Vol 56 No 7 July 2016 ₹ 100

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Publisher's Letter

Modernisation Of Power Plant Automation

Contribution of automation technology in increasing efficiency of power plants is not a new thing to us; however, with advancement in the field of automation, today the latest (automation) solutions have much more to contribute to the smooth and efficient handling of the power plants. Every technology has its own life, which is very much true in the case of power plant automation. Keeping this under consideration, globally, many utilities are going for revamping their power plant automation systems, either by completely replacing the old system or by acquiring partial 'value-added' solutions.

For example, recently, Valmet received an order from Kotkan Energia Oy to modernise the turbine automation and to supply a new turbine controller to the Hovinsaari biomass-fired power plant in Kotka, Finland. The new automation will be started up in September 2016 to improve turbine reliability and availability. While highlighting the benefits from the modernisation, Antti Roponen, Control and Instrumentation Specialist at Kotkan Energia says, "Valmet was able to offer us a modern turbine controller complemented by a condition monitoring solution as a turnkey delivery. Both of them can be integrated within our existing Valmet DNA automation system." In the future, the plant's turbine will be controlled through the main automation system instead of separate automation systems and link applications, which will improve process transparency.

Such modernisation projects in the power plant automation not only help in achieving better integration of the plant, but also ease the job of the operators, making them happy and improving overall productivity. The same thought is echoed when Tom Bäckman, Turbine Control Product Manager, Valmet, says, "The new automation will make the operators' work simpler and easier because it includes features such as start-up sequences. Automation maintenance will be easier since the same engineering tools will be used in the automation system and the turbine controller."

There are other examples too. Whether to go for partial revamp or an overall replacement that depends on several factors like: the plant's existing machinery, overall remaining estimated life of the plant, severity of the need for system mapping and so on. However in general, any such modernisation improves plant productivity and obviously that enhances profitability of the utility.

Do send in your comments at miyer@charypublications.in

> "Modernisation projects in the power plant automation not only help in achieving better integration of the plant, but also ease the job of the operators..."

Mahadevan

Editor-In-Chief

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

Single Issue: ` 100 / Annual Subscription: ` 1000

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

Vol 56. Issue No. 7 • July 2016

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ARTICLES

A new computer processor for robotic motion-planning developed at Duke University can plan movements for this robotic arm up to 10,000 times faster than existing approaches while consuming a small fraction of the power. Image Courtesy: Duke University

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Smart Metering: Very Essential For DISCOMs

P K Chatterjee (PK)

> Proper installation of Smart Metering Solutions creates a win-win situation for both – the consumer and the utility...

Whatever be the aspect of power reform that we take up as an agendum, we should not overlook the age-old (yet ever leniently treated) annexure attached to it, i.e., proper revenue generation and collection. Thus, we can't ignore the hourly need of Smart Metering to ensure uninterrupted and high quality power supply in the country.

The basic modus operandi of Smart Metering is through a chip (SIM card) inserted in the consumer's meter. It supplies all the necessary data regarding the onsite power consumption, consumption pattern, peak demand, power quality and so on…to the utility. Proper installation of Smart Metering creates a win-win situation for both – the consumer and the utility.

In many cases, it is seen that the supply exceeds demand or vice versa, Smart Metering enables the utility to measure the demand and plan the supply accordingly. Also, it reduces their manpower cost for meter reading, clerical errors etc. Perhaps the best contribution of Smart Metering is – utilities can take immediate action against defaulters by disconnecting their supply. Moreover, they can detect power tapping and take remedial action.

From consumer's end, it's a boon owing to the fact that the user can receive a cautionary message from the utility to be careful to control his/her power consumption. Also, in some countries the utilities are successfully offering the 'pay & use' plan for energy consumption. Accordingly, as soon as the energy usage exceeds the prepaid amount, the power supply automatically gets switched off. So on one hand, the customer is protected from getting a sudden big blow by the big bill amount, and on the other hand the utility secures its revenue.

If we see the Indian scenario where almost all DISCOMs are in loss, only a few states have taken up the Smart Metering drive, Andhra Pradesh (AP) is one of them. As per AP's plan, through compulsory Distribution Transformer metering; consumer indexing & GIS mapping of losses; upgrade/change transformers, meters etc.; Smart Metering of high-end consumers, feeder audit etc.; AT&C losses and transmission losses wil be brought down, besides eliminating the gap between cost of supply of power and realisation.

Smart Metering will also facilitate Net metering when that will be widely deployed. India proudly talks about its IT capability, why isn't that being deployed intensely to improve our power distribution segment?

P. K. Chatterjee

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

- Seth Godin }

Please e-mail me your views at pkchatterjee@charypublications.in

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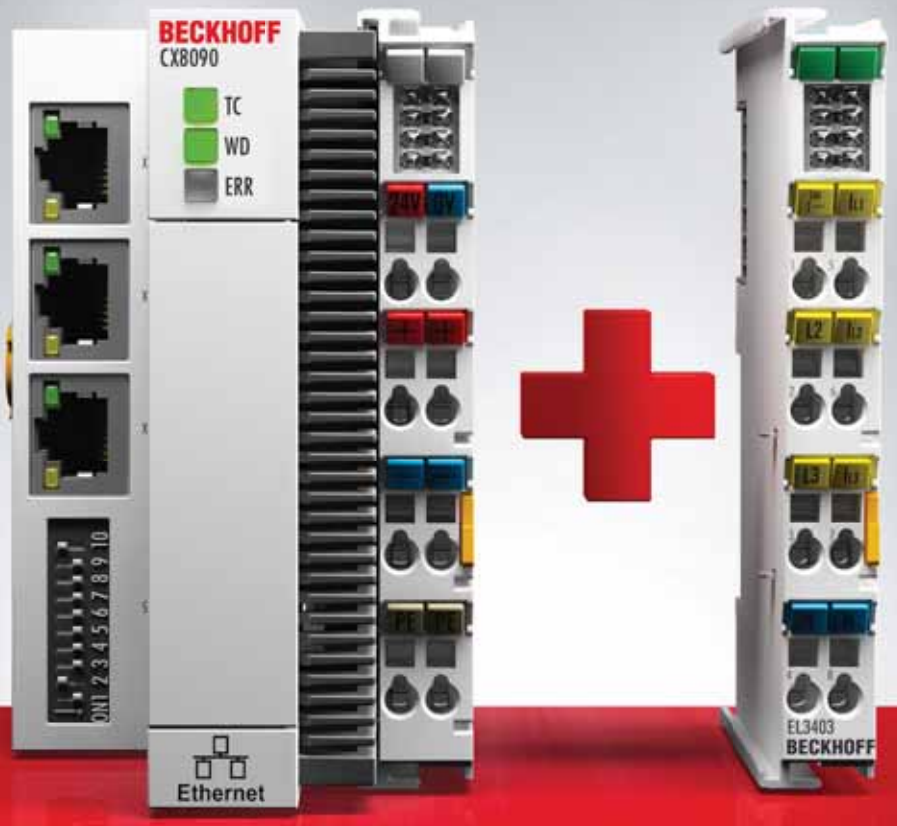

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New Automation Technology **BECKHOFF**

Rural electrification to be over by May 1, 2018

One hundred and forty five villages have been electrified across the country during 20 to 26th June 2016 under Deen Dayal Upadhyaya Gram Jyoti Yojna (DDUGJY). Out of these electrified villages, 67 villages belong to Assam, 16 in Jharkhand, 29 in Meghalaya, 8 in Rajasthan , 11 in Odisha, 3 in Madhya Pradesh, 8 in Bihar, 2 in Chhattisgarh and 1 in Uttar Pradesh.

In view of the Prime Minister, Narendra Modi's address to nation, on Independence Day (2015), Government of India has decided to electrify remaining 18,452 unelectrified villages within 1000 days i.e., by 01st May, 2018. The project has been taken on mission mode, and the strategy for electrification consists of squeezing the implementation schedule to 12 months – and also dividing village electrification process in 12 stage milestones with defined timelines for monitoring.

Eight thousand five hundred and twenty nine villages have been electrified till date. Out of remaining 9,923 villages, 459 villages are uninhabitated. 6,374 villages are to be electrified through grid, 2,754 villages to be electrified through off-grid where grid solutions are out of reach due to geographical barriers and 336 villages are to be electrified by State Govt own. Total 1654 villages were electrified during April 2015 to 14th Aug 2015 and after taking initiative by Government of India for taking it on mission mode, 6,875 additional villages have been electrified from 15th August 2015 to 26th June,2016.

In order to expedite the progress further, a close monitoring is being done through Gram Vidyut Abhiyanta (GVA), and various actions are also being taken on regular basis like reviewing the progress on monthly basis during the RPM meeting, sharing of list of villages that are at the stage of under energisation with the state DISCOM, identifying the villages where milestone progress are delayed.

Letter to the editor

Subject: High Efficiency Geared Motor

Dear Editor,

I would be interested to get high efficiency geared motors for EVs and EHVs for my clients for 2/3/4 and multi wheelers. Interested manufacturers may kindly mail me on: kulkarni.omprakash@drogk.com

Thanking you in advance,

Dr. Omprakash G. Kulkarni

Editor's reply:

Dear Readers,

Please get in touch with Dr Kulkarni.

Regards,
PK
Editor, ELECTRICAL INDIA

Subject: Article in your magazine

Dear Sir,

It was an interesting article written on the THERMAL PERFORMANCE OF DISTRIBUTION TRANSFORMERS AND CAUSES FOR TRANSFORMER FAILURES in Vol 56 No 6 June 2016 publication. Such revealing information has helped me in understanding the performance of distribution transformer.

Could you please share information related to particle count in oil that would affect transformer life, or please guide me to contacts and sources regarding this?

Suraj S, TTP Technologies Pvt Ltd.

Editor's reply:

Dear Mr. Suraj,

Please wait, we are trying to organise this. Regards.

PK
Editor, ELECTRICAL INDIA

Power minister praises stakeholders for their commitment

While addressing the gathering in the first National Workshop on Rooftop Solar Power, Piyush Goyal, Minister of State (IC) for Power, Coal and New & Renewable Energy said that efforts & commitment of all stakeholders made Renewable Energy (RE) targets achievable.

Piyush Goyal

Goyal gave away 41 awards to the best performing Ministries/Departments, State/UT Governments, State Nodal Agencies, State/UT Electricity Regulatory Commissions and Channel Partners during the event. Congratulating the awardees, he said that such awards not only encourage awardees to excel but also inspire the rest of us to put in our best efforts in the cause.

Forty four Ministries and Departments also presented Commitment Certificates for developing Rooftop Solar (RTS) power. The minister also launched a mobile app 'Surya Mitra' App at the event.

Speaking on the occasion, PK Sinha, Cabinet Secretary, said that the biggest challenge comes from within the sector.

He stressed that we have to work out business model in consultation with the regulators, which is beneficial for both DISCOMS and consumers.

He also added that although involving residential house tops for installing rooftop solar projects would not be that easy but would be worth the effort since it would provide volume to our initiative.

Dr. PK Mishra, Additional Principal Secretary to Prime Minister said that rooftop solar power is going to play an important role in our efforts towards renewable energy and sustainable energy initiatives.

Congratulating the awardees, Dr Mishra said, "I am sure that this workshop will provide new insights and will help in redefining new parameters of success in this sector."

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India, USA sign MoU to uphold energy sector's development

Recently, a Memorandum of Understanding (MoU) between the Government of India (GoI) and the Government of the United States of America has been signed to enhance cooperation on energy security, clean energy and climate change. PK Pujari, Secretary, Ministry of Power, G0I and Richard R Verma, US Ambassador to India, signed the MoU on behalf of GoI and the USA respectively.

Speaking on the occasion, Pujari said that USA and India are already working in some areas and this MoU will help in expanding our horizon. It will provide framework to work more closely not only for betterment of our own people but also for creating a positive environment for US companies working in India. Appreciating efforts of Indian Government, Verma said that this MoU will provide momentum for cooperative work which needs to be done in fields of energy security, clean energy and climate change.

The objective of the MoU is to enhance cooperation on energy security, clean energy and climate change through increased bilateral engagement and further joint initiatives for promoting sustainable growth. These activities are intended to increase incentives for innovation including research and development, and voluntary and mutually-agreed technology transfer, as well as the deployment of clean energy technologies in both countries; contribute to a global effort to curb the rise in greenhouse gas emissions; and enhance resilience to the impacts of climate change.

The priority initiatives under the MoU:

a. US-India energy smart cities partnership
b. Greening the grid
c. Promoting Energy Access through Clean Energy (PEACE) expansion
d. Energy efficiency including space cooling
e. Renewable energy
f. Energy security
g. Clean energy finance
h. U.S-India partnership for climate resilience
i. Air quality
j. Forestry, landscapes and REDD+
k. Fellowships
l. Accelerating innovation on clean energy and climate change.

Government to set up 1000 MW CTU- connected WPP

Ministry of New and Renewable Energy (MNRE) has launched Scheme for setting up of 1000 MW Wind Power Project (WPP) connected to transmission network of Central Transmission Utility (CTU) with an objective to facilitate supply of wind power to the non-windy states at a price discovered through transparent bidding process. Ministry has designated Solar Energy Corporation of India (SECI) as nodal agency for implementation of the scheme.

The scheme will encourage competitiveness through scaling up of project sizes and introduction of efficient and transparent e-bidding and e-auctioning processes. It will also facilitate fulfilment of Non-Solar Renewable Purchase Obligation (RPO) requirement of non-windy states.

Inage Courtesy: Tata Power...

A wind power project by Tata Power...

The GoI has set a target of achieving 175 GW power capacity from renewable energy resources by 2022, and out of this 60 GW has to come from wind power. The scheme will be implemented for setting up 1000 MW capacity of CTU connected WPPs by Wind Project Developers on build, own and operate basis. But, the capacity may go up, if there is higher demand from DISCOMs of non-windy states. MNRE has also issued draft guidelines for implementation of scheme for setting up of 1000 MW CTU connected WPPs issued by MNRE for stakeholders' consultation.

Indian transformers' market to witness further growth

Electricity shortage has been a major area of concern for India. In the year 2011, more than 33% of the rural population and 6% of the urban population of the country lacked electricity. Electricity issues such as blackouts and power shedding have been interrupting manufacturing and irrigation process across the country. Transformer, a significant electrical equipment that changes the voltage in the power transmission and distribution process acts to minimise the loss of energy. Power transfers and distribution transfers are two basic types of transformers wherein the distribution transformers can be oil-filled or dry type.

Inage Courtesy: Alstom...

Transformer is a significant electrical equipment...

The transformers market in India has been in a healthy state for quite some years now. The market is further expected to witness healthy growth rates and stimulating demand for the coming years. The initiatives undertaken by the Government of India along with the need of replacement of transformers installed in the earlier years is expected to drive growth in the Indian transformers market.

The government in the present era has shifted its focus to the T&D sector of the country, which is expected to offer abundant growth opportunities for the players operating in the electrical equipment market of India.

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CLP India, Suzlon Group enter into a JV agreement

CLP India, one of the biggest foreign investors in the Indian power sector, and Suzlon Group, one of the most important renewable energy solutions providers in the globe, recently entered into a Joint Venture (JV) for a 100 MW solar project at Veltoor in Telangana. As per the agreement, CLP India has acquired 49% stake in SE Solar, a Special Purpose Vehicle (SPV) set-up by Suzlon. Further, in future it also has the option to obtain the balance 51%. The project will be funded 80% by debt and 20% by equity. It is believed that, this project will make an important contribution to CLP's expansion plan and it'll aid CLP to meet its target of having 20% of power generated by renewable energy by 2020.

Rajiv Mishra

Tulsi Tanti

Rajiv Mishra, MD, CLP India, said, "Our approach to the market evolves around the kind of opportunities available as well as the prevailing policy framework. We have been keen to invest in solar in India to complement our Wind portfolio, and have evaluated projects that will be value-enhancing for our shareholders, whilst being attractive for our customers. The Veltoor solar project meets both the criteria... "

Tulsi Tanti, Chairman & MD, Suzlon Group, said, "Globally, renewable energy is witnessing a paradigm shift from being considered alternate to mainstream source of energy. Investments in both wind and solar have garnered traction owing to the improving cost competiveness enabled through technology advancements and the need to transition from fossil fuel dominated energy architecture. The target of 175 GW renewable energy by 2022 outlined by the GoI, offers an opportunity of over 100 GW solar in the next 6 years. I am confident, with the conducive policy environment and public-private partnership we will seize this opportunity..."

BHEL achieves yet another milestone in Afghanistan

Bharat Heavy Electricals Limited (BHEL) has achieved yet another milestone in Afghanistan by successfully commissioning two units of 14 MW each at Salma Hydro Electric Project (HEP) in Afghanistan.

Significantly, the Salma Dam (renamed as Afghan-India Friendship Dam) was inaugurated by the Hon'ble Prime Minister of India, Narendra Modi, in the presence of Ashraf Ghani, the President of Afghanistan. In recognition of BHEL's contribution towards setting up of the

BHEL felicitated for Salma HEP...

project, Atul Sobti, CMD, BHEL was honoured with an appreciation shield by the Hon'ble Union Minister of External Affairs, Sushma Swaraj and Union Minister of Water Resources, River Development and Ganga Rejuvenation, Sushri Uma Bharati.

This project has been funded under Government of India's grant to Government of Afghanistan.

In the execution of the Salma hydro project, BHEL faced numerous challenges in the movement of men and material through difficult terrains. BHEL successfully overcame all the challenges or obstacles.

Tech Mahindra strengthens Microgrid as a Service (MaaS)

Microgrid as a Service (MaaS), an internally funded startup at Tech Mahindra, has been strengthened as a service offering with two MoUs signed during Ontario Premier Kathleen Wynne's recently concluded trade mission to India.

One of the MoUs signed with the Center For Urban Energy (CUE), a part of Ryerson University, located in Toronto, Ontario in Canada, is for advances in the area of Microgrid platform, that will make renewable energy more affordable and reliable in collaboration with CUE. CUE will bring its research knowledge and expertise in developing simulation and emulation models as a part of tools required to design and operate a Microgrid.

A second MOU was signed with Himachal Pradesh State Electricity Board (HPSEB) and Advanced Energy Center (AEC), promoted by the Ontario's Ministry of Energy.

Tech Mahindra will work with these institutions to identify areas of co-operation, collaboration and innovation specific to the state of Himachal Pradesh (HP), especially in areas where electricity supply is yet to meet demand. In addition, the organisations will work to bring innovative energy solutions to HPSEB, and to actively promote energy sector investments in both regions.

Kathleen Wynne, Premier of Ontario said, "As a leader in renewable energy, Microgrids and clean tech, Ontario is well positioned to export our expertise, services and products to new markets. The MOUs between Ontario institutions and Tech Mahindra will strengthen Ontario's presence in India and help develop technology solutions to increase access to clean electricity and economic opportunity in both Ontario and India."

CP Gurnani, MD & CEO, Tech Mahindra stated, "For businesses who cannot afford any disruption in power today have to rely on Microgrids for efficient distribution. We are pleased at the opportunity..."

ABB's technology to give big boost to solar power industry

ABB has started to ship a central inverter (PVS980), which is an indispensable component in every solar installation with a 40% increase in power density. It basically converts Direct Current (DC) produced in solar panels into Alternating Current (AC) for use by electrical grids. Due to its 40% increase in the power density, there is a spectacular improvement that completely changes the economics of a solar installation. On the other hand, the PVS980 central inverter also allows operators to use 30% fewer inverters than previously. The high power 1500 VDC central inverter PVS980 is competent of processing additional incoming direct current power from Photovoltaic (PV) panels through one inverter, reducing the total number of inverters essential onsite that helps trim down overall costs across the lifetime of a solar plant.

Central inverters are not only used for applications such as large field installations but also for large arrays installed on buildings and industries. The PVS980 that was initially introduced at Intersolar as a concept last year has already started witnessing interest among customers, with a number of pilot projects in place. This new inverter is designed in a way as it effortlessly integrates into digital smart grids and function efficiently in reducing the carbon footprint of electricity consumption. Also, the inverter can function from below freezing to extreme heat in 100% humidity without jeopardising functionality, avoiding external air entering the critical compartments of the inverter.

Sami Atiya, President of ABB's Discrete Automation and Motion division, said, "ABB has pushed the boundaries of development in the inverter area once again. In line with our Next Level strategy, ABB is fully committed to the solar industry, strongly investing in R&D and regularly launching pioneering products to the market." EI

Siemens bags big order from Power Grid Corporation

Siemens Ltd. has won an order worth approximately Rs. 570 crore to supply Static Synchronous Compensator (STATCOM) solutions to Power Grid Corporation of India Ltd. (PGCIL).

The scope of the order includes design, engineering, supply, civil, installation, testing and commissioning of STATCOMs at four substation locations of PGCIL: Ranchi, Rourkela, Kishenganj and Jeypore across the states of Bihar, Jharkhand and Odisha.

Cutting-edge technology from Siemens will result in the installation of one of the world's largest STATCOM projects at 400 kV level with a dynamic swing range of 2000MVAr and 1250MVAr mechanically switched components.

The 400 kV STATCOMs are being manufactured at Siemens Ltd.'s manufacturing plant at Goa. With fast response time of STATCOM controls, power consumers will be benefitted in the form of constant grid voltage and frequency leading to availability of uninterrupted quality power.

"Siemens has once again demonstrated its indigenous manufacturing and technology capabilities to meet the growing demands of Indian power sector," said Dr. Harald Griem, Executive Vice President and Head, Energy Management Division, Siemens Ltd.

This is the first STATCOM order for Siemens Ltd., and is the latest chapter in the long and successful journey of Flexible AC Transmission Systems (FACTS) in India.

Siemens Ltd., together with PGCIL, has always been trendsetters in India for FACTS. It started in 2003 when Siemens delivered several Fixed Series Capacitors (FSC). The first Thyristor Controlled Series Capacitor (TCSC) in India followed in 2004. And the largest Indian Static Var Compensator (SVC) project started in 2014 with Siemens. EI

TPREL wins 30 MW solar project in Maharashtra under National Solar Mission

Tata Power Renewable Energy Ltd. (TPREL) is a 100% subsidiary of Tata Power. The company has recently won Solar grid connected photovoltaic projects of 30 MW in Maharashtra.

The projects have been awarded in the DCR category under the Jawaharlal Nehru National Solar Mission (JNNSM) Phase-II Batch-III Tranche-I under 'State Specific Bundling Scheme.'

TPREL has received the Letter of Intent to develop the projects, and will sign a 25 year Power Purchase Agreement (PPA) with NTPC Vidyut Vyapar Nigam Ltd.

Commenting on winning the project, Rahul Shah, CEO & ED-Tata Power Renewable Energy Ltd, said, "This is the third Letter of Intent received by Tata Power Renewable Energy Ltd., in recent months –and brings our solar bid wins to 145 MW. Receiving this Letter of Intent for 30 MW of non-fossil fuel energy will further add to our total generation capacity, thereby, significantly increasing our green footprint. This move is in line with the government's set target of 100 GW from solar energy by 2017."


Rahul Shah

"As a company, we will continue to grow our capacity through organic and inorganic means over the next few years to contribute to Tata Power's aggressive target of 20,000 MW of total capacity by 2025," he added.

The JNNSM, launched in January 2010, is a major initiative of the Government of India that aims to establish India as a global leader in solar energy by creating favourable policy conditions for its diffusion across the country. JNNSM had initiatilly set a target to 20 GW of solar installations by 2022, that was reset to achieve five times more at 100 GW by 2022. EI

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Nokia's solution makes Swiss electricity transmission system more efficient

Nokia has delivered state-of-the-art IP/MPLS (Internet Protocol/Multiprotocol Label Switching) and optical technology and services to Swiss electricity transmission system operator Swissgrid for the management of its electrical grid.

The new 'Grid Control Network' provides monitoring and switching for the electricity transmission grid, resulting in better alignment of power supply and demand, enhanced security and an exceptional level of reliability.

The new communications network became operational in Switzerland earlier this year. In a turnkey project, Nokia implemented two IP/MPLS-based networks – one an operational network and the other a business communications network. They are both overlaid on an encrypted Dense Wavelength Division Multiplexing (DWDM) and Coarse Wavelength Division Multiplex (CWDM) network, also from Nokia.

The solution is supporting mission-critical operational services such as Supervisory Control and Data Acquisition (SCADA) systems, Teleprotection, video surveillance via closed-circuit TV (CCTV), site access control and intrusion detection.

This will allow Swissgrid to maintain the highest level of reliability, safety and security across the entire grid.

The network is also enabling business communications between electricity substations and Swissgrid locations for tasks such as office Local Area Network (LAN) and Voice over IP (VoIP) in a highly secure way.

Rittal's heavy current busbar systems receive approval for on board application

The safe use of electrical equipment on board ships brings with it particular challenges. It's an area that Rittal continues to invest in, not least to ensure its systems function effectively under the test conditions which are required by the marine industry.

Now, the efficacy of its busbar systems RiLine, Maxi-PLS and Flat-PLS has been recognised by leading international shipping organisations.

Approvals for on board use have been granted by Lloyds Register (LR), Germanischer Lloyd (GL), Det Norske Veritas (DNV) and American Bureau of Shipping (ABS).

This follows the announcement last year that Maxi-PLS and Flat-PLS had successfully

Rittal's busbar systems...

passed the environmental test on 'Vibration,' satisfying the requirement of 0.7 g in the frequency range 5 – 100 Hz.

As such, these busbar systems and related components now have the required test data and documentation for: short circuit, temperature rise, dielectric strength, thermal resistance, use under vibration conditions.

RiLine, Maxi-PLS and Flat-PLS can be used on board ships in designated sealed areas, such as engine rooms, subject to observance of the required technical characteristics and the valid technical regulations.

Design-type approvals will also mean use of the busbar components in maritime applications is now much easier.

Rittal is globally present in the fields of enclosures, power distribution, climate control, IT infrastructure and software & services. It has five global service points, over 60 subsidiaries, and more than 200 partners worldwide.

GE to recommend Shell Mysella as engine oil for its Jenbacher gas engines

Shell recently has been named as GE's recommended global oil supplier for its Jenbacher Type 4 and Type 6 gas engines. Commencing from April 2016, the agreement between the both will last for three years. Shell Mysella gas engine oil will be supplied for use in GE's Jenbacher gas engines in over 80 countries.

Richard Jory, Shell's Vice President for Global Key Accounts, said, "This is a key milestone for Shell, taking our existing cooperation with GE's Jenbacher gas engines to the next level. By increasing the level of collaboration between Shell and GE, we aspire to offer GE's Jenbacher gas engine customers the excellent care and service experience we have around the world. We believe that together, anything is possible."

Each new GE Jenbacher Type 4 and Type 6 gas engine sold will feature a plate recommending Shell Mysella as its engine oil. Both the companies will continue to strengthen their cooperation in developing new engine oil formulations – to meet the needs of GE Jenbacher gas engines' consumers and expanding the range of engine models. Some of the markets covered by the agreement comprise Argentina, Australia, Brazil, Bangladesh, China, Denmark, France, Germany, Hungary, India, Indonesia, Italy, Netherlands, Pakistan, Russia, Spain, Turkey, UK and US.

Carlos Lange, President of GE's Distributed Power Business, said, "We have chosen to collaborate with Shell because of their innovative technology that can help increase GE's Jenbacher gas engine performance – and provide lubrication solutions that benefit all our customers. They have proven capacity in the field and have also built long standing relationships with GE's Jenbacher gas engines' end users and channel partners."

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Eaton's new locking devices to support data centres

Power management company Eaton's new Arrow Hart locking devices has been designed to help data centre customers reduce energy costs, equipment requirements and enable higher power designs. The power locking plugs, connectors and receptacles are designed to withstand high variations in atmospheric conditions encountered in data centre environments.

"Eaton's Arrow Hart wiring devices are designed to support higher energy efficiency and greater power density data center designs," said Grayling Love, Product Line Manager at Eaton.

Eaton's locking devices for data centres...

Eaton is positioned through its global solutions to answer today's most critical electrical power management challenges.

The locking devices line was designed for data center environments and new National Electrical Manufacturers Association (NEMA) configurations.

Eaton's products include plugs, connectors, receptacles and an isolated ground version in NEMA L25-30 ampere (A), 240 volt (V), 2 pole 3 wire, single phase and NEMA L26-30 three-phase 30A 240/415V 4 pole, 5 wire power.

The key features, common among Eaton's Arrow Hart locking devices, include reversible inserts providing for a wide diameter cord accommodation and a nylon shell for durability. Amperage and voltage ratings are printed on the body of the power lock devices for easy identification. The devices are (UL)-listed and meet Federal Specification W-C-596H.

Zorlu Energy wins energy infrastructure financing award

The leading finance magazine of Europe, Middle East and Africa, EMEA Finance, has granted "The Best Energy Infrastructure Financing" award to Zorlu Energy for the financing provided to Kızıldere III Geothermal Power Plant project, which is the fourth geothermal power plant investment in Turkey. In the contest where financing for the best sustainable energy projects were assessed, the project that was awarded and whose construction has been initiated will have totally 95.2 MW of installed power.

The financing provided by four leading banks of Turkey for Kızıldere III Geothermal Power Plant project initiated this year by Zorlu Energy, who represent 22% of total installed geothermal power of Turkey, has been granted "The Best Energy Infrastructure Financing" award for Middle East and Eastern Europe Area in 2015.

Zorlu Energy's expertise in renewable energy and the sustainability vision of the Kızıldere III project had an impact on this award granted by EMEA Finance Magazine, one of the most prestigious finance magazines of Europe, Middle East and Africa. As a follow up of Kızıldere I and Kızıldere II geothermal power plants, Kızıldere III Geothermal Power Plant is planned to have 95,2 MW of installed power with an expected investment cost of 320 million $.

The construction of Kızıldere III Geothermal Energy Power Plant has been started in addition to the existing Kızıldere I and Kızıldere II investments, which are conducted through Zorlu Doğal Elektrik Üretimi Inc., 100% affiliated to Zorlu Energy.

Sungrow displays new models of inverters in Intersolar Europe 2016

The world's largest PV inverter manufacturer, Sungrow, proclaimed that the company had to showcase quite a few inverters at the Intersolar Europe 2016.

The company's one of the key products for the emerging 1500 volt market, the SG3000HV-MV turnkey container solution is best characterised by its low system cost and high system efficiency.

Chiefly, it is designed to be grid-friendly with full grid support, including LVRT, OVRT, FRT and power restriction. Its reactive power control with power factor can be adjusted from 0.8 leading to 0.8 lagging and its active power is adjustable ranging from 0 to 100%.

In addition to this, it also has night time reactive power compensation capability and

The SG3000HV-MV turnkey container solution...

intelligent control that is compatible with multiple regional utility standards.

On the other hand, SG80KTL is a grid-tied, 3-phase, 1000V DC and transformerless string inverter that is able to be used in utility power plants, as well as commercial rooftops.

It is also designed to facilitate multiple inverters to be directly coupled at the AC side with 3MW power block design for lesser costs of AC transformers and installation.

Its maximum 1.4 DC/AC ratio and wide MPPT range lead to higher yields of power generation. In addition, as compared to the previous cooling system, the smart cooling system is believed to be more efficient to lower internal operation temperature that is useful to extend the inverter lifespan.

Professor Renxian Cao, the President of Sungrow said, "At Sungrow we are always committed to technical innovation and we believe that these new products will achieve this. We will continue to try and provide the best technical solutions for our customers and look forward to continuing to innovate, for them." Sungrow is a world-class technology provider, specialising in PV inverters and energy storage equipment for residential, commercial, and utility-scale PV power plant systems.

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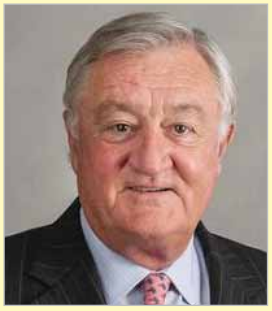
Global Power includes David Brown in board



David Brown

Brown has been involved in the energy industry for the majority of his career...

Global Power Equipment Group Inc. (Global Power); a design, engineering and manufacturing firm providing a broad array of equipment and services to the global power infrastructure, energy etc.; has appointed David A. B. Brown, Chairman and former President and CEO of Layne Christensen Company, to its Board of Directors.

Brown is the Chairman of the Board of Directors of Layne Christensen Company and is a member of the Board of Directors of EMCOR Group, Inc. He is the former President and Chief Executive Officer of Layne Christensen and the former Chairman of the Board of Directors of Pride International, Inc. until it was acquired by Ensco plc in May 2011. A Chartered Accountant and CPA, Brown has been involved in the energy industry for the majority of his career and served on several other boards. He earned his Bachelor of Commerce and a Masters in Accounting from McGill University and his MBA with Distinction from the Harvard Business School.

Brown is an independent nominee of Wynnefield Capital, a holder of 18.4% of total shares outstanding of Global Power stock, and was elected pursuant to the terms of an Election and Nomination Agreement.

Under the terms of the Election and Nomination Agreement, Wynnefield may designate another person to be a director of the company. The new directors will stand for election at the company's annual meeting. Certain current directors will not stand for re-election and the board will consist of seven directors, including the CEO, Terence Cryan.

M Kevin McEvoy elected to the EMCOR Group's Board of Directors

M. Kevin McEvoy

McEvoy also serves as Chairman of the National Ocean Industry Association...

At EMCOR Group Inc. 2016 Annual Meeting of Stockholders, M. Kevin McEvoy was appointed to the Company's Board of Directors. In the meeting the company's serving directors standing for re-election were also elected. McEvoy is the CEO of Oceaneering International, Inc. a global oilfield source of engineered services and products chiefly to the offshore oil and gas industry, with a focal point on deep water applications. He first joined Oceaneering in 1984, and has been its Chief Executive Officer and since 2011 he has been a member of its Board of Directors.

Stephen W. Bershad, Chairman of the Board of EMCOR Group, Inc. said, "We are pleased to welcome Kevin to the team. With his strong background and deep knowledge of and experience in the energy services industry, Kevin is an ideal addition to the EMCOR Board of Directors. I look forward to leveraging Kevin's strategic, operational and financial vision and leadership as we continue to grow our business and drive value for our shareholders."

He also presently serves as Chairman of the National Ocean Industry Association, a Director of the Petroleum Equipment Suppliers' Association, and is a member of the National Petroleum Council. Prior to this from 1972 to 1976 he served in the U.S. Navy and from 1976 to 1989 was a Lieutenant Commander in the United States Reserve.

University of Surrey appoints new Executive Dean of the FEPS

Paul Smith

Smith served as Head of School of Engineering from 2004 – 2007...

Professor Paul Smith has been appointed as a new Executive Dean by the University of Surrey for its internationally well-known Faculty of Engineering and Physical Sciences. He will be responsible for nine departments within the faculty and will take a lead role in the formulation of the academic strategy. He will take up the new role from 1st September, 2016.

He is a Professor of Composite Materials. He is an engineer and holds a first degree in engineering, from the University of Cambridge, where he consequently carried out doctoral research on the mechanical fastening of carbon fibre reinforced composites. Paul was promoted to a Personal Chair in 1997 and served as Head of School of Engineering from 2004 – 2007, after joining the University of Surrey in 1986 as a Lecturer in the Department of Materials Science and Engineering. He has held his present role of Associate Dean (International) in Faculty of Engineering and Physical Sciences (FEPS) since 2010, working to build up partnerships and encourage student mobility, both incoming and outgoing.

Professor Max Lu, President and Vice-Chancellor of the Surrey, said, "Paul is an exceptional leader with an excellent track record of high quality research. This has always been carried out in collaboration with industry, focused on impact as well as academic excellence. His appointment will be of tremendous value to the University of Surrey, and I am confident that Paul will be able to drive the faculty to even greater success and acclaim."

Professor Paul Smith expressed his thoughts by saying, "I am honoured to be appointed Executive Dean of the Faculty of Engineering and Physical Sciences, and I look forward to working with the many outstanding colleagues here."

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A Game Changer

Motion planning has been studied for 30 years, and recent advances have brought the time required to find a plan for a sophisticated robot down to a few seconds...

Robotic motion planning...

Once they've mastered the skills of toddlerhood, humans are pretty good at what roboticists call "motion planning" – reaching around obstacles to precisely pick up a soda in a crowded fridge, or slipping their hands around a screen to connect an unseen cable.

Daniel Sorin

But for robots with multi-jointed arms, motion planning is a hard problem that requires time-consuming computation. Simply picking an object up in an environment that has not been pre-engineered for the robot may require several seconds of computation.

Duke University researchers have introduced a specially-designed computer processor for motion planning that can plan up to 10,000 times faster than existing approaches while consuming a small fraction of the power. The new processor is fast enough to plan and operate in real time, and power-efficient enough to be used in large-scale manufacturing environments with thousands of robots.

"When you think about a car assembly line, the entire environment is carefully controlled so that the robots can blindly repeat the same movements over and over again," said George Konidaris, Assistant Professor of Computer Science and Electrical and Computer Engineering at Duke. "The car parts are in exactly the same place every time, and the robots are contained within cages so that humans don't wander past. But if your robot is using motion planning in real time and a part is in a different place, or there's some unexpected clutter, or a human walks by, it'll do the right thing."

Speedy motion planning saves the time and expense of engineering the environment around the robot, says Konidaris, who has presented the

George Konidaris

new work on June 20, 2016, at a conference called 'Robotics: Science and Systems' in Ann Arbor, Mich.

Motion planning has been studied for 30 years, and recent advances have brought the time required to find a plan for a sophisticated robot down to a few seconds. With few exceptions, these existing approaches rely on general-purpose CPUs or computationally faster but more power-hungry Graphics Processors (GPUs). The Duke team designed a new processor specifically for motion planning.

"While a general-purpose CPU is good at many tasks, it cannot compete with a processor specially designed for just a single task," said Daniel Sorin, Professor of Electrical and Computer Engineering and Computer Science at Duke.

Konidaris and Sorin's team designed their new processor to perform collision detection – the most time-consuming aspect of motion planning – such that the processor performs thousands of collision checks in parallel.

"We streamlined our design and focused our hardware and power budgets on just the specific tasks that matter for motion planning," said Sorin.

The technology works by breaking down the arm's operating space into thousands of 3D volumes called voxels. The algorithm then determines whether or not an object is present in one of the voxels contained within pre-programmed motion paths. Thanks to the specially designed hardware, the technology can check thousands of motion paths simultaneously, and then stitch together the shortest motion path possible using the 'safe' options remaining.

"The state-of-the-art prior to our work used high-performance, commodity graphics processors that consume 200 to 300 watts. And even then, it was taking hundreds of milliseconds, or even as much as a second, to find a plan. We're at less than a millisecond, and less than 10 watts. Even if we weren't faster, the power savings alone will add up in factories with thousands, or even millions, of robots," said Konidaris.

Konidaris also notes that the technology opens up new ways to use motion planning. Previously, planning was done once per movement, because it was so slow. But now it is fast enough that it could be used as a component of a more complex planning algorithm, perhaps one that sequences several simpler motions or plans ahead to reason about the movement of several objects," he said.

The new processor's speed and power efficiency could create many opportunities for automation. Konidaris, Sorin and their students are counting on it, and have incorporated a spinoff company, Realtime Robotics, to commercialise the technology. "Real-time motion planning could really be a game-changer for robotics," said Konidaris.

Image Courtesy: All images are from Duke University

JKUAT Receives KMA's Energy Management Award

The university has received the April 2016 Energy Management Award (EMA) in recognition of their effort to deploy innovative methods to reduce consumption and cut costs...

The Centre for Energy Efficiency and Conservation (CEEC), which is an arm of the Kenya Association of Manufacturers (KMA), has declared the Jomo Kenyatta University of Agriculture and Technology (JKUAT) as the top public institution in energy management in Kenya.

The university has received the April 2016 Energy Management Award (EMA) in recognition of their effort to deploy innovative methods to reduce consumption and cut costs.

Image Courtesy: JKUAT

Gitahi displays the Energy Management Award trophy…

JKUAT was evaluated on a number of fronts including availability of energy policy, planning and implementation of various energy aspects as well as adoption of energy saving and conservation innovations.

The University's Energy Manager, Anthony Gitahi attributed the win to JKUAT's strategy to foster an energy conscious community – through capacity and institution building; and policy orientation. "We have undertaken sensitization sessions to orient both staff and students to the new paradigm,' said Gitahi. "JKUAT has also developed an evaluation matrix to monitor consumption of various energy aspects like electricity, diesel, firewood and Liquid Petroleum Gas."

Besides an energy policy, the university has also instituted an advisory board to facilitate and guide implementation of various energy management programmes.

Through the Institute for Energy and Environmental Technology (IEET), JKUAT is also leveraging on renewable energy to further cut down reliance on conventional power.

IEET Director, Prof. Robert Kinyua said that the Institute was partly using biogas generated from research activities. He further added that JKUAT, in collaboration with Looop Inc, had finished installation of solar panels that would supply three kilowatts to power research laboratories at the University.

JKUAT was in 2014 awarded ISO 14001:2004 certification on Environmental Management Systems (EMS); becoming the first institution in East Africa to bag the award.

The milestone was result of the University's best practices in resource consumption, waste management and environmental enhancement.

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Simulation & Analysis Of Static Synchronous Series Compensator

With the increasing size and complexity of the transmission networks, the performance of the power systems decreases due to problems related with the load flow, power oscillations and voltage quality. Flexible AC Transmission (FACTS) offers effective schemes to meet these demands...

A Static Synchronous Series Compensator (SSSC) is used to investigate the effect of FACTS device in controlling active and reactive powers as well as damping power system oscillations in transient mode. Simulation results obtained in two machine power systems show the efficacy of this compensator as one of the devices member in controlling power flows, achieving the desired value for active and reactive powers, and damping oscillations appropriately.

An SSSC is used to investigate the effect of this device in controlling active and reactive powers as well as damping power system oscillations in transient mode.

The SSSC equipped with a source of energy in the DC link can supply or absorb the reactive and active power to or from the line. Simulations have been done in MATLAB/ SIMULINK environment.

The SSSC offers an alternative to conventional series capacitive line compensation. It is a solid-state voltage source that internally generates the desired compensating voltage independent of the line current. The voltage source nature of the SSSC provides the basis for its superior operating and performance characteristics not achievable by series capacitor type compensator: Internal reactive power generation and absorption without ac capacitors or reactors: control of reactive compensating voltage independent of the magnitude of the line current.

An SSSC is a member of FACTS family, which is connected in series with a power system, consisting of a solid state voltage source converter that generates a controllable alternating current voltage at fundamental frequency. When the injected voltage is kept in quadrature with the line current, it can be emulated as inductive or capacitive reactance – so as to influence the power flow through the transmission line. Primary purpose of an SSSC is to control power flow in steady state; it can also improve transient stability of a power system.

The proposed SSSC-based neuro-fuzzy controller provides efficient damping to power system oscillations and greatly improves the system voltage profile. The inter-area and local modes of power system oscillations are effectively damped by using this proposed SSSC controller.

The proposed stabilizers have been applied and tested on power system under severe disturbance and different loading conditions. It is also evident that the coordinated design of PSS and FACTS-based stabilizer provides great damping characteristics and enhances significantly the system stability compared to individual design. The simulation results show that FACTS devices improve the system stability, furthermore the SSSC-based stabilizer provide a better effectiveness than STATCOM-based stabilizer on damping power system oscillation.

The operation of the designed device is verified by a series of simulations in MATLAB environment and the obtained results proved to be satisfactory. The Total Harmonic Distortion studies performed both when SSSC is on and off shows that the harmonic content introduced to the line current is very low.

The voltage and current waveforms along with the instantaneous active and reactive power calculations reveal that the designed topology works satisfactorily. The compensation of the reactive power flow over the power line due to the power line inductance is compensated with the help of series injected voltage.

Modeling and control design of a converter used in an SSSC application, employing low frequency, fixed modulation index strategies, the magnitude of the output waveform is directly related to the DC-bus level by a fixed relation. DC-bus has to be varied to obtain the desired output voltage. A large signal model for the converter is derived in the paper, subsequently linearised to obtain a small signal model, which was used to propose a control strategy. The theory is then validated experimentally on a novel Voltage Sourced Converter configuration.

Table 1: Comparison of different FACT controllers...

Name	Type	Main Function	Controller Used	Comments
SVC(Static VAR Compensator)	Shunt	Voltage control	Thyristor	Variable impedance device
TCSC(Thyristor Controlled Series Compensation)	Series	Power flow control	Thyristor	Variable impedance device
TCPAR(Thyristor Controlled Phase Angle Regulator)	Series and Shunt	Power flow control	Thyristor	Phase control using series(quadrature) voltage injection
STATCOM(Static condenser)	Shunt	Voltage control	GTO	Variable voltage source
SSSC(Static Synchronous Series Compensator)	Series	Power flow control	GTO source	Variable voltage
UPFC(Unified Power Flow Controller)	Shunt and Series	Voltage and power flow control	GTO	Variable impedance device

In emerging electrical power systems, due to increased loading or due to severe contingencies often lead to situations, where the system no longer remains in the secure operating region. Under these situations, it is primary objective of the operator to apply control action to bring the power system into the secure region. FACTS devices can play an important role in power system security enhancement. A real power flow performance index sensitivity based approach and line voltage distribution factor have been proposed to decide optimal location of TCSC and SSSC to enhance the security of the power system. The effectiveness of the proposed controller has been tested on modified IEEE 30 bus system using Power World Simulator.

An adaptive SSSC in single machine infinite bus system model consists of a voltage source. Magnitude and angle of this voltage source depends on the SSSC control parameters. The voltage source model of SSSC incorporated into the generator output power equation simplifies the dynamic Eigen value analysis of the system. This model can then be used to compare and determine the system's dynamic behaviour, equipped with an adaptive SSSC.

A summary of different FACT controller schemes is given in table 1.

Static Synchronous Series Compensator (SSSC)

A static synchronous generator operated without an external electric energy source as a series compensator whose output voltage is in quadrature with, and controllable independently of, the line current for the purpose of increasing or decreasing the overall reactive voltage drop across the line and thereby controlling the transmitted electric power Fig.1. The SSSC may include transiently rated energy storage or energy absorbing devices to enhance the dynamic behaviour of the power system by additional temporary real power compensation, to increase or decrease momentarily, the overall resistive voltage drop across the line.

A SSSC consists of a coupling transformer, an inverter and a capacitor. The SSSC is series connected with a transmission line through the coupling transformer. In principle, the SSSC can generate and insert a series voltage, which can be regulated to change the impedance (precisely reactance) of the transmission line. In this way, the power flow of the transmission line, which the SSSC is connected with, can be controlled.

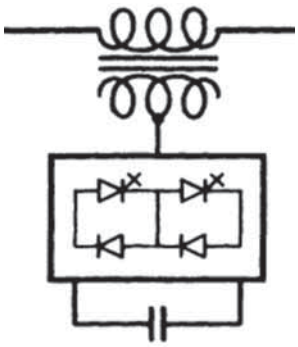

Figure 1: Basic SSSC circuit...

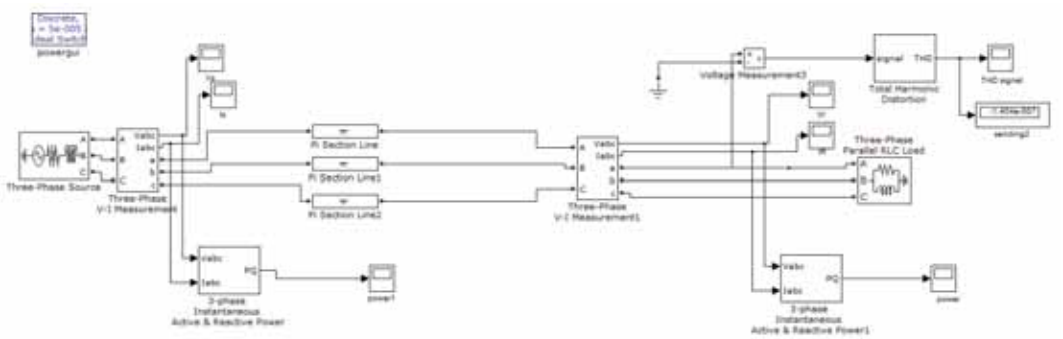

Figure 2: SIMULINK Model without SSSC...

The SSSC can provide capacitive or inductive compensating voltage independent of the line current up to its specified current rating. The practical minimum line current is that at which the SSSC can still absorb enough real power from the line to replenish its losses. The VA rating of the SSSC is simply the product of the maximum line current (at which compensation is still desired) and the maximum series compensating voltage:

$$VA = I_{max} Vq_{max}$$

In impedance compensation mode, the SSSC is established to maintain the maximum rated capacitive or compensating reactance at any line current up to the rated maximum. In practical applications, for variable impedance type compensators, I_{max} may be separately defined for the rated maximum steady-state line current and for a specified short duration over current. The basic VA rating of the major power components of the SSSC must be rated for these currents and for the relevant maximum voltages.

In many practical applications, only capacitive series line compensation is required. In these applications as well as in those which already use or plan to use series capacitors as part of the overall series compensation scheme, the SSSC may be combined cost effectively with a fixed capacitor, where an SSSC of 0.5 p.u. VA rating is combined with a fixed capacitor of 0.5 p.u. VAC rating to form a continuously controllable overall series compensator with a maximum compensating range of zero to 1.0 p.u. capacitive. This compensation scheme from the standpoints of major component (converter and fixed capacitor) ratings and operating losses is extremely advantageous, in spite of the fact that the fixed capacitor produces a compensating voltage that is proportional to the line current, and therefore, the controllable compensating voltage range of the overall compensator also becomes, to some degree, a function of the line current.

Objectives

The reactive shunt compensation is highly effective in maintaining the desired voltage profile along the transmission line interconnecting two busses of the AC system and providing support to the end voltage of radial lines in the face of increasing power demand. Thus, reactive shunt compensation, when applied at sufficiently close intervals along the line, could theoretically make it possible to transmit power up to thermal limit of the line, if a large enough angle between the two end voltages could be established.

However, shunt compensation is ineffective in controlling the actual transmitted power which, at a defined transmission voltage, is ultimately determined by the series line impedance and the angle between the end voltages of line.

It was always recognised that AC power transmission over long lines was primarily limited by the series reactive impedance of the line.

Series capacitive compensation was introduced decades ago to cancel a portion of the reactive line impedance and thereby increase the transmittable power. Subsequently, within the FACTS initiative, it has been demonstrated that variable series compensation is highly effective in both controlling power flow in the line and in improving stability.

Controllable series line compensation is a cornerstone of FACTS technology. It can be applied to achieve full utilisation of transmission assets by controlling the power flow in the lines, preventing loop flows and, with the use of fast controls, minimising the effect of system disturbances, thereby reducing traditional stability margin requirements.

In this section the basic approach of reactive series compensation will be reviewed to provide the necessary foundation for the treatment of power electronics based compensators.

The effect of series compensation on the basic factors, determining attainable maximal power transmission, voltage regulation, transmission efficiency will be examined.

Control attributes of SSSC

- Current control
- Damping oscillations

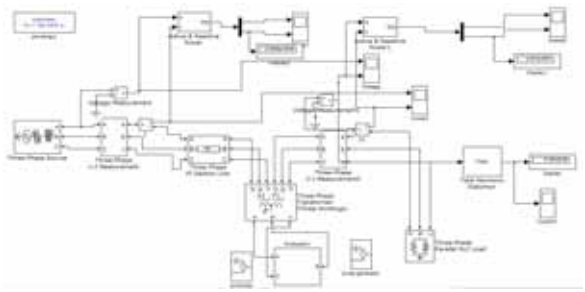

Figure 3: SIMULINK model with SSSC...

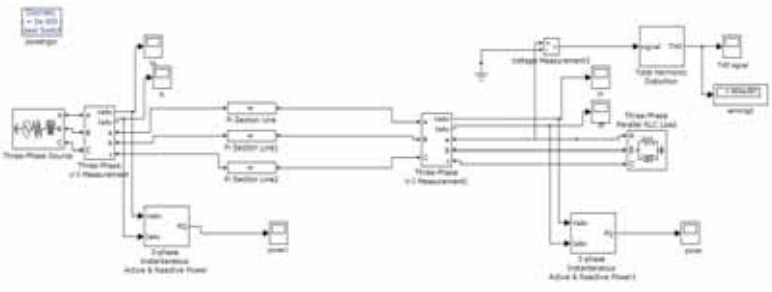

Figure 4: SSSC subsystem...

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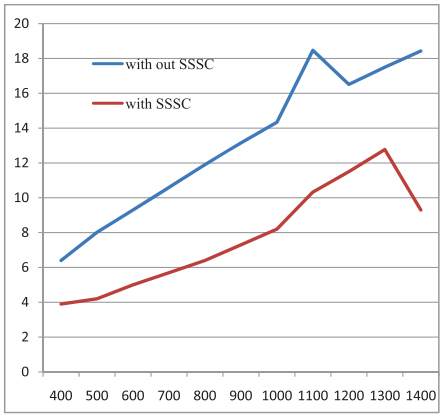

Figure 5: Voltage regulation with transmission line distance...

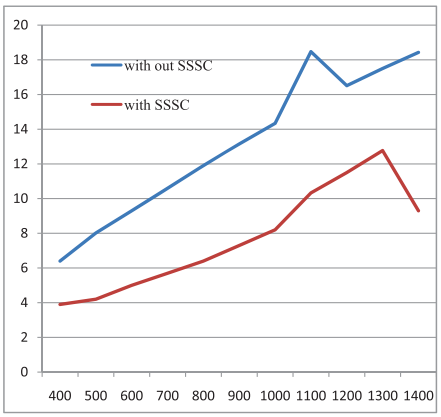

Figure 6: Sending end reactive power...

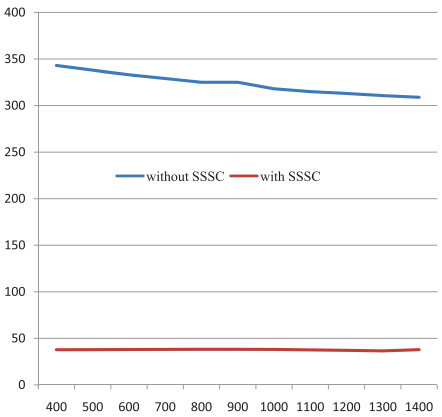

Figure 7: Receiving end reactive power...

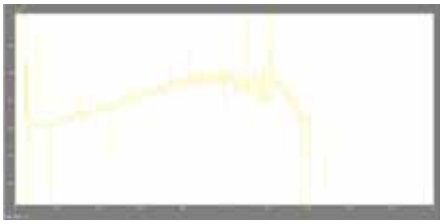

Figure 8: THD with SSSC...

- Transient and dynamic stability
- Voltage stability
- Fault current limiting

SSSC SIMULINK model

The SSSC is the versatile member of the FACTS family using power electronics to control power flow on power grids.

A SIMULINK model of SSSC consists of a coupling transformer, an inverter, and a capacitor, is series connected with a transmission line through the coupling transformer.

The load is assumed to be an inductive load in the order of MW/MVAr. The transmission line is the pi section transmission line.

The model is studied for a transmission line of pi varying distance from 400km to1400km, and results are obtained from fig 2 to 6, table II.

CONCLUSIONS

- The main role of SSSC is controlling the active and reactive powers; besides these – it could fairly improve the transient oscillations of the system.
- SSSC is capable of controlling the flow of power at a desired point on the transmission line. It injects a fast changing voltage in series with the line irrespective of the magnitude and phase of the current.

Table 2: Results of simulation...

Distance (km)	Without SSSC			With SSSC (%)		
	Voltage Regulation (%)	Receiving end Reactive Power (MVAr)	THD	Voltage Regulation (%)	Receiving end Reactive Power (MVar)	THD
400	6.4	343	0.56	3.9	37.8	0.0048
500	8.02	338	0.55	4.2	37.9	0.0045
600	9.30	333	0.56	5.0	38.1	0.0047
700	10.6	329	0.56	5.7	38.21	0.0047
800	11.9	325	0.56	6.4	38.27	0.004535
900	13.15	325	0.56	7.3	38.26	0.004535
1000	14.34	318	0.56	8.2	38.16	0.004535
1100	18.47	315	0.562	10.33	37.61	0.004535
120	16.51	313	0.56	11.5	37.15	0.004535
1300	17.50	310.7	0.566	12.77	36.54	0.004535
1400	18.43	308.9	0.565	9.3	37.9	0.004535

- The capability of SSSC to exchange both reactive and active power makes it possible to compensate both the reactive and resistive line voltage drops and there by maintain a high effective X/R ratio for the line independently of the degree of series compensation. Thus, optimal power transmission (high active to reactive power ratio) can be attained even at a high degree of series compensation.
- The reactive shunt compensation is highly effective in maintaining the desired voltage profile along the transmission line interconnecting two busses of the AC system and providing support to the end voltage of radial lines in the face of increasing power demand.
- The Total Harmonic Distortion studies – performed under both the conditions keeping SSSC on and off – shows that the harmonic content introduced to the line current is very low, due to the utilisation of a multi-pulse inverter in the construction of the device, which inherently filters harmonics up to certain levels and thus enhances the output waveform quality.
- Controllable series line compensation is applied to achieve full utilisation of transmission assets by controlling the power flow in the lines, preventing loop.
- With the use of fast controls, minimising the effect of system disturbances, thereby reducing traditional stability margin requirements.
- The non-capacitor like behaviour, the superior operating characteristics and application flexibility that SSSC offers effectively is a compensation for power flow control and system stability improvement.

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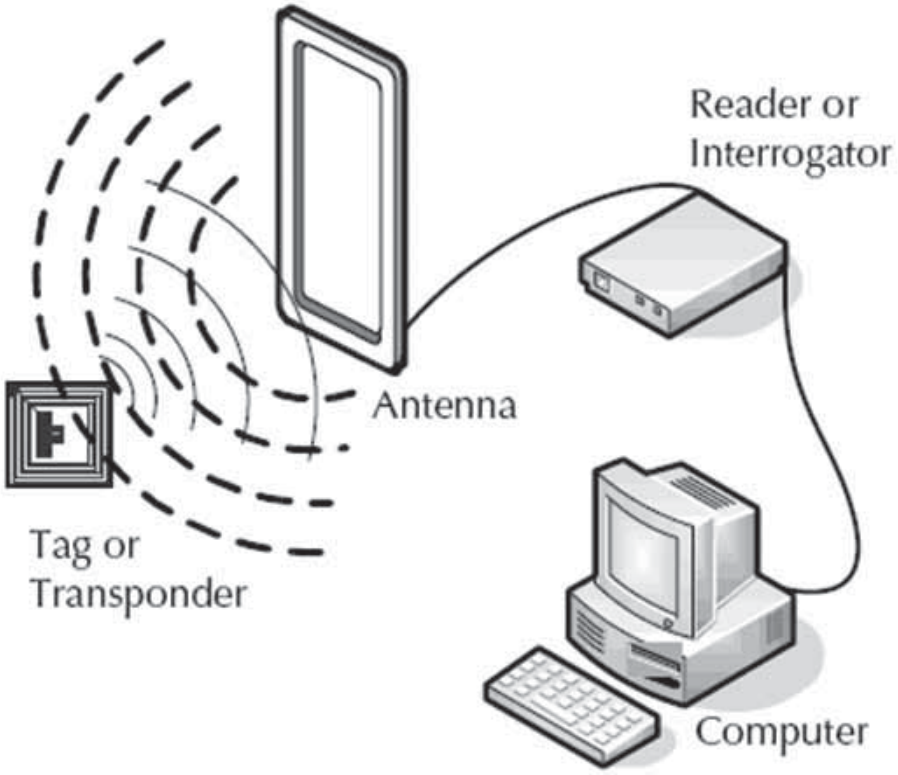
Automating Low Voltage Distribution Networks Using Sensor Technologies



Wireless sensors can play a key role in sensing the growth in energy demand and prompting actions to control this demand during peak hours. Intelligent electronic appliances fitted with sensors can communicate with the electric grid in real time to switch off or defer operation to cheaper off-peak hours, thus helping in energy balancing during peak loads...

In today's competitive environment, there is an increased pressure on the Distribution network operators to manage the state of the networks in real time to ensure reliable services. The regulators have enforced stringent guidelines and performance benchmarks (such as CAIDI, CAIFI, SAIDI and SAIFI), and there are heavy penalties for not adhering to these standards. This combined with the growing awareness of the customers of their rights to demand better services under the new electricity regulations have driven the distribution utilities to introduce innovative ways of managing their networks more efficiently and effectively. As a result, sensor-based technologies have assumed significance in managing low voltage networks down to the last mile.

Some of the key application where sensor based technologies are being used by the utilities for improving operations, revenues and energy efficiency are:

1. Asset management system
2. Transformer monitoring system

3. Fault management and service restoration
4. Real time network analysis
5. Power quality monitoring
6. Peak load management
7. Automated demand response

1. Asset management system

One of the main challenges of the distribution utilities is track their network assets throughout the life cycle, in order to manage assets costs with greater efficiency and higher profitability. Utilities are exploring new technologies for precise inventory control, with the ability to manage, track and secure critical assets in real-time, as part of the strategy.

The most commonly used technology is the "wireless" tracking devices. Tiny wireless RFID (Radio Frequency Identification) tags can be placed on a network asset such as distribution transformer or smart meter. These RFID devices communicate with the intelligent asset management system, which helps the utilities in asset planning, deployment, tracking and optimisation.

The active RFID tags are attached to assets which are to be tracked or monitored. These tags communicate with RF sensors strategically located near the assets and linked via wireless repeaters or a data communication bus to the asset management application, which then displays the real-time location of the tagged assets. The complete history of an asset or its movement is logged by the system through the use of active asset tags.

2. Transformer monitoring system

Distribution transformer is the heart of the LV distribution networks. The health of the Distribution transformer has to be monitored at all times to ensure continuous and reliable supply of electricity services. Introduction of sensors for on-line monitoring of key operating parameters reduces the risk of transformer failure and cuts maintenance costs.

The parameters which can be monitored on a Distribution transformer are:

1. Surface temperature
2. Winding temperature
3. Transformer oil level
4. Oil temperature
5. Gas and moisture in transformer oil

Monitoring of the above parameters involves on-line collection of data using sensor based measurements and transmitting the data to the remote monitoring application through suitable communication systems e.g. RF or ZigBee communication. The failures of transformers in service are broadly due to temperature rise, low oil levels, over load, poor quality of connections or improper installation.

Monitoring sensor data of distribution transformer for critical parameters of surface temperature, low oil level and over load could be utilized to take proactive action in fault prevention, thus increasing the reliability of distribution network.

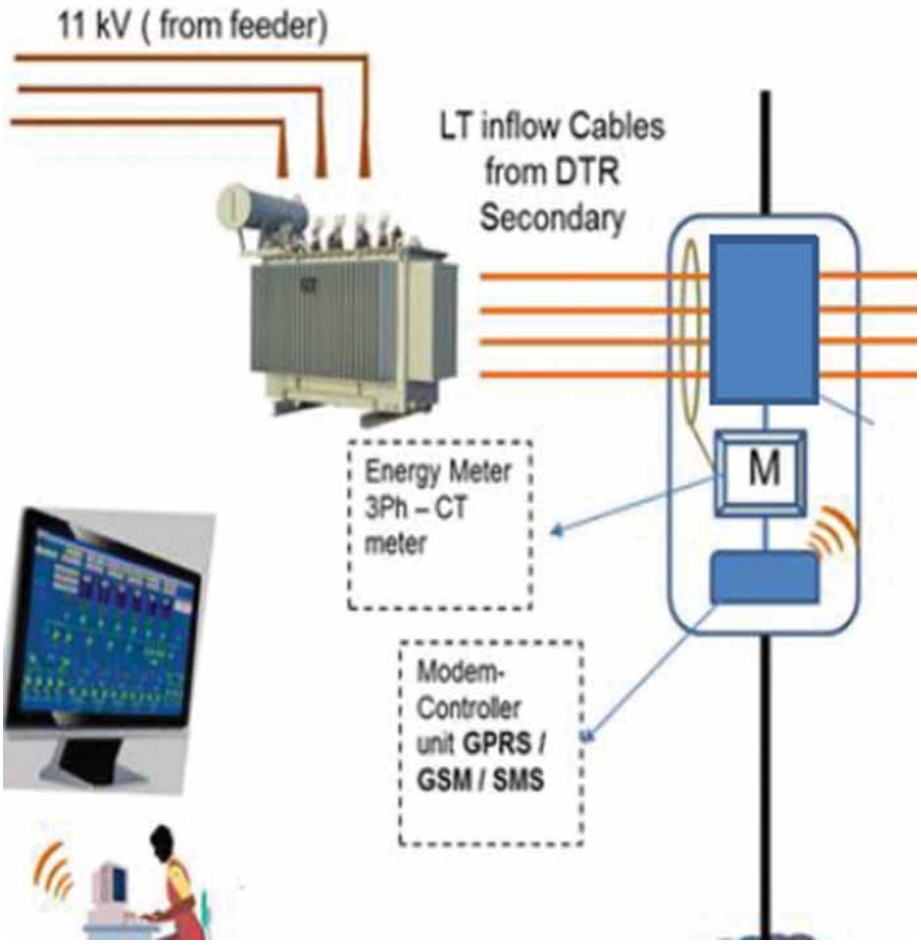
3. Fault management and service restoration

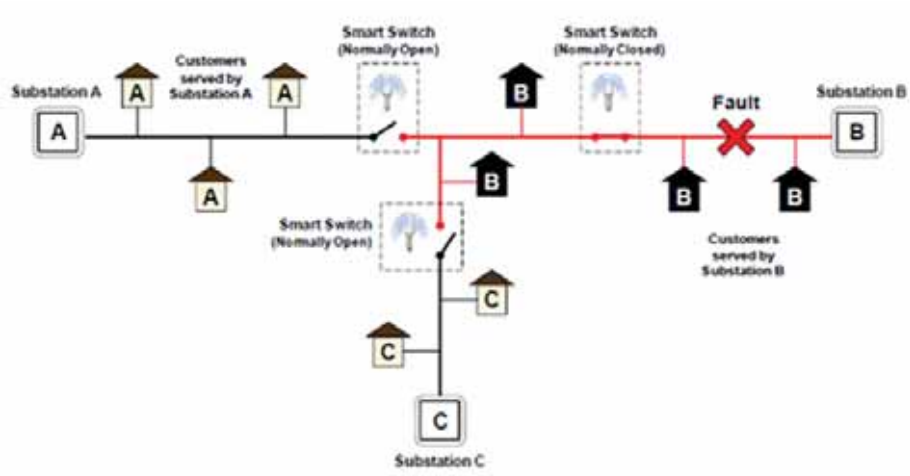
Fault passage current sensors on LV distribution systems can measure the current flow in real time and help in the early detection of overloading, short circuit or earth fault. The current signals can be graphically displayed on a remote Digital Fault Recorder (DFR), and the information can be utilised to validate the location of possible fault occurrence. Early detection of an impending fault can provide operators with a better understanding of the vulnerable sections of the network and the maintenance crew can be dispatched to reinforce those sections before a catastrophic fault may occur.

There is increased pressure from regulators and customers to reduce the number and duration of outages. Imposition of stiff penalties on utilities for poor network performance is incentivising the use of sensors for better management of power distribution system, early fault detection and pre-empting power outages. Utilities are therefore considering deployment of current sensors (Rogowski Coils, Hall Effect sensors) for better fault management and achieving regulatory targets of network performance through:

1. Quicker detection of a fault condition
2. Accurately determining the location of fault
3. Isolating of the faulty section of the LV network
4. Re-energizing heathy sections – upstream and downstream - outside the isolated faulty section

Any abnormal data from the sensors are analyzed and used to isolate the faulty sections and switch to alternate network plans





to minimise the impact of power disruption and facilitate early restoration of services in case of a fault. The sensor data help in optimal design of the switching plans of LV networks, considering all network constraints, system interlocks, protective devices and safety issues, and facilitate early restoration of services to a large part of the network and customers, without overloading.

4. Real time network analysis

Earlier, for traditional distribution networks without sensor-backed automation,utilities had to rely on customer calls to be aware of network outages. Now Supervisory Control And Data Acquisition (SCADA) at the substation get regular data from remote sensors via remote terminal units (RTUs) in real time, which is analysed to know the state of the networks.

Sensor-based technologies have made predictive analysis possible on the electrical networks, which helps in network fault prevention, optimization and planning. With real time analysis, it is possible to detect sudden sags or swells in feeder voltages and current, any abnormal load variations or physical conditions. Integrated with Transformer monitoring system, Outage management system and Electrical protection systems, real time analytics can help estimate the current state of the network and identify the characteristics which might need immediate attention to prevent major failures.

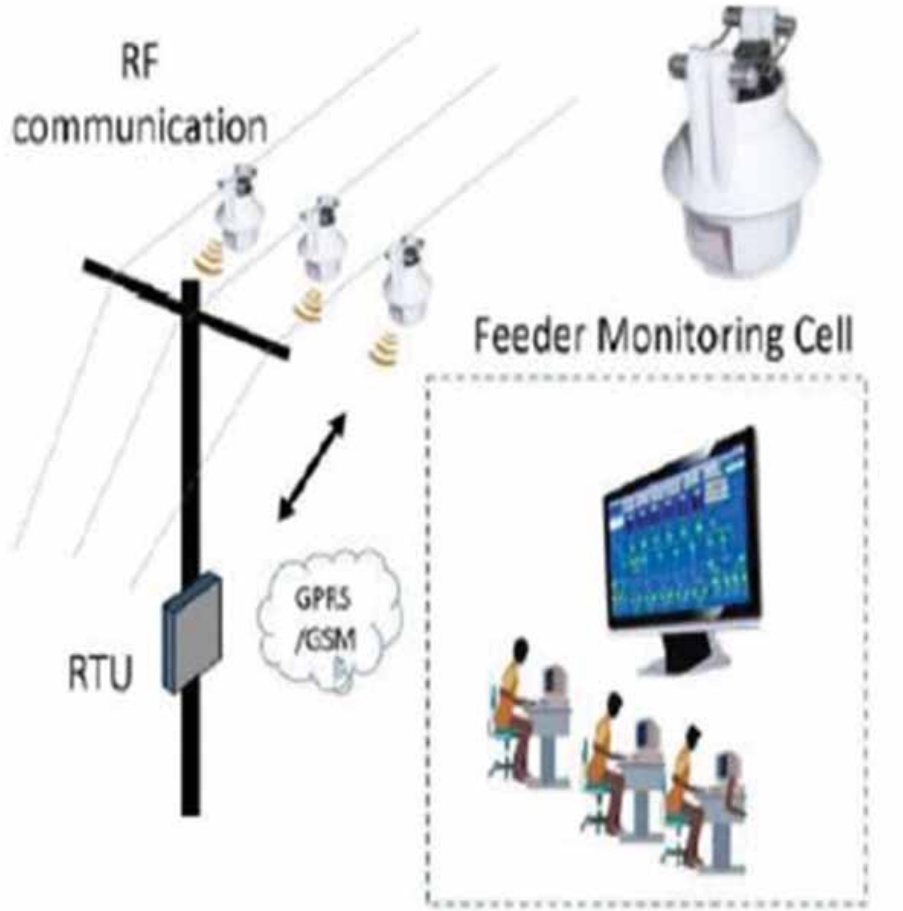
The intelligent Distribution Management System (DMS) relies on sensor data for real-time modelling of the distribution network. Signals from the fault sensors, help the DMS perform real time analytics to operate the protective devices in a coordinated manner to isolate the faulty sections and restore the network through alternate switching plans, in a safe and reliable manner.

5. Power quality monitoring

The quality of electrical power is an issue of increasing concern for industry players. The power quality of an electrical distribution network is affected by power line disturbance such as wave shape faults, overloading, capacitor switching transients, impulse transients or harmonic distortions. The rapid proliferation of energy efficient equipment, renewable energy sources and power electronics is increasing the presence of harmonics in the electrical supply.

This can often damage circuits and equipment, by overheating and failure, or by the inefficient use of increasingly expensive energy.Ideally, the best electrical supply would be a sinusoidal waveform of a constant magnitude and frequency. However, many loads are not purely resistive and the presence of magnetising current, effect of rectification and inherent impedance of certain loads may result in creation of harmonics or transients, which may degrade the power quality and cause technical losses.

Various measurement instruments of smart grids e.g., smart meters, protection relays and fault recorders may not measure all the power quality parameters. By using appropriate sensors and telemetry systems, it is possible to monitor power quality problems at regular intervals and analyse these data to reduce their effects, thus making the electrical network



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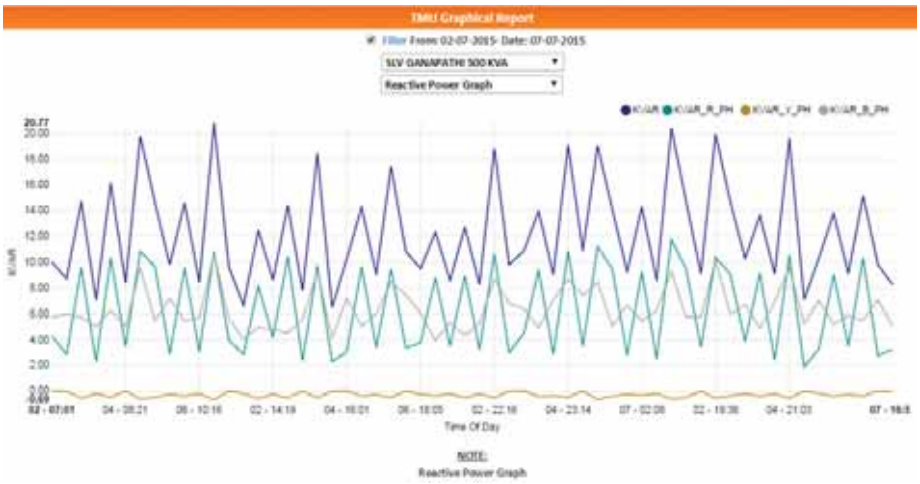


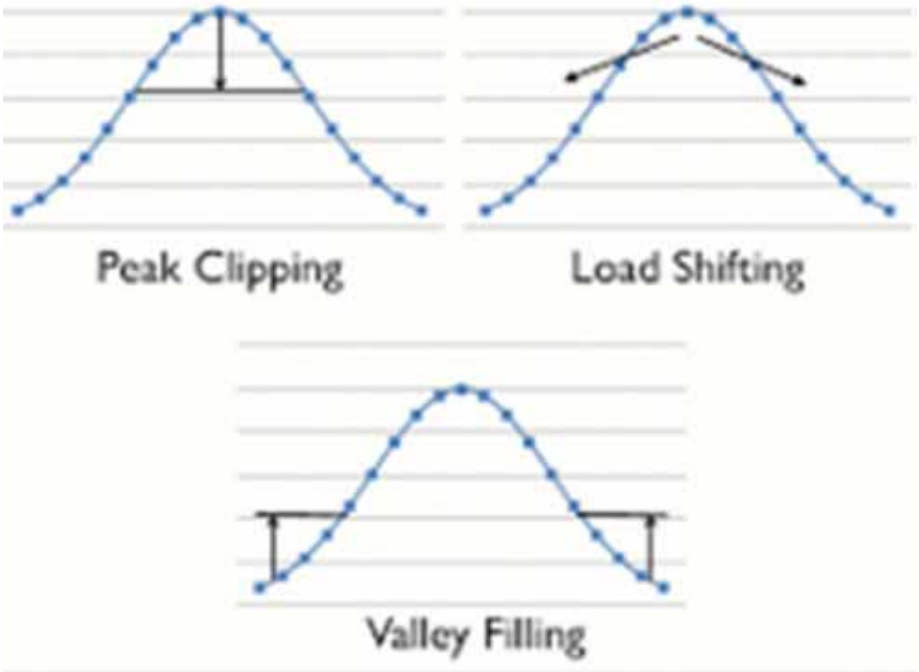
trouble free and more efficient.These sensors allow distribution network operators and high electrical load consumers to record vital information regarding power quality.

Sensor-based technology solves energy quality problems by timely identification of specific sources of harmonics. Each sensor unit measures and records harmonic and inter-harmonic frequencies, present on the main electricity supply at specific locations. The recorded data is then periodically transmitted through a wireless or wired communications network to a centralised database, where the information can be analysed and stored. The low cost of each sensor, combined with the convenience of wireless communication, enables monitoring electrical power quality at multiple locations of the network. This method significantly reduces costs by eliminating expensive diagnostic instrumentation, such as power quality analysers.

The sensor platform incorporates data management and visualisation software, which allows maintenance and operation personnel to use it for power quality measurements and analysis.

6. Peak load management

Sensors are transforming the operation of LV networks in combination with information and communication technologies (ICT) to build intelligence into the network for peak load management. Modern applications in energy generation, power distribution and energy consumption use sensors to make efficient use of green energy, increase automation in distribution and enable peak load management through different ways such as peak clipping, load shifting and valley filling.



Interconnecting consumer devices with the home area networks, and at the same time, communication with the utility networks through a home gateway facilitate residential energy management. Residential energy management uses utility-driven price signals which vary depending on the time of the day, called Time of Use (ToU) pricing. In TOU pricing, electricity consumption during peak hours costs more than electricity consumption during off-peak hours. In peak hours, demands of the consumers rise, and utilities are compelled to deployspinning reserves at a higher cost of energy and environment. Reducing peak load decreases the expenses for energy generation with corresponding decrease in greenhouse emissions.

Wireless sensors can play a key role in sensing the growth in energy demand and prompting actions to control this demand during peak hours. Intelligent electronic appliances fitted with sensors can communicate with the electric grid in real time to switch off or defer operation to cheaper off-peak hours, thus helping in energy balancing during peak loads. Another faster and reliable way of managing peak loads and balancing demands is through automated demand response.

7. Automated demand response

Automated demand response refers to a smart grid device or application interacting with customers to influence their consumption of electricity or their load demand during select time periods. This signals customers to decide to lower their consumption or shed electricity during peak periods, and shift their demand to off-peak periods to save energy costs. Utilities use automated demand response to achieve a balance between electricity generation and electricity consumption, thus helping in load optimization and grid stability.

Traditionally, demand response interactions were manual, but with the introduction of sensors and advanced control systems, the LV network interacts directly with its customers' load control systems to manage peak loads and balance consumption. Automated demand response combines the inherent benefits of automation to bring more reliable, faster and cheaper responses to the load demand signals.

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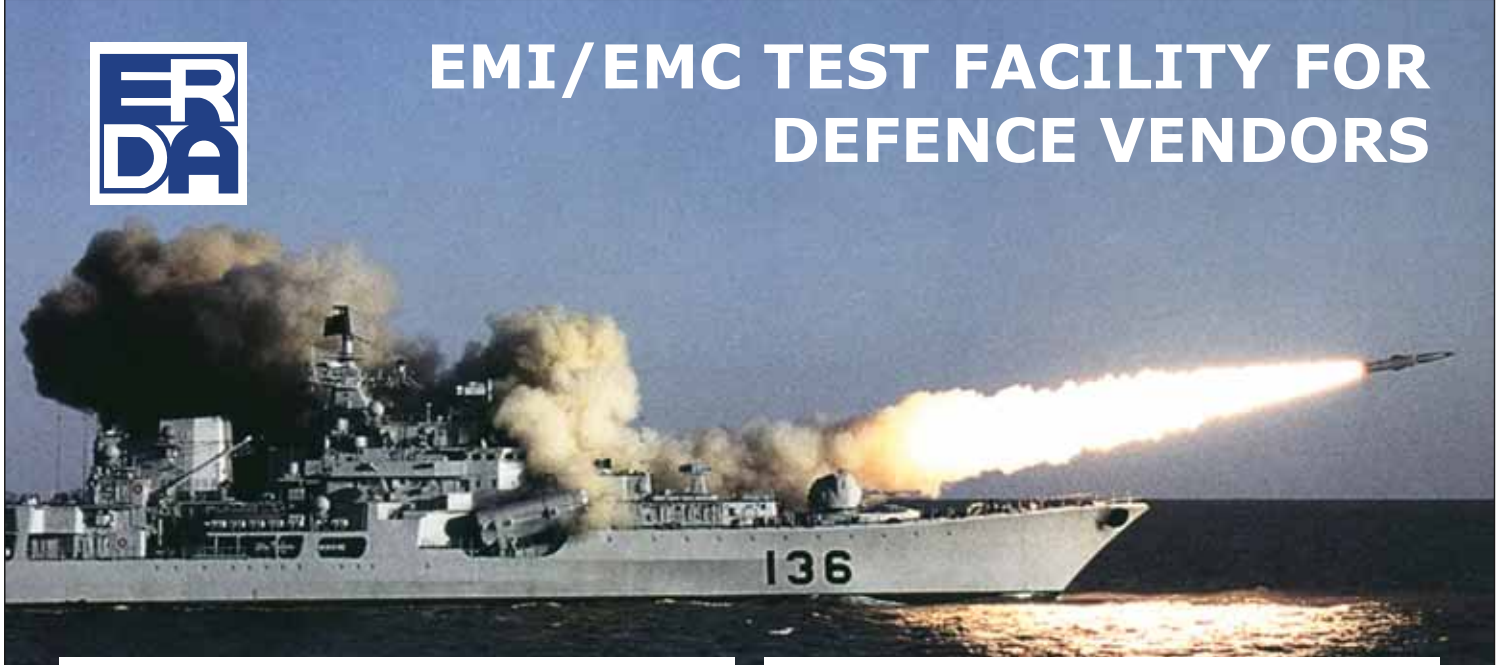

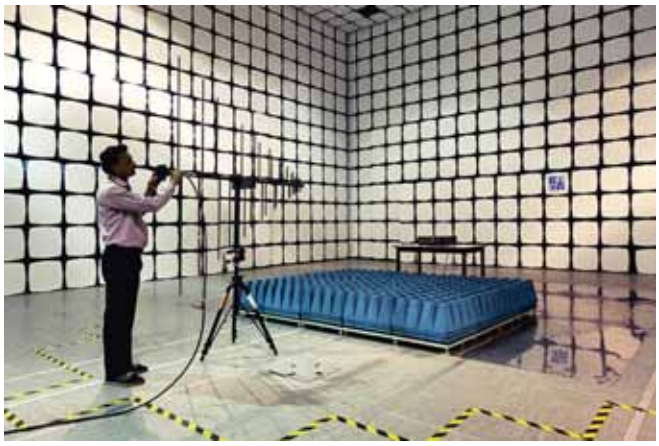

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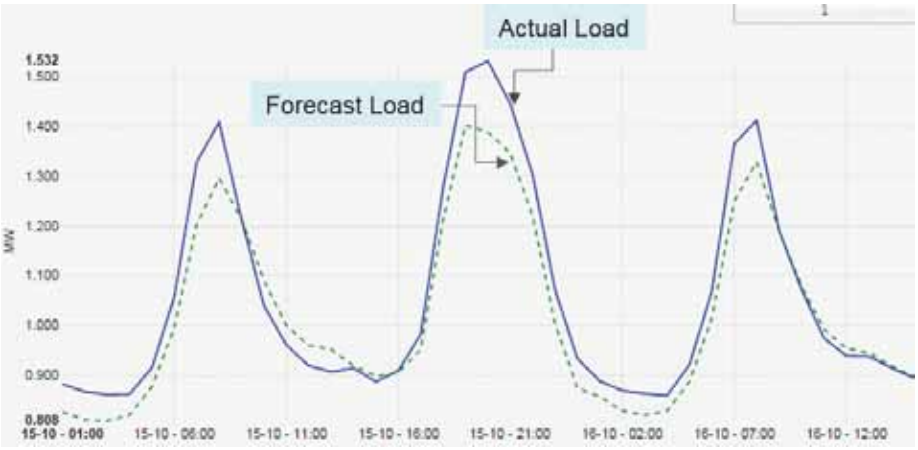
Automated demand response requires both the grid and the demand-side entities to install infrastructure to support the exchange of signals. The grid entity puts in place sensors capable of communicating demand response signals to their customer's automation equipment and the customer installs equipment capable of receiving these signals. Further, the demand response signals are relayed to the control systems where demand response strategies have been pre-programmed to execute the appropriate load control. Depending on the type of customer facility, such control systems could be as simple as a thermostat in a residence or as sophisticated as an industrial process control system. The smart network will receive feedback of the demand response signal on the facility's consumption via a smart meter or the control system.

With automated demand response, the customer can respond to smart meter or sensor signals indicative of desired levels of demand response as opposed to manual load control. Automated demand response represents a way for distribution network operators to avail of more demand-side resources as a cheaper option for grid balancing.



Conclusion

The assessment studies on the impact of sensor technology on LV distribution networks reveal that the technology has a high potential in improving operational efficiencies through proactive fault management, improving power quality, network reliability and controlling technical losses.

Other advantage of sensor-based technologies is the contribution to the reduction of greenhouse gas emissions, being able to maintain the health of LV networks in a sustainable and energy-efficient manner. Sensor based applications being used in smart power grids and combined with demand side management contribute to efficient use of energy resources and optimised network operation, thus helping in reducing the carbon footprint.

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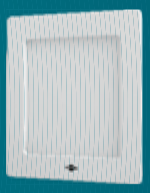

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Solar PV System In Educational Institute

Erected Solar Panels on Terrace of Shri Shivaji College, Akola...

The major requirement of electrical power in educational institutes is at day time, as major work of teaching-learning is carried out at day time. That is the plus point for the use of solar energy. Hybrid systems such as Solar-Wind, Solar-Diesel and Solar-Biomass may also be beneficial setups depending on the geographical condition...

Urbanization and economic development are leading to a rapid rise in energy demand in urban areas in our country leading to enhanced Green House Gas (GHG) emissions. Many cities around the world are setting targets and introducing polices for promoting renewable energy and reducing GHG emissions. Ministry of New and Renewable Energy (MNRE), Government of India has taken initiatives to develop green campuses under 'Development of Solar Cities' programme which aims at minimum 10% reduction in projected demand of conventional energy at the end of five years. The forward step in this respect is to utilize the background of educational institutes for renewable energy utilization.

The major requirement of electrical power in educational institutes is at day time, as major work of teaching-learning is carried out at day time. That is the plus point for the use of solar energy. Hybrid systems such as Solar-Wind, Solar-Diesel, and Solar-Biomass may be also beneficial set up depending on the geographical condition. But the solar energy is the most commonly available source, and it's economical with many factors. Factors may include easy erection, instant generation, easy repairs, tailor-made projects and tie grid projects etc.

Major power requirement in an educational institute is for lighting load. It includes lamps, fans, computers etc. There are power equipments in institutes such as air-conditioners, projectors, heaters etc. As in wiring system separate wiring path is provided for light and power circuit, it is easy to equip light circuit with solar power system.

At present there is limitation on solar energy production due to the space availability for solar panel erection. The shadow-free area required for installation of a rooftop solar PV system is about 12 m^2 per kW (kilowatt).

Rooftop available is having its own limitation due to the load bearing capacity of roof. Fixing of panels to the normal direction of incident radiations i.e. placement of solar panels at proper tilt angle may be a major problem. The minimum clearance required for cleaning and servicing of the panels is 0.6 metre from the parapet wall and in between rows of panels. In between the rows of solar panels sufficient gap needs to be provided to avoid the shading of a row by an adjacent row. Placing the panels on ground, disturb the playgrounds, space for cultural activities and garden. So due this limitation of solar PV (Photovoltaic) generation, light circuits can be easily fed with solar power.

Components of Solar PV System

Below is shown a block diagram of basic PV system. It can be used directly for DC load with the help of charge controller. With the help of battery and inverter same system can be used for serving AC load.

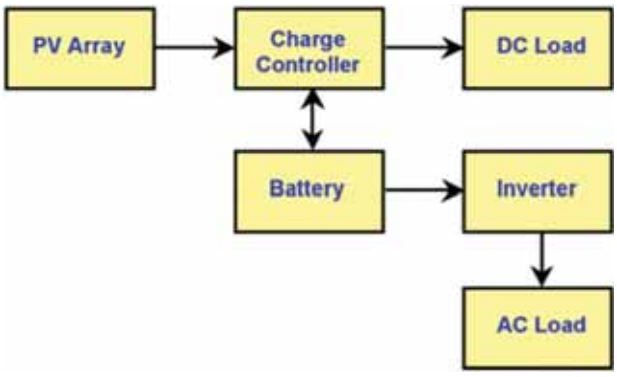

Fig. 1: Typical PV Stand-alone AC System...

The key component of solar PV system is the solar panel. The cost of solar panels in entire solar PV system is near about 50% of entire system. The Maximum Power Point Tracking (MPPT) charge controller is having major role for the increased efficiency of solar PV system output. Inverters are used to convert DC power into AC power. Industrial flexible cables are used as it is open to weather. It may be a armored or not depending on its use. Infrastructure for panel is another expenditure. Its erection is a typical task with reference to tilt angle facing to south-east or south-west. Below is given the general cost analysis (without battery) for 1kW system.

Table 1: Components & Cost of Solar System

Component	Amount (Rs.)	% of Total Cost
PV Modules (Crystalline)	52,000	52%
Inverters	23,000	23%
Balance of System (cables, etc.)	17,000	17%
Installation	8,000	8%
Total	1,00,000	

(Reference: Energy Alternatives India, EAI, Solar Mango, Rooftop Guide)

Factors Affecting PV Output

Energy efficiency factors must be carefully considered while designing any solar PV systems to get the best out of your efforts and investment. Following are six important considerations for efficient power output from PV system:

1. **Cable Thickness**: Normally in PV system DC voltages is 12V, 24V or 48V. For the same wattage much higher currents are involved in the PV systems. This brings into picture resistance losses in the wiring. So higher cross sectional area cables are used.
2. **Temperature**: Solar cells perform better in cold rather than in hot climate and as things stand, panels are rated at 25°C which can be significantly different from the real outdoor situation.
3. **Shading**: Ideally solar panels should be located such that there will never be shadows on them because a shadow on even a small part of the panel can have a surprisingly large effect on the output.
4. **Charge Controller**: An inherent characteristic of solar silicon cells is that the current produced by a particular light level is virtually constant up to a certain voltage (about 0.5V for silicon) and then drops off abruptly. MPPT (Maximum Power Point Tracking) charge controller tries keeping the panel at its maximum voltage and simultaneously produces the voltage required by the battery.
5. **Inverter Efficiency**: When the solar PV system is catering to the needs of the AC loads, an inverter is needed. Although inverters come with wide ranging efficiencies, typically affordable solar inverters are 80 to 90% efficient.
6. **Battery Efficiency**: Whenever backup is required batteries are needed for charge storage. Lead acid batteries are most commonly used. All batteries discharge less than what go into them; the efficiency depends on the battery design and quality of construction of cell of batteries.

Case Study: For the study of output power from solar system, system erected by Shri Shivaji College, Akola (MS) is studied. The college is multi faculty discipline with arts, commerce and science. Solar system is off grid connected (PCU: Power Conditioning Unit) of 6kVA capacity.

The system was commissioned on 20th Feb, 2016 in college. Solar power is given to two administrative offices and to two laboratories. Total connected load of offices is 2 kW and that of laboratories is 1.8 kW. Connected area lighting load operating at night is 500 Watt. Normal working of college is from 7.30am to 6.00pm. Preferences of operation of PCU for power supply is first solar, second grid and last battery. Load is adjusted up to the 75% capacity of inverter.

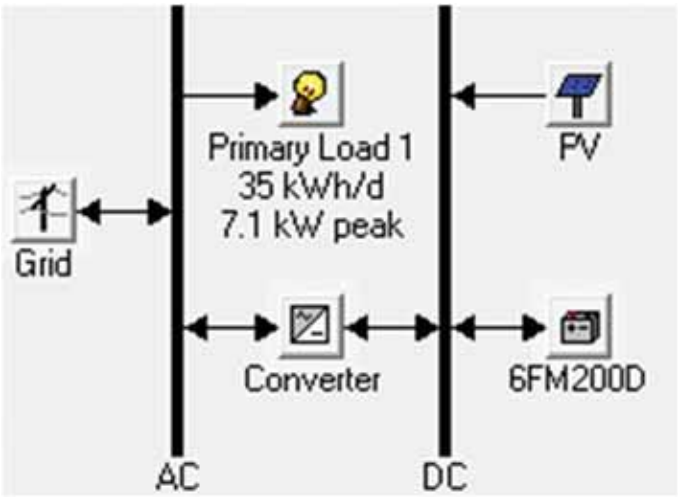

Fig. 2: HOMER Model of Solar System...

Fig. 3: PCU with Battery in Control Room...

Fig. 4: LCD Display for Solar System Readings...

Solar Resource Inputs

Akola is a hot place in the state of Maharashtra. As compared to wind energy potential, solar energy is available in ample quantity, throughout the year. HOMER model for solar radiation and radiation incident on PV array in the D-map format is shown above (Fig. 2).

Table 2: Solar Resources of Akola City

Latitude	Longitude	Clearness Index	Scaled Annual Ave. Radiation (kWh/m^2/day)
20. 59	77	0.560	5.25

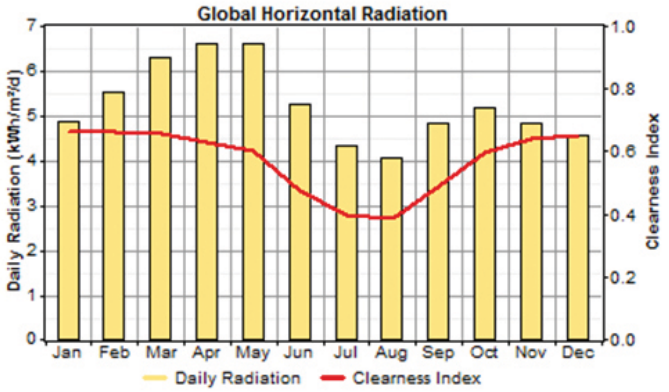

Fig. 5: Irradiance Graph of Akola City...

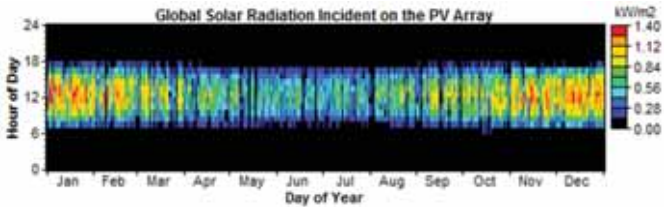

Fig. 6: D-Map of Irradiance Incident on PV Array in Akola City...

System Design

PCU (Power Conditioning Unit) is installed in the Power Control Room of College (Fig. 3). The panels are erected on 2nd floor at an angle of 50°C facing to south. Necessary connections of DC output from PV array are done to the input of PCU. The connection is brought by armored DC cable. Following are the components of solar PV system:

1. **Solar Panel**: It is two diode panel and product name is125Wp/12V/SN80. These are of 36 cell structure, connected in series. The entire panel is of 12 Volt, and 125 Watt capacity. For the system 5 strings of 8 series connected panels are used. It is the mandatory design factor as DC input to PCU (Power Conditioning Unit) is 96 Volt. Total numbers of panels used are 40 which is 5000 Wp (Refer opening image).
2. **G.I. Support to Panels**: Panels are arranged on 2nd floor of the college on GI frame structure at an angle of 50°C facing towards south. Sufficient clearance between the panels is kept for the air ventilation.
3. **Cables & Wires**: Single core Cu wire of 10 sq mm flexible, POLYCAB make is used for interconnection of solar panels. DC cable is used of 10 sq mm 2 core Cu Armored for the interconnection of panels output and PCU input. Industrial flexible wire POLYCAB make, of 2 core 10 sq mm is used for connection of protective switches.
4. **Busbar Box**: 2 Nos of busbar boxes are used, of 32 Amp rating having HRC fuse of 63 Amp rating.
5. **HRC Fuse**: For the circuit of array of panels, 32 Amp rating HRC fuses (5 Nos.) are used.
6. **Earthing**: Two earthing connections are provided KAPITRODE make, connected with 10 sq mm Cu multi strand wire.
7. **Lightning Arrestor**: One lightning arrestor is provided for

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Table 4: Component wise Cost Structure

Component	Capital ($)	Replacement ($)	O&M ($)	Fuel ($)	Salvage ($)	Total ($)
PV	6,470	0	639	0	0	7,109
Grid	0	0	7,103	0	0	7,103
Battery	1,370	1,192	639	0	-160	3,042
Converter	1,560	651	320	0	-121	2,409
System	9,400	1,843	8,701	0	-281	19,663

protection from lightning.

8. **DC MCB**: Two DC MCB of 2 Pole, 250 Volt, (HAGER make) are connected in DC cable.
9. **TPN Box**: Two TPN boxes 4 way outlet of L&T make is used. It is having 4 Pole MCB of 40Amp (2 Nos.), 4 Pole MCB of 32Amp (3 Nos.) and 4 Pole Isolator of 63 Amp (1 No.) is provided.
10. **PCU Unit**: Power Conditioning Unit (PCU) of Su-Cam make, 6kVA capacity, rated for input supply of 96 DC Volt, is used as a converter.
11. **Battery Bank**: Lead acid battery of 12 Volt, 200 AHr capacity, 8 Nos. are used.

Total Expenditure:

Expenditure per item incurred for the solar PV system is given below.

Table 3: Cost Structure of PV System

S. N.	Items	Rate (Rs.)	Quantity	Total (Rs.)
1	Solar Panel	50/ Watt	5000 Wp	2,50,000/-
2	G.I. Support	——		50,000/-
3	Cables & Wires	——		.70,000/-
4	Busbar Box	2000/- Each	2 Nos	.4,000/-
5	HRC Fuse	1000/- Each	5 Nos	.5,000/-
6	Earthing	20,000/- Each	2 Nos	.40,000/-
7	Lightning Arrestor	10,000/- Each	1 Nos	.10,000/-
8	DC MCB	5,000/- Each	2 Nos	.10,000/-
9	TPN Box	2,000/- Each	2 Nos	.4,000/-
10	TPN Box MCB	2,000/- Each	5 Nos	.10,000/-
11	PCU Unit	1,09,000/- Each	1 Nos	1,09,000/-
12	Battery Bank	12,000/-	8 Nos	96,000/-
Total Rs.				6,58,000/-

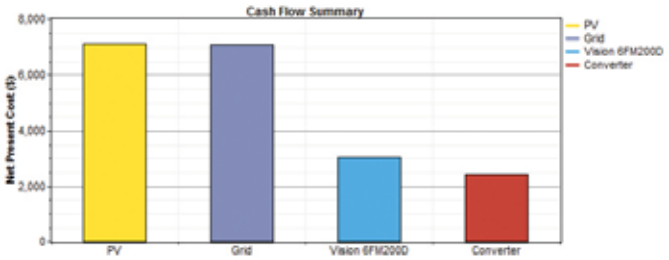

Fig. 7: HOMER-Graphical Representation of Cash Flow Summary...

Total life of PV panel is assumed for 25 years and that of PCU is 15 years. Infrastructure and cables/wires are assumed for the life of 10 years. Battery life is for 3 years.

No fuel charges are required for PV power generation. But the charges are incurred to charge batteries at night and to supply grid current to charge batteries at day time, in case the photovoltaic power generation is not sufficient to charge the batteries. It is shown in cash flow diagram (Fig. 8).

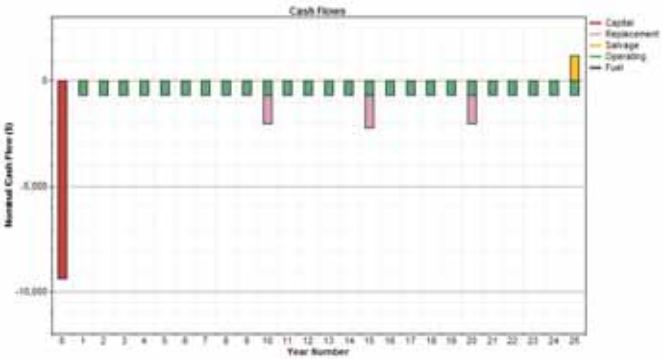

Fig. 8: HOMER-Graphical Representation of Cash Flow...

Primary Load Inputs

Below is given the graphs from HOMER model for the day of year and for monthly average of AC primary load. (Refer Figure 9 and Figure 10).

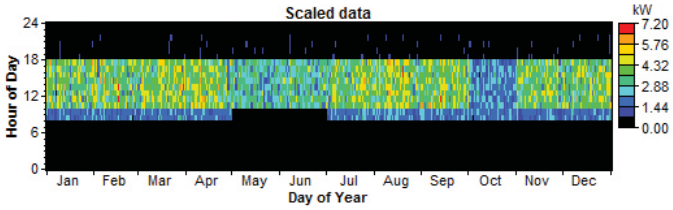

Fig. 9: HOMER- D-Map of Loading Condition...

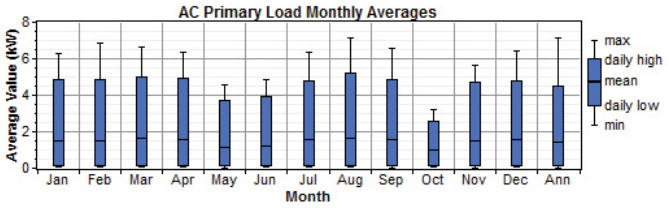

Fig. 10: HOMER-Graphical Representation of Monthly Average of AC Primary Load...

System Output

For the system output power three models are studied. First model is simulink model, which gives theoretical output of designed system.

Second model is HOMER model, which gives predicted output power and cost analysis.

Third model is actual reading from PCU.

A. MATLAB Application

6 kVA solar PV system is modeled to get I-V (Current-Voltage) and P-V (Power-Voltage) characteristics at temperature (T) 25°C and irradiance (G) 1000 w/m^2. The maximum power (DC) output from the simulation is 6.443e+03 Watt.

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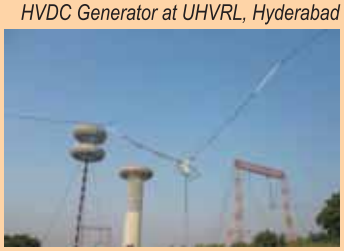

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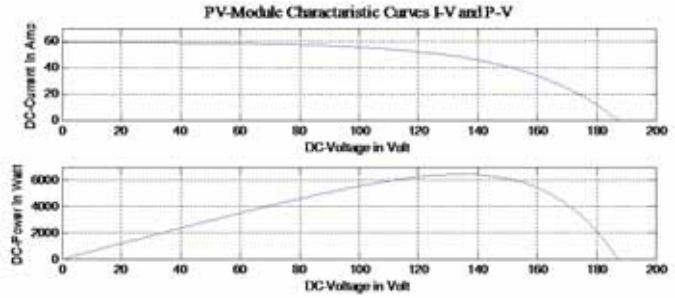

Fig. 11: Current- Voltage (I-V) &Power- Voltage (P-V) Characteristics...

Table 5: Tabulated Simulation Result

S. N.	Parameter	Reading
1	G	1000 W/m^2
2	T	25 °C
3	Voc	188 Volt
4	Imax	48.431Amp
5	Isc	59.252Amp
6	Pmax	6.443e+03Watt

B. HOMER Application

HOMER is the micropower optimization model, which simplifies the task of evaluating designs of both off-grid and grid-connected power systems for a variety of applications. Basic constraints are introduced to get optimized result.

Table 5: HOMER Output Readings of Inverter

Quantity	Inverter	Rectifier	Units
Hours of operation	4,403	0	hrs/yr
Energy in	8,616	0	kWh/yr
Energy out	7,755	0	kWh/yr
Losses	862	0	kWh/yr

Table 6: HOMER Output Readings of Power

Quantity	Value	Units
Rated capacity	5.40	kW
Mean output	0.98	kW
Mean output	23.6	kWh/d
Capacity factor	18.2	%
Total production	8,616	kWh/yr

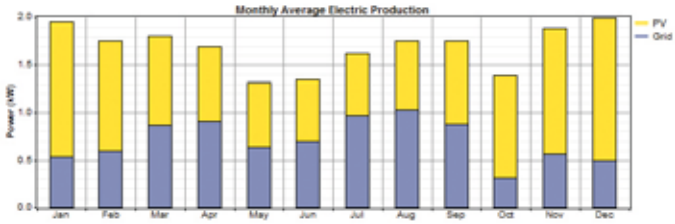

Fig. 12: HOMER-Monthly Average Production of PV and Grid Power...

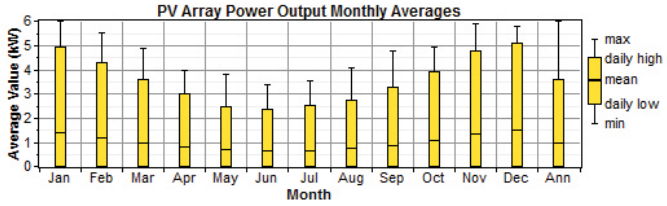

Fig. 13: HOMER-Monthly Average Production of PV Array Output Power...

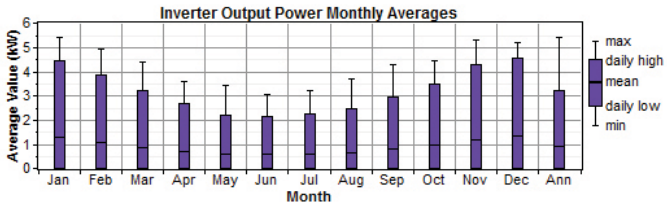

Fig. 14: HOMER-Monthly Average Production of Inverter Output Power...

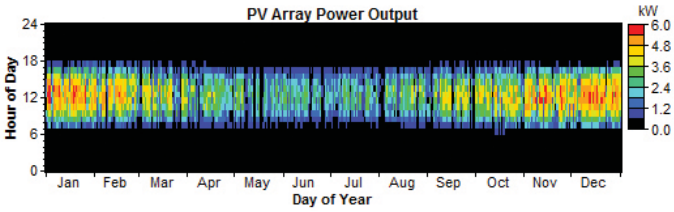

Fig. 15: HOMER-D-Map of Production of PV Array Output Power...

C. PCU Readings

Actual loaded conditions are noted and readings for PV power output and output power of converter are taken. Tabulated chart for reading is given below.

Table 7: PV Power Output at Different Load Conditions

S. N.	LOAD (%)	V - PV (Volt)	I - PV (Amp)	P- PV (Watt)
1	45	976	18.2	17763.2
2	46	958	9.2	8813.6
3	47	958	9.2	8813.6
4	48	1006	34.3	34505.8
5	49	990	29.4	29106
6	50	1004	34.3	34437.2
7	51	1008	33.9	34171.2
8	52	1010	33.9	34239
9	53	1006	34.4	34606.4
10	54	1010	36	36360
11	55	994	28.7	28527.8
12	56	1000	33.5	33500
13	57	962	9.8	9427.6
14	58	990	28.5	28215
15	59	998	36.1	36027.8

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* Expected

S. N.	LOAD (%)	V - PV (Volt)	I - PV (Amp)	P- PV (Watt)
16	60	998	36.2	36127.6
17	61	962	11.3	10870.6
18	62	992	33.7	33430.4
19	63	992	35.4	35116.8
20	64	992	35.4	35116.8
21	65	990	34.8	34452
22	66	950	10.8	10260
23	67	970	26.6	25802
24	68	962	16.7	16065.4
25	69	950	12	11400
26	70	976	34.8	33964.8

Table 8: Power Output of Converter at Different Load Conditions

S. N.	LOAD (%)	V – O/P (Volt)	I – O/P (Amp)	P – O/P (VA)
1	45	229	12	2752.8
2	46	230	12.1	2777
3	47	230	12.4	2845.8
4	48	230	12.6	2903
5	49	230	12.9	2972.2
6	50	231	13	2997.8
7	51	230	13.4	3080.7
8	52	230	13.6	3121.2
9	53	230	13.8	3168.5
10	54	230	14.2	3263.2
11	55	230	14.5	3327.8
12	56	230	14.6	3356.5
13	57	230	15	3448.5
14	58	229	15.4	3531.2
15	59	231	15.5	3572.8
16	60	230	15.8	3637.2
17	61	230	16.1	3703
18	62	230	16.1	3704.6
19	63	231	16.6	3826.3
20	64	230	16.9	3887
21	65	230	16.9	3885.3
22	66	230	17.3	3975.5
23	67	230	17.5	4025
24	68	230	17.8	4088.7
25	69	230	18.1	4163
26	70	230	18.2	4184.2

Graphical representation of output voltage, current and power against percentage load is shown in next Figures (16 to 18).

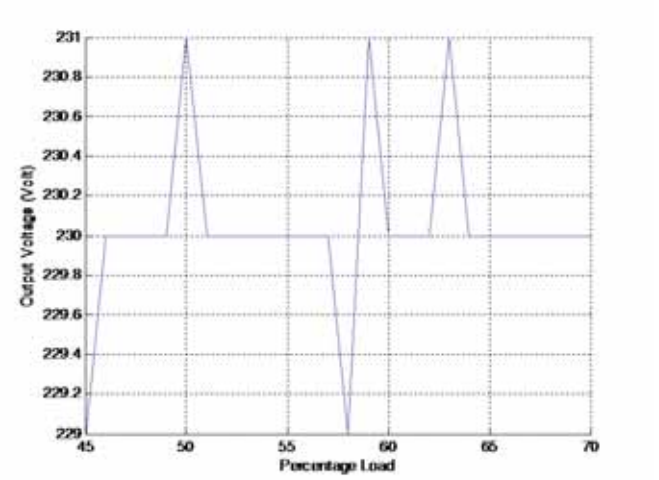

Fig. 16: Graph Showing Output Voltage and Percentage Load of PCU...

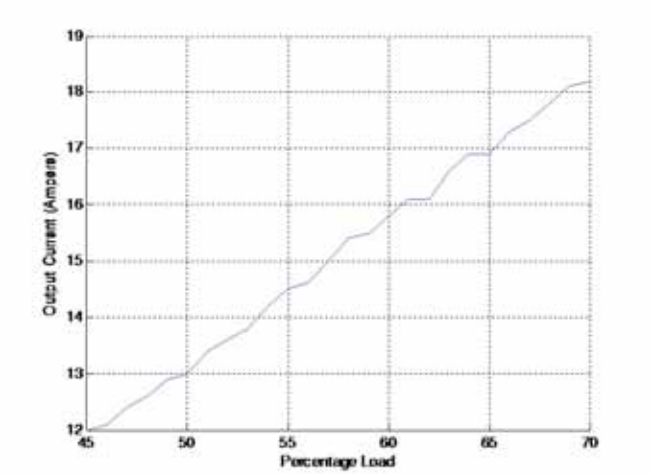

Fig. 17: Graph Showing Output Current and Percentage Load of PCU...

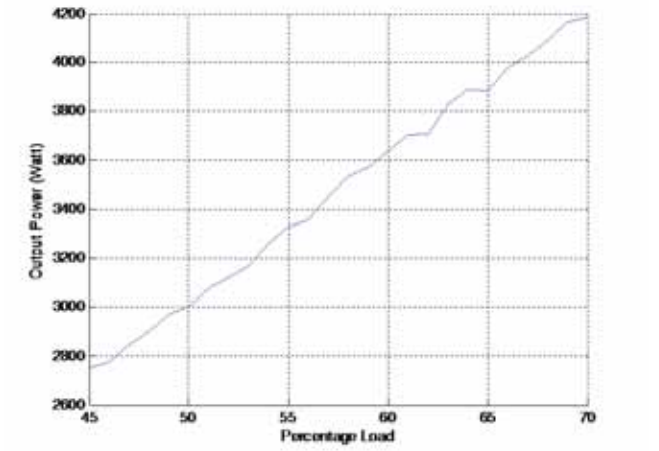

Fig. 18: Graph Showing Output Power and Percentage Load of PCU...

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Conclusion

Based on the methods used for output power calculation, that means by MATLAB, HOMER and PCU readings and the results obtained thereon, some notable conclusions can be drawn, which have been stated below:

1. Computation of output power by MATLAB-simulation is theoretical. Practically change in temperature and irradiance influence the output power.
2. As HOMER software considers the various constraints for the computation of output power, it gives realistic output power reading. The calculations are very well matched to the actual power output readings given by PCU.
3. HOMER simulates the operation of a system by making energy balance calculations for each of the 8,760 hours in a year. It specify and estimates the cost of installing and operating the system over the lifetime of the project.
4. PCU readings (LCD display) give the actual energy utilized, PV current, PV voltage, output voltage, battery voltage and loading staus.
5. From PCU readings it is evident that output voltage is nearly constant. MPPT charge controller works for this stage.
6. Output power varies with load condition. It is linearly increasing with increase in loading condition.

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7 Tips To Prevent Mishaps Related To Kite Flying

In India, kite flying is a very common game or leisure activity. However, wherever overhead electric lines, especially high voltage lines, are extended, this game may turn fatal. Austin Energy, U.S., gives seven good safety tips to avoid mihaps when flying kites:

- Keep away from all overhead wires, especially power lines.
- Fly your kite in open areas in dry weather. Avoid streets and highways and keep away from radio and cell phone towers.
- A kite in power lines is a lost kite – never try to retrieve it.
- When buying or making a kite, make sure it is constructed of wood, plastic or paper. Never use anything metallic such as aluminium foil or Mylar polyester film; they conduct electricity.
- Use dry kite string when flying your kite and never use wire.
- Stay away from utility poles, guy-wires and pad-mounted transformers – do not climb on any electrical equipment.
- Never fly a kite in stormy weather.

(**Adopted from inputs by Austin Energy**)

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Power Generation Automation – Requirements

Wi-Fi, a WLAN conforming to IEEE 802.11b is emerging as a good replacement for LAN. It allows people to log onto the Internet and receive e-mails on the move. WiMAX an 802.16 wireless metropolitan-area network with a range of 50 km, facilitates wireless broadband access in metros and rural areas, and is a cost effective alternative to cables...

The growth of the power sector is a key parameter to drive economic development. Over the years, installed generating capacity in India has increased from a meagre 1713 MW in 1950 to 288.665 GW as on 29th Feb., 2016. Electricity generation has also increased from 5.1 billion kWh in 1950 to 1048.673 billion kWh in 2014-15 indicating of 8.43% even though the per capita consumption of electricity in India is only 1010 kWh (2014-15), which is abysmally low compared to 4000 KWh of China with developed nations averaging around 15000 KWh of developed nations. As per IEA estimation, the per-capita energy consumption in India will be 1895 kWh by 2030. Even against this per capita consumption, the installed capacity should be more than 5, 00,000 MW by 2030 along with associated transmission and distribution network.

The Global Trends in Power Sector

Europe: State of the art technology & automation; deregulation.

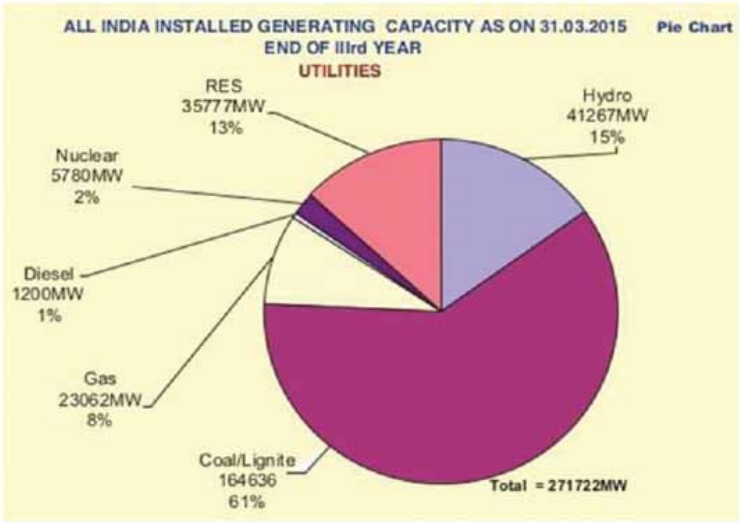
Japan: State of the art technology & automation; deregulation.

US: Newer technologies & automation; deregulation on hold.

Middle East: Mix of new & not so new technologies & automation; preparing for deregulation.

Asia: Slow trend to acquire new technologies; Non-serious deregulation.

India: Slow adoption of new technologies; deregulation decelerated; huge gap between demand & supply; huge technical & commercial losses.



Present State of Information Technology in India

It has been observed that the approach of the Power Companies/ Utilities in implementing IT has been piecemeal with standalone applications deployed for a limited operational requirement. In other words, IT has been used as a tool to address a specific issue at a time and not as a long-term, holistic strategy. The gap in IT adoption at home and abroad is apparent and glaring.

Common IT Strategy in All Power Utilities

From an overall view of the power sector in India, the nature of processes and other issues are similar across different utilities. It is, therefore, possible to prepare a common IT strategy. The common IT strategy can then be adopted by individual utilities, customising it for their specific needs, taking into account their functions and operational processes. The investments in IT would need to be phased and prioritised taking into account business criticality, organisation readiness and value to business. The implementation of IT would be long-term, and the advantages accrue only through disciplined usage. Therefore, to make it viable as well as to gain confidence and commitment of the users, several short-term, highly visible IT applications must be delivered with clearly measurable benefits. In this respect, introduction of automation in Power generation plants shall bring about immediate efficiency thus increasing generation from the same generators.

System Requirements for the Generation Plant Automation

The functions and the business processes in power system network are as per Table 1.

The automation modules should cover all these processes and all the applications are required to be integrated with centralised control. Further details for Generation automation are given in Table 2.

Case Study of 10 MW Biomass Based Plant in Village Jalkheri (Punjab)

The utilities are very cautious in selecting and implementing computerised automation in power plants because already pneumatic and other remote controls exist. Therefore, normally, the mechanical operations are automated as can be seen in the case study of 10 MW Biomass (rice/ wheat straw, mustard straw, rice husk, saw dust, cotton waste, or tree chips etc.) based plant of Punjab State Power Corporation Limited (erstwhile PSEB) set up in village Jalkheri (Distt. Patiala) in 1991. This is basically a mini thermal plant, which uses biomass as fuel instead of coal for releasing heat energy. Automation of the mechanical functions of this plant has been carried out by installing signal transmitters (transducers) at various locations as shown in logic control screen shot. The temperature/ pressure signals are picked up by these transducers and are transmitted to the Programmable Logical Units (PLCc) via copper cables. The PLCs perform I/O functions and are further linked to the computer control unit. The screen shot of the control is as under in Figure 1.

The logic control has all the necessary commands. The trends with respect to various equipment's under control are displayed in screen under Trends Display. Any abnormal behaviour of any equipment sets an alarm which is displayed in the screen as Alarms Display. The unit can be set for manual or for auto control as shown in Figure 2. The control can be applied to equipment's as shown in Figure 3.

One can control the governor to regulate the steam in the turbine, the air supply and furnace draught can be changed and in case of fault in any equipment such as pumps etc., the standby can also be selected while

Table 1

Generation						
Function →	Energy Management	Facility Management	Operations Management	Fuel Management	Environment Management	MIS
Business Process →	Load Forecasting, Energy Accounting, Billing, Trading & Settlements	Asset, Inventory, Maintenance Management	Real-time Automatic Generation & Frequency control, Aux. Power & Fuel Consumption Control and Compliance Monitoring	Supply chain, quality, procurement	Environment Monitoring, Residual Management	Performance Reporting-Financial, HR, Accounts Surveillance & vigilance

Table-2

Functionality desired in the System	Power Plant Machinery
Monitoring & Protection Systems	Multi-channel intelligent devices with logic programmable relays and with built-in system diagnostics. In-situ as well as remote display capability, to interface with DCS/Control Systems and LAN/WAN environment.
Data Acquisition System	Fully on-line continuously acquiring data, simultaneously from multiple machines/measurement channels on real time basis. System shall incorporate the latest communication schemes/ protocols. The system shall have the ability to provide diagnostic information required to make "Go - No Go" decisions quickly and efficiently.
Data Storage System, Data Display and interfacing with third party devices	Historical event and periodic static and dynamic data storage for the benefit of the machinery technicians and engineers. Machinery Baseline Data can be gathered and stored when the machine is in "good" or "normal" operating condition. This baseline data can then be overplayed on the current data, to make "difference analysis" a routine maintenance management function. In-plant, off-site and/ or third-party Machinery Diagnostic Service providers should be able to access the system remotely, to help identify and diagnose problems: to fine- tune and Re-optimize the system settings based on changes in machine life and plant operating conditions.
Automated Root cause Analysis & Decision Support Advisory System	Machinery audits should automatically be initiated based on observation of change in machinery parameters/ malfunction with reference to the machinery performance data; resident in the integrated database rule sets supplied with the application, as well as user-defined rule sets. The Malfunction Results data base is created that not only contains the results and severity of each malfunction, but includes text files linked to the audited machines which contain "Recommended Actions" to be undertaken by appropriate individuals within an organization, during specific malfunctions on specific machines, for different severities.

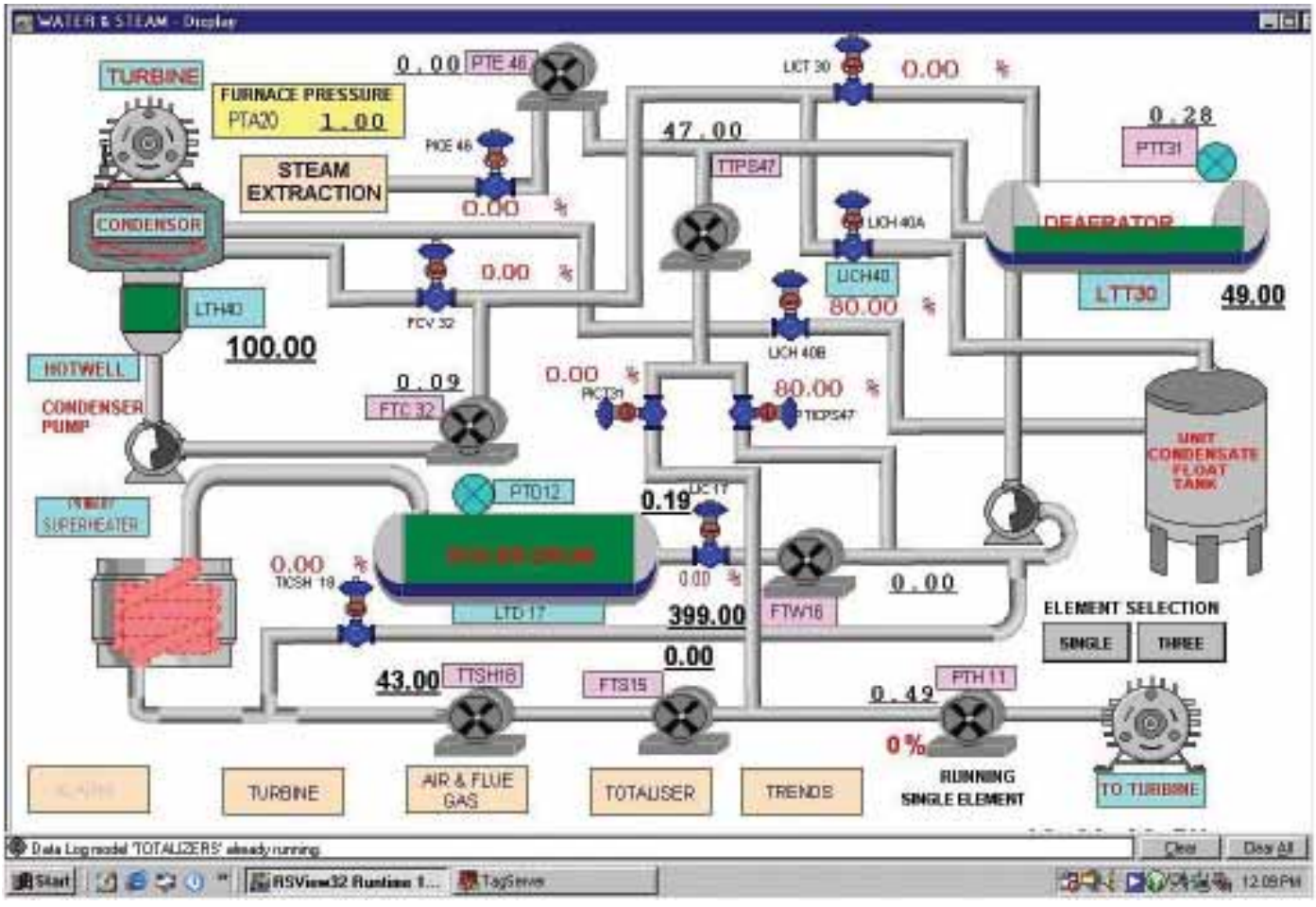


Figure 1: Logic Control Unit...

sitting before the computer screen. The automation of the plant has facilitated the real time monitoring and control of the plant. This automation application can be applied for electrical controls as well as for asset management. Different plants can be networked and controlled from a distance location as shown in Figure 4.

Network Architecture

Plant functions such as operation, maintenance, and management should be tightly integrated across all plant functional areas. The system should embrace the latest information and communication technologies (ICT), and multiple communication channels. Flexible, switchable interfaces should be at the heart of the systems.

Classification of Data Communications

Communication is and will increasingly be a must tool for the operation and maintenance of the power network as well as for administrative purposes. Technically speaking, from being a limiting factor, the increasing communication capacities now provide possibilities for operating and maintaining the power network and related businesses in different and more efficient ways. There are now diverse media for communications as discussed hereunder:

Electrical Links

PLC (Power Line Communication) or BPL (Broadband over Power Lines), also called EOP (Ethernet Over Power) refers to the transmission of signals over electrical lines, at frequencies other than the 50/60 Hz of the alternating current. This technology turns any electrical plug into a potential connection to all telecommunication services.

Although it has been widely used on SCADA systems from the beginning, the bandwidth is quite limited. Nevertheless, further research done over the last years is encouraging and it has been established that the information can be transmitted over low-tension electrical links at speeds of up to 45 Mb/s. Anyway, although high speed PLC transmission is still under development, it is the recommended solution – as it allows enterprises to cut down on expenses in infrastructure, and it is also an alternative to other technologies in case their use is not profitable, or not possible.

Telephonic Lines

- Telephone is the original communications network that uses the existing phone lines to deliver broadband. Broadband performance over telephone can vary a lot, depending on whether line is VDSL, ADSL or ADSL2+.
- VDSL is the best broadband service available with speeds up to 20Mbps or more in a radius of about 800 m from exchange or broadband cabinet.
- ADSL2+ delivers speeds of up to 10Mbps to properties located within a 2km radius from a broadband cabinet. ADSL is the most basic broadband connection available on telephone network. It delivers around 2 Mbps for distances up to 6km from the local cabinet.

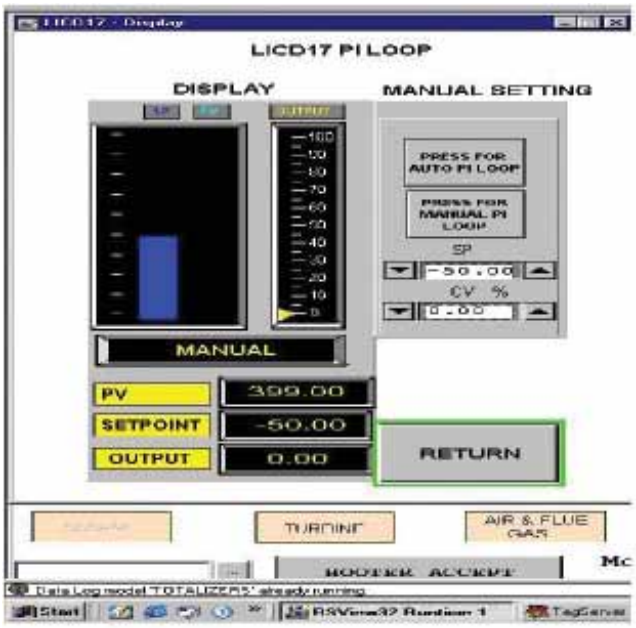


Figure 2: Auto-Manual Display...

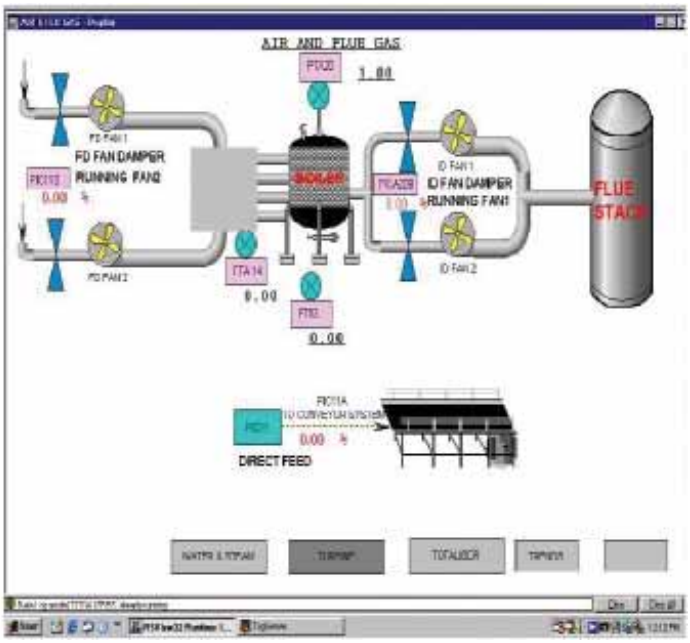


Figure 3: Air & Gas Display...

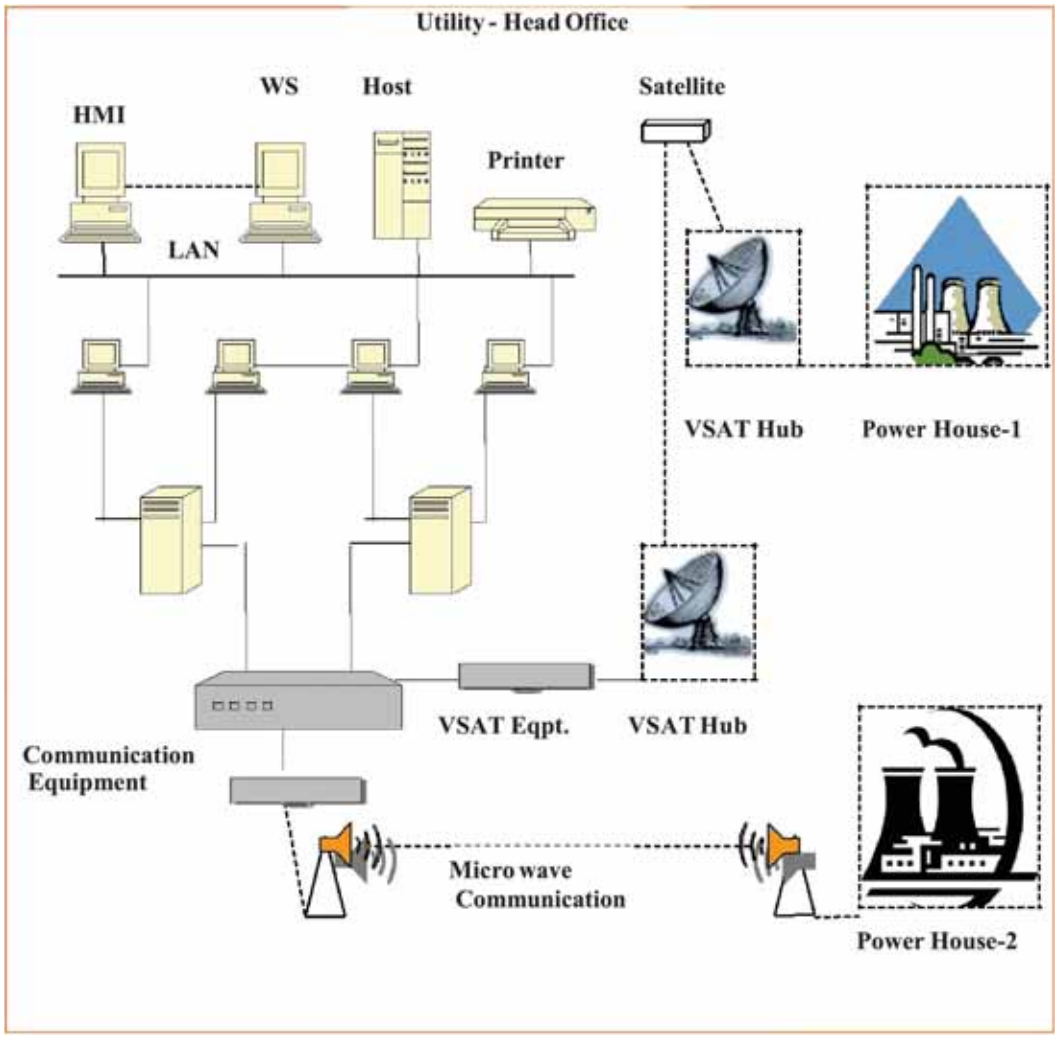


Figure 4: Utility Power Houses – Typical Architecture Diagram...

DSL Technologies

DSL delivers reliable, high-speed office-to-office connectivity over traditional copper wires and is available in most regions from ISPs, local phone companies or alternative exchange carriers. DSL provides speeds of 100 Mbps (megabits per second) or so. DSL permits the transfer of everything from e-mail and Web pages to multimedia files, enables remote users to rapidly access and make use of applications.

Optic Fiber

Fibre allows to do more online in less time with minimal or no disruptions. This internationally favoured broadband connection uses fibre optic cable, which houses hundreds of strands of fibre to transport huge amounts of data at speeds not seen in any other connection type. Fibre performance doesn't degrade over distance, so broadband speed is consistent no matter how near or far the business is located from the exchange or cabinet. Fiber-optic broadband communication highways (range of 100 Mb/s), make it possible to build WAN, providing high capacity facilities to/from office sites and substations. Most of the private operators have rolled out state of the art optic fiber based networks crisscrossing the country besides adopting the wireless in local loop route for connectivity. Fiber optic is the ideal material of serial communication used because of larger data transfer over lesser area with no electromagnetic interference, no external noise and is practically maintenance free.

Non-Guided Links

The use of radio and microwave signals is also a good solution to long distance transmissions. Solutions based on the 802.11 standard offer reach of up to several kilometres. It must be taken under consideration that the longer the link is, the lower is the effective transmission rate that can be obtained. Also, an important investment must be done in the antenna equipment when trying to communicate two distant points.

Wi-Fi & WiMax

Wi-Fi (wireless fidelity), a WLAN conforming to IEEE 802.11b is emerging as a good replacement for LAN. It allows people to log onto the Internet and receive e-mails on the move. WiMAX (Worldwide Interoperability for Microwave Access) an 802.16 wireless metropolitan-area network with a range of 50 km, facilitates wireless broadband access in metros and rural areas, and is a cost effective alternative to cables. Wireless network attached storage (NAS) functioning as file servers lets users access their allotted storage space on WI-Fi. Radio Frequency Identification (RFID) makes use of radio frequency waves to capture data in small, lightweight electronic read/write storage devices called `tags`. Data is accessible through handheld and fixed -mount readers in real time, using RF signals to transfer data to and from tags even in absence of line of sight.

Selection of Communication Media

But while selecting the communication media, the focus should, to a greater extent, be on analysing communication needs and requirements, providing a basis for a technical design. The different needs and requirements can be classified into three different main categories, reflecting the degree of importance of various communications needs.

- Real-time operational communication requirements
- Administrative communication requirements

Real-Time Operational Communication Requirements

Real-time operational communication encompasses communication in real time that is required to maintain operation of the power system. This class is, in turn, divided into real-time operational data communication and real-time operational speech communication.

- Protection function
- Status function

The communication is characterised by the fact that interaction must take place in real time, with hard time requirements. The communication requirements define the design of the technical solutions. For protection purposes, messages should be transmitted within a very short time frame. The maximum allowed time is in the range of 12-20 ms, depending on the type of protection scheme. The requirement has its origin in the fact that fault current disconnection shall function within approximately 100 ms.

Status functions are of the Supervisory Control And Data Acquisition/ Energy Management System (SCADA/EMS) type. Measured values must not be older than 15s, when arriving at the control centre. Breaker information shall arrive no later than 2 s after the event has occurred.

Administrative Communication Requirements

Data and information is made available to different functionaries for analysis and decision making so as to reduce down time, increase efficiency and profitability etc.

Interconnection of Workstations/Computers

The workstations/computers, servers and other devices installed in the power houses & at control centres are interconnected as discussed above by selecting particular communication technology depending upon the function and speed requirement. The interconnection of such devices in a particular geographical area is known as LAN (Local Area Network).

WAN Connections

To connect two or more LANs together, each LAN needs a device called an access router. The access router connects to a switch or hub on the local network and serves as a gateway to the WAN. The access routers establish LAN-to-LAN connections and forward network traffic between users at the remote sites.

WAN traffic can travel via the Internet, the public telephone network or a private network. Internet Service Providers (ISPs), telephone companies and many other alternate exchange carriers provide private network connections, which are dedicated lines that the power utility can lease.

Private networks operate independently of the public telephone infrastructure and the Internet and therefore offer the highest security. Connectivity over a public infrastructure is simpler to operate and less costly. A foremost security solution is VPN (Virtual Private Network). VPNs create protective virtual 'tunnels' through which data can travel between two locations.

They safeguard business communications over a public network like the Internet. The WAN connection depends on the data traffic and the types of connectivity services that are available in the region.

Operations and Maintenance

Having deployed the IT solutions, there is a need to sustain, maintain and effectively run the same. This is done by Networking and Systems Management (NSM) platforms which can be done in – house or can be outsourced.

Cyber Security

2014 was most remarkable for demonstrating that everything

connected to the Internet can, and will be hacked. On daily basis we heard of retailers, financial institutions, technology companies etc. being hacked. Therefore, cybersecurity particularly of generating stations is of utmost importance. To safeguard the proprietary, sensitive or business-critical communications, we need to deploy a VPN solution.

A viable, affordable strategy, VPNs enable data to travel in encrypted virtual 'tunnels' between sites and offer very high levels of protection with the use of VPN-enabled firewalls. Use of password and authentication techniques must be mandatory to permits only those who are designated to enter the network.

CONCLUSION

An automation system must be designed to optimise the economics of plant assets. Deregulation has acquired greater awareness of optimising operations. Maximising availability, efficiency and safety are crucial roles of an automation system. Furthermore, monitoring, reporting, and controlling emissions are required to be elevated to the highest corporate level, largely because of regulatory scrutiny. In sum, the current operational environment places more emphasis on automation and proper strategies to mitigate the key challenges for the development of power sector to ensure India's march towards inclusive growth. But as is the present reality, in spite of being fore-runner in IT solutions, India just barely scratched the surface of automation in the power supply system.

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B. E. Elec. (Hon's) & MBA/IT
Ex Joint Director /Regulations, PSEB
Also, Ex Joint Director /Regulations
Punjab State Electricity Regulatory Commission

Challenges Are Slowing Down Growth

Energy-hungry industrialising nations in Asia Pacific, the Middle East and Latin America have created a conducive environment for the growth of the shunt reactor market...

According to a latest Transparency Market Research (TMR) report, led by the rising investments in either upgrading or setting up new transmission and distribution networks worldwide, companies in the global shunt reactor market are witnessing new growth avenues. Increasing share of renewable energy in the global power industry and the resultant need to improve grid interconnectivity would help fuel the demand for shunt reactors. At the same time, increasing emphasis on reducing the loss of power during transmission and distribution is driving the market. Fresh investments in smart grids would further boost the growth of the global shunt reactors market. However, economic uncertainty in some countries in the Middle East has led to the postponement of large-scale investments in power transmission and distribution networks. This presents a challenge for companies in the shunt reactors market.

Increasing number of countries are turning toward renewable energy projects to meet their energy needs, thereby leading to the establishment of new renewable power generation facilities across the world. This presents immense opportunities for shunt reactor manufacturers and ancillary organizations because the active power generated by renewable energy sources is not only unpredictable but is also characterized by high degree of fluctuation. Shunt reactors can help compensate fluctuating active power, which makes them useful in renewable energy projects.

Image Courtesy: ABB

Presentation of a Shunt Reactor...

Energy-hungry industrialising nations in Asia Pacific, the Middle East and Latin America have created a conducive environment for the growth of the shunt reactor market. Demand for shunt reactors is the highest in Asia Pacific and North America.

Companies that have a firm foothold in the global shunt reactors market include ABB Limited, Siemens AG, Toshiba, Alstom SA, Mitsubishi Electric Corporation, Crompton Greaves, and Hyundai Heavy Industries.

Dr Min Zhang Receives RAEng Research Fellowship

These fellowships are designed to promote excellence in engineering by supporting early career researchers to develop successful academic research careers...

Dr Min Zhang has been awarded a prestigious Royal Academy of Engineering (RAEng) Research Fellowship to further her groundbreaking work into the use of High Superconductors (HTS) for future electrical aircraft.

RAEng Research Fellowships are designed to promote excellence in engineering by supporting early career researchers to develop successful academic research careers. As a key member of the University of Bath's Applied Superconductivity Group, Dr Zhang will use the Fellowship to explore long term collaborations with industry leaders such as Rolls Royce and Airbus.

Dr Min Zhang

Dr Zhang, Lecturer in the Department of Electronic & Electrical Engineering, said, "Electric aircraft is the game changing technology to reduce the aviation industry's heavy dependence on fossil fuels. By addressing one key challenge for the propulsion system, this fellowship will effectively advance superconductor technology and provide an essential route to tremendous new opportunities for future aerospace applications."

European governments have set ambitious targets to reduce carbon dioxide emissions by 2050 – and the development of electrical aircraft will be instrumental in meeting these targets. The key technical challenge for large electrical aircraft is developing advanced electrical drives with power densities rivaling jet engines.

Dr Zhang is currently growing an interdisciplinary research team to explore exciting new low-carbon technologies. Her recent activities include investigating Carbon Nanotube (CNT) wires for developing light electrical machines. EI

The laser cutting machine...

Manufacturing Rotors & Stators *Without Punching Tools, Using Laser Cutting*

The question is, at what point is a punching tool worthwhile, or how can you manufacture at low volumes economically, without using tools?

In today's world, you could be forgiven for thinking that electrical machines, motors and generators are being reinvented.

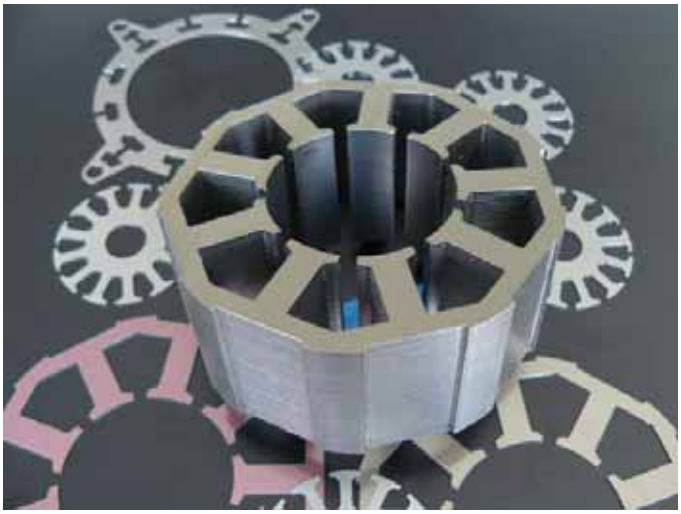
Energy efficiency, electromobility or having to adapt specifications to a particular application all present new challenges in the development of electrical machines.

Developers have new ideas as to how the perfect design for a particular application should look and the production department does not have the tools to make a prototype from these ideas.

But it is not only creating prototypes but also low volume production that causes headaches in manufacturing. Special electrical machines which are adapted to the application are often not produced in high volumes.

You can easily manufacture many of the components of an electrical machine without using tools for high-volume production. For example, you can use turning or milling to produce one-off components without any problem.

Thin parts manufactured to a high degree of precision...



Components manufactured without using tools...

But there is a lot of expertise in the design of rotors and stators. They are constructed from several hundred individual sheets. The sheets are punched in the traditional manner. There is also no doubt that volume production is the most economical method of production.

To achieve higher volumes in order to make the tool worthwhile, the motors are built into the modular construction system, so that as many motors as possible can be used for the same tool. This is not a good solution for having the optimum motor! Developers and the manufacturers would also like more freedom when working with low volume production.

When manufacturing punching tools, the cost and time factors do not fit with low volume production. Everyone tries to reduce the time and costs of low volume production with simple pattern tools, or with single-use stamping machines. But these technologies also significantly reduce the flexibility of the system.

The tendency for electric motors is moving towards thinner sheets. In extreme cases, sheets are used at a thickness of 0.1 or 0.2 mm, the standard today is 0.5 mm. This requires high-quality punching tools. If the design is decided and the volume is high enough, then this justifies the investment. If another change is required later, then it becomes expensive.

So the question is, at what point is a punching tool worthwhile, or how can you manufacture at low volumes economically, without using tools? Tools are expensive and they take time to manufacture.

Tool-free production is of particular interest during the development phase. A lot can be simulated on the computer but there is nothing like an actual trial! It is extremely beneficial if you can quickly implement new ideas and test them out.

But how can we manufacture a few electrical sheets to a high level of precision without a punching tool?

This is where laser technology comes into its own.

The perfect choice: convert the technical drawing to a machine program, place the sheet on the machine and cut with the laser.

There are lots of laser cutting machines on the market, but most of them do not achieve the required quality with electrical sheets. Geometrical accuracy is not enough and the cut edges are not free of burrs.

So what is the difference between laser cutting and laser cutting?

There is no single laser cutting machine that can do everything! Most laser cutting machines on the market are designed for standard sheet processing. They are designed for sheets which are 1 mm to 20 mm thick and an accuracy in the range of +/-0.2 mm is usually sufficient. It is standard practice to deburr the sheets after laser cutting.

Processes which have been acceptable in sheet processing in the past are no longer sufficient for the manufacture of electrical sheets. The sheets must be free from burrs when cut. The insulating layer on both sides means that it is not possible to machine the sheet afterwards. The accuracies required are in tolerance classes IT7 / IT8 which is only a few hundredths of a millimetre.

The laser cutting machine must be able to achieve this over the entire working range. Material thicknesses are below 1 mm which also puts special demands on the design of laser equipment.

The complete concept of the machine with the implemented laser technology must be designed for thin parts, which are manufactured to a high degree of precision with a high dynamic response.

The special requirements for electrical sheets mean that you need special laser cutting machines!

There are more and more specialists who are successfully working on the subject of laser cutting electrical sheets. This means that all the designs considered by the developer can be implemented and the motor can be tested quickly. If the result is still not satisfactory, new drawings are produced, the part is laser cut and then the new motor is ready for testing, all in a short period of time. When producing at low volumes, you can reduce costs and delivery times by using a production method, which doesn't require tools. Changes can be easily incorporated, no need to alter the tool. This applies to both small and large motors, for different material thicknesses and different coatings.

Complete flexibility is enjoyed when manufacturing rotor and stator sheets... EI

Bulling Dieter
Stiefelmayer Laser Tecknik
Germany

Rakesh Agarwal
M.D.
Laser Technologies Pvt. Ltd. India
(India-Distributor of Stiefelamyer Lasertechnik)

A Fully Isolated DAC Test Set

Performing offline PD measurements on MV and HV cables using a DAC voltage helps support the asset management process so that reliable decisions can be made for maintenance or replacement activities...

The MV DAC-30 by Megger can be used for quality control on newly installed cables as per IEEE 400.4 standard. The test set prevents unplanned outages, saving you time and money, and may also be used for condition monitoring on aged cable circuits.

The main use of the DAC test set is to identify, evaluate and locate Partial Discharge (PD) faults in the cable insulation and accessories of all types of medium voltage power cables. PD activity is an indication of incipient faults in the insulation – and is therefore widely regarded as one of the best 'early warning' indicators of the deterioration of medium and high voltage insulation.

Partial discharges are regarded as the main breakdown cause for MV and HV cables. Performing offline PD measurements on MV and HV cables using a DAC voltage helps support the asset management process so that reliable decisions can be made for maintenance or replacement activities.

Since the DAC frequency of the test voltage is close to nominal AC service conditions, all measured PD activities can be effectively evaluated – and are comparable with the power frequency. The PD Inception Voltage (PDIV) and PD Extinction Voltage (PDEV) can be easily determined due to the decaying amplitude of the test voltage.

As per the company, the MV DAC-30 is the first unit worldwide where the power source and PD coupler are fully integrated into a single portable unit. Thanks to the test sets fully integrated systems, there are no parts under high-voltage potential, ensuring highest level of safety for operators and the environment. In addition, to simplify transportation, the unit consists of two modules weighing less than 35kg each.

The system consists of a notebook as a control unit and the HV part. The HV part contains of two units allowing easy transportation and set-up. One of the unique features of the MV DAC-30 is that the HV part consists of a voltage source with internal PD detector. During testing no other 'live' components apart from the cable being tested are accessible like with other PD measurement systems.

Unique Partial Discharge (PD) software is used to perform PD analysis and reporting. The software features fully automatic calibration, as well as real-time PD data analysis and display; during the actual measurement, the software contains a PRPD pattern display and single-button report generation.

For further information: en.megger.com

The operating software guides the user through the entire process. Some key features are:

- Integrated cable data base;
- Fully automatic calibration;
- 'Live' PD mapping; evaluation and display of results during the actual measurement; and
- Reporting by mouse click.

Anticipated Power Supply Position In The Country during 2016-17

State / Region	ENERGY				PEAK			
	Requirement	Availability	Surplus(+)/ Deficit (-)		Requirement	Availability	Surplus(+)/ Deficit (-)	
	(MU)	(MU)	(MU)	(%)	(MW)	(MW)	(MW)	%
Chandigarh	1,705	1,689	-16	-0.9	350	343	-7	-2.0
Delhi	31,110	36,884	5,774	18.6	6,100	6,616	516	8.5
Haryana	49,800	51,069	1,269	2.5	8,950	9,263	313	3.5
Himachal Pradesh	9,209	9,504	295	3.2	1,525	1,645	120	7.9
Jammu & Kashmir	17,060	14,622	-2,438	-14.3	2,650	2,231	-419	-15.8
Punjab	52,080	48,296	-3,784	-7.3	11,200	10,525	-675	-6.0
Rajasthan	72,070	71,900	-170	-0.2	11,500	11,610	110	1.0
Uttar Pradesh	110,850	103,806	-7,044	-6.4	16,000	14,454	-1,546	-9.7
Uttarakhand	13,574	13,239	-336	-2.5	2,075	2,058	-17	-0.8
Northern Region	357,459	351,009	-6,450	-1.8	55,800	54,900	-900	-1.6
Chhattisgarh	27,176	28,722	1,546	5.7	4,190	4,588	398	9.5
Gujarat	104,845	109,225	4,380	4.2	14,860	15,480	620	4.2
Madhya Pradesh	74,199	83,052	8,853	11.9	11,481	12,439	958	8.3
Maharashtra	154,169	165,502	11,333	7.4	21,943	22,100	157	0.7
Daman & Diu	2,372	2,423	51	2.2	325	332	7	2.1
D.N. Haveli	5,615	5,737	121	2.2	713	737	24	3.4
Goa	4,367	4,366	-1	0.0	520	518	-2	-0.4
Western Region	379,087	405,370	26,283	6.9	51,436	56,715	5,279	10.3
Andhra Pradesh	54,215	50,079	-4,136	-7.6	7,859	6,773	-1,086	-13.8
Karnataka	69,781	73,021	3,240	4.6	11,152	9,905	-1,247	-11.2
Kerala	24,179	25,274	1,095	4.5	4,100	3,856	-244	-6.0
Tamil Nadu	103,806	115,455	11,649	11.2	14,800	15,511	711	4.8
Telangana	55,001	53,198	-1,803	-3.3	8,381	7,321	-1,060	-12.7
Puducherry	2,554	2,890	336	13.1	395	387	-8	-2.0
Southern Region	310,564	320,944	10,381	3.3	44,604	40,145	-4,459	-10.0
Bihar	26,369	19,713	-6,656	-25.2	3,900	3,183	-717	-18.4
DVC	20,365	21,062	697	3.4	2,855	4,139	1,284	45.0
Jharkhand	9,320	6,524	-2,796	-30.0	1,250	1,160	-90	-7.2
Orissa	29,805	30,464	659	2.2	4,400	4,576	176	4.0
West Bengal	52,867	45,610	-7,257	-13.7	8,439	8,138	-301	-3.6
Sikkim	423	954	531	125.3	90	164	74	82.1
Eastern Region	151,336	135,713	-15,622	-10.3	21,387	22,440	1,053	4.9
Arunachal Pradesh	830	756	-74	-8.9	147	195	48	32.7
Assam	9,309	7,227	-2,082	-22.4	1,560	1,306	-254	-16.3
Manipur	1,008	971	-37	-3.6	184	196	12	6.3
Meghalaya	2,215	2,065	-150	-6.8	430	482	52	12.0
Mizoram	533	589	56	10.6	101	123	22	22.1
Nagaland	849	722	-127	-15.0	140	145	5	3.4
Tripura	1,453	2,526	1,073	73.9	321	391	70	21.8
North-Eastern Region	16,197	14,858	-1,339	-8.3	2,801	2,695	-106	-3.8
All India	1,214,642	1,227,895	13,252	1.1	165,253	169,503	4,250	2.6

Source: Central Electricity Authority

A Practical Approach

The ETA factory: In addition to improving the energy efficiency of individual production facilities, there the focus is also on linking them in an energy-efficient manner...

The holistic approach adopted by the ETA factory enables 15 to 20% more energy to be saved in addition to optimising individual components. Compared with a conventional factory, the new concept enables savings of up to 40%...

Recently, the ETA model factory has officially opened its doors. Here, scientists at the Technical University (TU) Darmstadt are researching under real conditions and at full scale how industry can use energy more efficiently by linking all building and production components. By considering the entire system – consisting of machines, energy storage systems, building technology and the building envelope – the intention is to reduce the primary energy requirement in production by 40%.

Around three dozen companies and research institutions are working in the factory of the future. Using this large-scale 'research unit', known as the ETA factory, they want to realise previously untapped potential for saving energy. The project is being managed by the Institute of Production Management, Technology and Machine Tools (PTW) at TU Darmstadt. An industry working group disseminates the findings into the wider production technology research sector. ETA stands for Energy Efficiency, Technology and Application Centre. In the engineering sciences, the Greek letter 'eta' also denotes efficiency, i.e., a key energy indicator.

How the ETA factory originated is described by Professor Eberhard Abele, Director of the Institute for Production Management, Technology and Machine Tools, Mechanical Engineering Department, "The vision to build an energy efficiency factory on the campus was inspired by the positive experience with the Teaching Factory for Production

Official opening (L2R): Martin Beck (PTW), Professor Jens Schneider (TU Darmstadt), Professor Eberhard Abele (PTW), State Minister Tarek Al-Wazir (Hessian Ministry of Economics, Energy, Transport & Regional Development), Parliamentary State Secretary Brigitte Zypries (BMWi), Professor Hans Jürgen Prömel (President TU Darmstadt), Rolf Najork (CEO Bosch Rexroth). © Gerhard Hirn, BINE Informationsdienst

Management, which was previously realised on the Lichtwiese Campus."

Brigitte Zypries, Parliamentary State Secretary in the Federal Ministry for Economic Affairs and Energy said at the opening, "Increasing the energy efficiency is the key to successfully implementing the energy transition, whereby there is particular potential in industrial production. The joint ETA factory project is precisely aimed at researching this potential."

Factory as a large-scale research unit

The ETA factory building has a floor area of about 810 square metres. Unlike previous sheds, it is not merely an envelope for production plants but an integral part of them. The machinery and building work together and enable a particularly efficient use of energy. Holistic system: At a 1:1 scale, the factory depicts a typical production process, from the raw materials to the finished part, with control discs for hydraulic axial piston pumps rolling off the line at the end of the production chain.

The holistic approach adopted by the ETA factory enables 15 to 20% more energy to be saved in addition to optimising individual components. Compared to a conventional factory, the new concept enables savings of up to 40%.

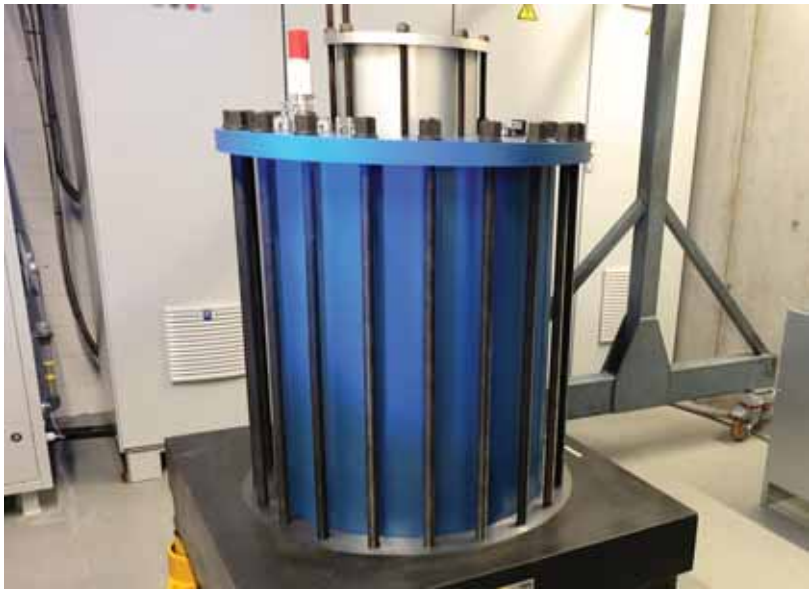
In addition to improving the energy efficiency of individual production facilities, the focus is also on linking them in an energy-efficient manner. For example, waste heat can be used in processes that require heat. As part of this strategy, the machine peripherals, building services technology and the factory building are also taken into consideration in addition to the production plants.

For example, the waste heat from the machine tools is used to provide other plant systems with heat or to heat the hall. The waste heat from heat treatment plants can be used to heat cleaning baths or provide cooling using sorption technology. The production building can serve as a heat sink for low-temperature waste heat. It can also be used for generating solar thermal heat or cold water by releasing heat to the environment.

New technologies have been integrated for test purposes; for example a newly developed energy storage flywheel is used to buffer peak loads. The facade covered with capillary matting makes it possible to heat, cool or provide air conditioning with little energy: the building's thermal insulation consists of foam concrete and the building structure is almost completely recyclable. The machines, technical infrastructure and building are all optimised in energy efficiency terms.

Key research areas

The subject of the research is the entire system, consisting of the building envelope and technical building services, the process technology and production, as well as the planning, recording and assessment of energy flows and the energy recovery, storage and reuse. In the model factory, researchers and developers can learn under real conditions how all subsystems and actors can be networked as well as which couplings are possible and transferable into practice. BI



A newly developed energy storage flywheel in the basement of the factory building caps peak loads… © Gerhard Hirn, BINE Informationsdienst

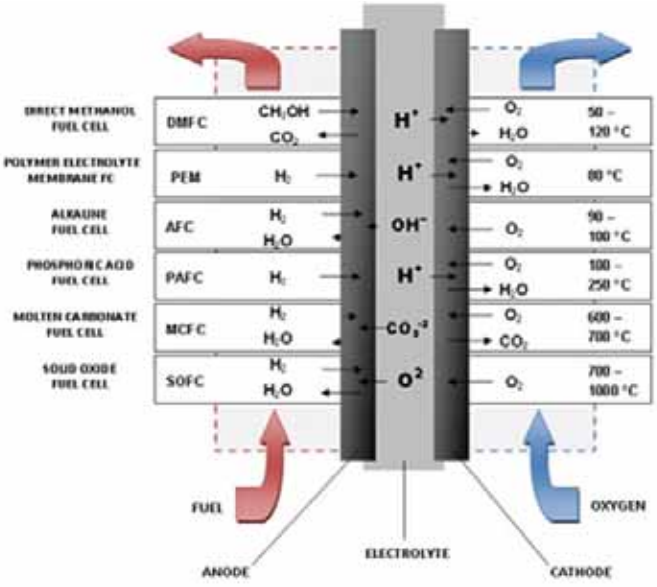
Fuel Cell Technology – Clean Energy

A fuel cell system that includes a 'fuel reformer' can obtain hydrogen from any hydrocarbon fuel like natural gas, methanol and even gasoline. Researchers are developing new diagnostic techniques to help optimise cost and lifetime of fuel cell systems...

There exists a need for cleaner source of energy to meet the growing energy demand in an environmentally sustainable way and hydrogen and fuel cells are expected to play a significant role to give the solution. Clean energy is needed to address the change in climate, air pollution, energy independence and energy demand. The increased amounts of carbon dioxide and other greenhouse gasses from burning fossil increase the global average temperature since 1850. This climate patterns alters the weather events like rainfall, sea levels, ocean acidification levels, Arctic glaciers, extreme weather events, animal habitats, etc., Hence, many research groups worldwide are working towards reductions in CO_2 emissions by re-examining our sources of energy. In addition, emissions from industry and motor vehicles release smog, ozone, particles, nitrogen oxides and sulphur oxides into our environment, which severely affects human health as well as the ecosystems. The other major reason for clean energy is energy independence and the technology to meet the supply demand chain. As the global population rises, and more and more people live energy-intensive lifestyles, there is a need to innovate new ways to meet this growing demand.These realities are driving the development of new technologies and ideas. Future energy systems will be cleaner, more efficient, and more reliable. Hydrogen and fuel cell systems can help meet the challenges ahead.

Hydrogen is the simplest element that consists of only one proton and one electron. It does not occur naturally as a gas, and always remains combined with other elements. Water, is a combination of hydrogen and oxygen (H_2O). Hydrogen is also found in many organic compounds like hydrocarbons such as gasoline, natural gas, methanol, and propane. Hydrogen can be obtained from hydrocarbons by a reforming process and from water by electrolysis. Hydrogen is high in energy, yet an engine that burns pure hydrogen produces almost no pollution. Unlike conventional technologies, fuel is not 'burned' but is combined in a chemical process. Fuel cell technology dates back to the 1800s, can be used to make electricity to power vehicles, homes, and businesses. And if you use a renewable energy source as the main source of hydrogen, a fuel cell can be considered a renewable energy source. Fuel cell works like a battery except that the chemical fuel is stored external to the device unlike batteries.

A fuel cell consists of two electrodes sandwiched around an electrolyte. Oxygen passes over one electrode and hydrogen over the other, generating electricity, water, and heat. Hydrogen fuel is fed into the 'anode' of the fuel cell. Oxygen/air enters the fuel cell through the cathode. With the help of a catalyst, the hydrogen atom splits into a proton and an electron, and the proton passes through the electrolyte. The electrons create a separate current that can be utilized before they return to the cathode, to be reunited with the hydrogen and oxygen in a molecule of water. A fuel cell system that includes a 'fuel reformer' can obtain hydrogen from any hydrocarbon fuel - from natural gas, methanol, and even gasoline. Other possible fuels include propane, hydrogen, anaerobic

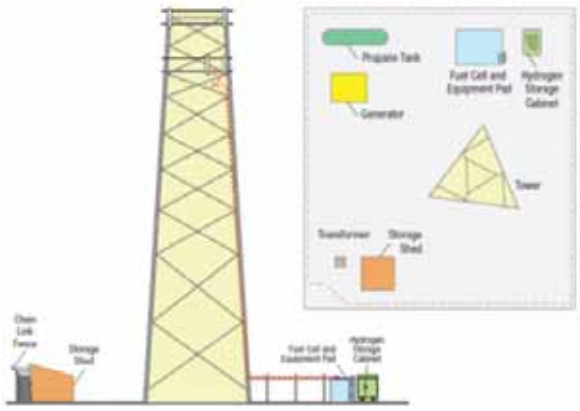


digester gas from wastewater treatment facilities, and landfill gas. Fuel cells are being designed for use in stationary electric power plants to provide reliable, clean, high quality electricity for distributed power generation. These small systems can provide primary or backup power to commercial and industrial customers such as hotels, hospitals, manufacturing facilities, and retail shopping centers. Eventually, smaller fuel cells will be sold for use in homes, most of which will connect to natural gas supplies. For industries that require high quality uninterruptable power, such as the computer technology industry, fuels cells can provide power without disruptions or voltage distortions. In addition to electricity, customers can take advantage of the heat from the fuel cell and use it for hot water, space heating and cooling, and industrial processes. Fuel cells are classified according to the type of electrolytes and operating temperature.

They can power any device ranging from a few microwatts to megawatts, operate from room temperature to 100^{o}C. The major challenges are in the hydrogen infrastructure, cost, durability etc., which prevents the market potential of fuel cells.

The application of fuel cells are divided into three broad categories viz., Portable fuel cells, including Auxiliary Power Units (APU), Stationary power fuel cells for a fixed location, Transport fuel cells for either primary propulsion or range-extending capability for vehicles. The power typically range from a few watts to 20kW for portable like campervans, boats, portable soldier power, personal electronics, battery chargers etc., 0.5kW to 500 kW for stationary like large stationary combined heat and power, small stationary micro CHP, UPS etc., and 1kW to 100 kW for transport applications like forklifts, electric vehicles. The type of fuel cells also can be varied depending on the application. For example, portable and transportation sector makes use of fuel cells like PEMFC and DMFC, while stationary applications use all the four types of fuel cells. The major players of fuel cell in the prime market are Fuel Cell Energy for Molten Carbonate Fuel Cells (MCFC), 300 kW, Bloom Energy for Solid Oxide Fuel Cells (SOFC), 200 kW, ClearEdge Power for Phosphoric Acid Fuel Cells (PAFC), 400 kW and Ballard for Proton Exchange Membrane Fuel Cells (PEMFC), 1MW using the ClearGen units at the headquarters of Toyota USA. One of the aspects of fuel cell technology that appealed to telecoms customers was the replacement of widely used fuels such as diesel, which is prone to theft. Ballard offers both hydrogen and methanol-fuelled backup power systems around 500 in numbers. During 2012, when Hurricane Sandy passed over the East Coast of the USA with devastating effect, fuel cell powered cell phone towers remained in operation for extended periods for customers in New York, New Jersey and Connecticut. Similarly, Altergy has more than 60 fuel cell systems installed in the disaster area and all were reported to function normally during and immediately after the storm. The more frequently fuel cells are seen to provide reliable power during similar events, the more interest there will be from around the world in utilising the technology.

Fuel cells for transportation sector includes Forklift trucks, other goods handling vehicles such as airport baggage trucks,Two- and three-wheeler vechicles such as scooters, Light duty vehicles (LDVs), such as cars and vans, Buses and trucks, Trains and trams, Ferries and smaller boats, Manned light aircraft, Unmanned Aerial Vehicles (UAVs) and Unmanned



Undersea Vehicles (UUVs) etc. However, they have so far seen limited use but this is set to change as most major automakers have targeted 2018 for commercial sales of their fuel cell vehicles. Initial locations for this rollout will most likely concentrate around clusters of early hydrogen refuelling infrastructure in Japan, Germany and the USA, and will then spread outwards from these centres as the market is established. Toyota Mirai, Hyundai ix35 are the recent models that are on the road using PEMFC technology. Capable of traveling 300-400 miles on a tank of hydrogen and refueling in three-five minutes, Fuel cell based electric vehicles combine the emissions-free driving of an electric vehicle with the range and convenience of a traditional internal combustion engine. They are up to three times more efficient than conventional vehicles, and when natural gas is used as a source for hydrogen. Having no internal moving parts, fuel cells also are quiet and highly reliable.

The fuel cell bus sector is showing a slow growth, with more prototypes being unveiled. Successful deployments have taken place in Europe, Japan, Canada and the USA but the high capital cost is still a barrier to widespread adoption. However, it is hoped that soon fuel cell bus prices will be comparable to diesel-hybrid bus prices.

From the Indian context, Many research groups from ARCI, CGCRI, BHEL, IIT Mumbai, IITMadras, IIT Delhi, CECRI,VSSC, Anna university, VIT, etc., are working on various aspects of only two types of fuel cells viz., polymer electrolyte membrane fuel cells and solid oxide fuel cells. Most of the groups are at the science level while ARCI and CGCRI are working at the system level. ARCI has got a dedicated team to develop PEMFC modules from a few watts to higher capacity level. They have just initiated to demonstrate their products at the sites where hydrogen is available.

Two recent reports, the Yale Environmental Performance Index ranked India 174th out of 178 countries on air pollution and India's growing telecom sector, the second largest in the world with more than 500,000 cellular towers, contributes more than 2% to India's total greenhouse gas emissions. Currently, the majority of remote or rural telecom sites use diesel generators, which can be extremely noisy, dirty and difficult to maintain. More recently, scientists at the Indian Institute of Tropical Meteorology reported that the Indian telecom sector could utilise up to 7.5 billion liters of diesel per year to power these mobile towers.

Intelligent Energy has deployed about 100 megawatts of fuel cells for telco tower backup power in India with customers including Microqual and ATL, and has about 400 megawatts under contract.The unit was reported to improve site power availability while reducing fuel use by 18% in a six month period.

Ballard Power Systems with RelianceJioInfocomm Limited (RJIL) will install their 100 ElectraGen-ME fuel cell backup power systems in its wireless telecom network in India.

Tata motors in collaboration with ISRO has demonstrated a FC bus with Ballard stack and 12 buses with Ballard vfuel cell systems are in the pipeline for demonstration, once when hydrogen infrastructure is ready.

Conclusion

A hydrogen-powered car could be ten times costlier than a car with an internal combustion engine. Researchers are developing new diagnostic techniques to help optimise cost and lifetime of fuel cell systems.

The ability to support new catalysts and supports, membranes which reduce the cost, improve the performance and increase the stability of catalysts systems is important. When it comes to commercialisation, cost and hydrogen infrastructure are the major key elements. EI

Sources: www.hydrogen.energy.gov; www.hyafc.org; www.fuelcelltoday.org

Dr N Rajalakshmi
Centre for Fuel Cell Technology
ARCI
Channai

Forthcoming Events At A Glance

NATIONAL

Led Today

Venue: Dr S P Mukherjee Stadium, Taleigao

Date: July 15th to 17th, 2016

Website: www.10times.com/led-today-taleigao

Electrical Building Technology

Venue: Pragati Maidan, New Delhi

Date: October 5th to 7th, 2016

Website: www.10times.com/ebti

Wire & Cable-2016

Venue: Bombay Convention & Exhibition Centre, Mumbai

Date: October 5th to 7th, 2016

Website: www.tradeshows.tradeindia.com/wire-india

Intersolar India 2016

Venue: Bombay Exhibition Centre (BEC), Mumbai

Date: October 19th to 21th, 2016

Website: www.intersolar.in

INTERNATIONAL

Dubai Solar Show

Venue: Dubai World Trade Center, UAE

Date: October 4th to 6th, 2016

Website: www.dubaisolarshow.com

Power Week 2016

Venue: Parkroyal, Beach Road Hotel, Singapore

Date: November 7th to 11th, 2016

Website: www.power-week.com

18th POWER Bangladesh 2016

Venue: Bashundhara Convention City, Dhaka

Date: November 10th to 12th, 2016

Website: www.cems-powerseries.com/powerbd

16th Indo-POWER 2016

Venue: Dubai, UAE

Date: November 23rd to 25th, 2016

Website: www.indo-power.com

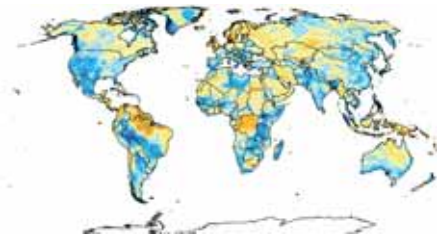
The Wind Developer Suite

AWS Truepower, an internationally known company in clean energy consulting, software, and engineering services, has created a new product offering called the Wind Developer Suite. It includes their leading software subscriptions – Windnavigator, Windographer and Openwind – and 12 consulting hours for one favourable price.

The Wind Developer Suite is attractive to customers prospecting wind sites, conducting energy assessments, visualising wind resource data, and designing and optimising wind farms. It is the only product on the market that provides all these tools from one provider. This all-inclusive package allows customers to budget their software needs, have access to highly qualified consultants with decades of experience, and save time and expense while using the same tools industry-leading experts use.

"The Wind Developer Suite empowers customers to be as effective and efficient as they can be, working in the manner they prefer. It is designed to allow customers who are so inclined to be more independent with a Do-It-Yourself feel, but it includes free consulting hours enabling customers to work more closely and collaboratively with experts, creating synergy. Customers only have to contact one company for account management, support, consulting and billing inquiries," says Michael Brower, AWS Truepower's President.

AWS Truepower prides itself on being a pioneer and is a consulting firm not afraid to educate customers on how to conduct their own research, and analyses using rigorous methods. It is dedicated to creating close, dependable, trustworthy relationships with its customers and understands time is money. With Wind Developer Suite, customers are empowered by having the option to do it themselves, knowing they have full access with the all-inclusive package and educational resources if they choose to.



Global wind performance map...

FLIR offers world-class digital multimeters

FLIR's DM92 and DM93 world-class digital multimeters offer advanced variable frequency drive filtering help you accurately analyse non-traditional sine waves and noisy signals. As per the company, no matter what electrical challenge you're up against, the DM92 and DM93's powerful lighting and durable design will make the job simple.

The DM93 offers additional features including Bluetooth technology to connect a compatible smartphone for remote viewing and sharing, and METERLiNK technology, to wirelessly embed electrical readings into radiometric infrared images on compatible FLIR thermal cameras.

Key features:

- Advanced variable frequency drive filtering and dual display show voltage and frequency at once;
- True RMS voltage and current;
- LoZ Mode eliminates ghost voltage error readings caused by long wires that share a conduit;
- Powerful LED worklights eliminate need for flashlight in dim lighting;
- Durable double-moulded construction (IP54, 3m Drop Test);
- Large, easy-to-read digits, backlit display and analog bargraph;
- Integrated Bluetooth technology connects to the FLIR Tools Mobile app on compatible mobile devices;
- METERLiNK technology wirelessly sends readings to compatible FLIR infrared cameras, embedding the data into live and saved thermal images; and
- Data Record captures electrical measurements and provides wireless data.

For further information: flirindia@flir.com.hk

Arrow Digital offers Massivit 1800 system

Arrow Digital Pvt Ltd. has joined hands with Massivit 3D Printing technologies Ltd. – a leading provider of large format 3D printing solutions. Now, they offer the Massivit 1800 system, which is the largest, fastest and most advanced large format 3D printing solution, based on Massivit proprietary GDP (Gel Dispensing Printing) technology. As per the company, it is a solution that will ignite the market explosion in the use of large 3D objects, through a variety of markets worldwide. Massivit 3D is the next revolution in advertising after digital printing.

The company informs that the Massivit 1800 system is the fastest large format 3D printer, which can print objects up to 1.8m / 6ft high and grow them at up to 35cm / 1ft per hour. The system is also equipped with dual process option that allows for easy printing of two different objects in parallel. Last but not the least, it offers economical 3D printing as its special software features and its 'support-less' printing result in fairly low material consumption.

The printer enables the creation of large 3D objects in a variety of markets worldwide. It allows print service providers, scenic fabricators and 3D service bureaus to produce unique, customised, unmatched large format 3D figures for a variety of uses for advertising, events design, theming of environments and more.

For further information: www.arrow-digital.com

Rishabh Instruments offers the ND1 3-phase power analyzer

This is an up-to-date device allowing the user to measure and record electrical energy quality parameters. It enables to detect interferences in internal industrial electric installations.

Data recorded by the ND1 analyzer provides the information for costs control systems and optimization of device operation in power energy installations and industrial systems. The device is designed in such a way that it unites the function of 5 instruments: Analyzer of 3-phase network parameters, universal measuring transducer, recorder of measuring data, web server – possible an easy remote monitoring of measuring and archival data through the internet browser controller – automatic control of electric energy key parameters using relay outputs.

The product received a prestigious European Medal, which is granted for products that fulfill legally required standards, appropriate licenses and patents enabling their sale on the European market.

The ND1 analyzer is characterized with following features:

- Measurement and recording of electric energy quality parameters acc. to the EN 50160 standard, over 300 other parameters of 3-phase power networks;
- Replaceable external Compact Flash memory of 4 GB capacity;
- Data storage in the internal 6 MB buffer with data supporting (before and after emergency states);
- Recording of decays and voltage drops acc. to the EN 50160 standard;
- Recording of selected measured parameters;
- LCD TFT 5,7", 320 x 240 pixels color screen, with touch screen panel;
- Casing protection grade from the frontal side: IP65;
- Dedicated visualization in the shape of: digital displays, analog views, bargraphs, harmonic charts, vector diagrams, statistics, logic inputs;
- Programming of the analyzer visualization (selection of the measured quantity and kind of presentation); and
- Contextual help in the user's configuration menu.

Its communication is enabled by: Ethernet 10 Base-T, Modbus TCP/IP, USB 1.1 Device, and RS-485 Modbus Slave.

For further information: www.rishabh.co.in

Fluke designs Endurance Series for secure configuration

The Endurance series of high-temperature infrared thermometers has been launched by Fluke Process Instruments. Featuring a stainless steel IP65 housing and galvanically insulated I/Os, these units facilitate constant procedure monitoring the most challenging industrial applications, including primary and secondary metals manufacturing, carbon processing, and silicon production.

They also meet the requirements of the semiconductor industry by providing a measurement resolution of 0.1 °C. Two models envelop wide measured temperature ranges of +550 °C to +1,800 °C and +1,000 °C to +3,200 °C, respectively. They can be functioned in one- or two-colour (ratio pyrometer) mode. Optical resolutions of up to 150:1 permit measurements of minor objects from a distance.

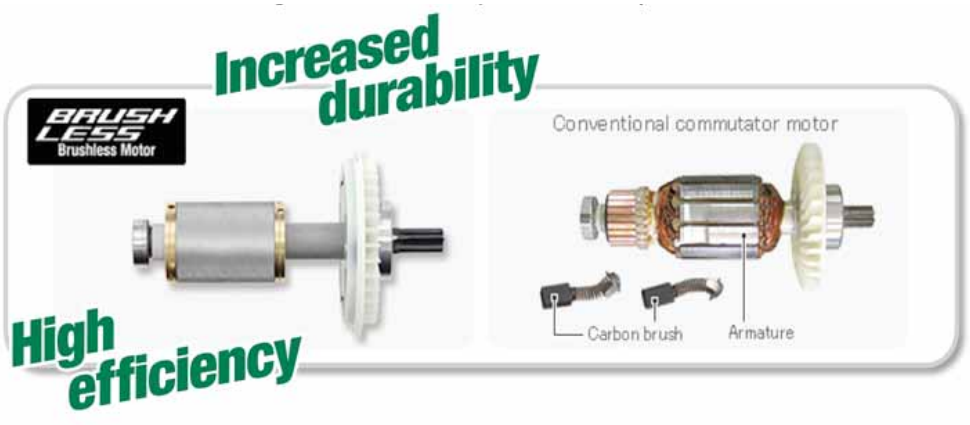
The series is designed for secure configuration and function. The sensors mark an intuitive rear-panel user interface and a built-in web server for data archiving, traceability, and process troubleshooting. The PC-based Endurance setup and monitoring software consists of time-saving tools, for instance the latest match function that involuntarily detects the accurate emissivity of the calculated surface.

Endurance series pyrometers make available a strong resolution for manufacturers, who seek to get better product quality and uniformity, reduce reject rates, maximise throughput and minimise energy costs.

For further information: www.flukeprocessinstruments.com

Hitachi Power Tools unveils high-tech AC Brushless Hammer Line

Hitachi Power Tools (Hitachi Koki USA, Ltd.) has unveiled a new line of AC Brushless SDS Max Rotary Hammers featuring Hitachi's Aluminium Housing Body (AHB) construction that delivers impressive internal and external durability, and select hammers in the line also incorporating User Vibration Protection (UVP) technology to minimise vibration transfer to the user.



This new line from Hitachi will lead the commercial industry in North America by delivering products that not only last longer due to reformative construction of the tool body and motor, but also can reduce the risk of developing a vibration-related injury due to prolonged exposure.

Hitachi is first to market in North America for AC Brushless motor technology with this new Rotary Hammer line. An AC Brushless motor is more efficient, leading to longer run time, increased power and extended durability with essentially no maintenance. Eliminating the need for carbon brushes means freedom from issues with the motor armature burning out, experiencing layer shorts or commutator wear in severe environments.

For further information: www.hitachipowertools.com

MTS Sensors offers highly robust, magnetostrictive Position Sensors

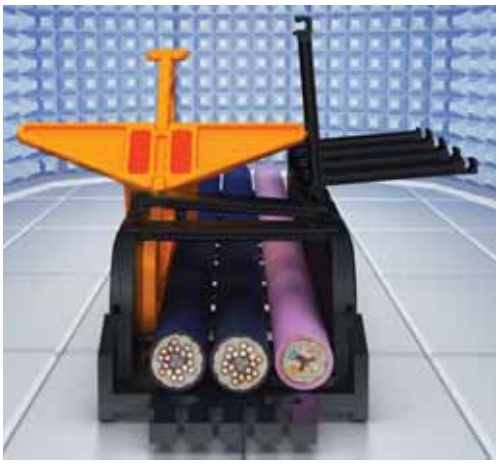
MTS Sensors, a division of MTS Systems Corporation, has expanded its E-Series of high accuracy position sensor devices with the introduction of the EP2. As with other members of the E-Series, the EP2 is a compact, smooth profile unit that is highly optimised for application scenarios – where there is only limited space available for mounting. Based on the company's proprietary Temposonics magnetostrictive technology, this latest MTS sensor device has a stroke length of up to 2540 mm. It exhibits linearity to within ≤0.02% full scale and ≤0.005% full scale repeatability.

The sensor element and the supporting electronics of the EP2 are both held within a rugged aluminium housing, allowing deployment into the most challenging of industrial environments. The position magnet travels over the complete sensor assembly - thereby resulting in smoother operation, greater installation flexibility and easier integration into the specific application.

The EP2 is offered in a variety of different output formats – including analog, CANopen, Serial Synchronous Interface (SSI) and simple start/stop. Use of multiple magnets can be supported where required, so that several different sets of positioning data can be ascertained. The EP2 has resilience to shock and vibration in accordance with IEC 60068-2-27 and 60068-2-6 standards respectively. An operational temperature range of -40°C to + 75°C is covered.

For further information: www.mtssensors.com

igus presents E2.1, a new generation of its two-piece energy chain



At the 2016 Hannover Messe igus presentED E2.1, a new generation of its two-piece energy chain. Based on continuous development and new customer requirements, the original series has been significantly improved. Compared to the previous version, the E2.1 offers revolutionary innovations to significantly improve the service life of customer applications.

For over 15 years, igus has had the E2/000 energy chain series in its product range, which combines a versatile and lightweight assembly with strength – and has become the standard chain in machinery construction for wood and metal processing worldwide. The E2.1 is a new energy chain in the range that also consists of two pieces: a chain link and a crossbar.

This can be opened on the outer radius on both sides with a screwdriver or the new chain opener, which is supplied for free with every initial order, and opened out or even completely removed subsequently. The crossbars can easily be closed again by hand. By means of a screwdriver, this new generation allows the crossbars to be opened from the side of the chain link, which is advantageous in pre-assembled chains and areas with restricted access. Another constructive advancement on the E2.1 is the 'brake' on the stop dog of the chain links. This ensures a very quiet chain travel with lower vibration and noise. Compared to the previous generation the E2.1 is quieter by around 50%.

The new E2.1 series has a very cable-friendly interior which adds more space for the same outer dimensions when compared to the E2/000. "For example, this can be an advantage in machine tools, because often very little space is available here," explains Harald Nehring, Authorised Officer for e-chain systems at igus.

In keeping with the design of the interior of the chain igus provides separators with rounded edges for a long service life of hoses and cables. For a precise mounting of the separators an integrated grid system is provided on the crossbars. At the Hannover Messe igus showed the new E2.1 with an interior height of 38 millimetres and an inner width of 65 millimetres. Other options and a version that snap's open along the inner radius will also be developed soon.

For further information: www.igus.in

Solar Umbrella – a mobile phone charging device

Solar umbrella outdoor furniture can charge mobile phones by solar panels. It has strong brushed aluminium rib and an aluminium pole. The diameter of the umbrella is 270 cm. The height of the pole is 165cm+85cm with 38mm diameter. The material of the umbrella is made with 200g Polyester6 and supported by a crank handle. Solar umbrella is available in green, yellow, red and white colour.

The specifications of a solar charger are as follows;

- It is waterproofed.
- It has a touch panel switch.
- Solar panel: 2*6W; total 12W
- Battery: 7500mAh5, USB: 2 ports, 5V, 2.1A; 1-2.1Ah current each port

For further information: www.itscoolsolar.com

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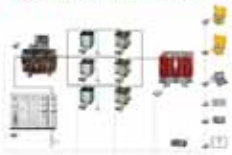

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K-Lite introduces LED Landscape - Redened

The Essence of lighting is one of the most important things in our lives. At K-Lite they are passionate about creating a distinctive atmosphere that improves the quality of life in the cities and towns by exploring the many potential facets of lighting that supports the wellbeing and safety of all.

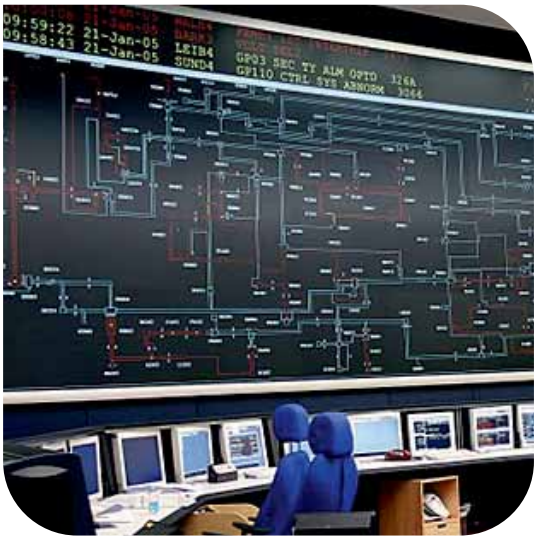
Founded in 1977 in India, K-Lite has grown to be the leading manufacturer of outdoor luminaires and decorative poles. K-Lite's proven performance in the landscape segment is because of its ability to stylishly convey the identity of a space with a blend of efficiency and modularity to maximise the visual comfort that is best suited to each specific space.

Their Landscape range includes:

Linear Wall Washer, Up-Down Lighters, LED Strips/Neon ex, Promenade Lighting, Bollards, Under Water Lighting, Post top luminaires, Bulk Heads, Path nders, Polar lighting and newly added series of Facade Lighting.

For further information: www.klite.in

SCOPE



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- **Digital value publication:** Published in form of sampled values (SV) that comply with the light edition (LE) of the UCA guide for implementing IEC 61850-9-2 (9-2 LE)
- **Time synchronization:** 1588 Ethernet clock or fiber/electrical PPS input or by GPS input

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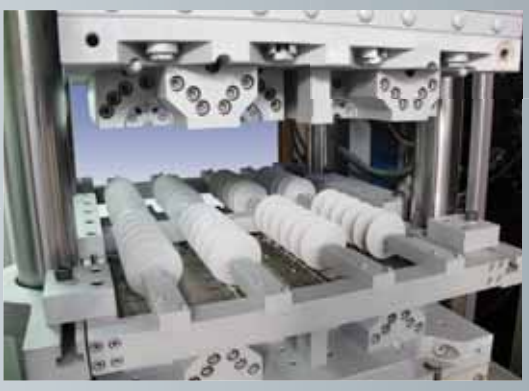

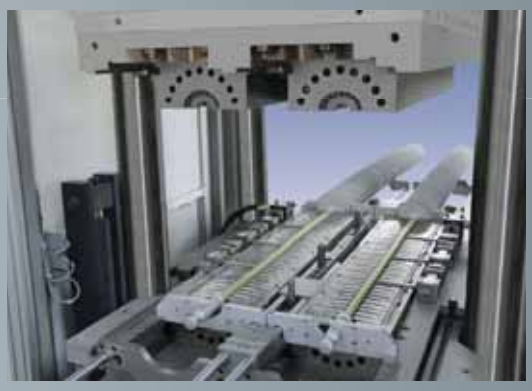

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