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Mahadevan Iyer

Editor-in-chief, Publisher & Managing Director

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“
Electrical India is eager to partner your dissemination ventures with its innovative multi-platforms...
”

First of all let me convey my thanks to all of you, who have already subscribed to our Weekly Newsletter. It is a matter of great pleasure to us that our new effort is receiving your attention. This is just the beginning and we have chalked out a number of plans for further value addition. Some of your valuable suggestions are under consideration, however, it may take some time to implement those because of technical reasons.

Meanwhile, the power sector is at a point of transition, as there is a big thrust on increasing generation capacity along with the focus on increasing efficiency. Beside building new generation plants and adding capacity to the existing ones, several power generation companies have initiated drives to replace their old or less efficient plant components. Also, there is a growth trend in the captive power generation plants' market.

Thus, as far as India is concerned as on date, like most other developing countries, here also on one hand the market for power plants and components thereon is growing – and on the other hand the component replacement market is finding new opportunities.

Therefore, it is evident that the power plant component manufacturers have a lot to cheer in the financial year 2015-16. However, in today's competitive environment, market presence needs to be asserted through appropriate dissemination strategy. Electrical India is eager to partner your dissemination ventures with its innovative multi-platforms. We are just a call or e-mail away to take your product(s) to the global buyers' arena.

Do send in your comments at miyer@charypublications.in

Mahadevan



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Manish Sawant
Director (Power Products Management)
Emerson Network Power (India)



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“

Price of power generated from solar plants is at par with or lower than the commercial tariff for consumers...

”



P K Chatterjee (PK)

Can't We act on our own?

In the last one decade or so, the concept of acquiring second homes in rural areas has been very popular among the Indian city dwellers. In many states, such colonies are being constructed often on several acres of land. Being in rural areas, these lands are blessed by unobstructed (shade-free) sunlight throughout the year. Also, often they have good wind to generate wind power. So, these are very good spots to install small-scale renewable projects.

According to a Ministry of New & Renewable Energy (MNRE) communiqué (June 2014), "The price of power generated from solar plants installed today is at par with or lower than the commercial tariff for consumers. The cost of solar power is on the decline trend while the cost of fossil fuel based electricity is increasing day by day."

Even if each small bungalow there produces around 10 kW that requires around 1250 sq ft (100 to 130 sq ft of shade-free roof area per kW) of shade-free terrace – and supply that to the local grid, the villagers around can enjoy the benefits of having electricity.

Also, as per the MNRE communiqué, "There is a large potential available for generating solar power using unutilised space on rooftops and wastelands around buildings. Small quantities of power generated by each individual household, industrial building, commercial building or any other type of building can be used to partly fulfill the requirement of the building occupants and surplus, if any, can be fed into the grid. The roof-top SPV systems on building's roof space can be installed to replace DG gensets for operation during load shedding."

If every urban housing society takes it up seriously, they can do a lot to save their own running cost and protect our environment. They will definitely enjoy the benefit of it in terms of being in a pollution-free environment. Thus, besides the large renewable projects those are being taken up as public private partnership (PPP) models, every individual or a group of citizens also can do a lot...

*Please send me your views at pkchatterjee@charypublications.in



P. K. Chatterjee

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Canada reemerges as India's civil nuclear energy development partner



Narendra Modi

Government of India entered into an agreement with M/s. Cameco Inc. Canada for supply of 3000 metric tones of 'uranium ore concentrate' during the

According to a communiqué from the Department of Atomic Energy (DAE): during the recent visit of PM Narendra Modi to Canada, DAE –

period 2015-2020. Canada is one of the world's largest producers of uranium, and Cameco is a uranium supplier of global standing.


The agreement reflects the mutual trust and understanding between India and Canada, and the growing strength of their civil nuclear cooperation.

It also signifies the re-emergence of Canada as one of the India's key and reliable partners in civil nuclear energy.

The uranium provided under the contract will be used for manufacturing of

nuclear fuel in India for the Indian nuclear power plants – under the International Atomic Energy Agency (IAEA) safeguards.

It will further enhance the utilisation of India's installed and upcoming nuclear power generation capacity.

The agreement is of direct significance to India's long-term energy security, and will facilitate India's efforts to enhance the share of low-carbon energy resources in its total energy mix with a view to addressing the most urgent global issue of climate change. 

Energy Minister, Piyush Goyal, discusses opportunities in the power and coal sectors with U.S. industry




**Piyush Goyal,
Energy Minister, India**

At an industry roundtable hosted by the U.S.-India Business Council (USIBC) in Washington D.C., Piyush Goyal, Minister of State with Independent Charge for Power, Coal, New & Renewable Energy discussed the \$250 billion investment opportunity in India's growing energy sector.

Addressing senior business executives from the energy sector, Minister Goyal said, "Since assuming office, our government has laid a very solid foundation for the ease of doing business in the country. India's power generation capacity has grown significantly – we have seen 8.5% growth in power generation year over year. We aim to provide electricity to all Indians by 2019."

USIBC Executive Vice President, Diane Farrell said, "Minister Goyal is an excellent representative for Government of India's commitment to ease of doing business in the country. Power is the backbone of any economy and vital to the Prime Minister's 'Make in India' initiative. It is encouraging to see the tremendous strides being made by the sector to place India on a firm growth trajectory. USIBC member companies are responsive to the Government of India's commitment to ease of doing business and remain optimistic about the investment opportunities."

The event was attended by senior executives from USIBC member companies: First Solar, Oracle, GE, XCoal, Gasification Technologies Council, Vermeer, AECOM, International Paper, 3M, Westinghouse and others. 

Like-minded organisations from India, EU meet in a B2B event

To create synergies and facilitate the creation of collaborations between EU and Indian innovators in energy, environment and transport, Enterprise Europe Network (EEN) India recently organised a unique B2B event during the Smart Cities India 2015 Expo at Pragati Maidan, New Delhi. The event witnessed over 150 representatives from like-minded organisations from India and Europe to connect during this three-day affair.

The event was a collaborative effort by the EEN India consortium led by the European Business and Technology Centre (EBTC), and partners Confederation of Indian Industry (CII), Global Innovation & Technology Alliance (GITA), Federation of Indian Export Organisations (FIEO) and the Steinbeis India Centre.

Poul V. Jensen (Director, EBTC) asserts that "It was a very special opportunity for Indian actors to connect with European technology owners and other organisations who came to India with the sole purpose of creating partnerships with India – be it government, innovators, organisations, research institutions – to share solutions and exchange experiences. Areas of expertise include smart buildings, future cities concepts, integrated PV, water treatment, MSW, energy storage and efficiency, and more! The EEN platform opens doors for Indian SMEs to access and explore a global network of technologies from more than 50 countries."

Anjan Das (Executive Director, CII) stated that "The event is very timely in view of the momentum created by recent campaigns by the Government of India such as Smart Cities, Clean India, Make in India and Digital India. The event is ideal to strengthen and support Indian MSMEs in technology, vital to achieve the ambitions of these campaign."

Sabyasachi Dasmohapatra (CEO, GITA) informed, "GITA is shortly going to launch the next round of Request for Proposals (RFP) under the bilateral industrial R&D programme, in which funding support is available for R&D projects with UK, Spain and Finland." 



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Fluke Ti400 infrared camera honoured in Plant Engineering awards




Fluke Ti400 infrared camera has been honoured in the 'Plant Engineering 2014 Product of the Year Awards.' Fluke Ti400 has won the Silver award for the ninth consecutive period in the maintenance tools & equipment category.

The Ti400 Infrared camera has advanced connectivity and accuracy to maximise technicians' productivity in the

field. It features laser sharp auto focus, which uses a built-in laser distance meter to calculate and display the distance to the designated target with pinpoint accuracy.

The camera includes voice annotation eliminating the need to write down notes. Its thermal sensitivity (NETD) enables the user to identify the

small temperature differences that can indicate big problems.

Fluke SmartView software, a professional suite of analysis, reporting tools for optimising and analysing infrared images, producing professional reports, optional field installable telephoto and wide angle lenses for added versatility. 

Red Lion's rugged graphite HMIs receive global ATEX and IECEx approvals



Rugged graphite human machine interface (HMI)...

Red Lion Controls, the global supplier in communication, monitoring and control for industrial automation and networking, announced that its rugged Graphite Human Machine Interface (HMI) operator panels have been certified

to operate in global ATEXzone 2/22 and IECExzone 2 environments. Following Underwriters Laboratories (UL) class I, division 2 listed status received last year, these approvals certify that Graphite HMIs are safe for use with industrial control equipment in potentially explosive, hazardous locations around the world. Red Lion's touch screen graphite HMIs are now able to provide organisations with powerful monitoring and control capabilities regardless of operating environment, even locations subject to potentially explosive atmospheres that may result from gas, vapour, mist and / or dust. This enables industrial customers in markets such as oil and gas, flour and grain, mining, chemical, painting and metal processing to benefit from rugged aluminium construction, wider operating temperatures and high shock / vibration tolerances.

"The addition of ATEX and IECEx certifications to Red Lion's graphite HMIs enable us to better serve additional markets that require rugged, sunlight-visible operator panels for use in hazardous locations," said Jeff Thornton, Director of Product Management at Red Lion Controls. "Plug-and-play expandability via modular PID control, I/O and communications modules combined with Crimson software eases configuration to simplify integration regardless of environment."

From factories to extreme locations, graphite HMIs enable customers to connect, monitor and control processes across a broad range of industries to meet varying industrial automation requirements. Since its launch in July of 2013, Red Lion's graphite platform has received numerous global accolades, including Automation World's "First Team Supplier, HMI Hardware" award, the "Industrial Control Award" from Plant Engineering China and "Best Product of the Year" from Control Engineering China. 

First 2015 Tongji-HARTING technology innovation



(From L2R): Prof. Lu, Prof. Chu of Tongji University and Edgar-Peter Duening (HARTING Electric, HARTING Electronic MD), Simon Chan (MD of HARTING China) and Johnson Chen (Product Application of HARTING Asia)...

The first 2015 Tongji-HARTING technology innovation contest unveiling ceremony was held at Jiren building of Tongji University jiaoding campus. Professor. Chu Zhigang, Secretary of Party Committee, Professor. Lu Zhenggang, Deputy Dean of Tongji University Institute of Rail Transit and Edgar-Peter Duening, Managing

Director of HARTING Electric, hosted the ceremony with media guest, HARTING staff and Tongji students. Edgar-Peter Duening and Professor Chu announced the opening of the contest.

In early 2014, Tongji and HARTING signed in an MoU (Memorandum of Understanding) of the cooperation to research and develop innovative and advanced railway technologies. As a part of HARTING scholarship, this contest was organised by Tongji University Institute of Rail Transit (IRT) and HARTING, aims at inspiring students' creativity and innovation as well as establishing a platform to integrate theory into practice. The contest opens to all students in Tongji University. HARTING provides full support in respect of technology and samples.

Prof. Lu introduced this contest based on "Technology Innovation". Edgar-Peter Duening also emphasised that the contest establishes a great platform for the students to implement theory into practice. HARTING is honoured to be the first cooperating enterprise of Tongji University Institute of Rail Transit (IRT) for such contest. By taking up the scholarship or award, we hope the students are committed to take new challenges and gear up themselves to be technology innovators, which in accordance with one of the HARTING vision – "We want to shape the future with technologies for PEOPLE". 



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Crompton's one-stop solution for home electricals

Crompton, India's trusted electrical brand has unveiled its first exclusive showroom for electrical goods at Lohar chawl, Mumbai. It has 60 exclusive showrooms with a network of 500 authorised service centres pan India. Through its toll-free number, the company ensures that the customer requests are addressed within 48 hours by skilled technicians.

The exclusive showroom is an experience zone and a one-stop shop for customers for a range of 'energy efficient' home electricals. It will provide a complete set of electrical solutions to the customer to enrich his/her experience through the lifecycle of a Crompton product. Consumers can choose from Crompton's wide range of air circulation options, lighting systems, water solutions and home appliances. It will aid consumers in ideating electrical aesthetics for their



Ramesh Kumar, Global Sales Head, Consumer Products, Crompton

home – and help them make an informed decision in bringing low power-consuming appliances for savings on their electricity bills. Almost every Indian household must have acquired a Crompton product in the past 77 years – and continues to do so with the same zeal. Crompton remains committed to their patronage as they expand their brand footprint as per their growth strategy to make electrical products affordable and accessible. The consumer durables market is expected to see significant growth, with India becoming the fifth largest market by 2025. Crompton with its versatile

product portfolio has significant market share in consumer durables and gears up to meet the future market trends. Their established leadership in fans, innovation in lighting, energy saving drive in pumps and trusted brand position in consumer appliances make Crompton a preferred choice of customers.

Ramesh Kumar, Global Sales Head, consumer products, Crompton said, "With the company-wide focus on customers and increasing retail presence, we are gearing up to expand our footprint through the 'Crompton Exclusive Showrooms'. They are a one-stop shop, which enables us to serve our customers through direct interaction and address their various buying needs. It provides greater brand accessibility to not just our valued customers but also serves as a platform to connect with our retailers and distributors."

State utility GETCO to use ABB's hybrid switchgear system – PASS



66 kilovolt (kV) and 220 kV hybrid switchgear...

ABB, the well known power and automation technology group, has won its largest order for hybrid switchgear – PASS (Plug and Switch System) in India. The state utility GETCO will use PASS for extension and upgrading of a number of existing 66 kV and 220 kV substations as well as for green field projects to strengthen the Indian power grid in the western state of Gujarat. GETCO selected hybrid switchgear technology because it involves reduced land requirement, less installation time, and does away with conventional disconnectors to improve availability of the substation.

ABB's scope includes the supply, erection, testing and commissioning of hybrid switchgear modules PASS that are designed and manufactured in ABB's Vadodara facility.

"This hybrid switchgear solution addresses limitations of downtime and space availability while delivering the same reliable quality that is associated with ABB," claimed Anupam Arya, Business Manager for PASS, ABB India. "This project is a reflection of the renewed focus on strengthening the T&D grid and augmenting the existing substation capacities of the region."

Alstom makes new record with 200th 765 kV transformer and reactor



765 kV transformer and reactor...

Since its inception in March 2009, this green field facility has gradually ramped up its production capabilities and has provided the highest number of 765 kV transformers and reactors for the Indian electrical grid.

Rathin Basu, Managing Director, Alstom T&D India said, "As frontrunners in the field of EHV 765 kV products, this is an outstanding achievement for Alstom and a great contribution towards the 'Make in India' spirit of the country. The company remains committed to the growth and advancement of India's transmission system through its innovative, best-in-class technology and solutions. We are thankful to our customers for putting their faith in Alstom's technology."

Apart from Power Grid, Alstom has been supplying its world class transformers to state utilities like Uttar Pradesh Power Transmission Company Limited, Rajasthan Rajya Vidyut Prasaran Nigam Limited, Maharashtra State Electricity Transmission Company Limited. Other customers include IPPs (Independent Power Producers) such as Larsen & Toubro, Essar and Lanco. Transformers are integral components of an electrical grid, and essential for the efficient and safe conversion of electricity between diverse voltage systems.

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Modified design improves building energy efficiency


Hoosier Energy Rural Electric Cooperative is a generation and transmission cooperative providing wholesale electric power and services to 18 member distribution cooperatives in central and southern Indiana and southeastern Illinois. The company's headquarters building has recently been awarded LEED Gold certification.

LEED, or Leadership in Energy and Environmental Design, is the nationally accepted benchmark for design, construction and operation of energy efficient facilities. The programme recognises best-in-class building strategies and practices. To receive LEED certification, building projects must satisfy prerequisites — and earn points to achieve one of four levels of certification.

The gold certification awarded to Hoosier Energy is the second-highest designation the U.S. Green Building Council bestows on buildings that demonstrate energy efficiency and sustainability.

The 83,000-square-foot building was designed by Schmidt & Associates

reliable power naturally extends to energy conservation. As a member-owned electric cooperative, we want to set a good example of energy efficient building design," said Steve Smith, President and Chief Executive Officer.

"The building is 48% more energy efficient than a structure built to conventional standards," said Matt Mabrey, who served as Hoosier Energy's Project Manager for the new facility. A cornerstone sustainability feature is a geothermal heating and cooling system that consists of 120 wells drilled 300 feet deep adjacent to the new headquarters. The interior features recycled materials including reclaimed wood from trees removed during construction. 

DESIGN

Architects with extensive input from employees to achieve the dual purposes of improving workforce productivity as well as providing a model for energy efficiency and environmental stewardship. "Our commitment to providing affordable,

Areva supplies cast-on-site used-fuel storage solution




Areva's NUHOMS HSM-H...
Image Courtesy: Areva

Areva TN will supply to Exelon Nuclear — 30 additional NUHOMS HSM-H used fuel storage modules at the Nine Mile Point nuclear station in Scriba, N.Y. Areva TN is a division of AREVA,

which is globally known for the transportation and storage of used nuclear fuel. As per the company, more than 40% of American utilities use Areva's advanced NUHOMS horizontal storage technology.

Beginning mid-2015, the Areva TN team and local labour will construct the Horizontal Storage Modules (HSMs) onsite to reduce the cost of transporting the materials and generate important savings for the customer. These modules will join the existing 40 units already at Nine Mile Point, also constructed onsite in 2011.

Areva's robust NUHOMS HSM-H system offers high seismic resistance through its thick reinforced concrete components, low profile, and interlinked rectangular modules. This above ground horizontal system offers greater structural stability, a high level of shielding and enables the ease of aging management inspections.

Greg Vesey, Senior Vice President, Areva TN Americas, said, "Thanks to the expertise and innovative spirit of our teams, we are able to offer Exelon a more economical used fuel storage solution by casting the modules at the Nine Mile Point site." 


Alstom signs its fifth contract with BWSC for supplying GRT



A view of the Alstom's Budapest-based Industrial Steam Turbine Development Centre...
Image Courtesy: Alstom

Burmeister & Wain Scandinavian Contractor (BWSC), a Danish power plant specialist is setting up its Tilbury biomass project. The plant is expected to generate 300 GWh of green electricity every year, enough to supply the

power needs of around 80,000 homes, when commissioned in July 2017. It will burn around 285,000 tonnes of waste wood a year.

Alstom has signed a contract with BWSC to supply a Geared Reaction Steam Turbine (GRT) for the biomass project. The 45MW waste wood power station will be located on the River Thames near to London, and it will be built by BWSC and Aalborg Energie Technik (AET). This contract follows two others that Alstom signed with BWSC for 23 and 50 MW turbines for schemes in Widnes and Snetterton earlier this year. The project specific design, engineering and manufacturing will be done at one of Alstom's specialist facilities, with support offered by the UK team. The GRTs are preassembled resulting in a cost efficient installation and commissioning solution. Alstom has optimised the GRT to maximise the power production, covering renewable and traditional fuel types in addition to industrial applications for process steam. 

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Vestas bags order for the Korytnica North project



Vestas is now taking a significant step in reducing the cost of energy for wind in Poland...
Image Courtesy: Vestas Wind Systems A/S

Wind Field Korytnica Sp. Z o.o., has placed an order with Vestas for their Korytnica North project in Poland. The 83 MW order for 25 V126-3.3 MW turbines includes delivery,

installation and commissioning of the wind turbines as well as a 15-year Active Output Management (AOM) 5000 service agreement. Delivery and commissioning of the turbines have been planned to take place in the fourth quarter of 2015.

"With the delivery of the first V126-3.3 MW turbines to the Korytnica North project, Vestas is now taking a significant step in reducing the cost of energy for wind in Poland," says Klaus Steen Mortensen, President of Vestas Northern Europe. "The Korytnica North project will help increase the proportion of cost competitive renewable energy in Poland, and we are very pleased that Wind Field Korytnica has chosen to work with us," expresses Mortensen. Vestas employs more than 150 people in Poland. The company has, since the establishment of Vestas Poland 12 years ago, delivered a total of 1,272 MW (or 620 wind turbines), and has gained a 30% market share of total installations in Poland.

User-traders to benefit more from ABB's new project



ABB control room...
Image Courtesy: ABB

Power and automation technologies company ABB has bagged the contract of a rural smart grid project on the Swedish island of Gotland in the Baltic Sea. The project will serve as a model for upgrading other rural grids to minimise environmental

impact by integrating a high proportion of intermittent wind power in the distribution network. It also aims to deploy new technological solutions to improve power quality. Within the implementation phase, ABB is building a 10 kV smart substation in the village of Källunge, which uses a state-of-the-art switchgear technology – based on the power company's Unigear Digital concept. To process data from this substation and the rural grid, ABB is customising and delivering an Advanced Distribution Management System (ADMS) and Supervisory Control and Data Acquisition (SCADA) system.

ABB is also installing switches equipped with safety and feedback functionality and equipping disconnectors with new remote surveillance and control capabilities. The ADMS will also locate and isolate fault zones from the rest of the grid and re-route electricity to minimise impact on consumers. A further aim of the project is to give consumers tools to actively participate in the energy market. To this end, an end-user software solution is already in place, supplying participating consumers with applications that enable them to adjust their energy consumption in response to wind forecasts and price fluctuations.

Growth in renewable energy segment is leading to more employment generation

With growing awareness and realisation of its multiple benefits, adoption of Renewable Energy (RE) is growing globally. As its obvious effect, a fast increase in direct or indirect employment is also being seen in or around this segment.

According to a recent report by the International Renewable Energy Agency (IRENA), at present, RE employs 7.7 mn people worldwide. This is an 18% rise from the last year's figure of 6.5 mn. The report, Renewable Energy and Jobs – Annual Review 2015, also provides a first-ever global estimate of the no. of jobs supported by large hydropower, with a conservative estimate of an additional 1.5 million direct jobs worldwide.

"RE continues to assert itself as a major global employer, generating strong economic and social benefits worldwide. This rise is being driven, in part, by declining RE

technology costs, which creates more jobs in installation, operations and maintenance. We expect this upward trend to continue as the business case for RE continues to strengthen," said IRENA Director-General Adnan Z. Amin.

As in previous years, RE employment is shaped by regional shifts, industry realignments, growing competition and advances in technologies and manufacturing processes. Jobs in the RE sector are increasingly being created in Asia, with five of the 10 countries with the most RE jobs now located in the region (China, India, Indonesia, Japan and Bangladesh). As a result, even with continued jobs growth, the European Union and the United States now represent 25% of global RE jobs, compared to 31% in 2012.

The 10 countries with the largest RE employment figures are China, Brazil, the

US, India, Germany, Indonesia, Japan, France, Bangladesh and Colombia.

The solar PV industry is the largest RE employer worldwide with 2.5 million jobs, followed by liquid biofuels with 1.8 million jobs, and wind power, which surpassed one million jobs for the first time this year.

The employment increase spreads across the RE spectrum with solar, wind, biofuels, biomass, biogas and small hydropower all seeing increases in employment.

"If we continue to invest in renewable energy and its multiple economic, environmental and social benefits, employment in renewables will continue to climb. IRENA's research estimates that doubling the share of renewable energy in the global energy mix by 2030, would result in more than sixteen million jobs worldwide," said Amin.



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Measuring Voltage Without Cables

OMICRON's CPC 100 and CP CU1 measure line and ground impedances and step & touch voltages...

You all know that high voltage installations or transmissions are absolutely essential considering several technicalities. However, any high voltage source or conductor poses a great risk to the workers and animals around the spot. Thus, when running high-voltage facilities, it is essential that suitable measures are employed to ensure the safety of people and animals. That is why it is important to test step and touch voltages within your facilities and the surrounding areas.

OMICRON's CPC 100 and CP CU1 measure line and ground impedances as well as step and touch voltages – thanks to the battery-operated handheld HGT1 device. The CPC 100 and CP CU1 measuring systems can read variable frequency test




HGT1: The handheld step & touch voltage tester...

currents. Mains-related interference can, therefore, be suppressed, resulting in accurate, repeatable measurements. Weighing in at 64 lbs (29 kg) and 62.8 lbs (28.5 kg), the CPC 100 and the CP CU1

measuring systems can easily be transported from one location to the next. By contrast, conventional methods require complicated procedures and very heavy equipment.

The HGT1 voltmeter, which measures selective frequencies, reads the test current from the CPC 100.

This allows the step and touch voltages to be measured easily and quickly, and simulates the body's electrical resistance, as per the required standards.

"With the HGT1, step and touch voltage testing can be carried out quickly, easily and accurately. You can carry out measurements at different locations as the HGT1 doesn't require long measuring cables," explains Moritz Pikisch, Product Manager at OMICRON. 

Saving Utility Response Time During Emergency

GE's advanced Predix platform for mobile software solutions leverages big data to drive operational efficiency and improve overall network performance and asset utilisation...

When major events such as severe storms knock the power out, expedited utility response times are crucial to ensure utility customers' well-being and timely restoration.


Critical information must be seamlessly exchanged between the utility's grid management solution – such as its Outage Management System (OMS) – and its field workers who are assessing networks and repairing the damage.

The new PowerOn Response software from GE's Digital Energy business does just that. By simultaneously integrating field and OMS data, a utility will have a much clearer

picture of where network damage exists, enabling repair crews to dramatically speed up the process of getting the power back on.

Many solutions available today focus solely on collecting data on network damage caused by major storm events. GE's PowerOn Response, however, goes a step further. Powered by GE's advanced Predix platform for mobile software solutions, it leverages big data to drive operational efficiency and improve overall network performance and asset utilisation. PowerOn Response enables utilities to share network data with OMS users and various utility stakeholders quickly and efficiently. It equips field workers with

the technology needed to access and analyse mass amounts of grid data on the fly from any common mobile device.

"Recently, many utility regulators have mandated that utilities automate their storm response processes to reduce the effects of outages associated with severe weather events. Our PowerOn Response software allows utilities to streamline the outage restoration process and improve the overall resiliency of their grid. This, in turn, enables them to meet both local regulatory mandates and the increased energy demands of their customers," said Keith Grassi, Global Product Line Leader, GE's Digital Energy Business. 

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Maxwell inducts new member in its board



Rick Bergman

Bergman's extensive business experience and contacts in the technology industry will make him a valuable resource and sounding board to pursue new avenues for Maxwell's growth...

Rick Bergman, President and CEO of Synaptics, Inc. – a well known developer of human interface solutions for intelligent devices, has been appointed to Maxwell's Board of Directors. Bergman joined Synaptics in 2011, after serving in a series of senior executive positions with AMD, where he was Senior Vice President and General Manager of AMD's Product Group from May 2009 to September 2011, and Senior Vice President and General Manager of AMD's Graphics Product Group (GPG) from October 2006 to May 2009. Until AMD acquired ATI in 2006, he was Senior Vice President and General Manager of ATI's PC Group.

Previously, he was Chief Operating Officer of S3 Graphics and before that he held other senior management positions in the technology industry after beginning his career with Texas Instruments and IBM. He holds a Bachelor of Science from the University of Michigan and a Master's degree in business administration from the University of Colorado's Executive MBA programme. "We are delighted that Mr. Bergman has agreed to join Maxwell's board. His extensive business experience and contacts in the technology industry will make him a valuable resource and sounding board as we continue to pursue new avenues for growth," said Mark Rossi, Chairman of the Maxwell's Board.

American Institute of Physics appoints new CEO



Robert G. W. Brown

"I am honoured to have been chosen to lead AIP and help shape physics and physical sciences for the 21st century..."

The American Institute of Physics (AIP) has selected applied physicist Robert G.W. Brown as its new Chief Executive Officer. Selected by an AIP Executive Search Committee and unanimously approved by AIP's Board of Directors, Brown previously served as the Chief Sensor Scientist at the Advanced Technology Center of Rockwell Collins, Inc., and worked concurrently as an adjunct full professor in the Beckman Laser Institute & Medical Clinic of the University of California, Irvine, and in UC Irvine's Department of Computer Science. He will

assume the office of AIP CEO on June 1, 2015. "The AIP Board of Directors is delighted to welcome Dr. Brown because he embodies all the qualities we sought in a new CEO," said Louis J. Lanzerotti, Chairman of the AIP Board of Directors. "His integrity as a scientist, his high personal achievement and his vision as a business leader will help AIP build upon its successes and chart a path forward to an even brighter future," he added. Brown comes to AIP with 40 years of experience as a leader in the physical sciences.

Sungevity fills its newly created CGO's position



Jan Slaghekke

"We are laser-focused on continuing to grow our solar services worldwide, and Jan's leadership will be instrumental in this continued expansion," said Andrew Birch, CEO, Sungevity...

Sungevity, a global solar energy provider, focused on making it easy and affordable for homeowners, has appointed Jan Slaghekke as Chief Global Officer (CGO), a new position for the company. Slaghekke will manage Sungevity's expansion and strategic relationships in key markets outside the U.S., including its partnership with E.On as they work collaboratively to enter the German market. The German launch will grow Sungevity's European footprint, building on its business in the Netherlands – where it earlier launched a partnership with E.On. "Global expansion is a top business priority for us, and our planned entry into Germany is a testament to

the success of our platform business model. We are laser-focused on continuing to grow our solar services worldwide and Jan's leadership will be instrumental in this continued expansion," said Andrew Birch, CEO, Sungevity.

Prior to joining Sungevity, Slaghekke held executive positions around the globe with BP for almost two decades, including the management of BP Alternative Energy's Wind and Thermal Power business across Europe and Asia. Earlier, he advised Vestas Wind Systems. He is a Bachelor of Economics from Bucknell University (US), and an international MBA from the Rotterdam School of Management, Erasmus University (Netherlands).



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Interview



“Our customers save on space, operate efficiently and gain access to latest technology...”

Emerson Network Power (India), a business of Emerson, has an expansive portfolio of intelligent, rapidly deployable hardware and software solutions for power management. In an exclusive interview with **Electrical India**, **Manish Sawant, Director (Power Products Management)**, from the company talks to **P. K. Chatterjee** on challenges in today's business environment and their smart solutions. Excerpts...

➤ **How important is it to supply continuous power to our business establishments?**

The recent announcements and policy bolsters from the government have led to a rise in the number of start-ups and businesses coming up in the country. This has also led to increasing demand for 24x7 power supply. Each industry today has at least some part of its business dependent on continuous power, e.g., datacentres or computing. Any down time on business processes / services etc., will not only result in loss of revenues in the longer run, but also loss of customers and brand recall.

Identifying these business processes and services and guarding them with surge protection devices is something that all CTOs will be looking at eventually. In light of the above, we will see a lot of businesses and organisations considering solutions like surge protection devices, industrial inverters and UPS solutions – and other power management products to safeguard their IT infrastructure and thereby help their businesses function unhindered 24x7.

➤ **What're the major (power) challenges posing risks to modern business environment?**

The modern business environment today faces some important power related challenges. The most important challenge out of them is an unreliable power grid, which is mostly rid with large snags and surges. The second most important challenge is that a majority of the businesses, which are located in Tier 1 and Tier 2 areas, seem to be affected by poor energy supply. Businesses are always looking for 24x7 clean power, which helps them function efficiently and smoothly, thereby resulting in servicing their customers better. Therefore, companies across sectors will now be looking at directing most of their operational investments towards creating a robust and agile back up power infrastructure for 24x7 business continuity.

Perhaps the biggest challenge dominating this area is the lack of awareness of basic power quality fundamentals for technologies powered by green initiatives including solar power. Often, users expect a UPS to automatically solve all power-related problems. Even after a UPS is installed, power problems can continue to occur as the root causes are often faulty earthing and grounding systems. Usage of poor quality batteries – and cheap power systems from unorganised market makes high power systems unreliable. Regular power quality audits and monitoring can prevent unplanned downtime, and make UPS and other systems work efficiently. Additionally, a lot of businesses now want to consider upping the ante on the purchase of cleaner and greener power sources – as their stakeholders place an ask on reducing the carbon footprint.



➤ **Is it necessary to measure power consumption at all points?**

With energy costs on the rise, majority of businesses are looking at curtailing their operational costs with the aim of improving business performance – and this is one of the primary reasons most businesses look at measuring the effectiveness of their power consumption.

For example, the average Power Usage Effectiveness (PUE) rating for datacentres is <1.8. Running today's datacentres with this speed has become of utmost importance to the businesses today – as this results in the datacentre running ultra-efficiently, and also helps good energy improvement and improvement in energy usage as compared to an average PUE, which is often 2.0 or higher.

➤ **Can profitability be enhanced through data analysis and good practices?**

Power consumption management is directly related to controlling overhead expenses for any organisation. This in turn directly reflects in the gross margins, and hence can impact the profitability of a firm to a great extent. Many companies today follow the standard practices of measuring, monitoring and controlling the consumption. Apart from that, with fine-grained real-time energy monitoring and control, businesses can also evolve datacentre designs to maximise their efficiency. Energy usage reports, which are complete with all data, are also important from the point of view of focusing attention on the major consumers, and real-time alerts can be introduced to automatically flag any behaviours that raise concerns based on the organisation's energy policies and guidelines. Alerts can also automatically trigger corrective actions, such as power capping, which ensures that operations stay within predefined thresholds.

➤ **What's Emerson's contribution to keep the business environment healthy?**

With regards to keeping a healthy business environment, Emerson Network Power has consistently been developing and researching on new technologies & solutions – in the midst of extreme

competition to keep up with the pace. We want to be perceived as a one-stop solution provider for business houses to protect and optimise their critical infrastructure. Our products and solutions – be it UPS systems, smart solutions and surge protection devices – are developed considering business criticality, low TCO, reliability and flexibility of adoption. In terms of our strategy, we are always focused on creating customer-centric solutions that help our customers with business solutions compared to single product offering.

We realise that our customers are always on the lookout for options that are hassle free and dependable. Emerson has a clear and dedicated vision towards maintaining its equity amongst partners and customers as their preferred vendor, providing quality products and solutions that are cost efficient and tailor-made for their specific needs.

We design and manufacture solar inverters for the residential market as well as for and small businesses. These small-light weight and efficient solar inverters facilitate time-saving installation and helps reduce reliance on costly as well as non-renewable fossil fuel sources with their great power density – and the ability to pass on excess power back to the grid. Emerson also produces solar inverters (Energy Export Unit –EEU) & (Energy Storage Unit –ESU) and its monitoring equipment. We have also made substantial progress in working closely with the Indian government.

➤ **What are your latest technological upgrades for the Indian businesses?**

We are the leader in the AC Power Business, which manufactures UPS ranging from 600VA to 3.3MVA. Some of our products have gained immense customer trust over the years. Our products offer best-in-class efficiency to the tune of 96.7%, which is the best in the industry. Most of our products are designed keeping in mind the latest modular and monolithic designs that are compact and user-friendly.

In keeping with our technology upgrades, we also provide smart solutions for our data centres. For example, a lot of SMEs are generating large amounts of data, but they

are working with limited IT infrastructure (say) with two to three servers. They do not have the capacity to invest in huge datacentres on account of space constraints. They are always on the lookout for smart solutions that can help them save and manage data without having to build new datacentre space. This approach, helps them increase their datacentre capacity, improve IT control and business efficiency without having to build a new datacentre, which would involve the company incurring huge costs.

Our well known solutions have enabled many companies with solutions such as – smart rows, smart aisles and smart mods, which are mini data centres in racks with various facilities.

➤ **How is the result?**

Our customers save on space, operate efficiently, and gain access to latest technology with upgrades that can be done – as and how the business situation demands. Products from Emerson Network Power's smart solution portfolio would work as they would be made up of precision cooling, UPSs, power management, monitoring, control technologies, and fire suppression – all in one enclosed system that is advantageous as businesses look for cost efficient and easy to maintain solutions. All of these, as well as the need for modular solutions, which are less complex where the IT infrastructure is viewed as one rather than piecemeal – are major reasons that have today spearheaded the demand for smart solutions.

➤ **What're the new technologies in the field of emergency power supply?**

In view of keeping up with the demands of businesses, companies are constantly researching on and developing new technologies & products that will help increase business efficiency & performance. Some of the new technologies that will make its way to the market and a great impact in the future are: i) battery-less technologies for very short back up (10 to 15 seconds) and ii) lithium ion batteries for back up beyond 15 seconds. 



More Secure Data Transfer In Moving Applications For Industry 4.0

igus sets new standards with fibre optic and CAT7 Ethernet cables...

For the factory of the future to work, a real-time communication of machines with each other at all levels must be guaranteed. To ensure that all stations can exchange their data with each other, Ethernet cables will be increasingly used in factories. Not just on stationary, but also specifically in moving equipment. For this reason, in the segment of copper-based Ethernet cables, igus offers 23 different types. All of them are designed exclusively for industrial, continuously moving applications, but they possess varied mechanical properties.

CAT7 Ethernet technology for continuously moving applications

igus recently displayed its new CAT7 cable CFBUS.052 at their fair stand in Hannover. For substantially increasing data safety, it has braided shields, pair shields and an overall braided shield with 90% optical cover, which ensure functionality even after millions of bending cycles in energy chains. The special core/braiding structure gives this CFBUS cable a long-lasting flexural strength. "A braided shield made with an optimised braid angle protects the overall shield against mechanical fractures as well as the

electromagnetic compatibility of the cable," explained Rainer Rössel, Head of the Chainflex Cables Division at igus.

The shielded pairs are stranded with an optimised pitch length so that on the one hand they meet high mechanical requirements, and on the other fulfil the electrical requirements in terms of data transmission. This CAT7 cable is flame retardant like all highly abrasion-resistant TPE CFBUS types. In addition, it has UL/CSA, EAC and CTP certifications and conforms to DESINA. The new cable is furthermore for use in clean room environments.

Communication without interference

Due to their immunity to electrical interference and the substantially higher data capacity data transmission over fibre optic cables is of potential importance for Industry 4.0. The range of fibre optic cables, which have also been specially developed for continuous movement, covers all areas of mechanical

requirements. For example with the CFLG.2EC series, igus offers an affordable fibre optic cable specifically designed for indoor use in handling or woodworking machines. The CFROBOT5 enables robots to have fail-safe communication in three-dimensional space. With the chainflex fibre optic cable CFLG.LB.PUR, igus also presents a special fibre optic cable series for the continuously moving application in the offshore and marine sectors. They are already



As igus operates the largest laboratory for continuously moving cables in the industry, spread over 1,750 sq. m., igus can give accurate information about application potentials and service life... (Source: igus GmbH)



With the chainflex fibre optic cable CFLG.LB.PUR, igus presented in Hannover a special fibre optic cable for the continuously moving application in the offshore and marine sector... (Source: igus GmbH)

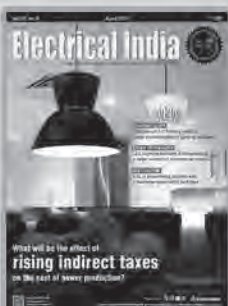
available with 2, 4 or 6 optical fibres or 2 optical fibres and 2 power supply wires. The stranded-together multimode or single-mode fibres are very bending-resistant types designed as a sub-cable, which can be fitted very easily and cheaply with connectors. Due to its extremely high strength aramid (Kevlar) braid over the overall stranding, even high tensile forces that may occur in hanging applications do not damage the cable.

The flame-resistant, pressure extruded PUR outer jacket, especially tailored for energy chain use, provides additional protection against external mechanical damage. Due to the DNV/GL offshore approval, the new fibre optic cable family, as well as the CAT7 cable, offers the capability to securely transmit data on offshore platforms and ships.

From the Hannover Messe onwards, igus offers a 36-month guarantee for all cables from the first ordered metre.



With the world's 1st CAT7 Ethernet cable for the movement in energy chains, igus ensures secure data transfer in the factory of the future... (Source: igus)



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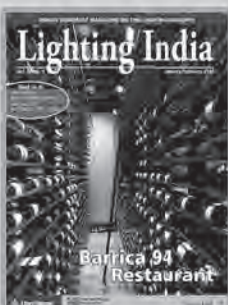
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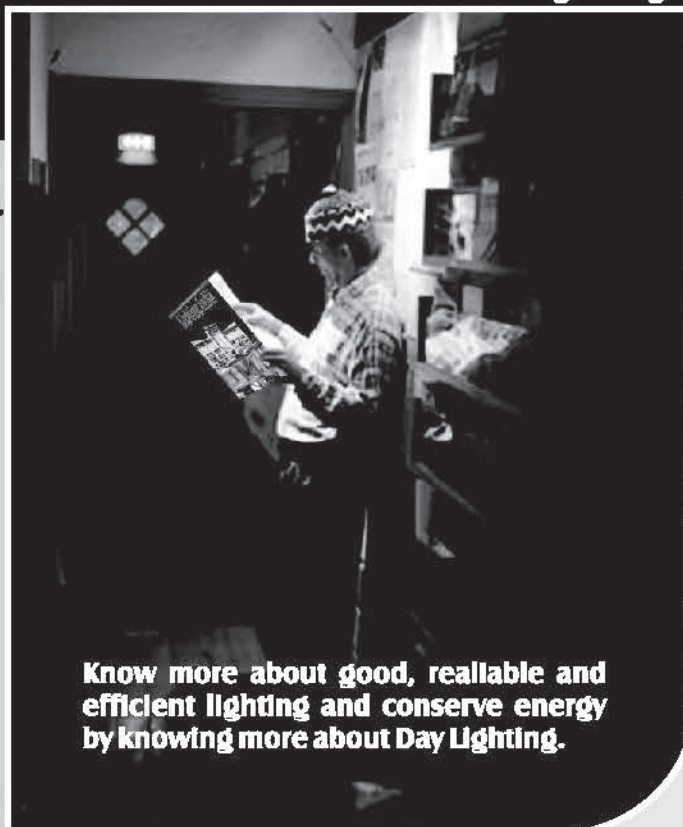


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The World's **Sixth Sense**[™]



Reviving The Ailing Indian Economy

How can we aim at energy security unless we reduce losses and consumption and explore the possibility of internal resources? But the first question is: is the matter being taken up seriously by us?





There are perennial power shortages in the country having adverse impact on the industrial production and agricultural products alike. These are the back bones of any modern economy. The small scale industries are reeling under power shortages with reported heavy losses in almost all states. This grave situation is likely to repeat for at least eight lean months of power shortage every year in the country. The onset of monsoon is likely to give temporary, short term relief – only if the rainfall is in good measure in the catchment area of the hydel power stations.

The large scale industries have their own problems as they cannot sustain on their own without capital intensive captive power sources. This is further adding stress to the already high capital investment woes.

We also know too well that it is but essential that any industry has to install and operate standby Diesel Generator (DG) set to ensure uninterrupted plant operation during power cuts. This additional, otherwise avoidable burden only accentuates the capital and production cost considerably. It is a bare fact that the operating cost of DG sets entirely depends on imported diesel fuel. The agricultural economy too is dependent on energy not only for operating pump sets, but also for processing and transportation of goods to distant destinations at an affordable cost. In the domestic and commercial buildings too, the need for standby units such as UPS, invertors and DG sets have become essential.

Achieve energy efficiency in the best possible manner

There are no two opinions that the power sector is plagued with colossal loss and inefficiency, cost of which is avoidable.

When we discuss about energy, we refer firstly to the electrical energy, which lights our homes; powers home appliances such as televisions, fans and air conditioners with which our day to day life is linked. Almost all the industrial production is electricity driven. Bulk of the production of this type of electricity comes from thermal power stations and partly from hydro electric generation with meager contribution

from renewable energy – such as wind and solar energy. There are too many problems associated with the generation, transmission and utilisation of the electrical power, including the problems of losses and inefficiencies with all these activities.

One more addition to the existing problem is the shortage of coal in the country to fuel the existing thermal power stations. This necessitates import of over 20% of the coal needs at exorbitant costs adding to the already strained economic woes, boosting the power cost and tariff further.

The belief and relief we shared that the electricity generation in the country is totally indigenous relying on internal resources is no longer true. What about the position of petroleum fuels – petrol and diesel, another major energy resource, on which our economy is totally dependent?

We started facing the initial energy crunch from the early seventies itself, from the days when the oil producing countries started forming a cartel and exerting pressure on the consuming countries, dictating terms and increasing price of crude oil time and again.

Unfortunately all our development is based on imported petroleum products, including the much needed transport sector, which affects our day to day life and price of essential commodities, leading to persistent inflationary trends.

The very fact that we totally rely on 80% of our petroleum needs by import is sufficient to illustrate how vulnerable and fragile our economy is to our dependence of imported petroleum fuels.

Our annual crude oil import bill has crossed \$144 billion in dollar terms in Financial Year 2011-12, when the dollar value was hovering around ₹ 53 /US\$, which is almost equivalent to a staggering ₹ 7.6 Lac Crores! The management of petroleum products in the country is beset with colossal losses, wastages and gross inefficiencies starting from storage, handling, distribution and above all effective usage of this scarce resource. These all contributed to an appalling 10 fold increase of our import bill for the past one decade.

The glaring revelation and anomalies exist in the usage of this precious fuel in the

country is evident when compared with the global consumption. Oil consumption per GDP in India is three times that of Japan and the US, and much more than that of China and Indonesia – the developing economies like India. We run the impending risk of this figure going further up with the slide in rupee value even if the quantity of crude import is static, which is quite unlikely. There is annual increase in import of crude by 7%, and the dollar value has on date increased from ₹ 53 to ₹ 60 (+).

The gravity of this risk is daunting, and demands embracing energy conservation with utmost alacrity. The government's consumption of the petrol and diesel oil is considered to be the maximum, whether in central or state administration, most of which is avoidable or controllable by strict and effective administrative steps and implementation of austerity measures. How can we aim at energy security unless we reduce losses and consumption and explore the possibility of internal resources? But is the matter being taken up sincerely by us?

It is now clear – from what we see in reality – that there are losses, wastages and inefficiencies in handling, storage transport and usage of the petroleum fuels – and also electric power. When we discuss losses and wastages, they are sometimes seen but most of the times unseen, which is true of electrical power as well as petroleum fuels. In the case of electric power, there are also losses in generation transmission and utilisation of electrical energy.

The total assessed losses in electrical energy, which may constitute both technical and administrative losses, vary from 25 to 30%. The total short fall between demand and supply also is somewhere within that figure. In other words, if we need to fill the gap between the much needed supply and demand, we must aim at a target zero of energy losses, and we have to find a solution for the problems of shortage of electrical energy.

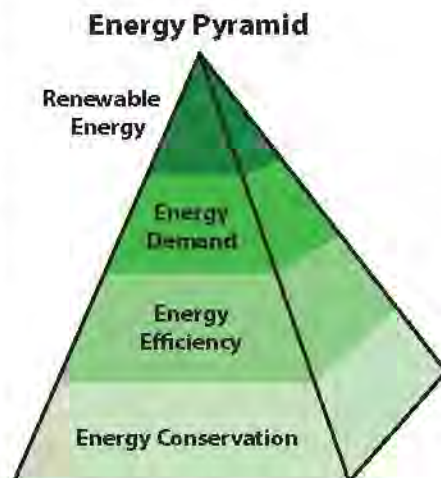
Challenges in implementing energy conservation measures

- The capital cost of a thermal power plant as on date is over ₹6 crores per MW of electrical power. If we succeed in filling



the gap between the supply and demand of electrical energy by a target zero losses, assuming the present installed capacity of ~ 2,60,000 MW, the capacity gain by way of energy conservation can be 50,000 MW. The capital investment cost of this project will be a whopping ₹ 30,00,000 crores, a mind boggling figure in the present depressing economic scenario in the country

- The assumption is made for the coal based thermal power plants, which still bear the lowest capital cost when compared to the power generated from other sources – such as nuclear, renewable, solar or wind sources, which are highly subsidised, adversely affecting our already fragile economy
- The capacity addition for hydel power generation, although existent in the country, is bleak – as the prospect of exploiting them any further is low due to stiff public resistance and the high cost of massive human rehabilitation
- The projected capital cost also does not take into account the enormous cost and inordinate delay involved in acquiring a coal mine of the needed capacity to provide uninterrupted supply of clean coal, and the associated problems of the additional capital investment. Acquiring and operating in the present day situation is simply impractical – since all the progress of the implementation of the proposed coal mining projects are stalled due to some reason or other, such as clearance of environmental plans and proposals, land acquisition etc., with no solution in site within the foreseeable future
- Even for the sake of argument, if this economically fragile nation takes a crucial decision to earmark the capital cost involved for these mammoth projects by hook or crook, it is a harsh reality that it takes a minimum of five years of gestation period for the projects to take off – and bear fruit from the conceptualisation to commissioning stage. There are already several projects waiting in the pipeline, which were conceptualised before 10 to 20 years with no possibility of seeing the end of the ordeal for some reason or other.



Benefits of energy conservation

From the foregoing facts, it is now clear that there is little possibility of addition to the capacity for power generation in the near future, and solution to the power shortage, hitting our economy to the bottom line. But the moment, we start energy conservation measures at little or no costs, we start saving or earning from day one, contributing to the strained economy to recover in smaller or greater measure.

Incremental measures

If we save 1 unit of energy whether in our home or commercial establishment or anywhere for that matter, we virtually save 2 units of generation – despite the source of energy whether it is from coal or hydel. In addition, in coal based power plants, the coal needs for generating unit power also gets correspondingly reduced to the savings of a nearly whopping six units of coal for a unit of generation.

If we save usage of petrol or diesel by even one litre, we reduce import of over 1 litre of petroleum and the cost of refining, transport and distribution, and losses involved in evaporation and handling. It is assessed that over 35% of the oil import bills can be saved, if energy conservation measures are strictly introduced, by minimising wastages of all kinds and bringing about efficiency in the administrative and operational systems & controls. This accounts for a whopping ₹ 3.00 lac crores of import bill per annum with a projected import bill of nearly ₹ 8.8 lac crores. This significant step would also ensure bringing down the current account deficits to a

manageable level, which has become a source of headache for the economists as well as policy makers in the country. All these series of concerted efforts taken on a nationwide scale in energy conservation could translate into remarkable cost saving in import, consumption of fuels and generation, which is a significant gain to our ailing economy.

Boosting industrial and agricultural production and productivity

As already pointed out, there is enormous loss in the country due to unutilised industrial capacity because of power shortages and power shut downs. Once the supply position improves the industrial or agricultural production also improves side by side. The reduction in use of standby power units, such as diesel generators, further brings down the operational cost – and the cost of production improving the industrial or agricultural production and productivity scenario in the country which is reeling under recession. The small scale industry sector, the backbone of our economy, struggling for survival, will be saved from total collapse along with the millions of workers depending on this sector. The improvement in the industrial or agricultural economy is accompanied by improved national economy, containment of inflationary trends and price rise, & creation of more job avenues.

Indirect benefits

- **Ensuring sustained economic growth:** If we are successful in achieving the target zero energy losses by implementing energy conservation measures, there is every possibility of doubling the economic growth rate of over 8 to 9 percentage of GDP or even more. Even small, or incremental improvements in energy efficiency will have a positive impact on the economy, corresponding to the quantum and magnitude of energy efficiency achieved. However, the growth and progress achieved in the economy by energy conservation measures would be more sustainable – when compared to monetary measures for controlling the sliding rupee value, which are more controlled by external factors
- **Creation of more employment opportunities:** One of the aftermaths of

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the economic down turn is the possible layoffs, retrenchments, job losses and consequent sufferings. But a stronger industrial economy resulting out of energy efficiency not only ensures job and work stability but also brings in its wake in many new avenues, where the youth, talents, and skills are needed.

How to achieve energy conservation goal of target zero energy loss?

It is mandatory that concerted efforts from the government, public, and the energy consuming industries and organisational sectors should take this onerous task on a war footing to achieve the zero target energy loss and take the economy forward to the new front. The government had understood the gravity of the situation long back and passed the Energy Conservation Act as early as in 2001, and made it mandatory to conduct energy audit and implement the recommendation every two years in all energy intensive industries and commercial buildings.

Although more than 14 years have elapsed, there is little progress in energy conservation efforts. But the time is ripe in this crucial stage for implementation of the mandatory provisions of the 'act' to bear fruit in this significant act, which is passed both in the Lok Sabha and Rajya Sabha. The public awareness in energy conservation efforts is also a 'must'. There should be awareness programme for educational institutions and even homes. After all, charity begins at home.

One of the major areas of creating awareness to the people of all strata of society is to campaign for the noble cause of conducting 'home energy management and audits.' The estimated cost saving expected by Indian Institute of Energy Management professionals is to the tune of 30,000 crores per annum from home and commercial sector, out of the total wastage of over ₹ 100,000 per annum identified in this sector.

What is the cost benefit of energy conservation?

Energy conservation: Perhaps the easiest way to start with it is, with simple positive changes that we can introduce in our day to day energy management styles, for example:

switching off the lights, fans, air conditioners etc., – which cost you nothing but only needs awareness and certain amount of discipline and organising the work and housekeeping and better administration. It is applicable in the home front, industry or any energy consuming units and governmental departments and administration.

How much can you save?

It is roughly estimated that nearly 10% of the energy bills could be saved with no cost options of this kind. The second medium cost option needs a nominal investment for replacing obsolete energy saving gadgets or devises without warranting major replacement. A simple example is fluorescent tube light assembly – wherein replacement of the resistance choke with an electronic choke brings about a saving of nearly 30% with nominal expense towards replacement. The cost of the replacement we can recover within six months, which can be termed as the 'pay back period'. The next high cost option is replacement of the obsolete energy guzzling gadgets or equipments with better technology fuel or energy saving gadgets. A reasonable maximum payback period of three years is considered amply justifiable for the replacement and the saving expectation of about 30%.

State of renewable energy resources in the present energy economy

This article is incomplete without discussing the renewable energy sector, where the future lies. It is an undeniable fact that the future is totally dependent on these resources, however, what about the economic significance of renewable energy sources?

- The fact remains that the capital cost of the renewable energy project is more than the conventional power projects
- The cost of power is much more than that of the grid supplies
- Renewable energy cannot sustain as on date without subsidy, having adverse direct impact on economy
- Unless and until the cost of the energy from renewable energy project is on par or even less than the cost of grid supply, the renewable projects are liable to have a negative effect on the economy

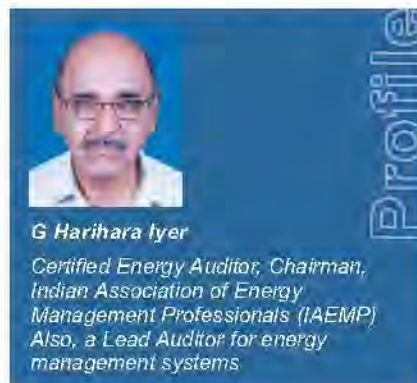
- Please go through the 'energy conservation pyramid.' Energy conservation and efficiency, both of them need little or no capital investment. Only human as well as political and administrative will, form the base of the pyramid, which is of maximum priority. Renewable energy involving maximum capital outlay and need for subsidy, has to be targetted after achieving 100% energy conservation and efficiency.

Energy Conservation Act – 2001

It is noteworthy to mention about this important Act passed in the Parliament way back in 2001 yet to be implemented, making it mandatory for the power intensive units to implement the relevant provisions of the act including conducting periodical energy audits.

Conclusions

- Energy conservation route is the easiest, cost effective and cheapest to achieve energy security by bridging the supply and demand gap
- Energy conservation route is in fact a 'low hanging fruit,' the benefit of which is within reach, ready to be enjoyed
- Energy conservation leads to better industrial and agricultural production and productivity liable to boost Indian economy to greater heights
- It's way to create more employment
- Easily implementable through Energy Conservation Act – 2001, passed way back in the parliament
- It is important to reconsider the subsidy element attached to the renewable energy projects to save the substantial cost element, and the economy.



G Hariharan Iyer

*Certified Energy Auditor, Chairman, Indian Association of Energy Management Professionals (IAEMP)
Also, a Lead Auditor for energy management systems*

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Measure To Manage Your AC Load

Energy measurement is the first step towards the energy management. Whether logging of consumption should be done on daily or weekly or monthly basis that depends on the usage of AC...

In the domestic electricity consumption, out of the total (say) 20 units per day consumption, more than 10 units are consumed by the Air Conditioning System (AC). If the same is monitored by just retrofitting a single phase static watt-hour meter costing around ₹ 400, then we can have day to day control on consumption of electricity for the purpose of air conditioning in domestic and commercial segments. That will prevent us from receiving annoying over inflated electricity bill after each month.

Need for monitoring AC systems

Energy measurement is the first step towards the energy management. Whether logging of consumption should be done on daily or weekly or monthly basis that depends on the usage of AC, as well as how an individual responds proactively. While using an AC, we must know the energy consumption for running it daily. Also, we should compare that with the total consumption per day in the domestic or commercial environment.

If more than one AC system is running in the premises, 'relative condition monitoring' of daily kWh of each of them will make the consumer think why the daily kWh difference

is occurring among the AC systems operating in the same premises? The difference in kWh in daily readings will promptly draw attention of the energy conscious consumer to conserve energy.

Earlier, I advocated that each existing AC system should be fitted externally with an hour meter costing ₹ 400/-. But addition of hour meter inside the new generation (already installed) AC systems is cumbersome. But for old window and split AC, this hour meter can be easily added on to the compressor thermostat circuit indoor.

Also, I suggest that AC OEMs can add this hour meter as an integral part of the indoor AC system. This will show an AC machine's total run-hours, and the AC compressor's cut-in/cut-out hours – to indicate the AC user how effectively he uses his AC system in his premises.

When we buy star-rated AC systems for ₹ 20,000 or more, they (AC system manufacturers) must integrate this hour meter in their indoor units. In AC usage, everyone is accountable to local and global warming. As the energy-inefficient AC users contribute to reduce energy consumption and global warming potential, the government should

offer tax reduction on the 5-star-rated AC systems and similar other electrical gadgets.

Because of the fall in price of the kWh meters from ~ ₹ 1000 to ₹ 400, these days it is much more easy for the AC consumer to assess his AC system's health by monitoring its daily consumption for the same given run hours. However, it is always better to assess an AC system's health by knowing the parameters like AC compressor's run-hours, AC machine's run-hours and the total consumption in the run-hours. This will give the clear picture of the AC machine's efficiency.

Reasons behind day-to-day varying power consumptions of the AC machines

Even if the same AC machine runs for nearly the fixed hours each day, its power consumption varies each day due to many factors. Following is a list of some of them:

- AC indoor temperature settings are generally set from 20 to 26°C. But it varies depending on every individual's need
- Clogging in the AC evaporator filter goes unnoticed (it needs to be cleaned once in two weeks)



Word of caution: This kWh meter image does not promote or canvass its brand. Because of the price affordability at ₹ 400/- and availability through e-commerce site, its image is displayed here..

- Condenser coils getting choked over a period of few months to years
- AC outdoor unit can be torched under the sun or we can comfort the same by weather roofing
- The refrigerant leaks minutely over a period when not noticed; AC runs more hours to cool
- The AC compressor run-hours vary due to operating for more hours or more people inside
- The conditioned air when leaking out of premises, forces the AC compressor run fully
- When heat sources like fridge, deep freezer come inside premises, they increase the AC run hours
- Higher ambient outside and solar heat ingress from the roof increase the AC run hours.

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- High insulation and dielectric strength
- LED indication for current reversal tampering and phase availability
- Durable polycarbonate enclosure, which is UV protected, flame retardant.

How is this meter hooked up?

This kWh meter needs to be fixed between the MCB isolator to the AC stabiliser inside the conditioned area. Or, if the user has only one AC, the same can be fixed near the EB mains distribution board from where, the user has run a heavy conductor cable to match the AC load. In offices, IT, ITES work spaces where individual machines are working, this can be fixed near the indoor unit at a readable level from the floor.

Applications of relative monitoring

- Relative condition monitoring of air conditioners (if more than one fixed) inside premises
- When the AC is serviced, the daily kWh reduction before and after the service done
- When ACs are serviced, to give more attention to service to excess power consuming AC system
- Same area cabins and same size AC why still the varying kWh consumption can be studied

- kWh reduction can be noticed instantly on every AC: in-house efficiency improvement
- In case of overcharging, kWh consumption increases first to show impending breakdown
- If the stabiliser malfunctions or due to heavy voltage variations, the kWh varies
- If two AC systems at the same premises are of 3-star and 5-star respectively, the 5-star savings can be confirmed by monitoring.

Govt to mandate the 'monitor to target energy reduction' programme

- The govt has taken the initiatives to the AC system conservation. Through the 'star labelling programme,' it has spread the AC energy consumption awareness. But the govt gave the carrot only till now to the consumer and not the carrot & stick to them. It has promoted 5-Star ratings in AC; and year after year, BEE is changing the AC star ratings now, improving the 5-Star efficiency ratings
- Showcasing the energy conservation is the first thing. But prompting the AC user with kWh meter is more of 'DO IT YOURSELF TO CONFIRM YOUR ACHIEVED SAVINGS.' We have to catalyse the energy efficiency practices by forcing the consumer to practice
- The proof of pudding is in the eating. The govt has showcased the AC efficiency norms. But same govt must mandate each of the AC consumers to verify with this type of affordable kWh

Practical way of daily monitoring

Please find below, the technical details of ₹ 400 rated Static Watt-hour Meter as taken from www.snapdeal.com. The consumer can choose any similar branded meter of this type near this price to suit to his needs.

- 1 phase, 2 wire , Accuracy Class: 1.0
- Conformation with IS:13779, original ISI rated
- Current: 5 to 30 Ampere AC as load current
- Reference voltage: 240 Volts, Reference frequency: 50 Hz
- Display: Electromechanical counter with one decimal



Energy Monitoring

meter to his existing AC. On condition monitoring his AC daily, weekly and monthly, each consumer will start saving electricity in his AC. The same consumer will showcase his savings to his neighbours, friends around him; this attitude will multiply and improve the energy efficient people culture


- So, to cultivate the energy efficient people culture among AC users, the govt has to make it compulsory to fix KWH meter in each and every existing AC system. Then each AC user will monitor his AC consumption to target reduction in his existing AC first. Later he will automatically switch over to 5-star rated AC
- The energy experts in BEE and in the ministry said in 2012, that energy-efficient electrical appliances (majority is AC only) used in household and commercial establishments can save about 20,000 MW (Mega Watt) of power per year, resulting in savings of ₹ 1.2 lakh crore in capital investment on new power plants.

India spent ₹ 23,000 crore in clean energy programmes till 2011. BEE says in 2012, that around 1.15 crore labeled air conditioners have been sold across the country during the past five years

- When the new AC consumer is buying his AC system, he must be mandated to buy this KWH meter along with AC to fix during installation. It is similar to the agriculture segment, the farmer is mandated to buy capacitor along with his new purchase of motor. This gives saving to him and reduction in T & D loss in rural sector
- When the consumer has decided to spend ₹ 20,000 + towards his new AC; over the counter, he can be convinced to buy this static KWH low cost meter for the sake of monitoring
- What will happen to the AC system user after installing this retrofit KWH meter to his AC after a few months /years of run?
 - a. He'll be 1st shocked to find his AC's guzzling power use all these years
 - b. Next, he will find relief in implementing in

his AC, the zero cost energy efficient running practices

- c. Next, he will be delighted to see more savings after implementing low cost ECON measures to his AC
- d. Later, the consumer will be Happy to share and showcase his KWH savings achieved in his AC to others.

All the above govt suggestions will become a reality practically today, if this one step is enforced by the govt to promote consumer's existing and new AC efficiency in domestic and commercial segments. 



Ashok Sethuraman

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Profile



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Failure Analysis Of Energy Meters In Testing Laboratory

Energy meter is the key component of supply system whose reliable functioning is very essential for accurate registering, controlling and monitoring, of power consumption...



In earlier days the function of the energy meters was just to measure the power consumed by the user, but now the meters are smart enough not only to measure the energy consumption – but also to control load and giving signal to the utility to cut or retain the supply by analysing the data recorded by meters. Apart from this, meters have to detect tamper and fraud, TOD billings, load survey of last 30 days or more, maximum demand value and times, power failure events and its recordings, harmonics measurement in the supply system etc.

Energy meter is the key component of supply system whose reliable functioning is very essential for accurate registering, controlling and monitoring, of power consumption. Through energy meters utilities get their revenues for the electrical power they supply to its various consumers. Hence, it is the basic need of all utilities to get the accurate revenue for the electricity generated and supplied to the consumer.

Energy meter testing is an important way to determine their reliability, safety and acceptability, hence testing must be a part of the development process for manufacturing of the energy meter.

To prove the reliability and accountability of energy meters, they have to be tested as per relevant national and international standards in accredited testing laboratories. Apart from the type test, purchasers are also interested to ensure that the meters comply with the entire tender specifications.

CPRI being a testing organisation has carried out testing on various types of energy meters and of different manufacturers. Different Utilities from all over the country send meters for testing as per their tender specification.

The objective of testing is to ensure that the meters are designed to comply as per the relevant standard and the customer's specifications. Apart from this the reliability in respect of electrical and mechanical design of the meters is also verified. In addition to the type tests the Indian meter Industry has to meet large nos. of anti-tamper features as per the purchaser's tender specifications.

Type tests on meters as per relevant Indian standard comprises following tests:

- Tests of insulation property
- Tests of accuracy requirement
- Tests of electrical requirement
- Tests for electromagnetic compatibility
- Tests for climatic influences
- Tests for mechanical requirement...

Failure cases in laboratory

General observations on failure and some of the critical cases are discussed here. The major failure are in insulation properties test.

Failure in the tests of insulation properties

This test is carried out to check basic insulation between the live parts and body of meter to provide protection against electric shock.

General observations during the test in case of failure of the meter:

- Display non functional
- No pulse output
- Accuracy of meter beyond the limit
- Power supply circuit is affected
- Error of meter is -33% in case of three phase meter. This indicates that, one phase circuit is affected.

Some of the reasons for failure are discussed in the following cases.

Case 1

Groove provided for screw to fix meter base and cover does not have sufficient insulation or the insulation at this place is weak – and hence when the base of the meter is placed on the conducting surface during application of 4kV High Voltage it was punctured.



Traces of insulation failure...

Case 2

Meter failed due to wire connected between neutral terminal and name plate. Clearance provided between name plate and the casing of the meter was not enough to withstand 4 kV High voltage.



Wire connected between neutral & name plate...

Case 3

Screw projected out at the back side of the terminal block, which is touching the earth plate during test.



Screw projected out...

Case 4

Sealing wire of meter touching the name plate placed inside the meter. When conducting foil wrapped around the meter during test, the sealing wire came in contact with the conducting foil providing the path for leakage current.



Flash over between name plate and sealing wire...

Case 5

Protective device used to clamp the impulse signal across the input of the meter got punctured when impulse voltage applied. The accuracy of the meter is -33% after the test.

Failure in the tests of accuracy requirement under influence quantities

Purpose of these tests is to verify the performance of the meter under various power line abnormalities.

General observations during the test:



- Meter didn't start at specified starting current
- Meter produced more than one pulse output during no load condition
- Accuracy of meter found beyond the limit
- Variation in % error under influence quantities found beyond the limits.

Case 1

Meter started recording energy corresponding to I_{Max} under the influence of stray magnetic field i.e., 67 mT. However, recording of energy at current I_{Max} is permitted only for abnormal magnetic field. This may be due to lack of interpretation of standard or the non uniformity of magnetic sensors used in meters.

Failure in the test of electrical requirements

Aim of the test is to verify design of the meter for electrical parameters in the field, to verify withstand capacity of the meter under fault condition.

General observation during test:

- The accuracy of meter found beyond the limits
- Variation in % error found beyond the limits
- Over heating due to loose connections...

Case 1

Phantom load getting overloaded when I_{max} applied to the meter due to loose connection of the screw of the current circuit during heating test.



Screw connecting CT inside the meter is loose...

Failure in tests of electromagnetic compatibility

These tests are carried out to check meter immunity for the electromagnetic radiations and its interference.

General observation:

- Meter produced pulses during no load test causing increment in kWh and results in change in information due to electromagnetic HF field.
- Error of meter varies more than 2% during the sweep of frequency. Majority of failures are in the range of 80 to 400 MHz.

Failure can be due to picking up the radiated signal or the conducted signal through cables. Proper filter design can prevent meter from failure due to noise picked up by cables. Shielding and filtering of noise at processors would prevent meter failure from radiated noise.

Failure in test of climatic condition

This test is carried out to determine ability of the meter and its components at extreme non operating condition or during storage.

General observations:

- Accuracy of the meter goes beyond defined class
- Display of the meter not functional.
- Meter records cover open tamper condition (if this feature provide in meter)
- Date and time in the meter get drifted.

Case 1

Meter display not functional and meter did not produced pulse output after the test.

Case 2

% Error of the meter found beyond accuracy class.

Failure in test of mechanical requirement

Purpose of this test is to determine any mechanical weakness or degradation in the specified performance of the meter.

General observation:

- Falling of components inside the meter during test
- Accuracy of the meter found beyond the accuracy class
- Meter did not read actual current/voltage applied
- Backlit of meter found not functional
- Meter logged cover open tamper
- Components like battery or capacitor fallen inside meter.

Case 1

Capacitor of the meter fallen down inside the meter during vibration test.



Capacitor with broken leads fallen during vibration test...

Case 2

Power back-up battery fallen down inside the meter during test.



Battery with broken leads fallen during vibration test...

Case 3

Meter did not measure voltage and current after the test indicating that the voltage or current circuit is disconnected.

Case 4

Meter was reading 2A current in R phase, however, the applied current to the concern phase was 10 A. Hence, the % error of the meter is - 31%.

Failure in tamper tests

Apart from the standard there are many tests, which are required as per the tender specifications of different utilities. Some of these tests and their results are discussed hereafter:

Failure in the test of abnormal frequency/ high frequency of 35 kV spark discharge test:

This is more common test specified by almost all utilities in India. The meter is subjected to very high voltage high frequency spark. Evaluation criteria for this test is different for different utilities like:

- Accuracy of the meter before and after the test shall not be affected
- The accuracy of the meter, real time clock disturb, memory data corruption, meter functioning hang up etc., shall not occur.
- General observations:
 - 1) Meter stops functioning during/after the test
 - 2) kWh reading of the meter changes
 - 3) Date and time of the meter changes during/after the test
 - 4) Meter starts recording energy corresponding to I_{max} current.
 - 5) Meter records cover open tamper or any other change of information.

Meter has to be shielded and earthed properly for compliance of this test.

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Failure in the test of influence of permanent magnetic field:

General observations noticed during test:

- Meter stopped functioning under the influence of 0.5T permanent magnet
- Percentage error of the meter found beyond the limit.

Failure in the test of D.C. injection in neutral circuit through diode:

During the test, the meter should record energy as per voltage measured between incoming phase and neutral terminals when D.C. signal is injected in the neutral terminal of the meter through diode from load side as well as from source side.

General observations noticed during test:

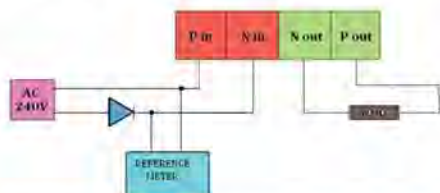
This test was performed on meters of seven manufacturers. Results of four manufacturer were more or less same, but there was huge difference between the results of other three manufacturer:

Percentage errors obtained during test are summarised below:

Test condition 1

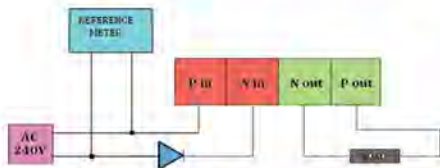
Diode is connected in incoming neutral circuit:

- When reference meter is connected to meter terminal



Manufactures	A,B,C,D	E	F	G
% Error	< 1	134	26	342

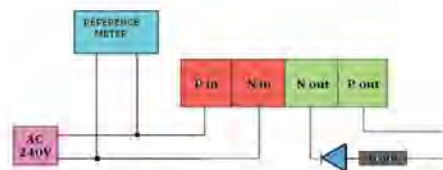
- When reference meter is connected to supply points



Manufactures	A,B,C,D	E	F	G
% Error	-40	36	-27	158

Test condition 2

Diode is connected in outgoing neutral circuit:



Manufactures	A,B,C,D	E	F	G
% Error	< 1	95	-30	0.43

The large variation in meter accuracy is due different interpretation of the tender clause. As the test is nonstandard, the utilities do not specify test requirement properly and therefore the each manufacturer interpret the condition differently. This tamper condition is normally complied by the manufacturers under some assumptions and implementing the logics in software.

Failure during receiving of meters in the laboratory:

There are few discrepancies noticed during receipt of meter (before starting of the test) in the laboratory.

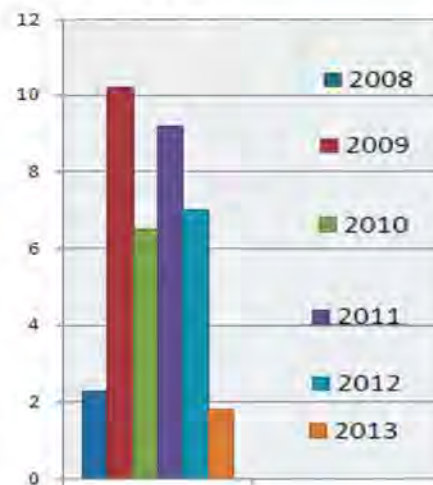
- Current date and time displayed by the meters are not correct
- Meters have already logged cover open tamper
- kWh resolution of the meters are not sufficient to conclude some of the tests of the standard.
- Percentage error of the meters found beyond the accuracy class because of current/ voltage read by the meter is not correct.

Statistical analysis of failure case: failure of energy meters in the laboratory (over the past five years that have been tested) are presented below:

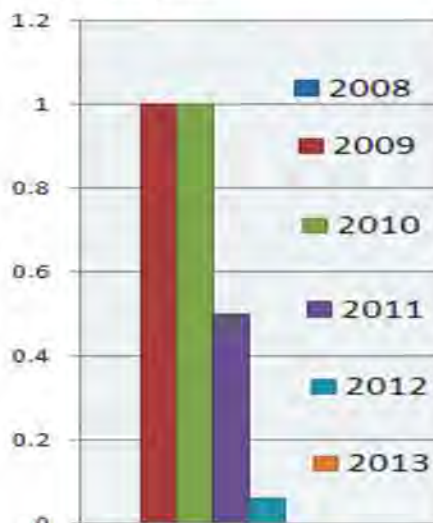
Year	Total Meters Tested	Total Meters Failed
2008	5813	57
2009	4717	55
2010	8042	50
2011	19204	75
2012	22585	52
2013	22813	115

Graphical representation of meter failure in the laboratory during 2008 to 2013 in the Energy Meter Testing Laboratory, CPRI, Bhopal

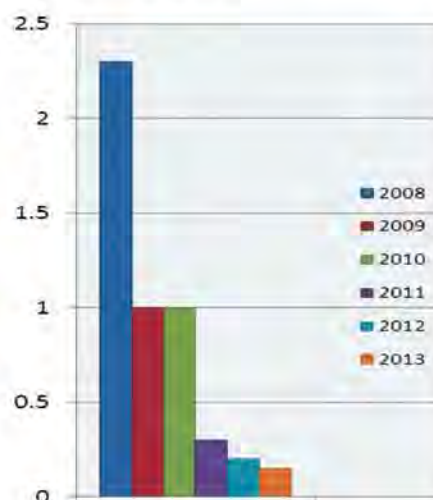
Impulse voltage test



AC high voltage test



Test on limits of error



Electrical Test & Measuring Solutions



Turns Ratio Meter



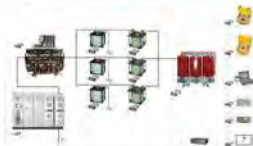
Winding Resistance Meter



Automatic Transformer Observing System



Digital Microhm Meter



Automatic Transformer Test System



Cast Resin Standard PT



Battery Conductance Analyser



M/s Raytech GmbH, Switzerland



M/s EMJAKPOWER, Switzerland



M/s Epro Gallapach GmbH, Austria



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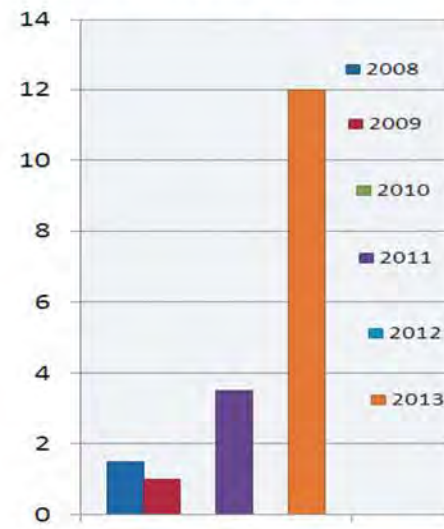
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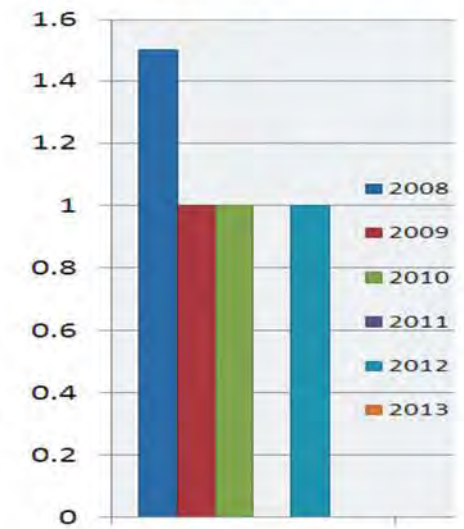
Voltage variation test



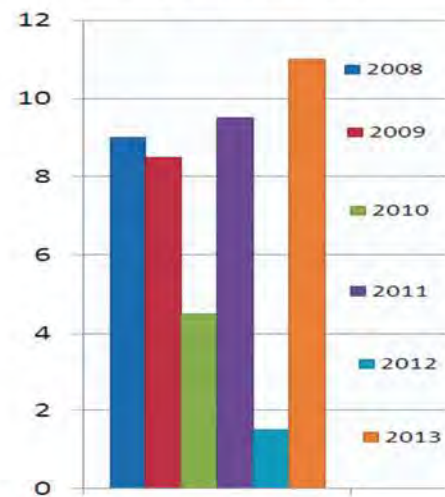
Test of influence of self heating



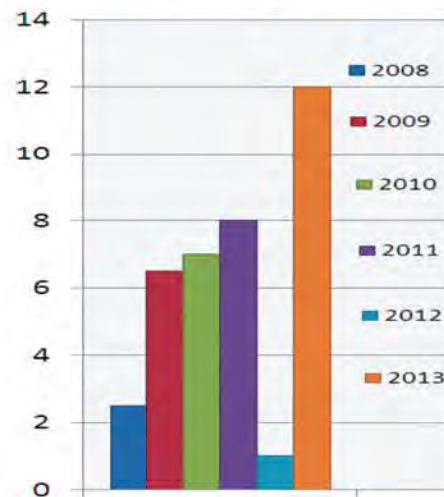
Tamper test-permanent magnet 0.5 T



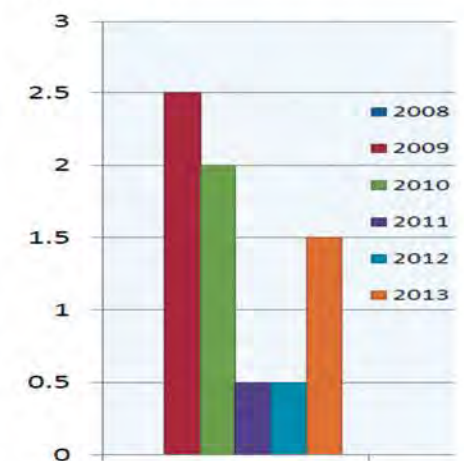
Test of DC magnetic induction 67 mT



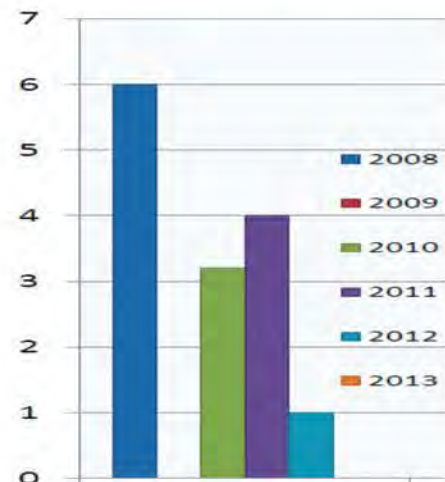
Immunity to electromagnet HF fields



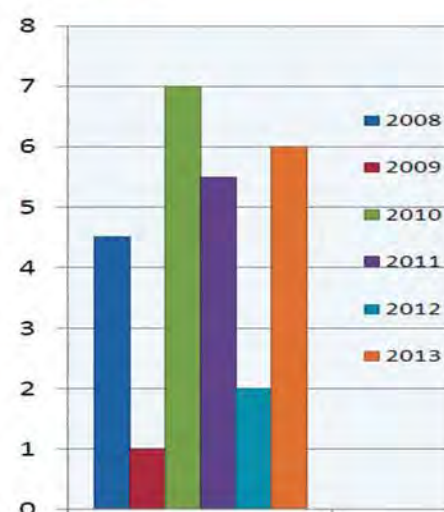
Tamper conditions as per various tender specifications



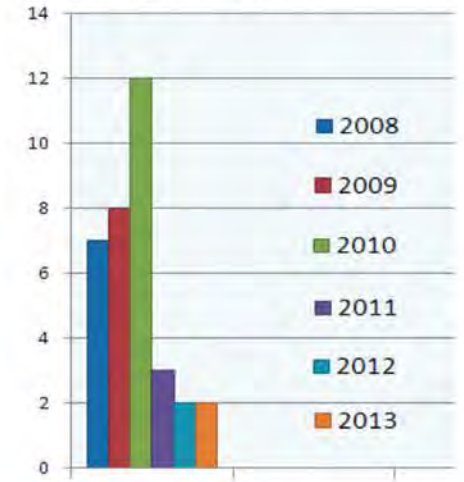
Test of abnormal DC magnetic induction 0.27T



Vibration test



Tamper test- abnormal/high frequency 35 kV spark discharge test





Conclusion

Although testing process is considered as a tedious, time consuming and expensive, still it is important for deciding the reliability of energy meters. General observation and some of the failure cases are discussed here to understand that the minor mistaking during designing and manufacturing processes results in failure of meters. During 'type test,' failure in any one test results in non compliance with the requirement of standard, hence, each and every test is equally important.

Utilities are continuously adding various tests in their tender specifications to make the energy meter more reliable – as revenue collections of utilities depend upon the accurate functioning of the energy meters. Understanding their requirement and adding the logical features in the meters accordingly – along with making the meters compatible with the standard requirements is the most tedious, but important task for the manufacturer.



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Ancillary Services For Power Sector

Ancillary services are value-added services towards supporting and improving reliability, security and quality of power. Owing to increasing competition among power players, deregulation, restructuring of power sector etc., the role of ancillary services has become very critical for smooth operation of power systems...





To improve economic viability and efficiency of power network, restructuring of power sector has been promoted. Unbundling of generation, transmission and distribution services has provided the option to the customers to choose those services that they need and pay for the services that they use. Unbundling has encouraged the competition among suppliers, and many private players have entered into market thereby lowering the costs of these services. All over the past years, the electric utilities were vertically integrated, owning and operating the whole chain of electricity from generation through transmission to distribution and supply. An ancillary service was therefore an integral part of electric supply, and was not dealt separately. Since the deregulation/restructuring of the electricity supply industry, the resources required for reliable operation have been treated as an ancillary service that the system operator has to obtain from other industry participants.

In a deregulated power system, the system operator often has no direct control over individual power stations – and has to purchase these services from other service providers. Ancillary services are support services in power system or grid operation, which facilitate basic function of generation, transmission and distribution of electricity by ensuring reliable delivery of power at stable frequency and voltage alongwith security of grid. Now, ancillary services are an indispensable part of the electricity industry.

Ancillary services

Ancillary services are all those activities on interconnected grid that are necessary to support transmission of power while maintaining reliable operation and ensuring required degree of quality and safety. As per Indian electricity grid code, ancillary services are services necessary to support power system or grid operation in maintaining power quality, reliability and security of the grid. Ancillary services may include scheduling and dispatch, frequency regulation, voltage control, generation reserves etc. General classification of ancillary services is:

- Frequency Controlled Ancillary Services
- Network Controlled Ancillary Services

Frequency controlled ancillary services:

These are used to maintain frequency within the desired range by balancing load and generation in real time. Three levels of control are generally used to achieve frequency controlled ancillary services i) primary frequency control requires response period of 5 to 10 seconds, ii) secondary response requires response period of 10 seconds to 10 minutes and iii) tertiary frequency control requires response period of 10 to 30 minutes.

Network controlled ancillary services:

These are required to maintain network parameters within permissible range. They are further classified as: a) Power flow control ancillary services:- These are used to control the flow on interconnectors within the limits. b) Voltage controlled Ancillary services :- These are used to maintain system voltage within desired range, three levels of control are required for voltage controlled ancillary services – they are primary, secondary and tertiary voltage control. c) System restart ancillary services :- These help in restarting system post blackout situations. These are required to backup capacity of system and capacity required to return to normal operation after major or partial blackout. So, system restart ancillary services are the services reserved for contingency situations – in which there has been a whole or partial system blackout and the electrical system must be restarted.

Classification of Ancillary services can also be based on common approach of how and when frequently these services are required by the system operator.

- Services required for routine operation
- Services required to prevent an outage from becoming catastrophe
- Services to restore system after blackout.

Needs for ancillary services

Consider Fig. 1 in which all generators, loads and interchanges are connected to the same bus. Frequency remains constant when generation is balanced by load, but in practice there are fluctuations in load, inaccurate control of generation, sudden outages of interconnectors and generators. Imbalance between load and generation cause frequency variation. Generators operate within narrow range of frequencies, protection system comes into action when frequency is too low or high, and the system operator must maintain frequency within limits. Local imbalance in an interconnected system causes change in tie line flows. Inadvertent flow overloads tie lines, protection system acting can cause imbalance. Frequency deviations have to be corrected quickly so that system can withstand further problems and weakening of system. Balancing services are needed to handle imbalances occurring at different time. Regulation service provided by generating units should handle rapid fluctuations in load, unintended variations in generation, should maintain frequency close to normal, interchange at desired values. Thus, ancillary services are either related to generation load balancing issues or network related issues.

Functions of ancillary services

As per Electric Power Research Institute (EPRI) functions of ancillary services can be broadly given as i) Regulation :- Use of generation or load power to maintain minute to minute generation load balance within control area. ii) Load following :- This service refers to load generation balance towards end of scheduling period. iii) Operating reserve :- It's provision of unloaded generation capacity that is synchronised to the grid and can immediately

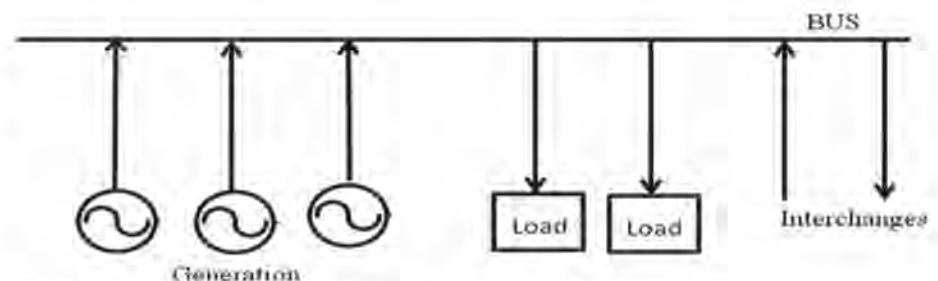


Fig. 1: Load generation interaction in power system network...



Technologies used in provision of ancillary services	
Network controlled ancillary services	Generators, Capacitors, Inductors, Synchronous condensers, FACTS controllers, Distributed energy resources
Frequency controlled ancillary services	Governors, Automatic generation and control, Rapid loading unit, Rapid deloading unit, Demand side management
System restart ancillary services	Generators, Distributed energy resources

respond to correct for generation load imbalances, caused by generation and /or transmission outages that is fully available for few minutes. iv) Reactive power and voltage control support:- Injection or absorption of reactive power from generators or capacitors to maintain system voltage within required ranges. v) System black start capability:- Ability of generation unit to proceed from shutdown condition to operating condition without assistance from the grid – and then to energise the grid to help the other unit start after blackout occurs. vi) Network stability services from generation sources:- Use of special equipments example dynamic braking resistances to maintain secure transmission.

Ancillary services for India

The following factors are driving forces for development and need for ancillary services in Indian power sector. i) Multiple buyers and sellers for power in power market, ii) Power market is under restructuring process, iii) Lack of adequate reserves, iv) Loose power pools, v) Absence of tight frequency control, vi) Lack of adequate primary, secondary and tertiary response, vi) Frequent unplanned load shedding and vii) Consistent shortages during peak hours.

Issues with growth of ancillary services

i) Stranded generation capacity :- The various reasons for stranded generation capacity are inadequate evacuation infrastructure, changing loading methodology from natural to surge impedance, inability of distributed companies to buy expensive power, absence of funding to purchase capacities in need. All possible generation capacities should be mainstreamed in order to reduce power cuts in country. ii) Variation in availability of renewable power into the grid :- The three key impacts of RES on ancillary services are: first variability and uncertainty increases ancillary services requirement, affecting scheduling

and pricing, secondly impacts vary depending on system condition, thus it's more difficult to predict and thirdly allowing renewable to participate in markets can offer more liquidity and challenges. iii) Peaking power requirements:- consistent shortages during peak hours due to supply demand gap. iv) Network issues related with contingency, destabilisation can be caused due to thermal overload, transient instability, and voltage instability. iv) Identification and providing effective solution:- Determining which ancillary services are needed, to what extent ancillary services are required to maintain system reliability, whether suppliers services can be metered and billed cost effectively. Who will pay for ancillary services and to whom? What will be the provisions for payment?

Obtaining ancillary services

Two approaches can be followed to obtain or procure these ancillary services: i) Compulsory provision and ii) Market for ancillary services. The choice is influenced by type of service, nature of power system, history of power system.

- **Compulsory provision:-** This ensures minimum deviation, system security and quality of power supply. Service provider has to meet some obligations.
- **Market for ancillary services:-** They are long-term contracts, spot market and combination of both spot and long-term contracts. Long-term contract: For services where quantity needed does not change and availability depends on equipment characteristics, for example: black start capability, inter trip scheme, frequency regulation. Spot market: Needs change over the course of day, price changes because of interaction with energy market, for example: reserves. Market-based ancillary services are economically more efficient than

compulsory provision, so buys only amount of service needed, only participants that find it profitable provide services, opens up opportunities for innovative solutions.

Beneficiaries due to ancillary services

Promotion and growth of ancillary services provide opportunities for generating units towards helping consumers meet higher demand and obtaining monetary incentives, utilisation of fragmented stranded capacity thus harnessing undischarged generation and optimisation, helping hand towards higher renewable power penetration thus complementing intermittency, can meet the peak power requirements leading towards better and stable system.

Steps for overcoming the issues faced in providing ancillary services

Regulation on market design and procurement mechanism, policy framework for provision of ancillary services, regulation on tariffs for power procurement aspects, price pooling and affordability, distribution generation sources are important resources for various kinds of ancillary services, free governor mode operation can be mechanism to provide frequency controlled ancillary service and promoting energy storage solutions.

Conclusion

This article highlighted the issues and importance of provision of ancillary services for power sector. Due to diverse nature and requirements of Indian power sector, ancillary services are required to enhance the reliability and quality of power system network.



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Performance Evaluation

In previous publications, authors have reported about the performance of the single-phase inverter topology based on controlled charging of the capacitor. The dynamic performance was not available. This article presents the dynamic performance of the inverter for various types of load, which includes leading, lagging and unity power factor, and analysis for 'total harmonic distortion' has been included...

Sinusoidal Pulse Width Modulation (SPWM) is used to digitize the output power, such that a sequence of voltage pulses can be generated by the toggling of power semiconductor switches. The sinusoidal modulated pulse widths enable the control of inverter output voltage and simultaneously reduce its harmonic content. A unipolar SPWM voltage modulation offers the advantage of doubling the switching frequency of the inverter that makes the output filter very smaller, cheaper and easier to implement. Conventionally, a triangle wave as a carrier signal is compared with the sinusoidal wave, and the SPWM gate signals are generated.



These gate signals are then distributed to power switches in a full bridge arrangement. The output voltage of the inverter is only a square waveform due to the switching, and the sine wave voltage is obtained via an LC filter that also reduces the harmonic content.

The control strategy can be digitized with the help of microcontroller for simpler hardware development, higher reliability and smaller filter size. Hence the operation with lower harmonic distortion can be achieved. Further the microcontroller based control strategy allows the flexibility of changing the control algorithms without any changes in the hardware setup. The block diagram of the entire system is shown in Fig. 1.

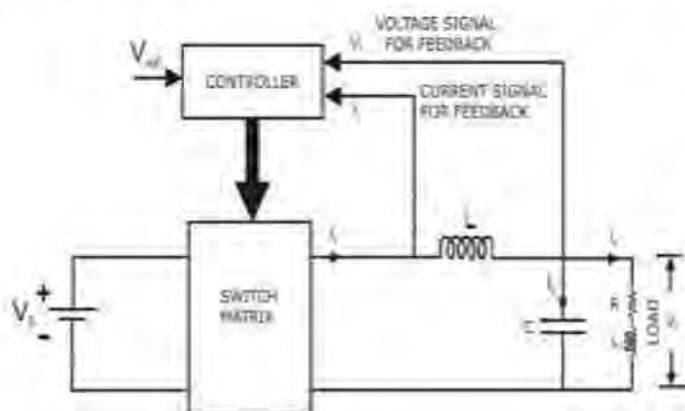


Fig. 1: Circuit diagram of the entire system...

Single phase inverter topology

The single phase switch matrix topology (Fig. 2) has four power switching devices. The input DC supply voltage is given to the power switches of the switch matrix and the gate pulses (SPWM) are also given correspondingly to them via controller. The output of the inverter, which is normally a square pulse is then given to the LC component to make it sinusoidal for the required application as sine inverter. The inductor current and the capacitor voltage are the feedbacks to the controller and V_{ref} is the reference voltage given by the user to the controller to reach the desired sinusoidal output voltage. Fig. 2 represents the single phase inverter topology.

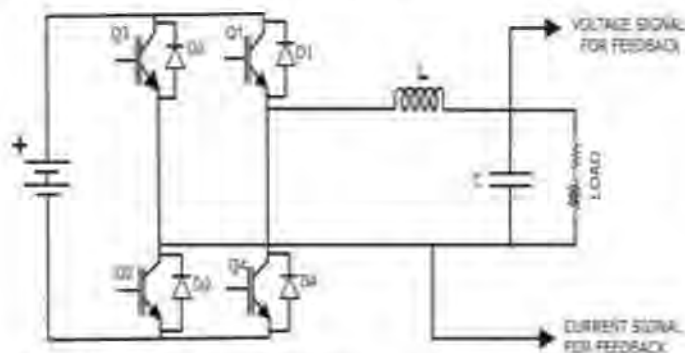


Fig. 2: Single phase inverter topology...

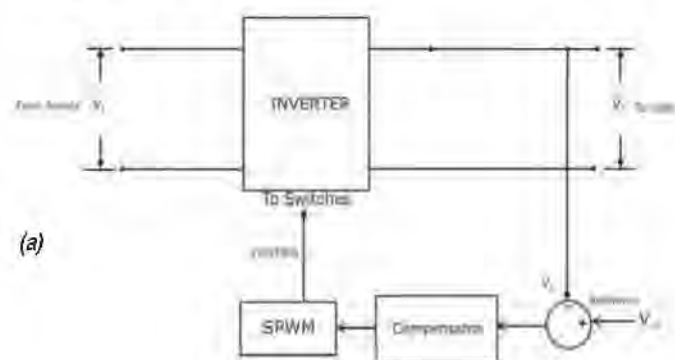
The capacitor-charging power supplies are investigated in the literature. They were used for pulse-power applications, where a

capacitor of sufficiently high magnitude is charged for a longer duration and the energy is discharged quickly to a load whenever required. Such a mechanism is not suitable for realising a sinusoidal power supply.

In previous publications, authors have reported about the performance of the single-phase inverter topology based on controlled charging of the capacitor. The dynamic performance was not available. This article presents the dynamic performance of the inverter for various types of load, which includes leading, lagging and unity power factor, and analysis for 'total harmonic distortion' has been included. The work is organised into five sections. The following section III presents the controller. Simulation results are discussed in Section IV and Section V concludes this article.

Controller

The controller forms the tracking mechanism to closely follow the output voltage and current waveform and compare this feedback ($V&I$) with the V_{ref} . This comparator gives i_{ref} to be compared with i_L to get the corresponding gate signals to synthesize the sinusoidal output voltage. Therefore, for successful operation of the controller, a reference sinusoidal wave V_{ref} at power frequency (i.e., 50 or 60 Hz) is required. By using this signal as reference, the controller forms the PWM signals. Appropriate modulated gate pulse width signals are given to the Inverter switches so as to achieve better dynamic performance – and to reduce the size of the inductor. The controller continuously monitors the inductor current and capacitor voltage through feedback network. Fig. 3 shows a schematic representation of the controllers. The Voltage-mode control shown in Fig. 3 (a) senses the output voltage V_o and compares it with a reference V_{ref} which can be practically synthesized from an exclusive standalone microcontroller. The result, suitably compensated to avoid instability, forms the control signal input to the PWM modulator. A slightly more advanced type, known as average current-mode control shown in Fig. 3 (b), uses a pair of nested loops. The inner loop derives an error signal from the difference of the inductor current – and the output of the outer loop, in which the error signal is derived as for voltage-mode control. Current-mode control carries a number of advantages over voltage-mode control – where selection of component values to optimise loop speed is concerned, and it is primarily with this form of control that this investigation is concerned.



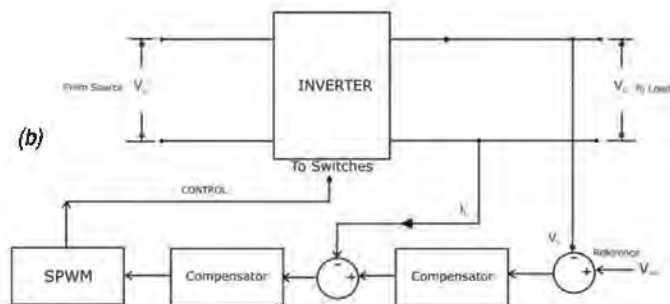


Fig. 3: Controllers for the Inverter:

(a) Voltage-mode control... (b) Current-mode control...

A block diagram of the average current-mode control is shown in the Fig. 4, where V_c is the feedback voltage signal across the capacitor and I_L the feedback current signal. A block diagram of the complete embedded controller is shown in the Fig. 5 in which the voltage signal and the current signal are given as feedback to the controller – and it makes the PWM modulator to control the switches Q1, Q2, Q3 and Q4 correspondingly such that the output voltage is always maintained close to the desired reference input signal.

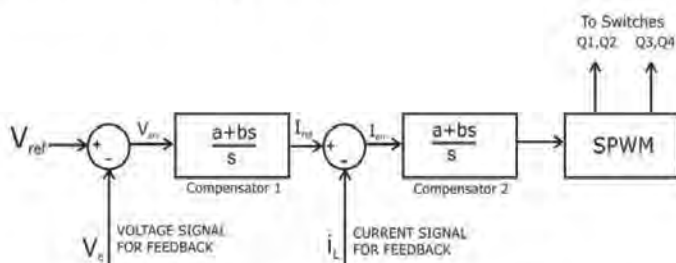


Fig. 4: Block diagram of the average current-mode control...

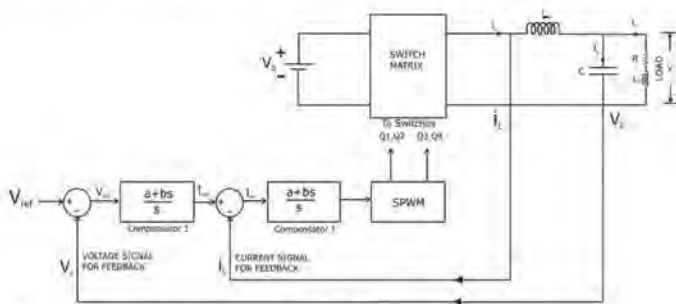


Fig. 5: Complete Embedded Controller...

Simulation results

In this section, the computer simulation of the inverter has been carried out to evaluate their performances using a MATLAB-Simulink software package for single phase. From Fig. 6 to Fig. 9 shows the simulation circuits and results for single phase inverter and SPWM circuits without controller as open-loop and with controller as closed-loop circuit. Here the PWM is implemented as unipolar voltage switching; the switches in the two legs of the inverter are not switched simultaneously. Unipolar voltage switching has the advantage of doubling the switching frequency as far as the output harmonics are

concerned, compared to the other switching schemes. Fig. 7 shows the Simulink model of SPWM circuit and Fig. 8 shows the gate pulse achieved by SPWM as unipolar voltage switching. The complete single phase inverter with closed loop control strategy is shown as Simulink model in the Fig. 9.

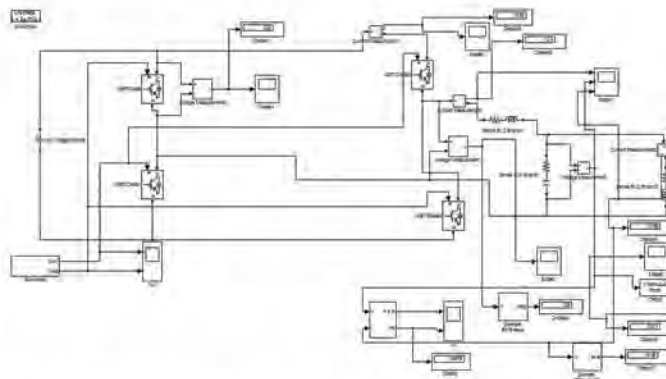


Fig. 6: Simulink model of single-phase inverter without controller (open loop)...

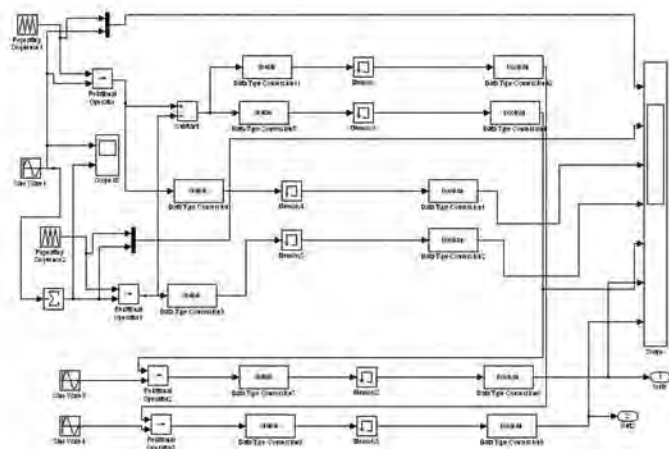


Fig. 7: Simulink model of SPWM circuit...

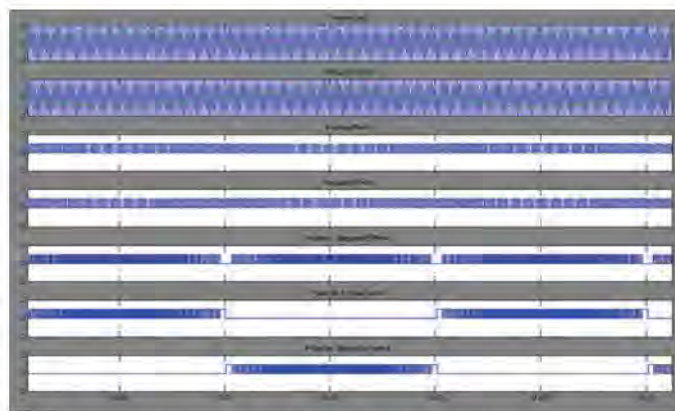


Fig. 8: Simulink result of gate pulse achieved by SPWM...

The following Fig. 10 to Fig. 17 shows the simulation results obtained from single-phase inverter both without and with controller

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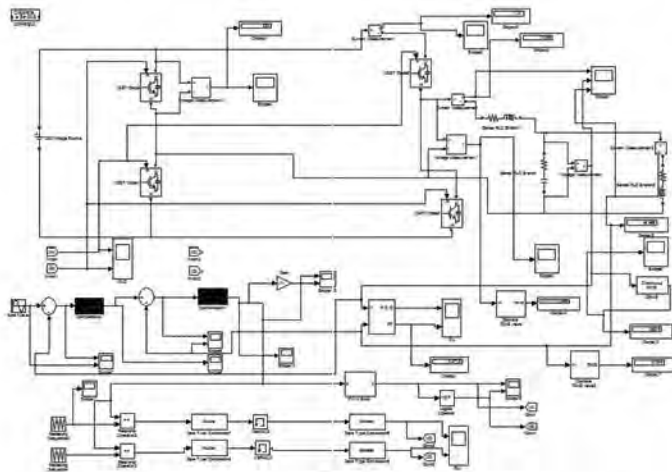


Fig. 9: Simulink model of single-phase inverter with controller (closed loop)...

(open and closed loop operation) explaining that the output voltage gets maintained close to the reference in closed loop control, and drastically varying with change of loads in open loop control and the analysis is done for various resistive and resistive-inductive loads.

Further results in the Fig. 18 to Fig. 25 are concerned with the various THD values obtained explaining that the THD value is reduced with the controller showing the improved performance of the proposed inverter. This explanation is further summarised in the Table 1 to Table 4 giving the overall improved performance of the proposed inverter with controller in terms of voltage obtained and also with various improved THD values.

It can be observed from the Simulink results in the Fig. 10 and 11 that for resistive load of $R=30\Omega$ and $R=40\Omega$ in the open loop performance, the output voltage is varied from $296V_{rms}$ to $366V_{rms}$ for respective variation of load. The same in the Fig. 12 and 13 shows the

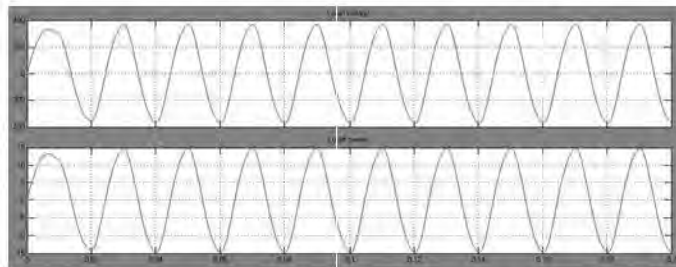


Fig. 10: Output voltage and output current for resistive load ($R = 30\Omega$) (Open loop)...

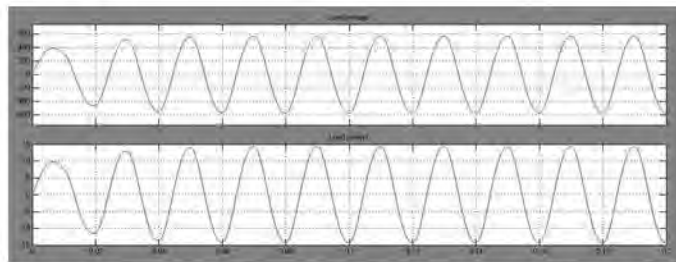


Fig. 11: Output voltage and output current for resistive load ($R = 40\Omega$) (Open loop)...

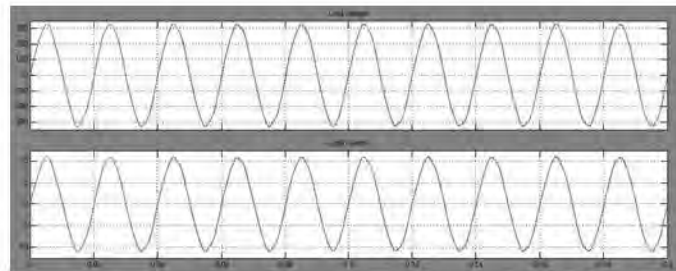


Fig. 12: Output voltage and output current for resistive load ($R = 30\Omega$) (Closed loop)...

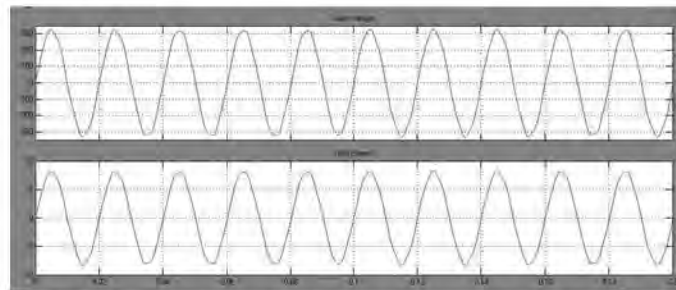


Fig. 13: Output voltage and output current for resistive load ($R = 40\Omega$) (Closed loop)...

performance of the closed loop control of the inverter that the output voltage is maintained close to the reference as $230.5V_{rms}$ for the variation of resistive load $R=30\Omega$ and $R=40\Omega$.

The open loop and closed loop comparative performance can also be seen from the Simulink results projected in the Fig. 14 and 15, that for resistive-inductive load of $R=25\Omega$, $L=20mH$ and $R=30\Omega$, $L=30mH$, the output voltage (open loop) gets varied from $245.7V_{rms}$ to $286V_{rms}$ respectively. But in the closed loop performance (Fig. 16, 17) the output voltage is maintained as close as $230V_{rms}$.

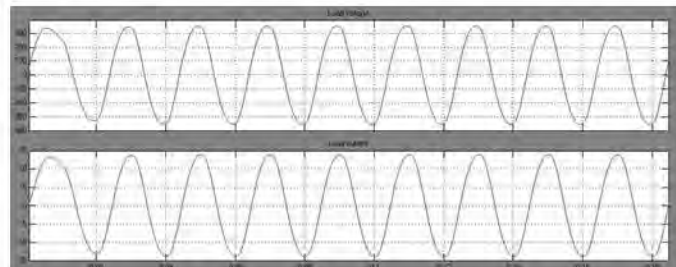


Fig. 14: Output voltage and output current for resistive-inductive load ($R = 25\Omega$, $L = 20mH$) (Open loop)...

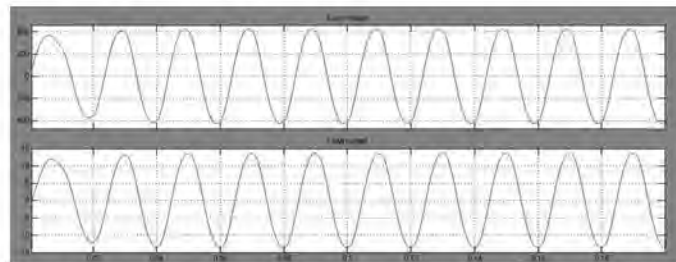


Fig. 15: Output voltage and output current for resistive-inductive load ($R = 30\Omega$, $L = 30mH$) (Open loop)...

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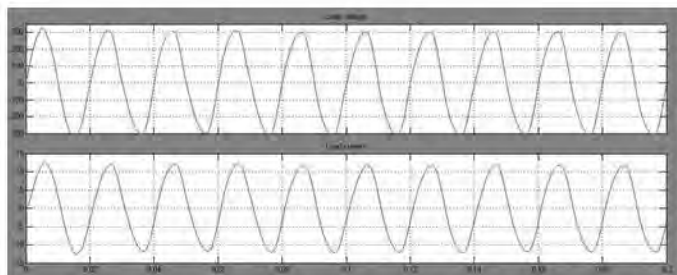


Fig. 16: Output voltage and output current for resistive-inductive load ($R = 25 \Omega$, $L = 20 \text{ mH}$) (Closed loop)...

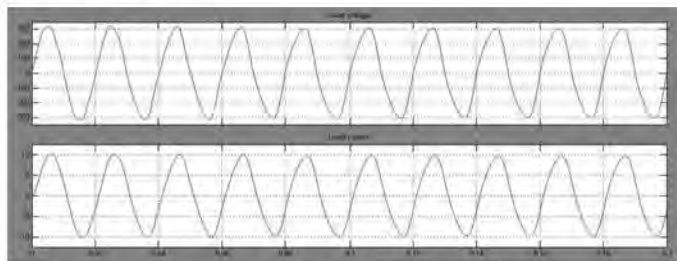


Fig. 17: Output voltage and output current for resistive-inductive load ($R = 30 \Omega$, $L = 30 \text{ mH}$) (Closed loop)...

The analysis for THD is done for both the open loop and closed loop circuits. For open loop performance of resistive load $R = 30 \Omega$ and $R = 40 \Omega$, the THD value in % is 2.72 and 3.50 respectively and is shown in the Fig. 18, 19.

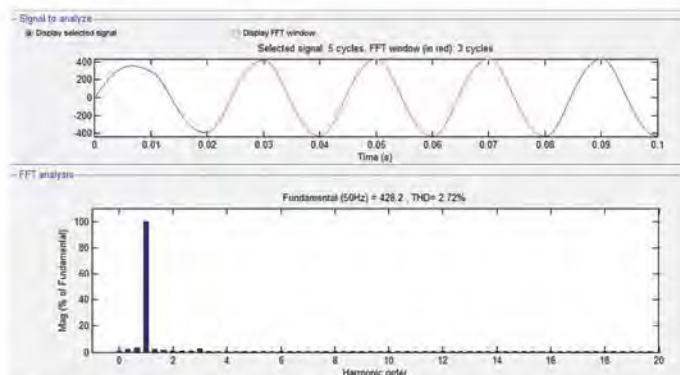


Fig. 18: THD value in % for resistive load ($R = 30 \Omega$) (Open loop)...

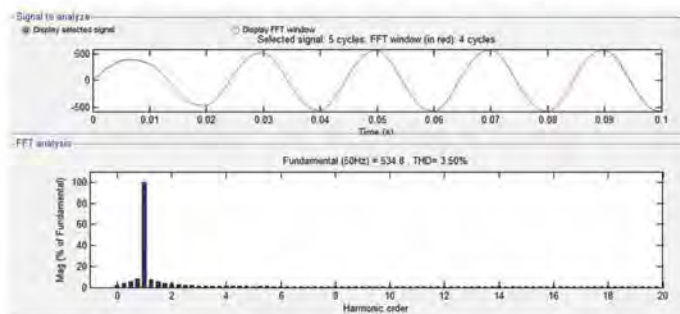


Fig. 19: THD value in % for resistive load ($R = 40 \Omega$) (Open loop)...

The analysis for the same load of $R = 30 \Omega$ and $R = 40 \Omega$ in closed loop circuit, the THD value in % is 1.62 and 2.55 respectively, which is low

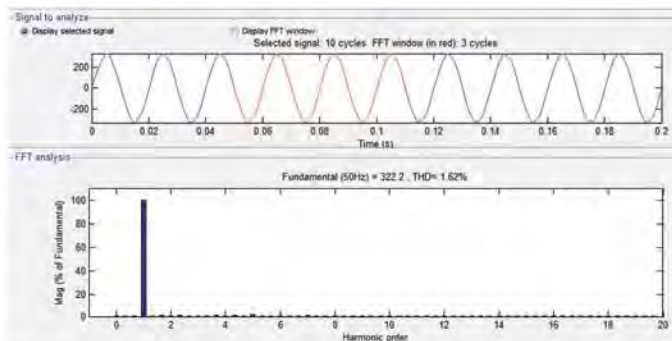


Fig. 20: THD value in % for resistive load ($R = 30 \Omega$) (Closed loop)...

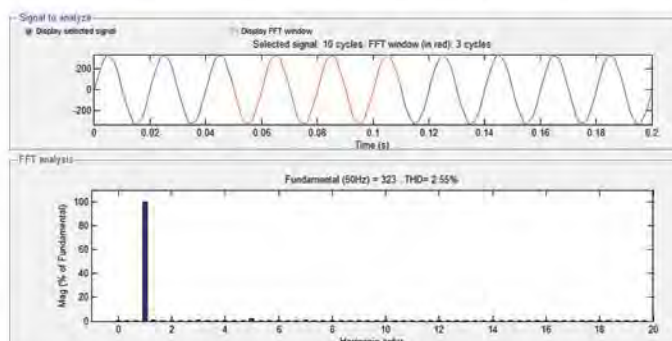


Fig. 21: THD value in % for resistive load ($R = 40 \Omega$) (Closed loop)...

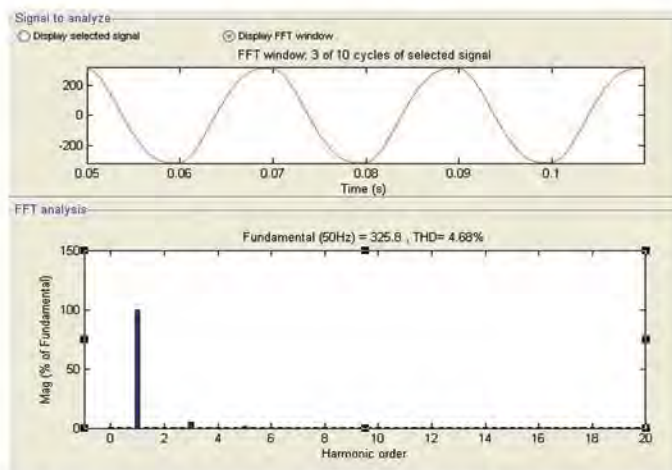


Fig. 22: THD value in % for resistive-inductive load ($R = 25 \Omega$, $L = 20 \text{ mH}$) (Open loop)...

compared to the open loop performance and is shown in the Fig. 20 and 21.

For resistive-inductive load of $R = 25 \Omega$, $L = 20 \text{ mH}$, the value of THD in % for open loop performance is 4.68 and for $R = 30 \Omega$, $L = 30 \text{ mH}$, the value of THD in % is 3.33. This is shown in the Fig. 22, 23. The THD analysis for the same load in closed loop performance is shown in the Fig. 24 and 25 and the value in % is 4.67 and 2.27 respectively.

The open loop and closed loop performance of the single phase sinusoidal inverter with pulse width modulated control strategy is



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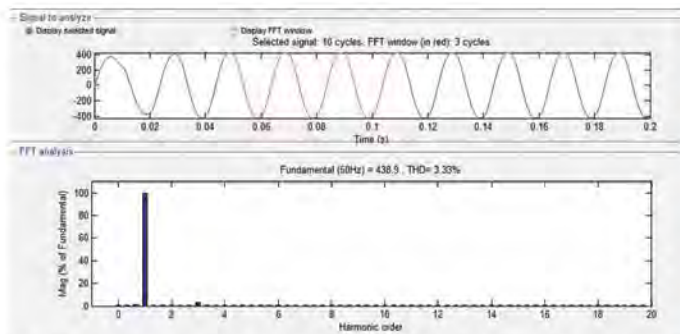


Fig. 23: THD value in % for resistive-inductive load ($R = 30 \Omega$, $L = 30 \text{ mH}$) (Open loop)...

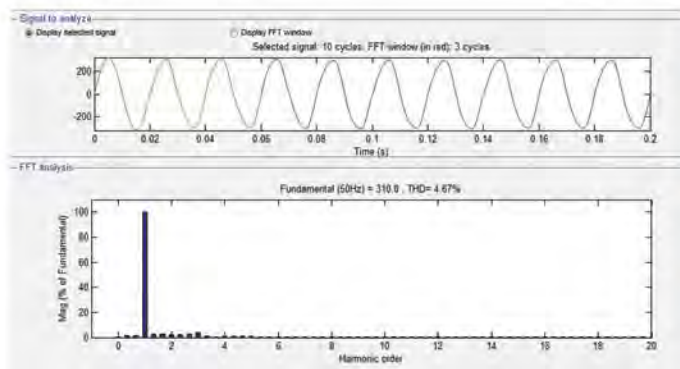


Fig. 24: THD value in % for resistive-inductive load ($R = 25 \Omega$, $L = 20 \text{ mH}$) (Closed loop)...

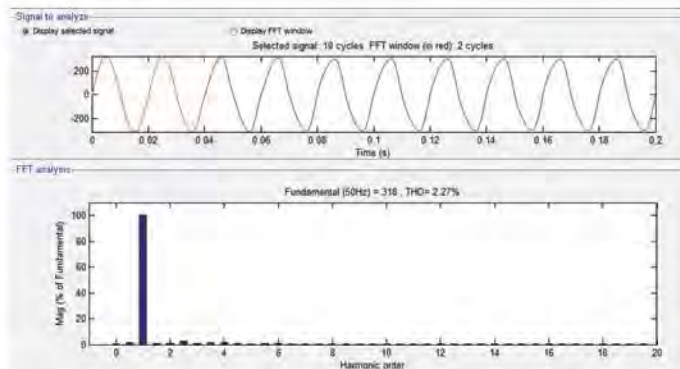


Fig. 25: THD value in % for resistive-inductive load ($R = 30 \Omega$, $L = 30 \text{ mH}$) (Closed loop)...

shown in tabulation from Table 1 to 4, explaining the improved performance of the inverter with simplified control strategy.

Conclusion

This article has evaluated the performance of the single phase sine inverter topology for its generation of desired sinusoidal waveform at its output and with lower harmonic distortions. The inverter is simulated in MATLAB-Simulink. The implementation of a single phase full bridge inverter with SPWM switching signal from a microcontroller minimises hardware requirement, with many functions performed through software. Implementation of SPWM control setup with microcontroller also

RLOAD (Ω)	VOLTAGE (V_{RMS})	CURRENT (A_{RMS})	THD (%)
25	257	10.2	3.45
30	296	9.8	2.72
35	333	9.5	2.44
40	366	9.12	3.50

Table 1: Open-Loop Performance For Various R- Loads...

RLOAD (Ω)	VOLTAGE (V_{RMS})	CURRENT (A_{RMS})	THD (%)
25	229	9.19	3.24
30	230.5	7.68	1.62
35	229.8	6.5	1.53
40	230.5	5.76	2.55

Table 2: Closed-Loop Performance For Various R- Loads...

RL LOAD	VOLTAGE (V_{RMS})	CURRENT (A_{RMS})	THD (%)
25 Ω 20mH	245.7	9.40	4.68
25 Ω 30mH	248	8.6	4.02
30 Ω 20mH	282.8	9.19	3.08
30 Ω 30mH	286	7.07	3.33

Table 3: Open-Loop Performance For Various RL- Loads...

RL LOAD	VOLTAGE (V_{RMS})	CURRENT (A_{RMS})	THD (%)
25 Ω 20mH	230.5	8.83	4.67
25 Ω 30mH	228.3	8.13	3.07
30 Ω 20mH	229.8	7.21	2.29
30 Ω 30mH	229.8	6.56	2.27

Table 4: Closed-Loop Performance For Various RL- Loads...

enables flexibility in changing the algorithms without changing the hardware setup. The unregulated DC at the input side of the inverter can be obtained from the solar panel for the efficient operation as green technology with the implementation of MPPT algorithm along with Buck-Boost converter setup and the desired sine wave can be obtained from the proposed inverter with lower THD.



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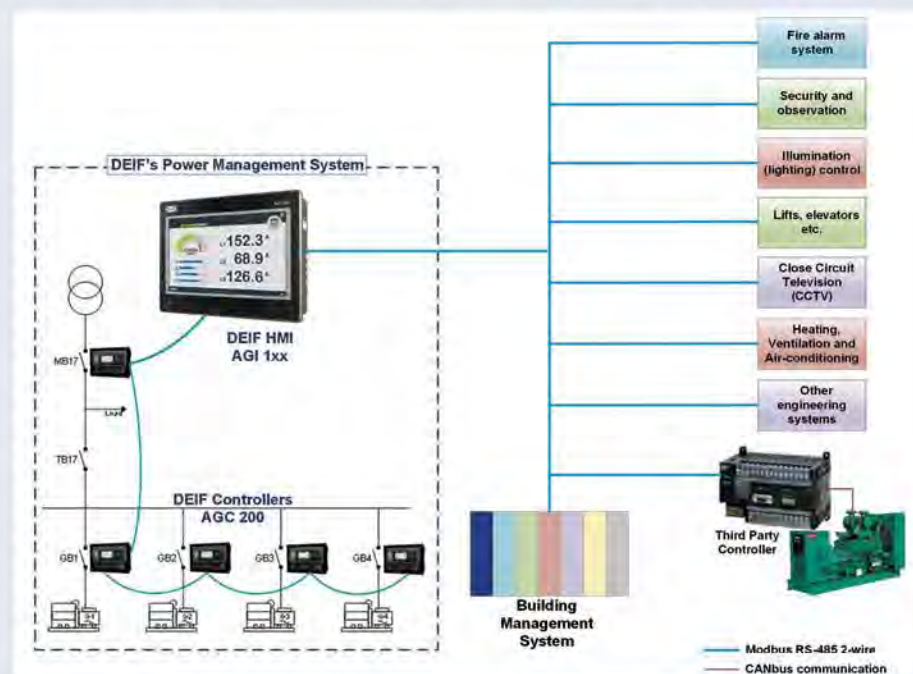
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Preparing Vessels For Dielectric Fluid Testing

This article examines the need for careful preparation of the vessels used in the testing of transformer dielectric fluids to ensure that reliable results are achieved. It discusses the factors that most commonly lead to unexpectedly low values for dielectric breakdown, and it gives practical information about techniques that will help in eliminating moisture and other forms of contamination...

When unexpected results are obtained while testing the dielectric breakdown voltage of transformer dielectric fluids, the cause can often be traced to inadequate preparation of the test vessel. In particular, it is likely that insufficient attention has been given to one or more of the following key elements of vessel preparation, viz.

- Storage and subsequent cleaning
- Setting the electrode gap
- Ensuring that the vessel is thoroughly rinsed and then immediately filled with the sample to be tested
- Protection of the sample against contact with air, and prevention of moisture contamination
- Selection of the optimum stirring option for the sample and for the test standard in use.

Neglect of any of these elements has the potential to cause an unexpected drop in the measured breakdown voltage. It is essential therefore, to ensure that all of these factors have been carefully considered and correctly implemented. To help users of dielectric fluid test sets to achieve this, each of the factors will now be examined in more details.



Fig. 1: A typical modern test vessel assembly fabricated from shatter resistant materials...

Vessel storage and cleaning

IEC 60156 recommends that a separate test vessel assembly (Figure 1) be used for each type of dielectric fluid that is to be tested. This standard requires that test vessels are filled with dry dielectric fluid of the appropriate type, then covered and stored in a dry place. ASTM proposes the alternative option of storing the vessels empty in a dust-free cabinet. Immediately prior to testing, vessels that have been stored full of fluid must be drained and all internal surfaces (including electrodes) rinsed with fluid taken from the sample to be tested.

The vessel must then be drained again, and carefully filled with the test sample, taking particular care to avoid the formation of bubbles. Vessels that have been stored empty, and those that are to be used for testing a different type of fluid from that which they were filled with during storage must be cleaned with an appropriate type of solvent before they are rinsed and filled.

ASTM D1816 specifies the use of a dry hydrocarbon solvent, such as kerosene (paraffin) that meets the requirements of D235. Solvents with a low boiling point should not be used as these evaporate rapidly, cooling the vessel and increasing the risk of condensation. Solvents commonly used include acetone and, in the USA, toluene. The use of toluene is, however, banned in Europe. Only lint-free clean-room wipes should be used for cleaning the vessel. Paper towels are not an acceptable substitute as they may introduce particles that hold moisture, causing the breakdown voltage of the fluid to be dramatically reduced. Touching the electrodes or the inside of the vessel should be avoided during cleaning, and the electrodes should be

checked for pitting or scratches that may result in the measured breakdown voltage being reduced. It is important to keep in mind that these cleaning guidelines apply to all parts that will come into contact with the fluid sample during testing.

Setting the electrode gap

Setting the electrode gap accurately is very important. Results are only valid if the gap is set correctly. A common problem is movement of the electrodes after the gap has been set and for this reason, many users of dielectric fluid test sets check the electrode gap frequently – in some cases before each test. While effective, this procedure can be inconvenient and time consuming. A better approach is to use a test set where the



Fig. 2: Using a gap gauge to set the electrode spacing...



electrodes can be locked in place after setting. For setting the electrodes, the use of flat, smooth gap gauge is recommended (Figure 2).

The best gauges have a black anodized coating that not only provides a very smooth surface but also shows when the gauge is worn, as the base metal of the gauge starts to become visible through the coating.

Rinsing and filling the testvessel

Before filling the test vessel, it is essential to rinse it with clean fluid or with fluid taken from the sample to be tested. Rinsing should always be carried out before each test, even when repetitive testing is being carried out in a laboratory. When rinsing the vessel, attention must be given not only to the vessel itself, but also to the impeller, magnetic bead, baffle plate, lid and electrodes. Rinsing should be applied to all surfaces that will come into contact with the fluid sample during testing. After the test vessel and associated components have been rinsed, it is absolutely essential for the vessel to be filled immediately with the fluid sample that is to be tested. In fact, ASTM D1816 specifies that the test vessel must be filled with the sample within 30 seconds of rinsing. This is because any significant delay (even a few minutes) can result in the film of fluid on the vessel walls absorbing water from the air. Since the vessel walls have a comparatively large surface area, this is likely to contaminate the fluid sample and reduce its breakdown voltage. In this context, it is worth noting that just 30 parts per million of water in the fluid will halve its breakdown voltage.

When filling the test vessel, the fluid sample should be poured into the vessel swiftly while taking care to minimise turbulence, as this will entrap air. After filling, the vessel should be allowed to stand for a few minutes before testing to give time for any air bubbles to clear. It is however, important not to extend the standing time unduly as, if this is done, the sample may absorb water from the air in the headspace above it, which once again will reduce the breakdown voltage. As soon as a visual inspection shows that the bubbles have

cleared, the baffle or lid should be fitted to prevent further contact between the sample and the air.

Protection of the sample against undue contact with the air

When using an impeller-type stirrer that employs a baffle plate to protect the fluid sample against contact with the air, it is essential to ensure that the sample does not pass over the upper surface of the baffle plate. It is, however, also important that the fluid sample is in full contact with the underside of the baffle plate (Figure 3). As specified in the test standards, this will prevent moisture being absorbed from contact between the circulating fluid and the air.

60156 is recommended whenever possible, as it will circulate the fluid in the lower part of the test vessel, whereas an impeller will circulate all of the fluid in the vessel. The magnetic bead therefore has the advantage that any moisture absorbed by contact between the surface of the fluid and the air is not stirred into the sample, which reduces the risk of contamination. If an impeller must be used, it is vital that air is prevented from coming into contact with the surface of the fluid by fitting the baffle plate correctly and ensuring that the fluid level is



Fig. 3: Correct fitting of the baffle plate is essential...

sufficient to make contact with the bottom of the plate without flowing over the top surface.

When testing to ASTM D1816

ASTM D1816 specifies that the fluid must be stirred throughout the test, using a two-bladed motor-driven impeller. The standard prescribes the impeller dimensions and pitch as well as its operating speed, which must be between 200 and 300 revolutions per minute. In meeting these requirements, it is essential to take precautions against the sample coming into contact with the air, as described in the section above that deals with testing to IEC 60156.

When testing to ASTM D877

ASTM D877 does not specify stirring of the fluid sample.

Impeller options

Many of the impellers supplied with dielectric fluid breakdown test sets adopt a compromise design that is intended to allow testing with both the IEC and ASTM test standards. A better option, however, is to use separate impellers for each test standard, as the design of the impellers can then be fully optimised to suit each standard (Figure 4). Special impellers are also available for use with heavily contaminated dielectric fluids (Figure 5). These have larger blades to help ensure the effective circulation of particulates between the electrodes during the test so that their full effect on breakdown voltage can be assessed. When these special impellers are used, it is important to bear in mind that vigorous stirring can exacerbate the incorporation of moisture captured on the surface film of fluid left behind after rinsing at the vessel preparation stage.



Fig. 4: The impeller on the left is optimised for ASTM D1816; the central impeller is designed for us with heavily contaminated fluids, whilst the impeller on the right is optimised for IEC 60156...



This makes the need for rapid filling even more critical if accurate breakdown results are to be obtained.

Small vessels


Breakdown voltage testing of the dielectric fluids used in transformers is usually carried out with test vessels of 400 ml capacity. However, some users of this type of testing now find that, in certain applications, it is advantageous to work with smaller test vessels, typically of 150 ml capacity. This is a particular benefit, for example, with tap changers that only use a small volume of dielectric fluid, which means that only small samples are available for testing. When these small vessels are used, the sample



Fig. 5: Full set of electrodes including the magnetic stirrer bead and gap gauges...

is not stirred during testing. This corresponds to the operating conditions for applications where small fluid volumes are used, as these do not involve fluid circulation.

Conclusion

Breakdown voltage testing of the dielectric fluids used in transformers quickly provides an invaluable first-line indication of the condition of the fluid. However, cleanliness and good preparation are essential if accurate and reliable test results are to be obtained. 



Paul Swinerd
Product Manager, Megger UK

Profile

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Physical Progress (Achievements)			
Ministry of New & Renewable Energy			
Programme/ Scheme wise Physical Progress in 2014-15 (During the month of March, 2015)			
Sector	FY- 2014-15		Cumulative Achievements
	Target	Achievement	(as on 31.03.2015)
I. GRID-INTERACTIVE POWER (CAPACITIES IN MW)			
Wind Power	2000.00	2312.00	23444.00
Small Hydro Power	250.00	251.61	4055.36
Biomass Power & Gasification	100.00	45.00	1410.20
Bagasse Cogeneration	300.00	360.00	3008.35
Waste to Power	20.00	8.50	115.08
Solar Power	1100.00	1112.07	3743.97
Total	3770.00	4089.18	35776.96
II. OFF-GRID/ CAPTIVE POWER (CAPACITIES IN MW_{EQ})			
Waste to Energy	10.00	21.78	154.47
Biomass (non-bagasse) Cogeneration	80.00	60.05	591.87
Biomass Gasifiers			
- Rural	0.80	0.61	17.95
- Industrial	8.00	6.15	152.05
Aero-Generators/Hybrid systems	0.50	0.27	2.53
SPV Systems	60.00	60.00*	234.35
Water mills/micro hydel	4.00	4.00	17.21
Bio-gas based energy system	0.00	0.30	4.07
Total	163.30	93.16	1174.50
III. OTHER RENEWABLE ENERGY SYSTEMS			
Family Biogas Plants (numbers in lakh)	1.10	0.65	48.18
Solar Water Heating – Coll. Areas (million m ²)	0.50	0.72	8.82
* Progress from some states is awaited.			
Tentative State-wise break-up of Renewable Power target to be achieved by the year 2022 (Posted on 30.03.2015)			Source: MNRE

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Green house effects on environment...

Energy plays a vital role in one's life. A country's prosperity is attributed to the standard of living of its people and the quantum of energy consumed. Often, per capita energy consumption is taken as a yard stick to measure the progress of a country. Although, energy is available in various forms, there is growing demand for clean, cheap and reliable energy, which is mainly attributed to the electrical energy because of its versatility.

Therefore, it is the bounden duty of every nation to ensure availability of energy to its people as well as for its development. The energy sources are broadly classified as conventional energy sources and non-conventional energy sources. Electrical energy mainly produced by using conventional energy sources such as coal, oil, natural gas, hydro power etc. However, because of the increasing demand for electrical power, the fossil fuel deposits are getting depleted at an alarming rate and eventually one has to look for other sources of energy for producing electricity. The

ever increasing demand for energy and the highly fluctuating fast depleting oil prices, have compelled the governments of the developing nations to resort for austerity measures – such as demand side management and supply side management for sustaining continuity in energy production. Soaring oil prices has a toll on the environment. It is imperative to find and develop alternative energy sources with appropriate technologies for meeting the demand.

Even though electricity is pollution free its generation is associated with negative environmental effects. Thermal power plants are major contributors for the pollution. Particulate matters are emitted into the atmosphere by these plants. The coal combustions also results in emission of volumes of carbon dioxide CO_2 and significant quantity of SO_x and NO_x , resulting in green house effect. The moisture present in the atmosphere reacts chemically with the NO_x and SO_x – culminating in bringing acid rains, which can damage crops and trees.

The increasing amount of CO_2 has already caused global warming – and its after effects are being felt by way of rise in global temperature, change in weather patterns and increase in sea levels. Figure 1 shows the CO_2 emission caused due to production of electricity from different sources. It is observed that for generating 1kWh of electrical energy, the CO_2 emissions in different types of fuels vary as given below:

- Fossil fuel: 443 to 1050 grams
- Nuclear : 66 grams
- Renewable: 9.5 to 38 grams

It is found that nuclear power plants are 7 to 38 times better than fossil fuels, whereas renewable energy plants are 2 to 7 times as more efficient than nuclear power plants as far as carbon foot prints are concerned. Scientists relate extreme weather events – such as typhoons, cyclones flash floods, forest fires and draughts to green house gas emissions.

The inter governmental panel in its draft agreement for climate change at PERUVIAN

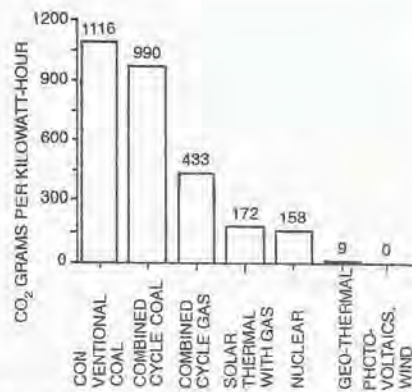
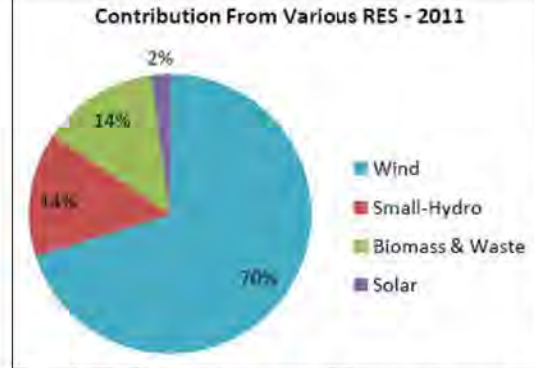


Fig. 1: CO₂ produced by different sources...

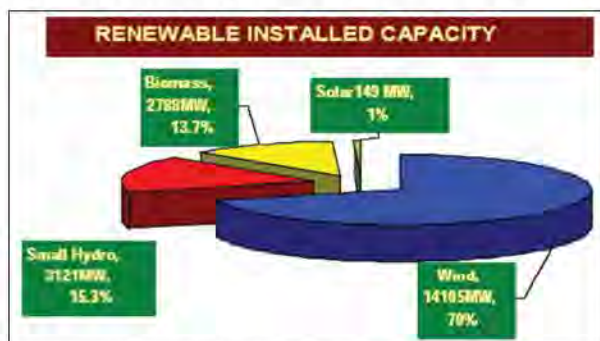


Contribution from various renewable energy sources...
(Source: Ministry of Power, Government of India)

China has also agreed to cap its CO₂ emission level by 2030.

Under the present circumstances it is extremely difficult to achieve the reduction in global temperature by 2°C for which complete stoppage of CO₂ emission for electricity production is required. Developing countries like India are endowed with rich renewable energy sources – such as solar, wind, biomass, geothermal etc.

By now, it is clear that with the limitations and constraints for building conventional power stations based on



Renewables installed capacity in India...

capital Lima titled "LIMA CALL FOR CLIMATE ACTION", has warned that 2014 is the hottest year on record. The global temperature has already risen by 0.8°C since the beginning of the industrial revolution. According to U.N. reports, global temperature is expected to rise by 4.8°C by the year 2100, which is sufficient to melt the ice bergs and increase in sea levels. The U.N. scientists in their report have also warned of the 'irreversible global damage' if the fossil fuel usage is continued at its present rate.

In case of developing countries, the rapid industrialisation policy of the governments to better the standard of living in urban and rural areas – has resulted in highly increased demand for power. The high rates of carbon emission and to work within the constraints of the climate change agreed within the U.N. framework for climate change – coupled with fluctuating oil prices and the quest for making the country one among the developed nations

have put developing nations under tremendous pressure.

There is a wide difference of opinion in the perception for reducing the green house gas emission between the developed and the developing nations. The developing nations want to improve their economy and eradicate poverty, for which electrical power is to be supplied at an

affordable cost at a faster pace. This is possible only through the technology adopted by using fossil fuel, which are cheap as compared to harvesting power from renewable energy sources.

The developing nations insist that developed nations must provide much needed resources, which is priced at \$100 billion dollars per year for technology transfer to curtail CO₂ emission. The developed countries on the other hand insist that all nations world over should equally contribute to reduce carbon emission, and every country have to specify their specific CO₂ reduction targets. Developing countries like India, Brazil could not agree to cap their CO₂ emission level target on the plea that they have not met the growth target. It is worthwhile to recall the U.N. summit 2010 on climate change where the participating countries had agreed to curtail global temp levels by 2°C above pre industrialisation level.

However, for the first time US has agreed

fossil fuels is quite expensive. Therefore, it is inevitable to effectively adopt appropriate renewable energy technologies – for bridging the gap between the supply and demand. Renewable energy mainly comes from the sun and manifest itself into various other forms such as wind, biomass, bio fuel, oceanic energy etc. The electricity produced by renewable energy may not be a substitute for conventional power, because of lack the appropriate technologies for effectively harnessing the energy. But, it can be made cheaper and quite competitive by the govt policies and support.

Renewable energy is the most economical and suitable for distributed generation integration to the grid and rural electrification, coupled with many advantages over conventional electric power. To have reliable secure power solutions, hybrid systems with renewable energy are preferred. It is inevitable that the developing nations world over have to look for tapping of the abundantly freely available renewable energy for sustainable growth and that is the only way for survival.

The U.N. scientists have warned of the 'irreversible global damage,' if the fossil fuel usage is continued at its present rate...

to cap their CO₂ emission by 26 to 28% of 2005 level by the year 2025, and



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GRIDTECH 2015, the international exhibition and conference successfully exposed the power engineers and T&D decision makers to new concepts and technologies...

Indian economy is at a transition point now. Whether it is in manufacturing setups, commercial premises or residential buildings, everywhere we need uninterrupted quality power supply at affordable price. Thus, it is time to shed off old technologies and embrace ultra-modern ones to ensure best control, highest reliability and seamless monitoring. All these can be ensured through wider awareness of the best global practices, better interactions with the technology providers and experiencing hands-on demonstrations by the experts.

With a view to fulfilling all these hourly needs, Power Grid Corporation of India Ltd. (POWERGRID), a Navratna PSU and the leading T&D player of the country, with the support of the (Indian) Power Ministry, organised the 5th international Exhibition and Conference GRIDTECH at Pragati Maidan, New Delhi from April 8 to 10.



Entrance to the venue of GRIDTECH 2015...

The exhibition brought together various international and national manufacturers, planners, policymakers, investors, consultants, research institutions etc. In fact, it turned into the largest integrated platform in the country where superior technologies and creative expertise in the transmission and distribution domain were displayed.

The event consisting of the three-day-long exhibition simultaneously with the two-day-long conference was inaugurated by Piyush

trenchant insights on relevant topics like integration of renewable energy sources, role of smart grids and energy efficiency measures.

In his inaugural speech, the power minister Goyal said, "The prime minister's vision for 24/7 quality power for all depends on the transmission and distribution sector to reach the bottom of the pyramid. With the new technologies we are bringing in, we will now create an ambitious grid programme that will meet the country's demand."

In the words of Devendra Chaudhury, Special Secretary, Ministry of Power, "The entire power sector is gearing up to meet the government's vision of power for all. We need to create an access platform that will help us provide electricity to the entire population."

While delivering his speech in the event, R N Nayak, Chairman & Managing Director, Power Grid Corporation of India, said, "The government's ambitious plan to provide 24x7



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Visitors are gathering information from the Electrical India magazine at our stall in the GRIDTECH 2015 venue...



Goyal, Minister of State with Independent Charge for Power, Coal and New and Renewable Energy. Both the days saw various panel discussions with leading industry experts exchanging views and sharing

power to all in the country by 2019 will require the deployment of latest technologies in the field of transmission, distribution, intelligent devices, information and communication technology. Against this background, Gridtech 2015 is the foremost platform where all leading stakeholders reiterate their commitment to bring about a transformative change in the sector thereby ensuring quality as well as affordability of power for all citizens."

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3 in 1 Prepaid Meter (Dual Source)

Recovering electricity dues remain one of the major challenges in the power sector. Most distributors face serious problems in recovering electricity bills especially from govt departments / apartment blocks / commercial complexes etc.

ElMeasure has developed a unique 3 in 1 Contactless Prepaid Energy Meter. It has parameters like water, gas etc.

It can be integrated, and its consumption can be monitored along with electrical parameters. The design is fully microcontroller-based. Thus, it gives an effective and reliable solution to the service providers.

The service provider needs to just install the meter, and further activities involve the consumer. It is sufficient for the service provider



to have just one manpower to recharge the card as per the consumer's request. The consumer will have to display the card in the front fascia of the meter for 3 secs. The advanced microcontroller electronics

inside the meter stores the no. of units recharged and measures the consumption. As the purchased units are used up, the meter disconnects the power supply until the next recharge.

Main features: Compact wall mounting design; Dual source measurement (EB & DG); 3 in 1 meter with option to integrate process parameters; Pre-paid metering using contactless smart cards; Accuracy Class 1.0; Cost effective 'pay as you use' 3-phase metering.

Application: Shopping malls / multiplexes;

Residential townships / apartments; Commercial buildings; Employee quarters.

Advantages: Upfront payment for electricity, and hence low overheads for service providers.

Advanced RF card technology; Tamper proof construction; Cost of manpower for billing / collection is substantially reduced; This avoids the hassles of human intervention as there is no need to enter the data into the meter. This makes the system more user friendly; Displays balance energy in the meter, thus enabling the consumer to plan when to recharge; No billing disputes; Allows consumer to budget electricity expenses; Helps consumer to contribute towards energy conservation; Available in single phase and three phase system. 

For further details contact:
marketing@elmeasure.com

Schröder Launches Zela, A Perfect Ambience Product



This modern luminaire Zela with its LED technology has a distinct flat and conical diffuser. This compactness is coupled with a careful design that harmoniously integrates both functionality and finish. The fins on the base

section add a certain elegance by continuing the flow of the pole. Zela emits a pleasant, low glare light, making it perfect for architectural spaces. It provides comfort with performance and efficiency. Zela, with its attractive features, provides a cost-effective indirect lighting solution for visual comfort while maintaining performance.

Its body is made of powder coated die-cast aluminium, and its canopy is of plastamid. Its flat conical protector is made of polycarbonate.

Features

- Low glare due to indirect lighting
- Designer : Michel Tortel
- Installation height (m): 3 to 6

- Colour temperature: Neutral White
- Optical compartment tightness level : IP 66
- Control gear tightness level : IP 66
- Weight (kg) : 4.9
- Symmetrical light distribution for general area lighting or asymmetrical light distribution for lighting of roads and streets
- It offers up to 87% savings on energy and maintenance
- Delivered pre-wired to ease installation
- Integrated surge protection 10 kV (optional)


Types of application

- Residential streets
- Squares and pedestrian areas
- Parks
- Car parks
- Bike paths

Concept

- **Thermix for long lasting performance**
– The thermal management of LEDs is crucial for a luminaire's reliability – and several parameters are optimised to maximise effectiveness and maintain flux over time



- Thermal compartmentalisation between the LEDs and the control gear
- Direct conduction by minimising the path between the heat source and the outside
- Optimised design of the external heat exchange surface
- **Future-proof with smart upgradability**
– Since LED technology is constantly evolving, both the photometric engine and the gears can be replaced at the end of the LEDs' lifespan to take advantage of future technological developments. 

Website:
www.schreder.com

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Testo's Energy Kit

To move towards a sustainable future and lower the increasingly expensive energy costs, energy audits have gained great importance in almost every industry. An energy audit in simple words is an inspection, survey and analysis of energy flows. It is used for energy conservation in a building, process or system to reduce the amount of energy input into the system without negatively affecting the output. The PAT Scheme (Perform Achieve Trade Scheme) introduced by Bureau of Energy Efficiency (BEE), under the Ministry of Power, industries have been notified about their energy efficiency targets. PAT scheme aims to reduce energy consumption in industries across India. This is mainly applicable for sectors such as iron and steel, cement, fertilizers, aluminium, textiles, thermal plants and paper which are energy intensive sectors. To implement this scheme, every industry has to appoint an energy audit cell to keep a track on its progress towards energy efficiency targets.

Need for energy kit

There are independent energy auditors or dedicated energy audit cell in companies, who are responsible for these energy audits. These

auditors and audit cells usually use few typical instruments for this purpose. However, selecting these instruments suited for most of the audits as well as giving them the best results, is a task in itself.


Testo has introduced the NEW Energy Kit with the entire testing and measuring instruments to equip the audit cell for this task.

What all instruments does the energy kit comprise of ?

Testo has put together the following instruments in one single attractive case to offer ease of carrying energy audits to the independent energy auditors and to the energy audit cells as well. Enlisted below are the instruments that would be available in this NEW Energy Kit:

- Flue Gas Analyzer Testo 310 for combustion efficiency optimisation by monitoring the O₂ and CO levels and calculating the CO₂ percentage excess air level and efficiency
- Thermal Imager Testo 870 for detecting even the smallest temperature differences to identify anomalies in time by creating a heat profile of components & assemblies



- Pocket sized lux meter Testo 540 for measurement of illumination level
- Sound level meter Testo 816-1 with integrated data storage for measurement of noise level
- Pocket-sized RPM meter Testo 460 for measurement of speed of rotation equipment
- InfraRed temperature measuring instrument Testo 830 for measuring temperature
- Digital clamp meter for measurement of current without interrupting the connection
- Digital multimeter and insulation tester for measuring voltage, current and resistance. 

Website:

<http://www.testo.in/energy-kit/>

Motwane IT250G SPOT – 5kV Digital Insulation And Continuity Tester

The Motwane had been offering absolute range of testing products and solutions designed in-house for serving multiple segment of Electrical Power and Energy sector. Being pioneer in insulation testing, they provide wide range of testing products from SPOT Insulation Resistance testing to advanced fully diagnostic digital insulation resistance tester with test voltage of 50V to 10kV and up to 15 TΩ.

Are you still using Hand Crank, Cumbersome, and analog insulation resistance testers?

Switch to Digital. It's time for testing with your most compact SPOT Insulation Resistance tester. The IT250G SPOT.

The company claims that this nifty offering from their trusted range of insulation. The IT250G SPOT is a 5kV voltage selectable digital insulation tester measures digitally




and also in analog. It is a battery operated most compact device made to give stable and reliable performance in energy intensive area. 'Auto power off' enhances battery life – and pleasant amber backlit allows the user to work in dusk environment also. The maximum resistance range of the product is up to

250G, which is primarily suitable for Distribution Transformers, Instrument Transformers, Motors, Cables, Pumps etc.

Auto discharge facility, Internal data storage to Guard Terminal for eliminating surface leakages; the IT250G is loaded with features that make easy onsite testing for testing service providers. The programmable timer allows PI and DAR measurement manually.

It is ideally suited during routine maintenance, testing, installation and commissioning in industrial switchyard, electrical substations and preventative maintenance.

Get hands-on to the new addition in Motwane's 5kV insulation family. 

For further details contact:

sales@motwane.com

Venture Lighting Introduces Ultra Energy Efficient Electromagnetic Ballasts



This ballast family is Venture's premium range with 95% efficacy

similar to any highly efficient electronic ballast. It is Venture's most sustainable product line offering longer life to achieve high quality of light and low power consumption. HSD252224HE for operating 250W HPSV/MH lamps (considering a 15-hrs of operation/day) provides an energy saving of 110 KWH in a year when compared to commercially available magnetic ballast of the same wattage. Due to low energy consumption, it gives a faster return on investment. Similarly, HSD402224HE, which is meant for operating 400 W white lux MH lamps, can save 135 KWH.

Our Product Range Includes:

- 1 Distribution Transformers
- 2 Servo Voltage Stabilizers
- 3 Ultra Isolation Transformers
- 4 Induction Furnace Transformers
- 5 Special Purpose Transformers
- 6 Distribution Transformer with OLTC
- 7 Dry Type Transformer (VPI)

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Website: www.gtbtransformers.com

Features

Energy efficiency 95%; Low power consumption; Fast return on investment; High reliability; Cost effective; Working ambient temp. up to 65°C; Vacuum pressure impregnated;

Precision wound; Optimised lamp performance; Longer life; Usable on the existing fixture.

For further details contact:

marketing@vlinidia.com



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More Flexibility With Large Number Of Poles

The Han Ex product portfolio is offering new standard inserts and housings in the proven HARTING sizes – providing users with greater flexibility. Han Ex is deployed chiefly in the mining, chemistry and process automation industries.

The connectors are designed to conform with the preconditions for the ignition protection intrinsic safety category, and may also therefore be applied in the explosion endangered zones 1 and 2. In intrinsically safe electrical circuits the power is limited so that even if a spark occurs it cannot ignite potentially explosive



Connector Han Ex

selected to enable applications in methane-coal dust atmospheres. In addition, they comply with the IP protection class 65 in the plugged state. The blue colouring of the

surroundings. The product portfolio offers new standard inserts and housings in the proven HARTING sizes of 6 to 24B.

The housing alloy has been selected to enable applications in methane-coal dust atmospheres. In addition, they comply with the IP protection class 65 in the plugged state. The blue colouring of the

housing serves as a marking for intrinsically safe electrical circuits. The Han Ex contact inserts also offer a large number of poles in the most compact space. Up to 64 contacts are possible in combination with a 24B housing. The crimp, screw and cage clamp connection technologies are all available. The housings offer cable outlets of M20 to M40, while a robust and reliable metal bracket serves as locking system.

For further details contact:
abhishek.bimal@HARTING.com

UNO POWER By Phoenix Contact – High Efficiency With Compact Size “BASIC FI+UNCTIONALLITY COMPACT”



Phoenix Contact's existing product range only offered limited competitiveness. UNO POWER now opens up new applications in the lower power range of up to 240 W.

A power supply unit is now available on the market for the first time which offers basic functionality in a particularly compact design with highly-efficient operations. Moreover, it impresses customers with its outstanding quality standards.

The new UNO POWER product range offers the ideal solution for power supplies of up to 240 W power, particularly in compact control boxes, with its high power density in narrow housing. The product's high efficiency saves energy and ensures cool – and therefore durable control cabinet components.

UNO POWER power supplies, which now includes 17 modules. They are available in five widths and nine power ratings: 25, 30, 40, 55, 60, 90, 100, 150 and 240 W. UNO POWER is characterized by a compact design, high power density and energy efficiency.

Phoenix can place their UNO in the following application areas:-

- Machine builders
- Renewable source of energy
- Urban infrastructure
- Process industry
- Power generation

The positioning of UNO POWER in the power supply unit product range is communicated clearly and comprehensibly to ensure optimum power supply unit selection for the application in question, in a swift and simple manner.

For further details contact:
adverts@phoenixcontact.co.in

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