexTest4009](http://igus.in/chainflexTest4009)





### Protection Class CTs

In addition to general specification required for CT design, Protection CTs require an Accuracy Limit Factor (ALF). This is the multiple of rated current up to which the CT will operate while complying with the accuracy class requirements. In general the following applies:

- Instantaneous over current relays & trip coils : 2.5VA class 10P5.
- Thermal Inverse time relays : 7.5VA class 10P10.
- Low consumption relays : 2.5VA class 10P10.
- Inverse definite min. time (IDMT) Over current relays : 15VA class 10P10/15.
- IDMT earth fault relays with fault stability or accurate time grading required : 15VA class 5P10.

### Special Type CTs

#### Class PS CTs

Class PS CTs are special CTs used mainly in balanced protection systems (including restricted earth fault) where the system is sensitively dependent on CT accuracy. Further to the general CT specifications, we now need to know:

- V<sub>kp</sub> – Voltage knee point
- I<sub>o</sub> – Maximum magnetizing current at V<sub>kp</sub>
- R<sub>s</sub> – Maximum resistance of the secondary winding.

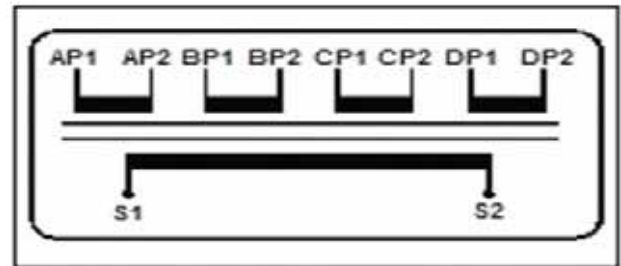
**Knee Point Voltage:** That point on the magnetizing curve where an increase of 10% in the flux density (voltage) causes an increase of 50% in the magnetizing force (current).

### Summation CTs

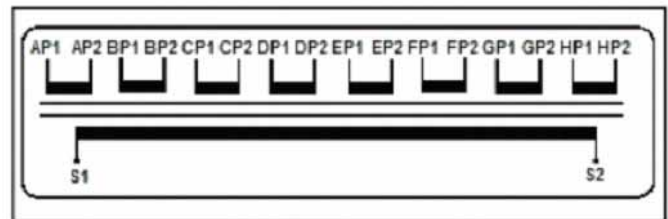


In electrical supply practice, it may become necessary to obtain sum of currents in a number of feeders. To achieve this, Summation CTs are used. These CTs are used with feeder CTs. Which may or may not have same ratios. Each feeder is provided with its own CT and the secondary windings of these are connected to the appropriate primary windings of the Summation CT. The summation CT has a single secondary winding which is connected to the burden. It is essential that Summation CTs are used on currents of same frequency and phase. Summation CTs are generally manufactured conforming to IS 6949.

#### Rish Xmer Sigma 75



#### Rish Xmer Sigma 150



### Conclusion

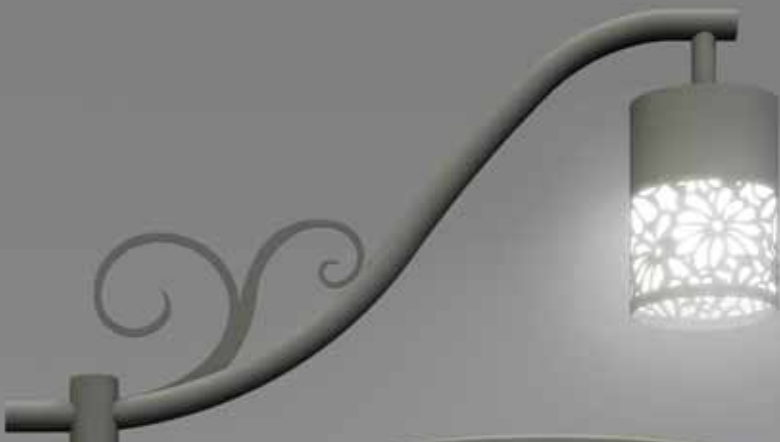
As Rishabh is having the complete basket of low tension current transformers manufactured in a world class CT manufacturing setup consisting of an automatic testing facility for all CTs with a printed Test Certificate, we have a real technological excellence in current transformers.



**Santosh R. Bhangale**  
Product Manager – Analog Expertise  
Rishabh Instruments Pvt. Ltd.  
Nasik - India



Garden Lighting Solutions



Snaky Lighting Pole

India's Lighting Company

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# An Overview Of Some **SPECIALY DESIGNED ELECTRICAL EQUIPMENT**

*There are eight types of protections applied to the electrical equipment for their safe use in explosive atmosphere. These special electrical equipment are known as Ex equipment. Ex stands for explosion proof or explosion protected...*



Underground coalmines require number of electrical equipment for production of coal and for safety of the miners working belowground. The use of electrical equipment in gassy mines is governed by Coal Mines Regulations (CMR) 1957 and Central Electricity Authority (CEA) 2010 (earlier Indian Electricity Rules 1956), which allow use of electrical equipment having type of protection flameproof (Ex 'd'), increased safety (Ex 'e') and intrinsically safe (Ex 'i') under 181(3) provision of CMR. There are other protection techniques used for design of electrical equipment for use in hazardous areas of surface industries, which basically ensures the prevention of explosion or fire due to electricity in such areas.

Categories of underground coal mines as per CMR as per gassiness:

The underground coal seams in working mines in India are categorized into Degree I, Degree II and Degree III of gassiness depending on the volume of inflammable gas present per cubic meter of coal and defined in the coal mines regulation 1957.

- The degree of gassiness of seams is defined as follows:
- Gassy seam of Degree I: A coal seam or part thereof lying within the precincts of a mine not being an opencast working whether or not inflammable gas is actual detected in the general body of the air at any place in its working belowground, or when the percentage of the inflammable gas, if and when detected, in such general body of air does not exceed 0.1 and the rates of emission of such gas does not exceed one cubic meter per tonne of coal produced (i.e. 1 m<sup>3</sup>/tonne).
- Gassy seam of Degree II: A coal seam or part thereof lying within the precincts of a mine not being an opencast working in which the percentage of inflammable gas in the general body of air at any place in the working of the seam is more than 0.1 or the rate of emission of inflammable gas per tone of the coal produced exceeds one cubic meter but does not exceed ten cubic meters (i.e. 1 - 10 m<sup>3</sup>/tonne).
- Gassy seam of Degree III: A coal seam or part thereof lying within the precincts of a mine not being an open cast workings in which the rate of emission of inflammable gas per tonne of coal produced exceeds ten cubic meters (i.e. > 10 m<sup>3</sup>/tonne).

Classification of hazardous areas of surface industries as per IS 5572: 2009 (IEC 60079-10-1 (2008)):

- Zone 0 is the area in which hazardous atmosphere is normally present continuously.

- Zone-1 is the area in which hazardous atmosphere is likely to occur under normal operating condition, and
- Zone 2 is the area in which hazardous atmosphere is likely to occur only under abnormal operating conditions.

**Basic concept of electrical equipment design and selection of equipment in hazardous areas:**

The ignition of flammable gases, vapors, liquids or dust in presence of oxygen contained, in the surrounding air may lead to explosion, a rapid physical or chemical reaction accompanied by an increase in temperature and pressure. Basic requirements for an explosion to take place in atmosphere are: flammable substance (fuel, gases, vapors), oxygen (air) and source of ignition. The mixture of gas or vapor with air in a proper ratio (within explosive range) is potentially ignitable mixture. Electrical parts or components can generate different sources of ignition e.g. spark or arc, hot surface and static electricity.

Special design techniques (types of protection) for electrical/ electronic equipment:

It is clear that there are two major factors which are responsible for a gas explosion, explosive atmosphere and source of ignition.

The first strategy for prevention of explosion is to take all precautions so that an explosive environment is not created. But it is not possible in the industries where gases are emitted during the process of production or extraction of coal in gassy mines. Therefore, it is necessary to protect the source of ignition in the potentially explosive atmosphere. It can be achieved by various methods. These methods or special measures used for electrical equipment during their design and use to prevent explosion which basically depends upon prevention of formation of fire triangle or on its confinement. The special measures applied to them known as types of protection.

There are eight types of protections applied to the electrical equipment for their safe use in explosive atmosphere. These special electrical equipment are known as Ex equipment. Ex stands for explosion proof or explosion protected. Table-1 shows the different Ex equipment with examples and use in surface industries.

The protection may be achieved either by suitably constructing the enclosure or suitably designing the apparatus or the circuits depending on the application. In background of each protection the main thing is to

Table 1: Examples of different Ex equipment

Type of Protection	Examples of Ex equipment	Condition/ Area of use	Zone
Increased Safety Non Sparking	Terminal boxes/ Motors/ lighting fittings	Where explosive atmosphere is not present or presents for very short period	Zone 2
Intrinsic Safety	Very low power apparatus: Sensors/ telecommunication system/ RFIDS	Where explosive atmosphere is present continuously	Zone 0 and also in Zone 1 and Zone 2
Encapsulation	Miniature devices/ Small components	Where explosive atmosphere is normally present	Zone 1 and Zone 2
Pressurization	Control panels/ Motors/ Transformers	Where explosive atmosphere is normally present	Zone 1 and Zone 2
Oil immersion	Transformers	Where explosive atmosphere is normally present	Zone 1 and Zone 2
Sand filled	Transformers	Where explosive atmosphere is normally present	Zone 1 and Zone 2
Flameproof	Junction boxes/ Control panels/ switching devices/ Gate end boxes/ Motors/ Lighting fittings	Where explosive atmosphere is normally present	Zone 1 and Zone 2





Table 2: Types of protection for electrical equipment and methods of protection

Method	Type of Protection
Designed to prevent any ignition source from arising	Ex 'e' Increased Safety Ex 'n' Non Sparking
Designed to limit the ignition energy of the circuit	Ex 'i' Intrinsic Safety
Designed to prevent the flammable mixture reaching a means of ignition	Ex 'm' Encapsulation Ex 'p' Pressurization Ex 'o' Oil immersion Ex 'q' Powder/ sand filled
Designed to prevent any ignition from spreading	Ex 'd' Flameproof Enclosure

prevent the contact among explosive mixture, ignition source and the supportive environment, generally oxygen (Please refer Table 2).

### Explosion probability and selection of equipment

The probability of explosion (Pex) can be defined based on the probability of occurrence of explosive atmosphere (Pa) and probability of formation of ignition source (Ps),

$$P_{ex} = P_a \times P_s$$

It is clear that area having less probability of occurrence of explosive atmosphere (Pa) will have minimum chances of explosion. The simultaneous occurrence of explosive atmosphere and ignition source is also important. From Table-3 it is clear that the protection techniques Ex 'n' and Ex 'e' are basically designed to prevent any ignition source from arising, similarly flameproof protection is designed to prevent any ignition from spreading. In case of pressurized protection the equipment is designed to prevent the flammable mixture reaching a means of ignition.

### Types of protection permitted in gassy mines as per CMR

Under Regulation 181(3) of Coal Mines Regulations-1957, flameproof, increased safety and intrinsically safe electrical apparatus and cables can be used in underground coal mines only when they are approved by the Chief Inspector of Mines also designated as Directorate General of Mines Safety.

CMR 1957 outlines use of flameproof, increased safety and intrinsically safe equipment in below ground gassy mines. These protection techniques are described here to understand the concept and method of design requirements:

#### (i) Explosion Proof or Flameproof (Ex d) as per IS/ IEC 60079-1

In chapter 1 of CMR 1957, the flame proof apparatus is defined as follows:

“Flame proof apparatus” means an apparatus that can withstand without injury any explosion of the inflammable gas that may occur within it and can prevent the transmission of flame such as will ignite the inflammable gas which may be present in the surrounding atmosphere.”

### Performance requirements

- These enclosures allow explosion to take place inside the enclosure but do not allow explosion to permeate to surrounding hazardous area.
- They are capable of withstanding the internal explosion & their mechanical integrity remains unaffected.
- The surface temperature of enclosures does not exceed the auto ignition temperature of surrounding flammable gases while in operation.

### Construction features

- Flame path and gap (length & clearance) is ensured as per volume of enclosure and gas group of the hazardous atmosphere
- Material of construction is chosen to avoid frictional sparks

### Applications

In general equipments such as Control & Power panels' etc. having arcing devices such as fuses and switchgears etc. can be designed and use as flameproof.

Chapter-XV of CMR 1957 outlines the use of flameproof equipment as follows:

“In every gassy seam of the second or third degree only flame proof electrical apparatus and equipment shall be used belowground unless otherwise provided for under the Indian Electricity Rules, 1956]...”

Use of flameproof equipment in gassy mines as per CMR:

In degree I: at any place lies in-by of last ventilation connection

In degree II: at any place which lies in-by of last ventilation connection and return airways and any place within 90 meters of any working face or goaf.

In degree III: at any place which lies in-by of last ventilation connection and return airways and any place within 270 meters of any working face or goaf.

It is clear that as the rate of emission of flammable gas per tonne of coal is increasing the effective area (in terms of distance) of explosive atmosphere inside the mine from the working face and goaf is increasing.





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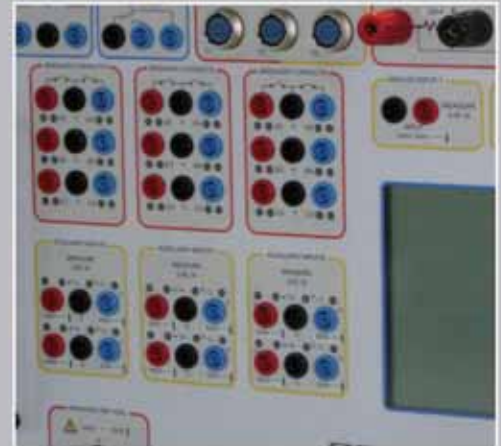
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Table 3: Ex equipment and use in hazardous area as per explosion probability

Type of protection	Pa	Ps	Pex	Use of type of protection in hazardous areas					
				Zone 0	Zone 1	Zone 2	Degree I	Degree II	Degree III
Ex 'd'	≤1	1		x	√	√	√	√	√
Ex 'i'	≤1	0	0	<sup>a</sup> √	√	√	√	√	√
Ex 'e'	<<1	0	0	x	x	√	√	x	x
Ex 'p'	0	1	0	x	√	√	x	x	x
Ex 'o'	0	1	0	x	√	√	x	x	x
Ex 'm'	0	1	0	x	√	√	x	x	x
Ex 'q'	0	1	0	x	√	√	x	x	x
Ex 'n'	<<1	0	0	x	x	√	x	x	x

Notes:

 Pex ≤ 1 only in case of flameproof equipment and is confined inside the enclosure hence safe

<sup>a</sup> For Ex 'ia' type of protection only

### (ii) Intrinsically Safe (Ex i) as per IS/IEC 60079-11

IS/IEC 60079-11 (2006) defines an intrinsically safe circuit as follows:

“Circuit in which any spark or any thermal effect produced in the conditions specified in this standard, which include normal operation and specified fault conditions is not capable of causing ignition of a given explosive gas atmosphere.”

Intrinsically safe apparatus: electrical apparatus in which all the circuits are intrinsically safe circuits.

#### Construction features

- The energy stored and dissipated during a normal or fault conditions is insufficient to ignite the surrounding flammable gases.
- The surface temperature of the components like ICs, Capacitors, Inductors, resistors, etc. mounted inside does not exceed auto ignition temperature of surrounding flammable gases.
- All the components / PCB track / wire cross section are chosen with high safety margins to prevent temperature rise under fault condition thus preventing ignition.
- Adequate clearance and creepage distance are maintained between conducting wires
- In addition with many devices safety barriers are used to isolate field devices under fault condition.

#### Application

In general various low power devices such as gas detectors, signaling, telephonic and communication equipment can be designed and use as intrinsically safe.

Chapter-IX of CMR 1957 outlines the use of intrinsically safe apparatus as follows:

“In every gassy seam of the second or third degree], all signaling or telephonic communication circuit shall be constructed, installed, protected, operated and maintained in such a manner as be intrinsically safe.”

### Use of intrinsically safe apparatus in gassy mines

In all gassy mines: at any place all signaling or telephonic communication circuit shall be intrinsically safe.

### (iii) Increased Safety (Ex e) as per IS/IEC 60079-7

#### Performance requirements

- Explosion inside enclosure is prevented by ensuring that ignition of flammable gases do not take place by eliminating all contributory factors like arc, spark and hot surfaces.
- The surface temperature of enclosures or components mounted inside does not exceed auto ignition temperature of surrounding flammable gases.
- These enclosures are not required to withstand explosion inside the enclosure.
- These enclosures should have minimum ingress protection of IP 54
- The power to the motors is withdrawn before attaining limiting temperature by the stator winding of the motor in case of stalled rotor condition.

#### Construction features

- No arcing or sparking devices such as fuse & switchgears are used. No making and breaking of contacts is allowed.
- Ignition is prevented by use of non-sparking components with higher thermal rating having safety margins to prevent sparks & rise in temperature.
- High impact resistant materials like FRP or GRP not holding static charge or metals are used.
- Clearance and creepage distances are maintained to prevent sparking between conductive terminals.
- Anti-loosening & vibration proof terminals are used.
- Enclosure is protected against possible ingress of dust and water to prevent conductive layer formation between current carrying parts.

The source of ignition does not form when the equipment is constructed as per laid design features. The increased safety motors are also designed and assessed against any possible risk of stator winding discharge and air gap sparking in cage rotor construction of motors.

#### Applications

- Terminal housing, luminaries and motors.
- Use of Increased safety equipment in gassy mines as per CMR:



“In degree I gassy mines,.....electrically operated or battery operated portable or transportable apparatus such as shuttle car, men or material transporting equipment of increased safety ‘e’ shall be permitted at any place with suitable monitoring devices for detection of gases, if any.”

For gassy mines of degree I, gas detector is interlocked with the Ex ‘e’ apparatus and disconnects the power to the apparatus when flammable gas is detected more than 1.25% in air.

### Types of protection for use in explosive atmosphere other than coal mines

All types of protections permitted for coalmines are also applicable for surface industries. In addition, following types of protections are also used for electrical equipment for surface industries and oil mines and are described below:

#### (i) Non-Sparking or non-incendive (Ex n) as per IS/IEC 60079-15

##### Performance requirements

- Explosion inside enclosure is prevented by ensuring that ignition of flammable gases do not take place by eliminating all contributory factors like arc, spark and hot surface.
- The surface temperature of enclosures or components mounted inside does not exceed auto ignition temperature of surrounding flammable gases.
- These enclosures are not required to withstand explosion inside the enclosure.
- These enclosures should have minimum ingress protection of IP 54

##### Construction features

- No arcing or sparking devices such as fuse & switchgears are used. No making and breaking of contacts is allowed.
- In these types of equipment, only such components are used, which are incapable of producing sparks thus eliminating source of ignition.
- Clearance and creepage distances are maintained to prevent sparking between conductive terminals.
- Enclosure is protected against possible ingress of dust and water to prevent conductive layer formation between current carrying parts. The source of ignition does not form when the equipment is

constructed as per laid design features. The non-sparking motors are also designed and assessed against any possible risk of stator winding discharge and air gap sparking in cage rotor construction of motors.

##### Application

- Motors, luminaries, terminal housing etc.

#### (ii) Encapsulation (Ex m) as per IS/IEC 60079-18

##### Performance requirements

- Ensuring exclusion of flammable substance coming in contact with source of ignition by encapsulation prevents explosion.
- The surface temperature of enclosures or components mounted inside does not exceed auto ignition temperature of surrounding flammable gases.

##### Construction features

- Either potting with resin or sealing compound to achieve encapsulation.
- By encapsulation ingress of surrounding ambient is prevented.
- This is prevalent for small devices & electronic components.

##### Applications

- Static coils in ballast, solenoid valves or motors, relays and other control gear of limited power and complete PCBs with electronic circuits, zener barriers etc.
- Control Components like indicating lamps, push button elements and control switches etc.

#### (iii) Pressurized Protection (Ex p) as per IS/IEC 60079-2

##### Performance requirements

- Explosion inside enclosure is prevented by purging flammable media and ensuring non-ingress of flammable media by keeping positive pressure of uncontaminated purge media.
- The surface temperature of enclosures does not exceed auto ignition temperature of surrounding flammable gases.
- These enclosures are not required to withstand explosion inside the enclosure.

##### Construction features

- Under this type of protection component & devices are installed inside a purge and pressurized enclosures. A positive pressure of uncontaminated air or other neutral gas is maintained inside enclosure so as to exclude surrounding flammable media thus eliminating risk of explosion.
- Flammable media is purged from the enclosure and then only internal components are energized.
- In case of failure of overpressure in purge enclosure, the alarm is initiated and in critical condition the apparatus is de-energized.

##### Applications

- Electrical equipment whose normal operation involves sparks, arcing or hot components and complex assemblies like large motors, transformers, switchgear and control cabinets and analysis devices.

#### (iv) Oil Filled (Ex o) as per IS/IEC 60079-6

##### Performance requirements

- Ensuring exclusion of flammable substance coming in contact with



source of ignition by submerging arcing or sparking components in oil prevents explosion.

- The surface temperature of enclosures or components mounted inside does not exceed auto ignition temperature of surrounding flammable gases due to cooling by oil.

**Construction features**

- Oil having high dielectric strength & good thermal conductivity are very good media for spark / arc quenching.
- They are in use since very long in High Rating Power Electrical equipments like Circuit Breakers. They are also in use in transformers for cooling.
- However they have negative aspect of flammability & forming carbon particle during arc quenching.
- In spite of these negative aspect they remain a good source for arc quenching & thus used to exclude source of ignition in Hazardous area in Oil quenched equipments.

**Applications**

- Large transformers, switchgear, starting resistors and complete starting controllers.

**(v) Powder filling / sand filing (Ex q) as per IS/IEC 60079-5**

**Performance requirements & construction features**

- Quartz grade sand is a very good media to suppress arc / sparks and is used in sand filled equipments to prevent explosion hazard by isolating spark from surrounding hazardous gases.

**Applications**

- Capacitors, electronic sub-assemblies or transformers etc.

**Conclusions and points to remember**

The equipment protection technique gives a universal acceptance of the designed equipment for a classified hazardous location and broadly followed worldwide. To understand the concept of protection some key points can be drawn as follows w.r.t. different protections:



Type of Protection	Key points to remember
Ex 'e' Increased Safety Ex 'n' Non Sparking	proper creepage distance and clearance between terminals, limitations of maximum temperature of internal components, weatherproof housing
Ex 'i' Intrinsic Safety	low power consuming circuits, limitations on selection of L, C and R, etc.
Ex 'o' Oil immersion	complete immersion of electrical parts in the oil, selection of oil of higher flash point
Ex 'q' Powder/ sand filled	powder/ quartz / sand filling in the empty space/ surrounding of electrical parts
Ex 'm' Encapsulation	compound sealing of electrical/ electronic components, compound with good physical properties with less water absorption and wide continuous operation temperature
Ex 'p' Pressurization	purging and pressurization of apparatus, control instrumentation for pressurization and purging, alarm and power cutoff devices
Ex 'd' Flameproof Enclosure	adequate gap and threads between joints of proper length (flamepath), mechanically strong housing and glass parts

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**R K Vishwakarma**  
Sr. Scientist in Flame & Explosion Laboratory of CSIR- Central Institute of Mining & Fuel Research



**Dr. Bhagirath Ahirwal**  
Associate Member  
Institution of Engineers (India)



**Dr. A. K. Singh**  
Senior principal scientist,  
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## Applications :

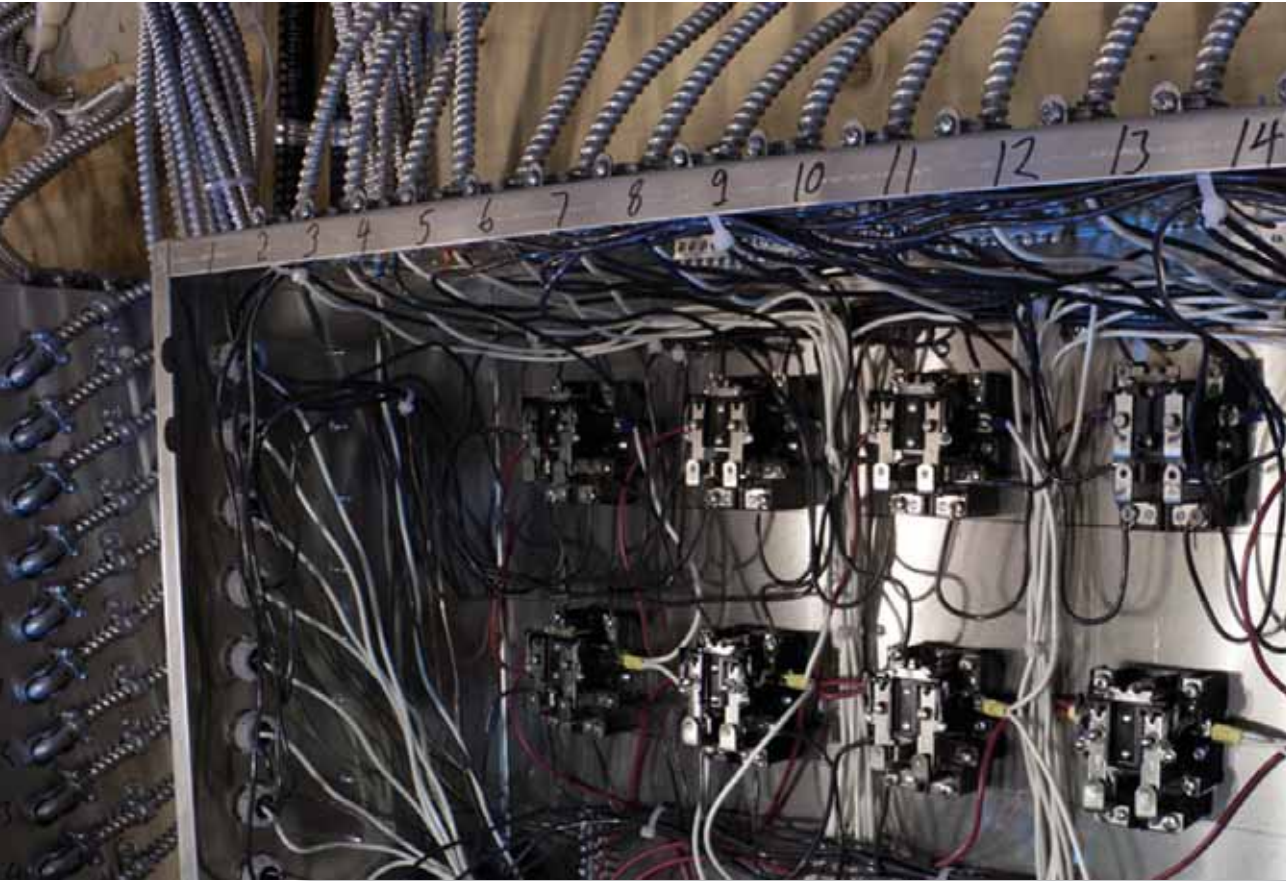
- Industries having Variable Frequency Drives, Inverters UPS, furnaces such as Paper, Steel Rolling, Textile, Garment, Software Parks, Automotive, Battery Manufacturing, Continuous Process Plants and Pharmaceutical Industries etc.
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# Industrial Networking

The challenge with industrial controls as well as with other electronic devices intended for use in industrial environments is to have them function reliably in spite of adverse conditions...

**I**ndustrial environments present much harsher conditions than are found in typical office environments. They not only often have extremes of temperatures, humidity, dirt, and corrosive materials, they may also contain devices such as motors and mechanical switches, which cause a large amount of electromagnetic interference (EMI).

The challenge with industrial controls as well as with other electronic devices intended for use in these environments is to have them function reliably in spite of adverse conditions. This may mean using a device that's built to withstand harsh conditions, protecting the device in a specialized cabinet, or both. Industrial networking solutions are suitable for use in:

- Agriculture
- Military applications

- Factory environments
- Manufacturing
- Oil/gas drilling and mining
- Public utilities
- Traffic control
- Transportation

## Extended temperature range

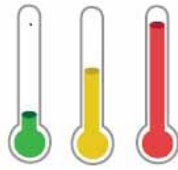
Many industrial devices are installed outdoors in unventilated sealed enclosures, which freeze in the winter and heat to extremely high temperatures in the summer. They and their power supplies are expected to perform over a wide temperature range. Typically they're rated so you can select one appropriate to your environment. Operating temperature tolerances are defined as:

- Standard: 0° to +40° C (32° to 104° F)
- Hardened: -25° to 60° C (-13° to +140° F)



- Extreme: -40° C to +75° C (-40° to +167° F)

Because industrial components are sealed against contaminants and also because they're often installed inside enclosures, they rely on air convection rather than fans for cooling.



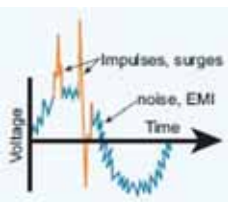
### Mounting

Components for office or data center use are usually either freestanding or mounted on 19" rails in a cabinet or rack. Industrial devices, on the other hand, are usually panel mounted by bolting them to a flat surface, or they may be DIN rail mounted. DIN rail is an industry-standard metal rail that is used both wall-mounted and rack-mounted. Industrial devices mount directly on the rail or may come with separate DIN rail brackets.



### Power supplies

The power supplied to industrial sites can vary tremendously. AC power varies anywhere from 60 VAC to 960 VAC, and often only DC power is supplied, with 24 VDC or 48 VDC being common. Industrial power may be three-phase power, which is used for power transmission across power grids and is favored for large



motors and heavy loads at industrial sites. It's also frequently "dirty" power, subject to noise, voltage fluctuations, and spikes. This inconsistent power is hard on the electronic components in industrial devices and can cause equipment damage or data loss.

Because of this variability, industrial control devices are either sold entirely separately from their power supply or are available with a choice of power supplies. Unlike ordinary networking devices, industrial controls require you to choose the correct power supply for both device and application. Industrial power supplies must be matched to both the type of power input they'll be receiving from the power grid and the power output they'll be expected to provide to the industrial control device.

### EMI protection

Industrial areas are also prone to electromagnetic interference (EMI) and radio-frequency interference (RFI). Interference and noise from EMI/RFI creates unwanted signals that may interfere with network performance.



Devices for industrial applications are usually built to withstand higher EMI than those intended for office or data center use. Chassis are usually shielded, and EMI signals can be absorbed by using capacitor-based circuits or through special coatings as well. Resistance to moisture and contaminants is the enemy of electronic components, and industrial devices are often subject to water in all its forms, from high humidity and condensation to

drips and splashes. Industrial devices are also often subject to dirt, dust, oil, salt spray, and chemicals when they're installed outdoors or indoors in an environment such as a factory floor.

For these reasons, industrial components are usually housed in hardened metal cases that are sealed against contaminants, including particulates such as airborne dust, as well as moisture, and sometimes chemicals. One way to protect industrial devices from their environment is with an enclosure designed to seal out contaminants such as dust and moisture. These enclosures are usually NEMA rated to describe the amount of protection they provide.

### Ingress protection ratings

Once limited to networks in office environments, Ethernet has also proven to be a robust alternative to the RS-232 interfaces traditionally used with industrial devices such as programmable logic controllers. Ethernet brings speed, versatility, and cost savings to industrial environments. The requirements of industrial environments are different from those of offices, and there have been a proliferation of industrial standards. The most commonly accepted are the Ingress Protection (IP) ratings developed by the European Committee for Electro technical Standardization (CENELEC), which specify the environmental protection an enclosure provides. IP ratings consist of two or three numbers. The first number refers to protection from solid objects or materials; the second number refers to protection from liquids and the third number, commonly omitted from the rating, refers to protection against mechanical impacts.

First IP Number	Second IP Number	Third IP Number
0: No protection	0: No protection	0: No protection
1: Protection from solid foreign objects of 50 millimeters or greater	1: Protection from vertically falling drops of water and condensation	1: Protection from impact of 0.225 joule (150 grams falling from 15 centimeters)
2: Protection from solid objects up to 12 millimeters	2: Protection from direct sprays of water up to 15° from the vertical	2: Protection from impact of 0.375 joules (250 grams falling from 15 centimeters)
3: Protection from solid objects more than 2.5 millimeters	3: Protection from direct sprays of water up to 60° from the vertical	3: Protection from impact of 05 joule (250 grams falling from 20 centimeters)
4: Protection from solid objects more than 1 millimeter	4: Protection from splashing water from all directions	4: Protection from impact of 2.0 joules (500 grams falling from 40 centimeters)
5: Protected from dust, limited ingress	5: Protected from low pressure water jets from all directions	5: Protected from impact of 6.0 joules (1.5 kilograms falling from 40 centimeters)
6: Totally protected from dust	6: Totally protected high-pressure water jets	6: Protection from impact of 20 joules (5 kilograms falling from 40 centimeters)
	7: Protection from temporary immersion up to 1 meter	
	8: Protection from long period immersion under pressure	

An IP67 rating means that the connector is totally protected from dust and is protected from the effects of immersion in 15 centimeters to 1 meter of water for 30 minutes.





# Security and Surveillance

## Keeping an eye on things

**P**rotect your property and assets, and ensure the safety of employees, with a security and surveillance system. Whether you have one building or a large campus, implementing a security network might be easier than you think — especially if you don't have to run all new cabling.

In this campus scenario, the security surveillance system combines new and existing technologies and cabling.

- A. The operations center houses the data center and security command center.
- B. When first built, the guard station had an analog phone, which was connected to the operations center via twisted-pair cabling. As technology evolved, new security requirements mandated that the guard station include a PC, security camera, and an IP phone. To achieve this, the company could have trenched a new fiber cable to the guard station for IP connectivity, but opted instead for a much faster and much more economical route. They decided to deploy a pair of LB300 Series EthernetExtenders (page H26) over the existing twisted-pair cabling. The basement of the operations center building houses the company's security center. The company wanted to mount IP security cameras on the roof of the building. Because the cameras would be more than 300 feet from the security center, the company decided to run fiber to the

cameras. To convert the fiber to copper CAT6 cable and to power the cameras, the company installed **LEH1000 Series**

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- C. Fiber cable was trenched to connect the operations center to the company's second building.
- D. The company recently upgraded its parking lot security cameras from analog to digital. The old analog cameras were connected via coax cable. To provide IP connectivity to the new digital cameras over the existing coax cable and to eliminate costly fiber trenching and disruption, the company used the multidrop Industrial **LB532 Series** Ethernet Extenders
- E. While upgrading its rooftop security cameras, the company also added a security camera to the electrical/generator building. As there was no IP connection between the buildings, the company decided to use a pair of **LWE200 Series** 5-GHz Wireless Ethernet Extenders with PoE to connect the cameras.



### Analog cameras vs. IP cameras

An analog camera is a traditional CCTV camera. It sends video over coax or UTP cable to a digital video recorder (DVR). While analog cameras perform well, they are limited to resolutions of the NTSC/PAL standards of 720 × 575 pixels or 0.4 megapixel. Analog camera resolutions range from 420 to 700, which at the high end can produce sharp images. IP cameras are digital cameras. One of the biggest advantages of IP cameras is their resolution that can range from 1.3 megapixels to 5 megapixels (2592 x 1944) or above. Generally, IP cameras give resolutions 6 to 20 times higher than analog cameras. IP cameras traditionally provide better zoom-in images than analog cameras as well. In addition, most IP cameras are intelligent and can perform additional security tasks, such as sending a message when they detect motion. Many systems today are hybrid systems incorporating both analog and IP cameras.

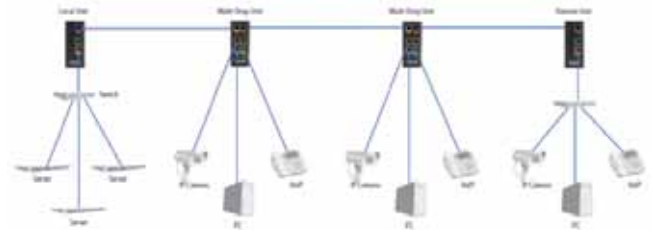
Feature	IP Camera	Analog Camera
Video Quality	Overall higher quality. Wider video scene.	Overall lower quality. More difficult to zoom in. Better in low-light conditions
Resolution	5 megapixels or more. Compressed, encoded.	NTSC/PAL standards, 580 TVL resolution max. (0.4 megapixels). Uncompressed
Transmission Media	Twisted-pair, coax (with extender), wireless	Twisted-pair, coax, wireless with less resolution.
PoE	Yes	No
Distance	Ethernet cable: 330 ft.; Over IP network: unlimited; Easy network expansion	Video over UTP: 1 mile; Coax cable: 1000 ft.
Act as Network Device	Yes	No
Bandwidth	Higher	Lower
Expandability	Easy	More difficult
Reliability	Tied to network.	Mature technology. Long history of reliability.
Security	Encrypted. Difficult to intercept. Subject to cyber-attacks.	Less secure. Can be physically intercepted.
Cost	Higher	Lower



**Extender Ethernet connections over existing twisted pair.**

**Black Box LB532A Series Industrial Ethernet Extenders, G-SHDSL**

- Extends industrial 10/100BASE-TX Ethernet connections at speeds up to 5.7 Mbps.
- Use to connect industrial Ethernet devices and remote LANs up to 6.9 km apart.
- Use as a repeater in multi-drop applications.
- Tough—meets IP40 specs and withstands temperatures of -40° to 85° C.
- Includes a built-in, four-port, autosensing 10-/100-BASE-TX switch.



Description	Part #
Industrial Ethernet Extenders, G.SHDSL	
Multi-Drop Unit	LB532A-M
Local Unit	LB532A-L
Remote Unit	LB532A-R

**The scalable switch you can customize with copper and fiber ports.**

**Black Box LE2700 Series Hardened Managed Modular Switch**

- Scalable, flexible, cost-effective modular design enables you to add capacity as demand increases.
- Modular Chassis supports 10/100/1000BASE-T, 100/1000-Mbps SFP, 100-Mbps SC/ST, or 10-GbE SFP+ modules.
- Choose from 4- and 8-port switch modules.
- Optional SFP/SFP+ modules for choice of fiber ranges and speed.
- Withstands extreme temperatures of -40 to +185° F (-40 to +85°C).





**MANUFACTURER & EXPORTERS**

ACSR,AAA & AA Conductors  
 HT & LT Aerial Bunched Cables  
 HT & LT XLPE UG Power Cables  
 LT PVC Power & Control Cables  
 Bare & Insulated Copper Conductor  
 Airdac, Communication & Concentric Cables

**Widely accepted by:**  
 Major Discoms & EPCs Contractors  
 NTPC, PGCIL, BHEL  
 Power Utility Companies  
 EPCs Consultants  
 Industrial Projects in India & Abroad.



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**Built tough**

The LE2700 Series Hardened Managed Modular Switch system is designed for demanding applications such as:

- Oil/gas well and pipeline control and monitoring.
- Municipalities for public safety and traffic control.
- Security and surveillance providers for backhauling IP camera video and alarms.
- Utilities, including electric substations and water/waste water.
- SCADA/PLC/M2M systems for remote/automated communications.
- HVAC systems remote control and monitoring.

**Scalable, flexible, cost-effective**

This switch system is more than just tough. It's extremely versatile with a range of interface options. The modular design gives you the ability to add the right quantity, speed, and type of interfaces you need. If your needs change in the future, you can just swap out modules. Choose from copper and fiber modules, including a 10-GbE SFP+ module.

**Ensure 100% uptime**

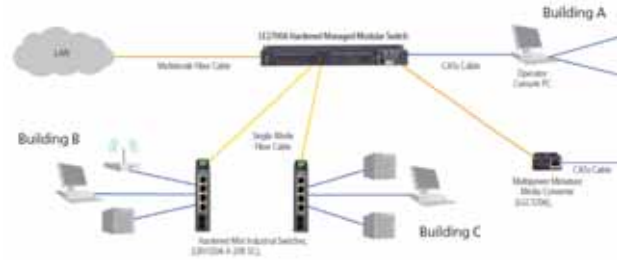
With dual power supplies, the switch is designed for redundancy. Set it up in a ring topology. If a link fails, the switch automatically falls over in less than 30 milliseconds. The switch is also compatible with redundant switches from other manufacturers.

**Very manageable**

This switch includes extensive management software enabling you to manage it locally or remotely eliminating costly and time-consuming truck rolls. Software includes: SNMP, QoS, VLAN, IGMP Snooping, DHCP, MSTP, and more.

**SFP customization**

By plugging in different SFPs, you can customize the switch to the distances and connectors you need. Use the LFP400 Series SFP



transceivers with all modules except the LE2731C. Use the SFP+ transceivers (LSP420 Series) with the 10-GbE module (LE2731C).

Description	Part #
LE2700 Series Hardened Managed Modular Switch Chassis	
4-Slot	LE2700A
4-Slot with Low Voltage Supply	LE2700LV
4-Port Modules	
10-GbE SFP+, Slot 4 Only	LE2731C
100-/1000-Mbps SFP, Slot 4 Only	LE2722C
100FX Multimode Fiber, 2 km, SC	LE2710C
100FX Multimode Fiber, 2 km, ST	LE2711C
8-Port Modules	
10/100/1000BASE-T, RJ-45	LE2720C
100-/1000-Mbps SFP	LE2721C
Spare Power Supply	LE2700A-PS
Spare Low Voltage Supply	LE2700LV-PS

**Keep Network Traffic Flowing**  
**Spanning Tree and Alpha-Ring**  
**Spanning Tree Protocol (STP)**

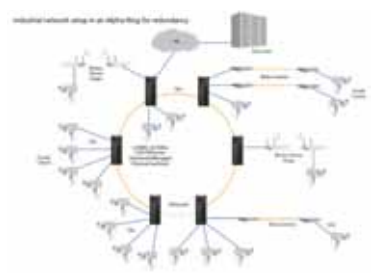
The Spanning Tree Protocol (standardized as IEEE 802.1d) specifies a network design with redundant links to provide automatic backup paths if an active link fails. STP also avoids the creation of bridge loops that cause broadcast storms. Without STP, Ethernet switches with redundant links have no standardized way to keep from looping data over and over again to the other switches in the network, eventually disabling the network's ability to pass data. The idea behind a Spanning Tree topology is to enable switches to automatically discover a subset of the network topology that is loopfree, i.e., a tree. With STP turned on, the switches will perform the spanning tree algorithm when they are first connected, as well as any time there is a topology change, and automatically communicate with each other in a loop-free mode. Then, should a failure of one of the active links occur, STP unblocks the redundant links to enable the network to continue transmitting traffic.

**The Alpha-Ring Protocol**

The Alpha-Ring protocol is a proprietary protocol designed to provide a faster network recovery time after a failure than standard STP. As the name suggests, Alpha-Ring enables the switches to be organized in a ring arrangement. During normal operation, the backup path for the Alpha-Ring is blocked, and data follows the other links around the ring. If, however, one of the active links fails, the Alpha-Ring protocol unblocks the backup path to enable data to keep flowing. Typical failover for Alpha-Ring protocol is less than 30 milliseconds. In addition, unlike STP, Alpha-Ring does not operate using any bandwidth-consuming packets to check the ring status. The ring port connections are monitored by each switch individually without the need for test packets to be generated and transmitted around the ring.

**Ethernet Ring Protocols**

Although Ethernet is usually thought of as having a star or bus topology, it's also possible to build an Ethernet network as a ring. This configuration has the advantage of providing a redundant pathway if a link goes down. A ring topology is often used in applications such as traffic signals and surveillance where long distances may make it difficult to run links in a star formation from a central switch and where downtime must be limited.



**Generally speaking, ring architectures have these advantages:**

1. They have fast failover times, typically sub-50ms.
2. They require a decreased number of ports. Fewer ports are needed to provide the same amount of resiliency as centralized switched networks with redundant paths. This results in decreased initial investment and lower ongoing maintenance costs.
3. They are scalable and enable a step-by-step network rollout. More switches can be added to the ring incrementally. The full traffic does not need to traverse a main/distribution switch.
4. They use bandwidth efficiently; dedicated paths are not required.
5. They simplify configuration. Predefined paths between the switches that are connected to the ring are not needed.

**Priyanka Kharkar**  
Marketing Executive - India  
Black Box Network Services

www.electricalindia.in



# Greenest Place On Planet Earth



*Steam spouts from a geothermal well... (Photo via SKNIS)*

In January 2018, Nevis is expected to take a huge step in claiming the title as the 'Greenest Place on Planet Earth'. Nevis' Deputy Premier, Mark Brantley, made this disclosure while giving an update in the production of geothermal energy on the most recent edition of the Government's radio programme 'Working for You'.

"It is an initiative that we (Nevis) embarked on some 10 years ago," Minister Brantley stated, adding that the project is definitely worthwhile. "We finally got to a point where we can say to the public that based on the agreements entered into, the geothermal plant should be completed by December 2017."

While commenting on the cost, Brantley said that the developers were responsible for raising the necessary capital to implement the project. They were also responsible for harnessing the resource and building the infrastructure to transfer the energy to the national grid. When that transfer takes place, consumers should see a dramatic change in their electricity bills.

"The maintenance, running, day-to-day cost are not costly," the deputy premier stated, citing operating projections. "In fact, based on current forecasts [for] geothermal energy, the public in Nevis is likely to see its energy bills drop by as much as 50% based on current costing and that is bearing in mind that oil prices are at historic lows."

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*The public in Nevis is likely to see its energy bills drop by as much as 50% based on current costing and that is bearing in mind that oil prices are at historic lows...*



Power Minister Piyush Goyal (Centre) during the inauguration of ELECRAMA 2016...

## Innovation, Invention & Introduction: All Under One Roof

*ELECRAMA-2016 witnessed participation from Countries like that of Germany, Taiwan, Korea, South Africa, Nepal, Kingdom of Lesotho to name a few...*

The 12<sup>th</sup> edition of ELECRAMA, the world's largest Transmission and Distribution Exhibition was a power packed event, which was held at BIEC, Bengaluru from 13 to 17<sup>th</sup> February, 2016. The event witnessed the presence of who's who in the power industry both domestic and international. The five days international flagship event of IEEMA was inaugurated by Piyush Goyal, Minister of State (IC) for Power Coal, New & Renewable Energy, Government of India, in the presence of the Energy Minister of State of Karnataka, D K Shivakumar, Power Secretary, P K Pujari, Coal Secretary, Anil Swarup, State Power Secretaries, CMDs of Power Utilities, Senior officials of Ministry of Power, Babu Babel, President, IEEMA, ELECRAMA 2016, Organising Committee Chairman, Aaditya R Dhoot, senior bureaucrats and industry leaders.

The show provided the stakeholders in the power industry a worldview on technology, best practices, new systems and forecasting the trends in the future of electricity, both from the technology and a socio-economic point of view. The event is the largest and most prestigious event in its space in the world. Spread over a gross area of 84,000 m<sup>2</sup>, the exhibition hosted visitors from over 120 countries and overall more than 120,000 footfalls. There were over 1000 exhibitors showcasing diverse products, technologies and solutions.

There were many co-located and concurrent event where Hon'ble Minister for Railways Suresh Prabhu and Hon'ble Minister for Heavy Industries Anant Geete marked their presence.

### World Utility Summit

World Utility Summit was a pioneering thought leadership

forum, attempted to set the agenda for the future, actively playing the role of a key enabler for the eco-system, to develop optimal solutions, technology and products. The summit was the first step in the long journey in order to create integrated and sustainable utilities of the future. Hon'ble Railways Minister, Suresh Prabhu inaugurated the World Utility Summit (WUS) during ELECRAMA 2016 – World Electricity Forum. The three-day World Utility Summit hosted senior leaders of utilities, energy efficiency bodies, standards organizations, regulators, finance professionals and policy makers from around the world.



Aditya Dhoot, Chairman (Second from right), during the inauguration of ELECRAMA 2016...



Anant Geete (Centre) inaugurated the International T&D Conclave during ELECRAMA 2016...

### Reverse Buyer Seller Meet

Reverse Buyer Seller Meet (RBSM), the biggest meeting place of International Buyers who plan to source electrical products and equipment from India concluded with \$400mn business at ELECRAMA 2016. In line with the PM Narendra Modi's vision of 'Make in India,' RBSM was a platform for Indian industry to showcase its competitive products and services. Fifty two countries from across the globe attended the RBSM – where buyers from Africa, ASEAN, CIS, and SAARC, along with Iran were participating.

### International T&D Conclave

Along with ELECRAMA-2016, the International T&D Conclave was organized by IEEMA, which offered a platform for the power industry to discuss challenges and solutions with regard to the transmission and distribution sector. Minister of Heavy Industries and Public Enterprises of India, Anant Geete inaugurated the International T&D Conclave during ELECRAMA 2016. The theme of the conclave was Technology & Demand.

### CIGRE Tutorials

One of the interesting concurrent events at ELECRAMA was the CIGRE Tutorials. This edition concentrated on five topics – Overhead Lines, Smart Grids, HVDC, Substations, HV Equipment. The tutorials were held at the Renewable Energy Pavilion at Hall 5 of BIEC, Bengaluru. The welcome address was given by Director, CIGRE (India) and Director Central Board of Irrigation and Power, PP Wahi, and Secretary, CIGRE (India) and Director Central Board of Irrigation and Power, V K Kanjlia.

### Network 2 Network

Being one of the first of its kind interactive platform – 'NETWORK2NETWORTH' —was organized concurrently with ELECRAMA-2016 by IEEMA. The two-day event began on February 16, 2016. The objective of this platform was to bridge the gap between the finance and power sector.

### Innovation Day- Engineer Infinite - ELECRAMA 2016

As a part of innovation day, EI16 (Short form of Engineer Infinite 2016) was the Student Project Competition running concurrently with ELECRAMA-2016 exhibition this competition was an opportunity to the students of engineering (Diploma, UG, PG and Research Scholars) to leverage their theoretical knowledge and creativity to address diverse real life issues that need attention, in the electrical energy sector.

### Foray Of Renewable Pavilion In ELECRAMA 2016

Renewables are going to be an essential part of the energies of the future. Realizing the importance of this factor, for the first time, a dedicated pavilion was planned at ELECRAMA-2016 for companies offering renewable energy related technologies. The pavilion gave platform for equipment manufacturers, public sector representatives from renewable sector to display and interact with visitors.

### Electricity: How It began

ELECRAMA-2016 took us back to the origins of Electricity. Though the idea of electricity was sparked in the early 1800s, the visually delightful journey of the '125 years of electricity' pavilion started from 1879, when Thomas Alva Edison invented commercially viable electricity. What started then as an invention has now become one of the basic needs of life.

### International Participation

ELECRAMA-2016 witnessed participation from Countries like that of Germany, Taiwan, Korea, South Africa, Nepal, Kingdom of Lesotho to name a few.





# A Review Of The HANNOVER MESSE 2016 Preview

*(L2R) Johann Soder, John B. Emerson and Dr. Jochen Köckler during inauguration of the HANNOVER MESSE 2016 Press Preview...*

*At HANNOVERMESSE 2016, all eyes will be on Industry 4.0 (advanced manufacturing). True to the fair's 2016 lead theme of "Integrated Industry – Discover Solutions," visitors will be treated to promising ways of making their factories and energy systems smart by means of digital technology...*

The HANNOVER MESSE 2016 Press Preview took place on Wednesday, 27th January 2016, at the Hannover Exhibition Center in Hannover, Germany. In the event, around 40 companies presented their latest products and innovative technologies to more than 100 journalists from all over the world.

Every year a leading industrialized nation is selected as the Partner Country of HANNOVER MESSE. This time, the world's largest single economy, the USA has been welcomed as the partner to the event. The US economy is superlative in the true sense: with a GDP of almost \$ 17 trillion the USA accounts for more than one quarter of the entire world economy.

The Pre-show began with an introductory press briefing. Dr. Jochen Köckler, Member of the Managing Board, Deutsche Messe AG delivered his presentation on "Overview, trends and themes (of) HANNOVER MESSE 2016." John B. Emerson, U.S. Ambassador to the Federal Republic of Germany, highlighted the role of the US on enriching the technology show this year. Johann Soder, Managing Director of Engineering and Innovation, SEW EURODRIVE spoke on "The human in Industrie (Industry) 4.0." Soder's presentation was highly admired by the audience – altogether it took the audience to

the factories of the future, which are envisaged to be operated by robots only.

The HANNOVER MESSE 2016, 25 to 29 April will present the latest developments in the fields of Industrial Automation, Digital Factory, Energy, Industrial Supply, Research & Technology. US President, Barack Obama will inaugurate the Hannover Messe 2016 trade fair, and around 254 exhibitors will present their latest technologies in the venue. According to Emerson, "Innovation is the DNA of growth." Thus, there will be focuses on several emerging fields of profession that are coming up, e.g., Apps Development.

With the passage of time, the challenges also have changed. At this point of time, the US and Europe together handle around 40% of global trade. In this connected world, economic cooperation is must for success. Thus, US' partnership in the fair will open up new vistas for further progress. Hannover Messe 2016 trade fair will reflect why co-operation and partnership are so important for growth.

Soder explained the future lies in intelligent factories and intelligent products. By 2020 the things will be achievable. The intelligent factories will be self-controlled and scalable. Smart operation, smart transportation and cooperation between human



and technology will be the next stage. Mobile logistics, systems with decentralized energy systems will be a common place soon. With less human efforts, the future work places will be much more comfortable.

Some of the companies who displayed their products in Hannover Messe Preview are ABB AG, Aseantics GmbH, Beckhoff Automation, Bosch Rexroth AG, ContiTech AG, Festo AG, Fraunhofer Institut, GSABELEKTROTECHNIK GmbH, Hans Turck GmbH, Harting KGaA, IBG / Goeke Technology Group, ifm electronics, igus GmbH, Inepro Metering BV, it's OWL Clustermanagement, ITT Control Technologies, JOKARI, KIT (Karlsruher Institut), KUKA AG, Lenze AG, Omron Electronics, Phoenix Contact GmbH, Poco Graphite, Poppelmann GmbH, SEW Eurodrive GmbH, SICK AG, Siemens AG, SOCOMEC, Technologie Initiative Smart Factory, Universal Robots, Weico GmbH, Weidmuller, WIBU Systems AG, Young Tec Enterprises and ZIEHL ABEGG.

Universal Robots displayed their products in the pre-event. They make robot technology accessible to all levels of industry. By offering a user-friendly, affordable robot, the company lowers the automation barrier enabling automation in areas previously considered too complex or costly. Jokari has more than 80 stripping tools. They displayed their latest innovation in cable strippers.

Beckhoff Automation talked about their newest software generation for PC-based control technology. Their TwinCAT 3 offers advanced PLC programming with object-oriented extensions, C++ and Matlab/Simulink integration. GSAB Elektrotechnik displayed their innovative cabinets and distribution boxes. ABB highlighted how Internet of Things is helping their customers through their products, SOCOMEC displayed their Load Break Switches with multiple innovations inside the products. They focused on the efficiency of DIRIS Digiware. SEW Eurodrive drew attention on the Future Factory, Really-Easy-to-Use System and the next stage of Human - Machine Integration (HMI). Omron Electronics showed their capability in robot adjustment with time, they also displayed their new industrial PC (IPC), Omron's product development is focused on Industry 4.0.

At HANNOVER MESSE 2016, all eyes will be on Industry 4.0 (advanced manufacturing). Over five action-packed days, some 5,000 exhibitors will be showcasing the latest technologies for the factories and energy systems. The event's Partner Country for 2016 - the United States of America - will be presenting its high-tech offerings "Made in the USA", and U.S. President Barack Obama will be leveraging the world's foremost trade fair for industrial technology to promote the Transatlantic Trade and Investment Partnership (TTIP). 





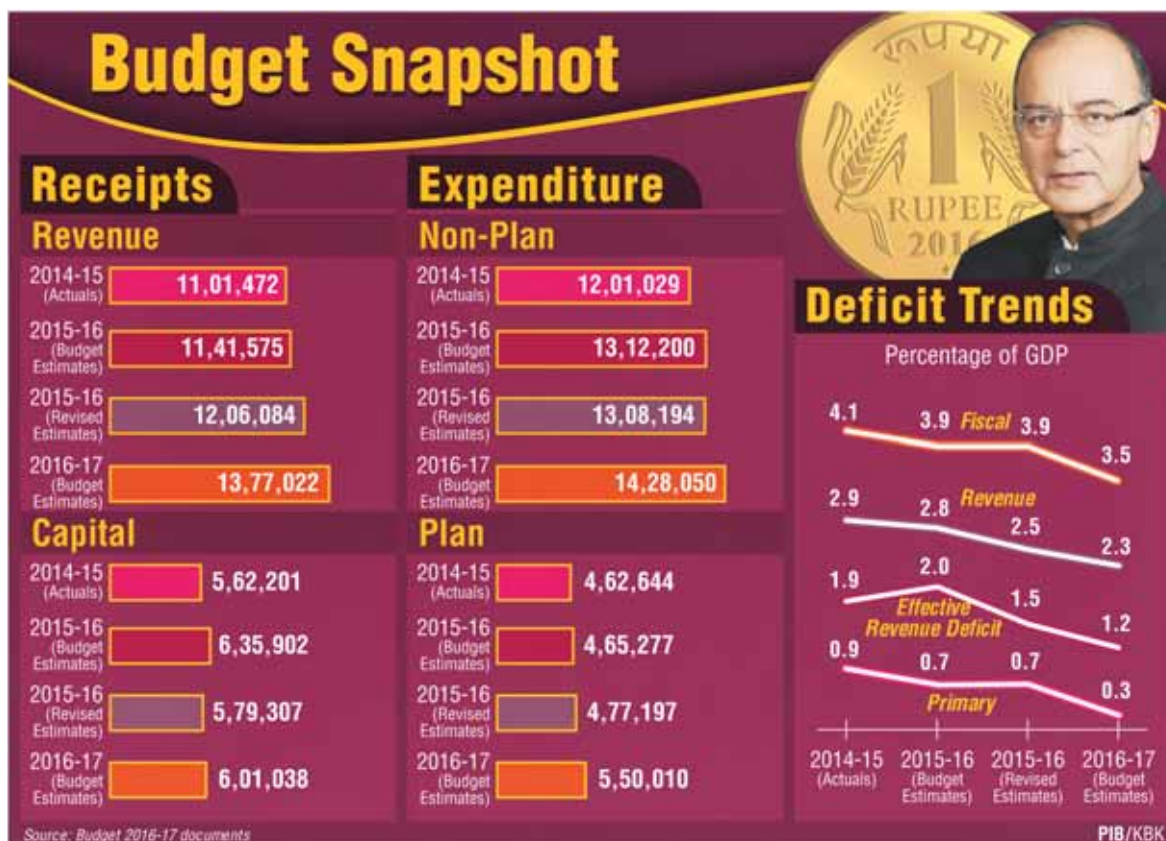


## Union Budget 2016-17: At A Glance

### Budget at a Glance: Key Figures

(Figures in ₹ crore)	2014-15 Actuals	2015-16 Budget Estimates	2015-16 Revised Estimates	2016-17 Budget Estimates
Revenue Receipts	11,01,472	11,41,575	12,06,084	<b>13,77,022</b>
Capital Receipts	5,62,201	6,35,902	5,79,307	<b>6,01,038</b>
Total Receipts	16,63,673	17,77,477	17,85,391	<b>19,78,060</b>
Non-Plan Expenditure	12,01,029	13,12,200	13,08,194	<b>14,28,050</b>
Plan Expenditure	4,62,644	4,65,277	4,77,197	<b>5,50,010</b>
Total Expenditure	16,63,673	17,77,477	17,85,391	<b>19,78,060</b>
Revenue Deficit	3,65,519	3,94,472	3,41,589	<b>3,54,015</b>
Effective Revenue Deficit	2,34,759	2,68,000	2,09,585	<b>1,87,175</b>
Fiscal Deficit	5,10,725	5,55,649	5,35,090	<b>5,33,904</b>
Primary Deficit	1,08,281	99,504	92,469	<b>41,234</b>

Source: Budget 2016-17 documents PIB/KBK






# Ethernet Technology



preLink is the end-to-end Ethernet connection technology that extends all the way from IT through to the manufacturing level. This fast and easy way to set up networks is now also available as an RJ45 connector face in robust Han 3 A housing.

With its preLink connection technology, HARTING has succeeded in separating the previously fixed connection of cable and connector into two independent, reusable components. On the one hand, there is the preLink termination block with holder for 4- or 8-wire Ethernet cable, which can be assembled with 100% certainty in a single step using designated preLink assembly tool. This termination block fits into a variety of RJ45 or M12 sockets and connectors.

The advantage of the system is that the termination block can be removed in seconds and placed on a different connector. Consequently, cables and connectors can be swapped independently of each other. When placed in the well-known Han 3 A housing, the result is a fully industrial-strength interface between machinery and equipment and the Ethernet network. 

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

## Declaration FORM IV

Statement about ownership & other particulars of the newspaper entitled ELECTRICAL INDIA required to be published under Rule 8 of the Registration of Newspapers (Central Rules, 1956).

1. Place of Publication : 201, Premalaya,  
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Nationality : Indian  
Address : As above
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Mumbai  
5th March, 2016

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Sign of Publisher

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Central Power Research Institute	35
Dynamic Cables Pvt.. Ltd.	71
Electrical Control & System	39
Epcos India Pvt. Ltd.	65
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## Toshiba T&D System **Steps Up Its 'Make In India' Drive**

Toshiba Transmission & Distribution System (India) Pvt Ltd (TTDI) currently manufactures small, medium and Extra High Voltage (EHV) transformers. The company will use a newly established line to start production of Ultra High Voltage (UHV) transformers up to 1200kV, and will also improve manufacturing and operating efficiency of distribution transformers...



**T**oshiba Transmission & Distribution System (India) Pvt Ltd (TTDI) has completed a major 3-billion Yen investment (approx. US \$ 30 million) at its Hyderabad factory, which has boosted its production capacity for transformers up by 50% – and established a new line for production of ‘New Technology’ switchgears like Gas Insulated Switchgear and Solid Insulated Switchgear. The expansion will allow TTDI to meet growing demand in India and globally.

Commenting on the new facilities of increased capacity at the Hyderabad factory, Dr.

Katsutoshi Toda, Chairman and Managing Director of TTDI said, “Since the foundation of TTDI, we have always endeavoured in introducing new technology products and solutions – and improving product quality through technology transfers from Japan. In line with our ‘Make in India’ commitment, we have augmented capacity of existing lines and commenced new production lines 3 billion Yen investment. TTDI will seek to expand its business through full-scale operation – and provide cost-competitive products by localizing procurement, design and manufacturing within India.”

TTDI currently manufactures small, medium and Extra High Voltage transformers. The company will use the line to start production of Ultra High Voltage transformers up to 1200k V, and will also improve

### New Production Lines established for T&D equipment are ready for full scale operation for Gas Insulated, Solid Insulated Switchgears & UHVAC Transformers...

manufacturing and operating efficiency of distribution transformers. The new line for Gas-insulated Switchgear will also accomplish the anticipated demand growth in this product, especially in urban areas.

“The comprehensive upgradation and expansion is as per our strategy of securing a 20% share of the India T&D market in the coming years. We will also reinforce TTDI as a core T&D production base for other majors, including Europe, ASEAN and Africa,” he added.

In India demand for Transmission & Distribution (T&D) products is being spurred by rapid population growth and the need to upgrade its grid.

TTDI will offer High quality, high efficiency products that are needed to ensure a stable and reliable power supply.

The company is not only focusing on bringing technologies in India but also on the ‘Skill Development’ by bringing the expertise of Japanese specialists, resulting in a major improvement in the manufacturing process and product quality.

Toshiba continues to contribute to the development of Indian society with Toshiba Group’s wide range of technologies and solutions in three areas crucial for building a better tomorrow: ‘Making Energy’, ‘Transmitting and Storing Energy’ and ‘Smart use of Energy’. TTDI aims to improve the quality of life for the Indian people and create abundant value that contributes to a sustainable society. **BT**

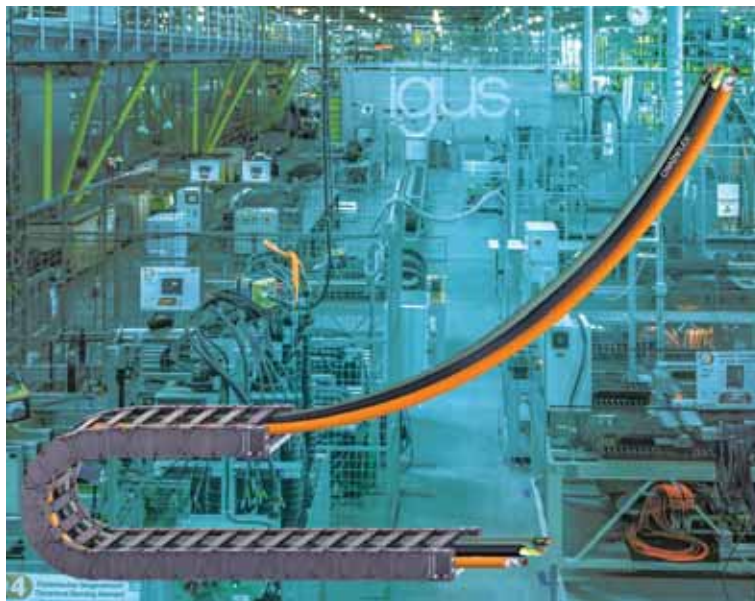


### About Toshiba Transmission & Distribution Systems (India) Private Limited (TTDI)

Toshiba Transmission & Distribution Systems (India) Private Limited is a wholly owned subsidiary Of Toshiba Corporation Japan. Toshiba Transmission & Distribution System group is a world leader in the supply of integrated solutions for energy Transmission & Distribution (T&D). Its systems effectively control T&D in order to deliver reliable & efficient electricity from power plant to factories, transportation system and other Infrastructure Sectors. Toshiba Corporation, Japan has acquired the business of power transformers, distribution transformers and switchgears from Vijai Electricals Limited, Rudraram Works, Hyderabad, Telangana State, India. **BT**



# igus presents chainflex cables



*With 100 million Euros in revenue from cables, the largest cable selection for the e-chain and the industry's biggest test laboratory, igus is a leader among the field of cable manufacturers for moving applications...*

*(Source: igus GmbH)*

*igus is the only manufacturer able to offer a 36-month guarantee for all chainflex cables, including torsion cables such as the world's first CAT7 cable for robotics...*

**W**ith 100 million Euros of revenue from cable sales over the last year, igus is maintaining its status as a world leader among cable manufacturers for moving applications in energy chains. Thanks to the industry's largest test laboratory in Cologne, Germany, now expanded to 2,750 square metres, the motion plastics specialist is the only supplier on the market – and able to offer a 36-month guarantee on all chainflex cables. Increasing industrial automation is prompting igus to make significant investments in innovation, reliability and fast delivery worldwide.

The motion plastics specialist igus revolutionised the cable design for moving applications in e-chains 25 years ago and has been offering motor, control and data cables for specialised moving applications in energy chains through the chainflex brand ever since. The use in energy chains requires specific cable designs to increase the cable's service life and, as a result, the service life of the application.

In this area in particular, igus can draw on its experience as market leader for e-chains and on its expertise of more than 50 years with all things plastics-related. "As market leader for e-chains, the advantage at igus is that we develop both energy chains as well as cables. For this reason, we can test and offer both as a system," emphasises Frank Blase, CEO at igus GmbH.

igus is having plenty of success in this area. The chainflex

business area exceeded 100 million euros in revenue last year, which made up more than 20% of the total revenue at igus. In the Indian market alone, igus generated 250 million INR (3.5 million euros), which is an increase of approximately 25% over the revenue from cables in the previous year.

The Cologne-based company has 1,040 cables to make up the widest product range on offer with respect to energy chain applications. Of these, no less than 3,200 drive cables at seven price points can be fabricated according to 22 manufacturer standards. Components such as energy chains and cables are fabricated at the Indian office in Bangalore. This ensures that local customers receive their orders more quickly.

"The degree of automation in companies is continuously increasing, particularly due to Industry 4.0. At the same time, it is necessary to guarantee an interruption-free flow of data, media and energy. This really motivates us to invest significant resources in innovation, product reliability and fast, worldwide availability, to ensure that our customers receive the best possible ratio of price to reliability," says Blase.

## **2,750 sqm of movement for innovation and reliability**

Considerable investments are being made in the industry's largest test laboratory. Here, more than 70 cable test machines

**Electrical Test & Measuring Solutions**



Turns Ratio Meter



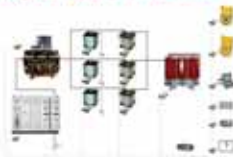
Winding Resistance Meter



Automatic Transformer Observing System



Digital Microhm Meter



Automatic Transformer Test System



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DIE CAST ROTOR TESTER

OUR PRODUCT RANGE			
Winding Resistance Meter	Standard Current Transformer	Static Frequency Converter (EPS)	Oil BDV Test Set
Turns Ratio Meter	Standard Voltage Transformer	Mobile EPS	Flash point Test Set
Digital Microhm Meter	Transformer Loss Measuring System	High Voltage PD Filters	Oxidation Stability
Contact Resistance Meter	Automatic Transformer Test System	Coupling Capacitor/ HV Dividers	Battery Analyzer
Motor Tester	Rotor Tester	Stator Tester	Surge Tester



perform over two billion test cycles per year. On an average, 650 cable tests are conducted simultaneously. New test rigs enable fast acceleration speeds of 15 m/s<sup>2</sup> over 50 metres; a new cryochamber now allows tests in temperatures as low as -40°C. Thanks to new torsion attachments and the expansion of the outdoor installation for long travel paths, cable use can be simulated under real conditions.

The overall area of the test laboratory increased by 1,000 square metres to a current total area of 2,750 square metres. Thanks to a multitude of tests, igus is the only manufacturer able to offer a 36-month guarantee for all chainflex cables, including torsion cables such as the world's first CAT7 cable for robotics. These tests also allow igus to provide exact specifications in its catalogue regarding bend radii, temperature ranges and service life for special use in the e-chain, in addition to the standard norms. The results from the test laboratory are also used for the five online tools for chainflex and three online tools for ready cable. igus has invested significantly in the online area to allow customers to quickly determine the service life in moving applications and find, configure and order the most suitable cables for their particular application.


### Worldwide local delivery according to the customer's needs

igus has considerably expanded its production and storage

capacity in North America, Asia and Europe to ensure even faster delivery to its customers in local markets. A warehouse expansion is also in the works for the Indian market. With cable production on three continents and 14 storage and assembly centres worldwide, customers receive the exact cable needed for their production system from stock: single, individually cut cables, reeled piece goods, fabricated cables or ready-to-install energy chain systems. igus also offers on-site system installation service.

### With increasing automation, quality becomes ever more important

The best possible reliability for the customer is also the goal of igus' unique quality assurance in the production area: 20% of any chainflex batch is always removed and checked for proper function at the test laboratory following an initial visual inspection. igus wants to offer the most affordable cable worldwide that is guaranteed to work every time.

But, as Frank Blase emphasises, an affordable price is not everything. "Now and in future, affordable pricing will not be the sole concern of customers. Their primary concern is the quality and reliability of a cable, particularly as it relates to special movements in the energy chain. We consider ourselves the first point of contact for finding a solution for our customers and our 36-month guarantee makes it clear that chainflex lasts." 



One more milestone – ElMeasure proves that to be in the controlling segment is "Intelligent Earth leakage Relay" (ELR). Conventional ELR works with the settings through the potentiometers or DIP switches and whenever it crosses the limit it trips. Problem with this kind of relays are accuracy and malfunctioning. ElMeasure is committed to have good products and first time Microcontroller based IELR with 4 digit 7 segments RED bright Digital display, which is very unique as compared to conventional ELRs.

### Unique features

1. Inverse curve - Trip time is inversely proportional to leakage current. This IELR is Intelligent, when the Leakage current is 10 times higher than the set current it trips 10 times faster.
2. Continues leakage current display (Programmable) – Leakage current displays to enhance the user to understand the quality of Electrical network / Machine online. This can be disabled through setup.
3. Continuous Display of Trip Leakage current (Programmable) – In case of tripping IELR captures and Displays the tripped Current with the resolution of 4 digit helps the user to analyse and correct the problem. This can be disabled through setup.
4. Continuous scrolling display for set current and set Time.
5. Field Programmable through front panel keys with password protection – No limitations on the Leakage Current settings.
6. Wide input range 60mA to 12A and the trip time programmable from 300ms to 30 seconds.
7. Manual test and Reset Keys.

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



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**Pin Pointing**  
- Simultaneous display of acoustic & magnetic waveforms  
- Use as Route Tracer along with the Audio Generator

**SIM Filter**

**Cable Identification System**

**Damp Discharge Rods**

**Trolley mounted set up**



Cable Fault Pre Locator



Cable Fault Pin pointer



Cable Fault SIM Filter





# The MRCT is capable of testing CTs in a 765 kV switchyard.



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**Strategies for Success in Rubber and Silicone Injection Moulding**



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Plot No.10, Road No.1, G.I.D.C., Kathwada,  
AHMEDABAD 382430, India

Phone +91 79 6619 0000

Fax +91 79 6619 0076

Mail [sales@desmaindia.com](mailto:sales@desmaindia.com)

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# XTRM-3

Fully Automatic  
Transformer  
Turns Ratio Meter



A Heavy Duty 200V AC fully Automatic transformer turns ratio meter suitable for testing HV and LV class 3 phase and single phase transformers, instrument is capable to measure turns ratio, voltage ratio, excitation current and verification of vector group.

## Why XTRM - 3 !!!

- Fully automatic, no manual balancing required
- Testing single phase and three phase transformers
- Automatic measurement of transformer vector group
- Calculation of ratio error
- Facility to save 500 Test results
- In- built printer
- CE and EMC compatible
- IP 54 compatible

## Applications

- Turns Ratio testing of Single phase/ Three phase Auto Transformers, Power Transformers and Distribution Transformers
- Verification & Checking of on load Tap Changers



Measures ratio Upto **1 : 10000**

**200V AC** Test Voltage

Vector Group Detection

**Emergency Stop** for Accidental Disconnection

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