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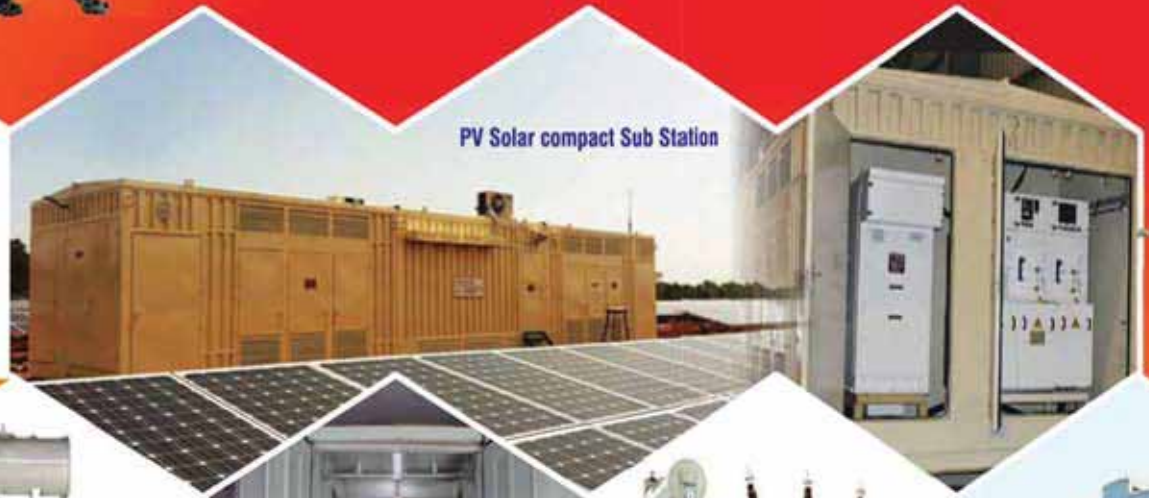

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Publisher's Letter

Mahadevan Iyer

"Electrical India has been largely instrumental in promoting renewable energy for more than past two decades..."

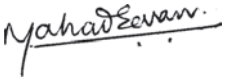
Countdown has begun for the India's biggest trade fair of the electrical and (power) electronics industry, ELECRAMA 2016. Well, the country's entire electrical and (power) electronics community is literally at the hatching point either to disseminate their state-of-the-art technologies or to absorb the latest ones available in today's world.

This time ELECRAMA will introduce several never-presented-before platforms such as 'Energies of Tomorrow;' 'R&D – Railway, Nuclear & Defence;' and 'Renewable Energy' pavilions etc..

After the Conference of Parties (COP 21) at Paris, while the entire world is gearing up to accelerate their green power journey, ELECRAMA 2016 is coming up with baskets full of innovative technologies in the green power field. Although COP 21 has been a historic event to catalyse the shift of paradigm of the global energy community, our prudent prime minister Narendra Modi took initiative to harness renewable energy at an unprecedented speed much earlier, declaring his plan for 175 GW of renewable power by 2022.

Contextually, Electrical India has been largely instrumental in promoting renewable energy for more than past two decades. Today, we can proudly claim that since the end of nineties, the 55-year-old B2B magazine started covering various aspects of renewable energy. The fact is in those days; hardly anyone was serious about renewable energy in this country. Today, we are happy to watch that there is a country-wide movement in support of harnessing renewable energy, and our union government is also supporting the cause very seriously.

Do send in your comments at miyer@charypublications.in



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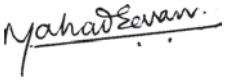

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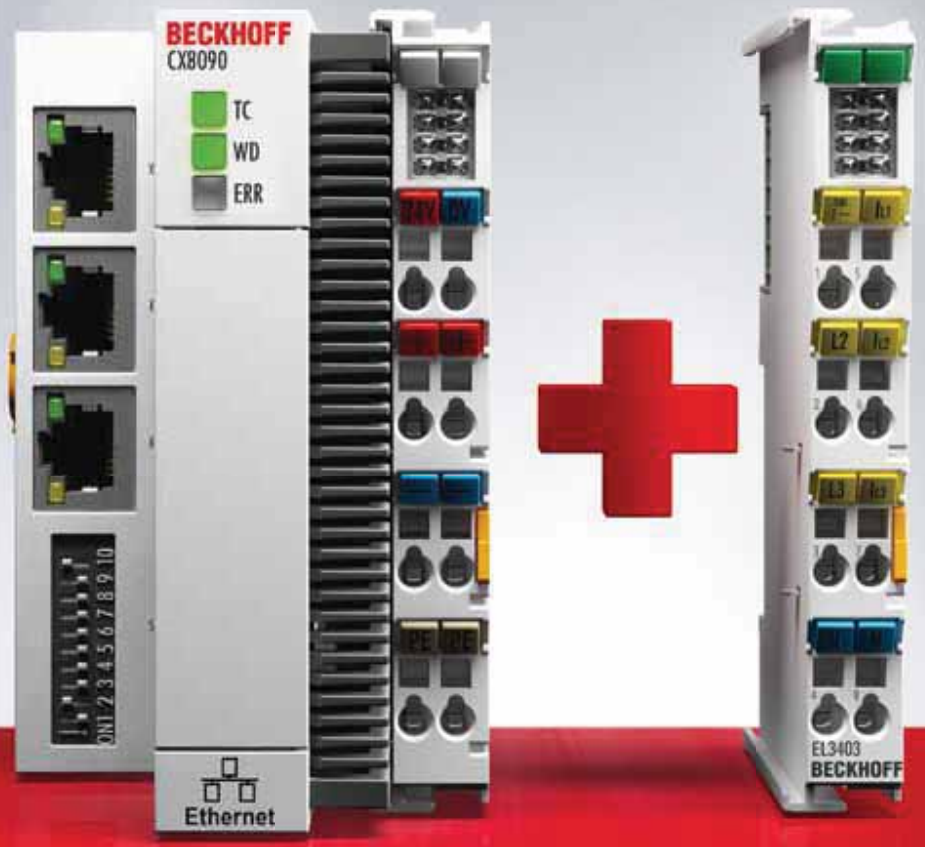

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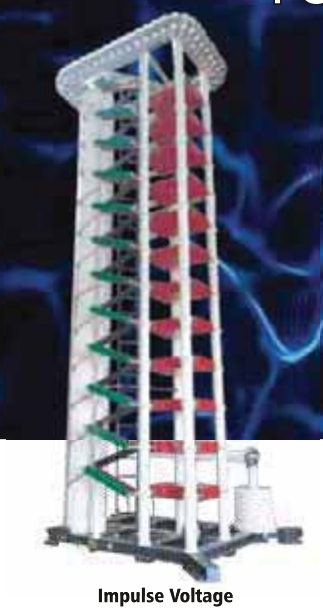

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P K Chatterjee (PK)

Making 'Make in India' Successful

Based on the theme of Innovation, Design and Sustainability, from 13 to 18th February, 2016, Mumbai will host the 'Make in India' celebration. The week-long mega event will be inaugurated by our revered prime minister and (I will say) industrial-growth-tycoon Narendra Modi. The week will spark a renewed sense of pride in Indian industry across India's manufacturing sectors in the coming decade.

As an Indian citizen and remaining within the B2B industry for the last two decades, I have every reason to be glad to note the industrial revolution that is taking place in our country. However, at this juncture, I would like to reiterate the caution words that Nobel laureate Prof David Gross recently communicated through his speech in the 103rd Indian Science Congress in Mysore.

Prof Gross said, "Transistors did not come from entertainment companies. Nuclear technology was not discovered by oil companies with large budgets seeking alternate sources of energy, but by men like Einstein." He emphasized that science should also be pursued for sheer curiosity, and stated that a nation which did not encourage its youth to pursue basic science would lose brilliant minds to other nations where they were encouraged.

> ***"The selection procedures for higher studies should be made more rational..."***

According to him, the 'Make in India' slogan requires 'Invent in India' for newer technologies, and for that we have to 'Discover in India.' He also pointed out that for 'Make in India', its products will have to be competitive as there are already superior and cheaper goods being manufactured in Korea and other countries.

The Nobel laureate professor also pointed out that India has enormous potential and could do better by more investments in basic sciences, and Research and Development (R&D). I completely agree with him. Additionally, I will add that we need to build capable talent pools. At present our education system is making many engineers who are fit for call centres and scientists to fill clerical posts in banks. The selection procedures for higher studies should be made more rational to make the 'Make in India' movement successful.

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

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NORTH-EAST

Electrification in Assam is progressing fast

Ministry of Power has electrified 13 villages in Assam in the third week of December 2015, under Deen Dayal Upadhyaya Gram Jyoti Yojana. Out of these electrified villages, three belong to Baksa district, one in Darrang and other nine villages fall in Nagaon district of the state. In view of the Prime Minister, Narendra Modi's address to nation, on Independence Day (2015), Government of India has decided to electrify remaining 18,500 un-electrified villages by 01st May, 2018. The project has been taken on mission mode and strategy for electrification consists of squeezed implementation schedule of 12 months with 12 stage milestones for village electrification monitoring with defined timelines. EI

UDAY

Jharkhand to derive net benefit of Rs. 5,300 crores through UDAY

Recently, the Government of India, the State of Jharkhand and the JBVNL (Jharkhand Bijli Vitran Nigam Limited) signed a Memorandum of Understanding (MOU) under the Scheme UDAY – "Ujjwal Discom Assurance Yojana." The MoU for operational & Financial turnaround of Discoms was signed by Dr AK Verma, JS (Distribution), Ministry of Power, SKG Rahate Principle Secretary (Energy), Jharkhand and Ameet Kumar, MD, Jharkhand Bijli Vitaran Nigam Ltd (JBVNL) in presence of Chief Minister of Jharkhand Raghubar Das, PK Pujari, Secretary, Ministry of Power, Upendra Tripathy, Secretary, Ministry of New & Renewable Energy, Anil Swarup, Secretary, Ministry of Coal and Rajiv Gauba, Chief Secretary, Jharkhand.

Jharkhand, the land of mines and minerals, would derive an overall net benefit of approximately Rs. 5,300 crores through UDAY. Signing of this MOU heralds the onset of major distribution reforms in the country under UDAY.

Speaking on the occasion, Raghubar Das, Chief Minister of Jharkhand, said that this is a remarkable moment in history of power sector of the country. The MoU will help in electrifying remaining 2200 villages in state and thereby making the Prime Minister, Narendra Modi's vision of providing 24x7 electricity to all, a reality.

He also informed that the Jharkhand government is planning to provide off-grid power in 434 villages due to their geographical barriers. P.K. Pujari, Secretary, Ministry of Power said that UDAY will usher new dawn in Nation's Power Distribution sector. He further added that the scheme has addressed concerns of all the stakeholders and thus become a win-win situation for all of them. EI

RENEWABLE ENERGY

Suzlon Group's chairman welcomes COP21 climate change agreement

While different stake holders are expressing their own views on the recently signed Paris climate change agreement, one of the pioneers of Indian wind power movement, Tulsi Tanti, Chairman, Suzlon Group, welcomes the move. Tanti says, "Draft version of the deal addresses the concerns that India had expressed. This is a big step towards a low carbon economy and I congratulate everybody who participated at the Conference of Parties (COP)-21 and demonstrated a unified vision to mitigate climate change. Prime Minister Narendra Modi's vision of working towards a greener tomorrow is now a reality."

He reiterates, "The draft of the deal proposes limiting global warming to 'well below' 2 degrees Celsius and committing $100 billion a year from 2020 to help developing countries cope with the problem. India has pushed for the concept of 'differentiation' to be clearly spelt out in all elements of the agreement, and had proposed that developed countries must have a greater responsibility to accept emission reduction targets while they must be the only ones to mandatorily provide financial resources."

"The content of the draft deal is an 'important achievement' for India. 'Sustainable lifestyles and climate justice' are mentioned in the final draft of the agreement. I am happy to see that the draft addresses the concerns of India. Differentiation for developed and developing countries is mentioned across all pillars of action – mitigation, adaptation, finance, technology capacity and transparency," opines the Chairman of Suzlon.

Tulsi Tanti

"Renewable sources of energy will therefore play a critical role in emission reduction and make a real impact on mitigating climate change risks. I urge all countries to collaborate in order to a build a sustainable future," adds the eminent advocate of Green Power. Suzlon Group is ranked as the world's 5th largest wind turbine supplier, in terms of cumulative installed capacity. EI

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ELECTRIFICATION

Ministry of Power electrifies 160 villages

The Ministry of Power of India has electrified 160 villages till 2nd January 2016. Out of these electrified villages, 57 villages in Chhattisgarh, 40 in Odisha, 27 in Bihar, 16 in Rajasthan, 9 in Jharkhand and Uttar Pradesh each and one village falls in states of Tripura and Assam each.

Electrification of 160 villages resulted in overall increase of 42% over the week before of ongoing electrification process under Deen Dayal Upadhyaya Gram Jyoti Yojna(DDUGJY).

In his tweet, Piyush Goyal, Union Minister of State (IC) for Power, Coal and New & Renewable Energy said, "Happy to share that we electrified 160 villages last week, an increase of 42% over the week before."

SOLAR POWER

Recurrent Energy closes financing for 75 MW Astoria 2 SPP

Canadian Solar Inc. has informed that its wholly owned subsidiary, Recurrent Energy, one of North America's largest solar project developers, closed on a tax equity investment commitment with GE unit GE Energy Financial Services for the 75 megawatt (MWac) Astoria 2 Solar Power Project (SPP). Recurrent Energy also closed a debt facility for the Astoria 2 project, currently under construction in California.

Recurrent Energy will be the managing member of the Astoria 2 solar power project, and plans to own and operate the facility. Santander Bank, N.A. (Santander) was the coordinating lead arranger of a five member bank club including NORD/LB, Rabobank, Key Bank, and CIT Bank, which will provide project-level construction debt, a letter of credit facility and a back-leveraged term loan facility, totaling approximately $180 million.

"The Astoria 2 transaction completes the financing of Recurrent Energy's late-stage portfolio and is our second transaction with GE. The support of this bank club and the expansion of our work with GE reflects our ability to consistently deliver high quality solar assets," said Shawn Qu, Chairman and CEO of Canadian Solar.

"Investing in the Astoria 2 project builds upon our relationships with Recurrent Energy and Canadian Solar and continues the expansion of our global renewable energy footprint," says Kevin Walsh, Managing Director and Head of Renewables at GE Energy Financial Services.

SOLAR ROOFTOP

Grid connected rooftop solar systems get a big boost

The Cabinet Committee on Economic Affairs, chaired by the Prime Minister Narendra Modi has approved the scaling up of budget from Rs, 600 crore to Rs. 5,000 crore for implementation of Grid Connected Rooftops systems over a period of five years up to 2019-20 under National Solar Mission (NSM). This will support Installation of 4200 MW Solar Rooftop systems in the country in next five years.

The capital subsidy of 30% will be provided for general category States/UTs and 70% for special category States i.e., North-Eastern States including Sikkim, Uttarakhand, Himachal Pradesh, Jammu & Kashmir and Lakshadweep, Andaman & Nicobar Islands. There will be no subsidy for commercial and industrial establishments in the private sector – since they are eligible for other benefits such as accelerated depreciation, custom duty concessions, excise duty exemptions, tax holiday etc.

This capacity of 4200 MWp will come up through the residential, government, social and institutional sector (hospitals, educational institutions etc.). Industrial and commercial sectors will be encouraged for installations without subsidy. This will create the market, build the confidence of the consumers and will enable the balance capacity through

market mode to achieve the target of 40,000 MWp by 2022.

The government has revised the target of National Solar Mission (NSM) from 20,000 MWp to 1,00,000 MWp by 2022. Out of the 40,000 MWp is to come through grid connected solar rooftop systems. This approval will boost the installations in a big way and will act as a catalyst to achieve the goal of 40,000 MWp.

BUSINESS

Siemens secures order from WBSETCL

Siemens Ltd. has won an order worth approximately Rs. 102 crore to supply a 400 kV Gas Insulated Switchgear (GIS) Substation to West Bengal State Electricity Transmission Company Limited (WBSETCL). The scope of the order includes engineering, supply, installation and commissioning of the GIS Substation. The 400 kV GIS solution is being manufactured at Siemens Ltd.'s manufacturing plant at Aurangabad. As the State Transmission Utility provider, Transmission Licensee and State Load Dispatch Centre, WBSETCL is responsible for transmitting electricity from generating sources to load centres through a transmission network spread across West Bengal.

PROJECT

Work progress is fast in DeGrussa solar project

Low cost renewable energy is competitive with traditional fossil fuels in many off-grid and mining applications globally. For Sandfire Resources NL, a mid-tier Australian mining company, the juwi Group developed a 10.6 MW solar hybrid system to fully integrate with the existing 19 MW diesel-fired power station at the DeGrussa Mine. Single axis tracking and a 6 MW battery will be used to maximise the use of lower cost solar power to provide the majority of daytime electricity while reducing the mine's total diesel consumption by over 20% The flagship project will be commissioning in early this year (2016).

The innovative $40 million project – which is one of the largest integrated off-grid solar and battery storage facilities – will consist of 34,080 solar PV panels covering a total area of over 20 hectares at a site located immediately adjacent to the DeGrussa underground mine and processing plant. Construction commenced in mid-July (2015) with clearing and levelling of the site and subsequent installation of 4700 steel posts in diagonal arrays to mount the solar PV panels on a single-axis tracking system. This system allows the panels to track the sun during the day, improving its overall performance.

A view of the DeGrussa project...

Site electrical work is also well advanced with the installation of underground electrical infrastructure including conduits ready for low-voltage and communication cabling to allow the interconnection of the panels, and to connect the facility to the 6 MW lithium-ion battery storage facility and the existing 19 MW diesel-fired power station at DeGrussa.

GENSETS

Rolls-Royce delivers gensets to hospital in Kuwait

Rolls-Royce is delivering 23 MTU Onsite Energy standby gensets as part of the expansion and modernisation of the existing Al Farwaniya hospital in Kuwait City by the Kuwait Ministry of Health, due for completion by mid-2019. The brand MTU Onsite Energy is part of Rolls-Royce Power Systems within the Land & Sea division of Rolls-Royce.

MTU Partner Albisher & Z Alkazemi Company (A&A) recently closed the deal for delivery of the 23 gensets with prime contractor Sayed Hamid Behbehani & Sons Co. (SHBC) in Kuwait. The diesel-powered gensets based on MTU Series 4000 20-cylinder engines each deliver a maximum of 2,750 kVA of prime power.

"In case of any instability in the power supply, the 23 gensets keep the hospital running smoothly by delivering some 50 MW of power in a matter of seconds. With ambient temperatures ranging as high as 55°C, keeping the hospital's air-conditioning system up and running is crucial," said Ashraf Tamim, General Manager of A&A.

APPOINTMENT

Atul Sobti becomes new CMD of BHEL

Atul Sobti, 56, has assumed charge as CMD of India's largest Maharatna Public Sector engineering and manufacturing enterprise, Bharat Heavy Electricals Limited (BHEL). Prior to this, he was Director on the Board of BHEL, heading two crucial portfolios of Power and Finance. Earlier, he also held additional charge of the post of Director (Engineering, R&D).

In addition, he is the Chairman of Raichur Power Corporation Limited, a Joint Venture company of BHEL and Karnataka Power Corporation Limited. Before his elevation to the Board in December, 2013, he was Executive Director (Power) at BHEL, New Delhi, and was also holding concurrent charge of Industrial Systems Group, a Bengaluru based unit of BHEL.

Significantly, as Director (Power), Sobti was responsible for spearheading and strategizing for the Power Sector business of BHEL and under his stewardship, BHEL's power business has achieved major milestones including the highest ever capacity addition/synchronization of 13,452 MW and 11,941 MW in financial years 2013-14 and 2014-15, respectively. In fact, in fiscal 2014-15, BHEL exceeded Ministry of Power's capacity addition target by 19% Under his leadership, the trend has continued in the current fiscal (2015-16) and BHEL has already commissioned or synchronised projects of around 8,000 MW, the highest ever in the first nine months of a financial year. He has been instrumental in strategizing and securing a series of orders from various state utilities including Telangana, Andhra Pradesh, Karnataka, Gujarat, Tamil Nadu, Uttarakhand and Punjab besides Central Utilities like NTPC and NLC.

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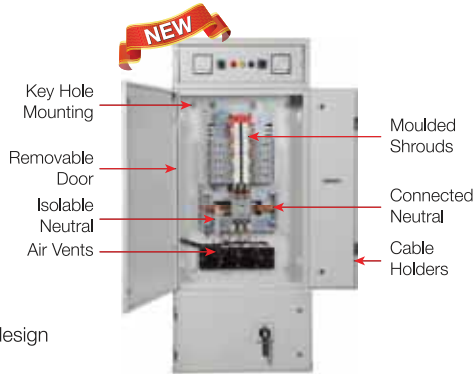

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SOLAR ROOFTOP

Rooftop system by Solar Town to provide great savings

Solar Town Energy Solutions Pvt. Ltd. (SolarTown) has completed installation of a solar rooftop system on a 2,400 square feet multi-level residential property located in Filmnagar, Hyderabad that is estimated to save the homeowner about Rs.4 lakhs over the 20 year lease period.

The solar system is part of a first-of-its-kind residential lease program in India by Solar Town with zero up-front costs and fixed monthly rates lower than DISCOMs, shielding homeowners against increasing electricity prices, with a 17% savings starting on day one.

The 6 kW rooftop systems offset a major portion of the customer's energy consumption. Currently, residential customers with power usage greater than 400 units, which can be typical for residences larger than 800 square feet with high consumption appliances such as air-conditioning systems, pay Rs.8.5 per unit for electricity in Hyderabad with rates increasing at approximately six percent per year. Under this solar lease program, the homeowner will pay a fixed monthly lease to Solar Town for the twenty year term.

AWARD

Bharat Heavy Electricals Limited receives CBIP Award 2016

Bharat Heavy Electricals Limited (BHEL), the company maintaining a widespread overseas footprint in 76 countries and with a 20,000 MW per annum capacity for power plant equipment manufacturing, has been awarded the CBIP Award 2016 for 'Best Power Equipment Manufacturing Organisation.' The award was received by Atul Sobti, CMD, BHEL, from Sushri Uma Bharti, Hon'ble Union Minister of Water Resources, River Development and Ganga Rejuvenation, on CBIP Day 2016. BHEL has been conferred with the award for its outstanding contribution to the development of the power sector including power generation, transmission & renewable energy.

SOLAR PROJECT

Rays Power Infra bags big chunk of solar project in Uttarakhand

Rays Power Infra Pvt. Ltd. has bagged a sizeable percentage of the total capacity of the Uttarakhand Solar Tender. The total capacity of the tender was 170 MW, of which Rays Infra acquired 80 MW on behalf of its clients. This was done under co-development and pre-bid EPC tie-up s for a financial bid opening conducted in Dehradun in October 2015.

Moreover, Rays Power Infra, which had submitted a bid for 90 MW was successful in securing a satisfactory range from L1 tariff meaning INR 5.57 per kWh and the H2 tariff at INR 5.98 per kWh. With this the company's order book stands at 215 MW of solar power projects with an additional turnover of over Rs 500 crore. For a company as young as Rays Power Infra, this is a commendable achievement.

Commenting on the development, Ketan Mehta, Director, Rays Power Infra said, "The allocation of 80 MW from a total capacity of 170 MW of the Uttarakhand solar tender to Rays Power Infra demonstrates the excellent market confidence our brand commands. We have steadily consolidated our portfolio and won the confidence of not just our loyal clients, but other stakeholders of the renewable energy sector in India, which includes government interests. India has begun harnessing the potential of solar power as an environmentally viable alternative to scarce fossil fuels, and as a brand we take great pride in being one of the front-runners as EPC service-providers. The bagging of a big chunk of the Uttarakhand solar tender reinforces our position as such."

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AWARD

NTPC receives CBIP Award- 2016

NTPC, India's largest energy conglomerate with roots planted way back in 1975 to accelerate power development in India, has been given CBIP Award - 2016 for being 'Best Performing Utility in Thermal Power Sector,' and setting benchmarks for efficiency and reliability with focus on technology.

The award was received by A K Jha, CMD, NTPC from Sushri Uma Bharti , Union Minister for Water Resources, River Development and Ganga Rejuvenation at a function held in New Delhi.

CBIP (Central Board of Irrigation and Power), a premier institution, rendering dedicated services to professional organisations, engineers and individuals for the last about 80 years, resulting in accelerated development in the twin disciplines of Water Resources and Power in the country and abroad. CBIP has grown into an eminent organisation of international importance while serving the nation equally with great distinction. CBIP is Indian chapter for 10 international organisations related to Water resources & Power sectors.

DELEGATION

DEWA receives Itron's delegation

HE Saeed Mohammed Al Tayer, MD & CEO of Dubai Electricity and Water Authority (DEWA), recently received a delegation from Itron, a US smart meter company, at DEWA's headquarters. The delegation included Simon Pontin, Vice President and Chief Technology Officer, Norbet Rickert, Senior Director of Smart Grid EMEA, Hussain Rizvi, Regional Director, Smart Grid Solutions Middle East and Turkey.

DEWA's Abdullah Obaidullah, Executive Vice President of Water & Civil, Rashid Bin Humaidan, Executive Vice President of Distribution Power, Waleed Salman, Executive Vice President of Strategy & Business Development, and Moza Al Akraf, CIO of DEWA, also attended the meeting.

The meeting supported the Smart Applications initiative for smart meters and grids, one of three smart initiatives announced by DEWA, along with Shams Dubai to encourage household and building owners to install photovoltaic panels on rooftops to generate solar power, and Green Charger to build the infrastructure and charging stations for electric vehicles in the Emirate.

The parties discussed mutual interests in electricity, water smart grids, the Advanced Metering Infrastructure (AMI) and related installation plans within SAP to measure, integrate and automate all DEWA's operations to deliver top-quality services for its customers, employees and partners.

Within the first phase, DEWA is currently installing 200,000 smart meters. DEWA plans to install over one million smart meters by 2020 across Dubai, and replace all mechanical and electromechanical meters during the next few years. The smart meters project complements the smart grid project by DEWA to implement a number of technical features in electricity networks - by using the latest SCADA systems, smart monitoring and control automation systems to provide electricity and water services to the highest standards of availability, efficiency and reliability.

HYBRID VEHICLE

Volvo's hybrid buses now to run on Indian roads

To promote environmentally-friendly vehicles, the Indian government has recently launched the FAME India (Faster Adoption and Manufacturing of Hybrid and Electric vehicles in India) scheme, offering incentives on electric and hybrid vehicles.

Thus, Volvo has introduced its hybrid technology in India. The first Volvo hybrid city bus pilot will start in Navi Mumbai with Navi Mumbai Municipal Transport (NMMT), a major transportation service in Navi Mumbai and its surrounding areas and cities.

"Volvo has a leading position in hybrid technology and electromobility. Hybrid buses is an important solution for cities that want to reduce vehicle emissions. I am very proud that Volvo is the first bus manufacturer to introduce hybrid buses in India", said Håkan Agnevall, President Volvo Buses. The Volvo hybrids will be manufactured in the company's facility in Bangalore.

"The unveiling of the first Volvo hybrid city bus in India is contextual given the impetus from the central government to popularise public transport, while supporting the adoption of clean technology. Volvo has played a key role in redefining urban commute for millions of passengers in Indian cities. Now, with the Volvo hybrid city bus we are confident of transforming the public transport landscape further, by inspiring more cities to adopt this solution," said Akash Passey, Senior Vice President, Region International, Volvo Buses.

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JOINT EFFORT

Orange, ENGIE bring electricity to rural Africa

Based on Orange's expertise as a telecoms carrier and ENGIE's experience in renewable energy production, aggregation and maintenance, the two groups will trial a range of domestic power supply solutions for rural populations that could then be marketed by Orange.

These solutions could, for instance, include individual solar kits and small-scale, local electricity networks. The service could then be billed via mobile using Orange Money.

The trials will allow the companies to validate the technical solutions, the sales and distribution models, and the economic feasibility of the service before making it available on a larger scale.

The deal between Orange and ENGIE – both official partners of COP21 – reasserts the companies' willingness to use their technological knowledge to achieve sustainable progress and economic and social development in Africa. Orange and ENGIE are keen to play their role as socially responsible players in Africa, where an estimated 69% of the population in sub-Saharan Africa and 90% of the rural population in the same region have no access to the electricity grid. The strength of the partnership is based on Orange's expertise as an international telecoms carrier present in 19 countries in Africa and the Middle East, and ENGIE's know-how as an international player in the energy sector. EI

MICROGRID

BGE to test microgrids at two Maryland locations

Microgrids are self-contained, small-scale electric grids with their own power generation source that can power a commercial center independently of the regional power grid when necessary, such as in the aftermath of a severe impact storm. Baltimore Gas and Electric (BGE) Company is proposing to develop two electric microgrids – one in Baltimore City and one in Howard County – as part of a pilot programme to test the microgrid concept.

The BGE application to the Maryland Public Service Commission (PSC) proposes developing pilot public purpose microgrids at Edmondson Village in Baltimore City and at the Kings Contrivance Village Center in Howard County. Both areas meet criteria conducive to the tests, including supporting a mix of community services beneficial to the public, such as grocery stores, pharmacies, clinics, gas stations and public buildings that could potentially be used for emergency coordination and shelters during a regional event affecting the power grid.

"Microgrids are designed to strengthen the reliability and resiliency of the electric grid and provide geographic locations that can maintain power and provide vital community services to our customers when a region in our service territory experiences widespread outages. We look forward to using the pilot to better understand how microgrids can enhance the electric system serving our customers in the future," said Rob Biagiotti, Vice President and Chief Customer Officer, BGE.

BGE's proposed pilot builds on the Maryland Energy Administration's 2014 Resiliency Through Microgrids Task Force Report that concluded in part that microgrids are in the public interest, and electric utilities should apply to the PSC for approval to develop microgrids. EI

WIND ENERGY

Commercial operation started in Oklahoma's Kay Wind project

Kay Wind; a 299-megawatt wind facility located in Kay County, Oklahoma; began commercial operation on December 12, 2015. Apex Clean Energy; an independent renewable energy company, developed, managed construction of, and will operate the project; which is the largest single-phase wind farm in Oklahoma.

It is the first wind facility owned by Southern Company subsidiary Southern Power, which is also expected to purchase the 150 MW Grant Wind facility from Apex upon completion of construction.

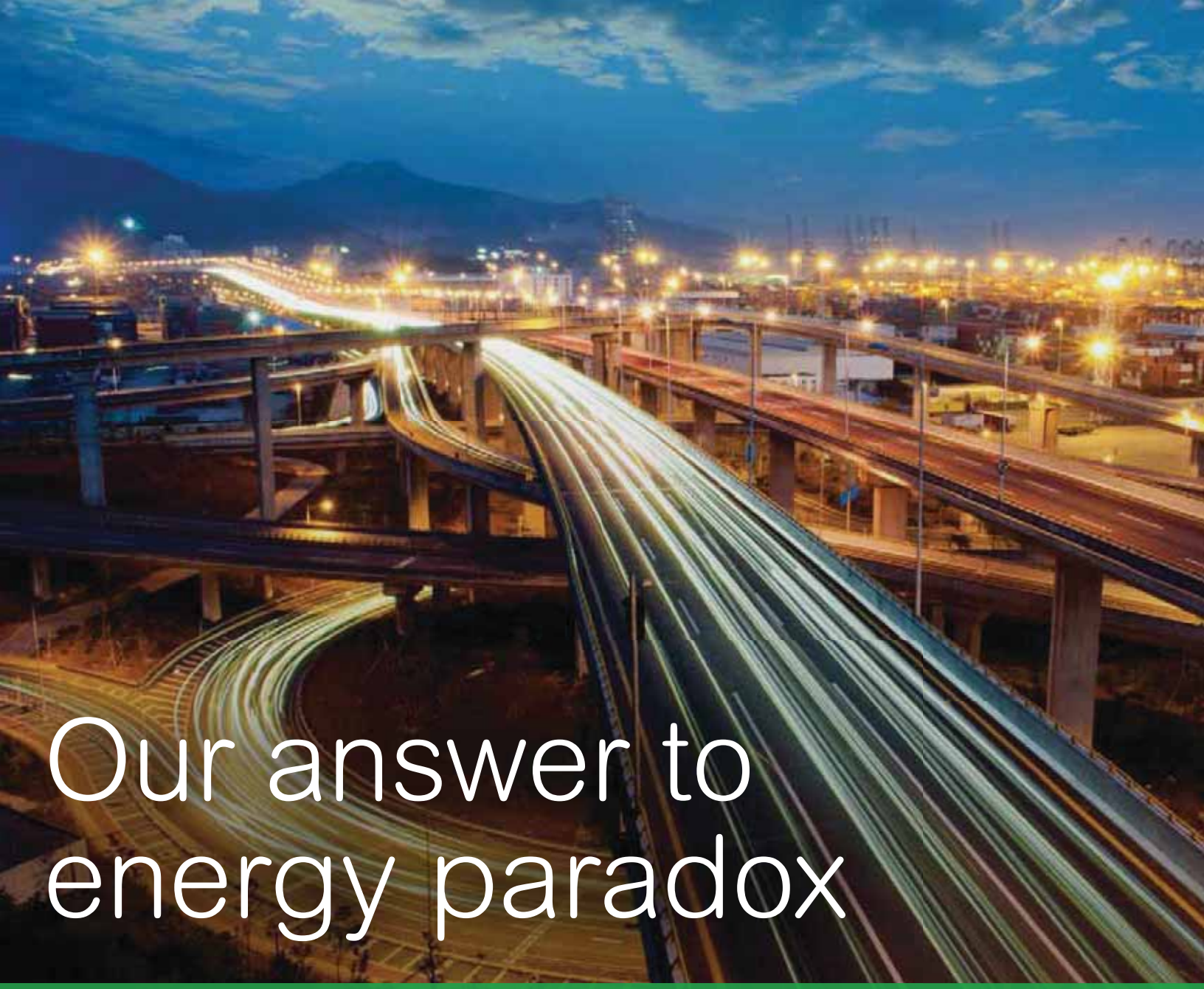
Mark Goodwin, President of Apex, said, "The Kay transaction demonstrates Apex's ability to develop and deliver turnkey projects to its customers. Now that the project is operational, we look forward to managing this unique asset for Southern Power."

Kay Wind is expected to generate enough electricity to help meet the energy needs of approximately 100,000 homes. Apex brought three other wind projects online in 2015: Hoopeston Wind in Illinois, Balko Wind in Oklahoma, and Cameron Wind in Texas. Two more of its Oklahoma projects, Grant Wind and Kingfisher Wind, are expected to begin operations in 2016.

Image Courtesy: Siemens

Apex Clean Energy ordered Siemens SWT-2.3-108 turbines for its Kay Wind project...

Contextually, Siemens supported installation of 130 wind turbines that the company supplied for the 299 MW project. Apex will continue to serve as asset manager of the project. A long-term service and maintenance agreement was also has been signed for the project and includes Siemens' remote monitoring and diagnostic services. EI



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ORDER

L&T Construction wins power T&D orders

The Power Transmission & Distribution Business of L&T Construction has won orders worth Rs. 1038 crores in the international and domestic markets in November 2015. Larsen & Toubro Saudi Arabia LLC, a fully owned subsidiary of L&T, has bagged an order valued at SAR 405.75 Million (USD 108.2 Million) for the construction of five 132 kV Substations at Hail area from the National Grid, Saudi Arabia, a subsidiary of Saudi Electricity Company.

The scope involves detailed designing, engineering, testing and commissioning of the 132 kV gas insulated switchgear, 132/13.8 kV, 50/67 MVA power transformers, 132/33 kV, 80/100 MVA power transformers, 13.8 kV switchgears, 33 kV switchgear, control & protection system, substation automation system, HVAC, Novec firefighting system with associated auxiliary systems and civil works. These projects are in the central province of Saudi Arabia and are scheduled to be completed in 24 months.

In the domestic market, the business has bagged an order from the Odisha Power Transmission Corporation Limited (OPTCL).

Forming a part of the power system improvement project in the state capital, the order is for engineering, supply, erection and commissioning of several KMs of underground EHV & HV cable networks, compact substations and other distribution elements in the city of Bhubaneswar, Odisha.

COMMUNITY PROJECT

Community solar projects in Africa kicks-off

INTASAVE Energy, a global not-for-profit and environmental enterprise, has successfully reached its $100,000 crowdfunding target that will see the installation of the first Solar Nano Grids (SONGs) in the villages of Lemolo B and Echareria in Kenya, each of which will service the needs of at least 250 people. This is the first major milestone for the project that aims to reach over 500 communities across Kenya, South Africa and Mozambique within three years, transforming the lives of up to 250,000 people, as part of INTASAVE Energy's vision for every person on the planet to have access to clean, reliable and affordable power.

Having passed the $100,000 target, INTASAVE Energy is extending the deadline to January 1st 2016 to allow further contributions to be made through its not-for-profit crowdfunding campaign on Indiegogo.

"The more funding we can raise at this stage, the more solar nano grids we can roll out to communities in Africa. Anyone can contribute from as little as $10 to help families in off-grid communities not only with household electricity, but to be able to mill corn, incubate chickens, run water pumps and manage micro enterprises, in a clean and sustainable way using SONGs – electricity is essential for development," said Arran de Moubray, Head of Renewable Energy, INTASAVE-CARIBSAVE Group, adding "Kenya was chosen as an ideal starting point in Africa because 30 million people (75% of the population) in Kenya are without electricity, 95% of whom are located in off-grid rural areas, which are simply not viable for larger solar installations".

DISTRIBUTED ENERGY

S&W Cogen Solutions joins hands with 3PI

Sterling and Wilson (S&W) Pvt. Ltd., a company globally known for Turnkey MEP services and engineering, procurement and construction of distributed energy systems, has partnered with Professional Power Products (3PI), a wholly owned subsidiary of Power Solutions International, Inc. (PSI), through a new venture, Sterling and Wilson Cogen Solutions, LLC (SWCS).

The new company has been formed to pursue the rapidly expanding North American cogeneration / Combined Heat and Power (CHP) market. SWCS will initially open offices in Chicago, Philadelphia and New York, with plans to expand into other regions as the market continues to grow.

"Sterling and Wilson has been following the growth of the North American cogeneration market for the last several years. S&W has analysed the market through our internal strategy group and through major global consulting companies, and these studies show the market is positioned for massive expansion. We've had all the resources necessary to capture a large segment of this 40-gigawatt market – except for a U.S. company with the necessary products and services that shared our vision. After an extensive search, we have found a partner to support that growth in PSI and its subsidiary 3PI," said Rajesh Shah, President of Sterling and Wilson Co-gen Solutions Pvt. Ltd.

SWCS' goal is to become the dominant player in the small to mid-sized cogeneration market (under 20MW) by providing companies with the customised products and services they desire. Through the combined capabilities of S&W, 3PI and PSI, SWCS will supply development, engineering, product, construction, service and financing of CHP systems, making it the only company in the market that can internally control all aspects of such projects.

Mr. Rajesh Shah, President, Sterling and Wilson Cogen Solutions Pvt. Ltd.

"We are extremely excited to be selected by an industry leader like S&W to be its partner and supplier of engines and packaging services. S&W's entry into this market validates our vision for the expansion of our power generation engine products and the growth of 3PI," said Gary Winemaster, PSI's Chairman and CEO.

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MARKET

Global market for microsensors to witness growth

Microsensors are devices that detect events, or changes in quantities, and deliver a corresponding output, typically in the form of an optical or electrical signal. The microsensor market is broadly categorized into three segments, namely MEMS, biochips and nanosensors. MEMS is a sensing device that integrates mechanical elements, sensors, actuators and electronics in a common silicon substrate. Biochips are silicon chip–based detection devices that integrate a living organism and a transducer to provide a signal for detecting the presence of a particular substance. Nanosensors are based on nanotechnology and incorporate nano-engineered structures such as nanotubes.

Strong growth in diverse sectors such as automotive, consumer electronics, healthcare and military is propelling the demand for such different types of microsensors, across the globe. Some of the leading players in the global microsensor market include Robert Bosch GmbH, STMicroelectronics N.V., Analog Devices Inc., Texas Instruments Incorporated and OMRON CORP. among others.

According to the report titled 'Global Microsensor Market Forecast & Opportunities, 2019' the global market for microsensors is forecast to exhibit a healthy CAGR of around 10% during 2014-19. Americas continues to dominate the global microsensor market on account of growth in the automotive, consumer electronics and healthcare sectors in the region. Asia-Pacific, particularly countries such as Japan and China, is also emerging as a major market for microsensors, standing second only to the Americas in terms of revenue share in the global microsensor market. Among all the three market segments, the MEMS segment accounted for the largest revenue share in 2013. Market for MEMS pressure, accelerometer and gyroscopic sensors is witnessing healthy growth, primarily due to growing adoption of these sensors in consumer electronics and automotive applications, globally. EI

MANUFACTURING

WEG to build a motor manufacturing facility in Portugal

WEG will invest 15 million Euros to build a new manufacturing facility, to produce electric motors, in Santo Tirso, Portugal. The factory will come up on about 18,000 m² area, on a 44,000 m² site, with the possibility of expansion up to 100,000m².

Similar to other WEG manufacturing plants, this facility will adopt a modular design, allowing the gradual and continuous increase in production capacity allowing WEG to meet expansion needs over several years.

"The new Santo Tirso base will be dedicated to the production of low voltage motors (up to 3.5 tons), while our other Portuguese unit, based in Maia, will add space to produce explosion-proof motors," explains Luis Alberto Tiefensee, Managing Director of WEG Motors.

The first production module in Santo Tirso will come into operation in mid-2016 and generate about 150 new jobs.

Taking into account that the sustainability of WEG's growth depends fundamentally on an ethically correct conduct in the relationship between stakeholders. EI

WEG

The first production module in Santo Tirso should come into operation in mid-2016...

MATERIAL

Panasonic develops new material for stretchable electronics

Panasonic Corporation has developed a soft, flexible, and stretchable polymer resin film using its proprietary stretchable resin technology. The company will also provide a transparent electrode material and conductive paste along with this insulating film.

This newly developed material is an insulating film material that stretches and returns to its original shape, a feature that is hard to find in conventional flexible materials. It adapts to desired manners of folding and to varying free-form surfaces, substantially reducing existing design constraints. For example, it enables the construction of soft and stretchable electronic devices that are adaptable to a variety of forms, such as of clothing and the body. The newly developed material is deployable in a broad range of applications, from wearable devices to sensors, displays and robots.

The stretchable resin film offers the following features developed on the basis of the company's proprietary stretchable resin technology. The newly developed film and materials will be on exhibition at the 17th Printed Wiring Boards Expo to be held from January 13 to 15, 2016 at Tokyo Big Sight. EI

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PARTNERSHIP

Cyan enters Chinese smart metering market

Cyan, the integrated system and software design company delivering mesh based flexible wireless solutions for utility metering and lighting control, has signed a strategic partnership agreement with Newcapec Electronics Company Limited (Newcapec), a well known solutions provider in China.

Together, Cyan and Newcapec will explore new opportunities in next generation smart metering applications for the power, gas and water industries as well as emerging city applications, such as lighting and sensors, both in China and internationally.

Cyan and Newcapec have agreed to collaborate with the aim of adding value to the Chinese Smart Metering market using their combined solutions, as well as identifying and developing new applications across emerging smart energy, 'Smart Cities' and Internet of Things (IoT) markets. John Cronin, Executive Chairman of Cyan, says, "We are pleased to be partnering with Newcapec to provide increased value through our integrated solutions. Our aim is to deliver smart metering solutions to enable enhanced intelligence for both utilities and consumers, and to support energy efficiency, consumption and demand side management initiatives. In addition, we will work together to identify new applications for our combined technology within the IoT and 'Smart Cities' to support the creation of sustainable, viable living spaces with Cyan's integrated platform providing insight and control.

John Cronin

POWER GENERATION

EnSync's strategy matches with the international trend in power generation

EnSync, Inc., dba EnSync Energy Systems, a well known developer of innovative energy management systems for the utility, commercial, industrial and multi-tenant building markets, states that recent and pending decisions aimed at shifting more electricity generation to sustainable sources confirms that EnSync's technologies and strategy are well aligned with the domestic and international direction of policies and programmes designed to further the adoption of renewable energy.

The company has closed over $12 million of Power Purchase Agreements that incorporate key incentives that have been extended and enhanced with the President Obama's signature on the 2016 Omnibus Funding Bill. Key EnSync executives have played a role in urging Congress to approve these incentives. These enhanced incentives will substantially increase EnSync's already promising pipeline for Power Purchase Agreements that include solar-plus-storage. In combination with EnSync's industry leading product developments, we expect EnSync, in the longer term, to realise a substantial growth in new markets and increase penetration in existing markets both nationally and globally.

Internationally, the recent Paris Climate Accord creates the need for an energy portfolio that relies less on fossil fuels and more on renewable energy as a means of reducing carbon emissions. From this accord, will come additional global incentives by individual countries to meet their compliance targets. The company is well positioned with its Solar Power Inc. (SOPW) partnership to take advantage of these incentives when instituted. In particular, the partnership is setting up organisational structures in China, Australia, Germany and Japan – all key participants to the Climate Change Accord.

CO-OPERATION

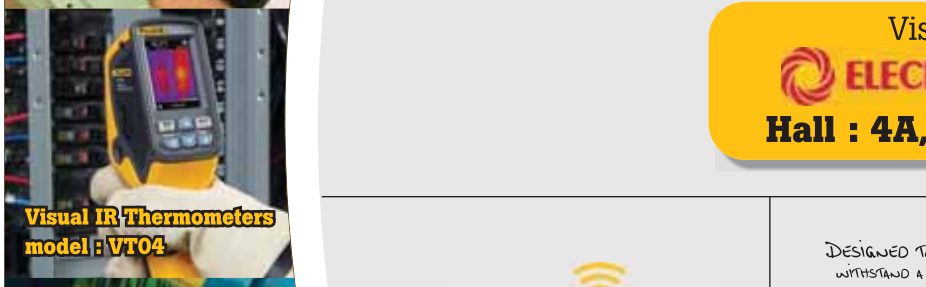
F&S signs MoU with Malaysia Innovation Hub

Frost & Sullivan (F&S) signed a Memorandum of Understanding (MoU) with the Malaysia Innovation Hub (MIH) to promote co-operation in the areas of business advisory, commercialisation and marketing across sectors. The formal signing of the memorandum took place at MIH's headquarters at the University of Malaya recently, which was witnessed by the representatives from the Alibaba Group and the Ministry of Higher Education. The agreement was signed by Tan Sri Dr Ghauth Jasmon, the Chairman of MIH and Hazmi Yusof, Managing Director Malaysia, Frost & Sullivan.

Frost & Sullivan's collaboration with MIH aims to help accelerate the pace of IP commercialisation. Under this agreement, F&S will assist in identifying projects of mutual interest and work with them in building a converged knowledge and marketing platform that can accelerate businesses towards transformational growth.

Commenting on the agreement, Dr Ghauth noted that this partnership is timely because Malaysia is focusing its efforts on building an Innovation ecosystem. "Through our combined efforts, we hope to set in place a framework that will drive innovation and help Malaysia stay relevant amidst the rapidly evolving market environment," said Dr. Ghauth.

Hazmi Yusof shared that F&S was well-placed to assist MIH, given the company's strong track record. With its broad industry coverage and strong business network, the company is able to match investors and conglomerates who are looking to be part of the effort. "Frost & Sullivan is excited and honoured to partner MIH. This exciting collaboration will provide an excellent opportunity and build a distinctive platform for local businesses to exchange ideas and experiences to enhance Malaysia's innovation ecosystem," he said. MIH is a Malaysian Government assisted non-profit organisation.



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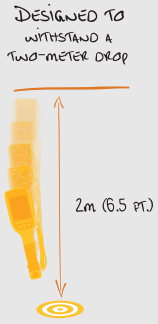

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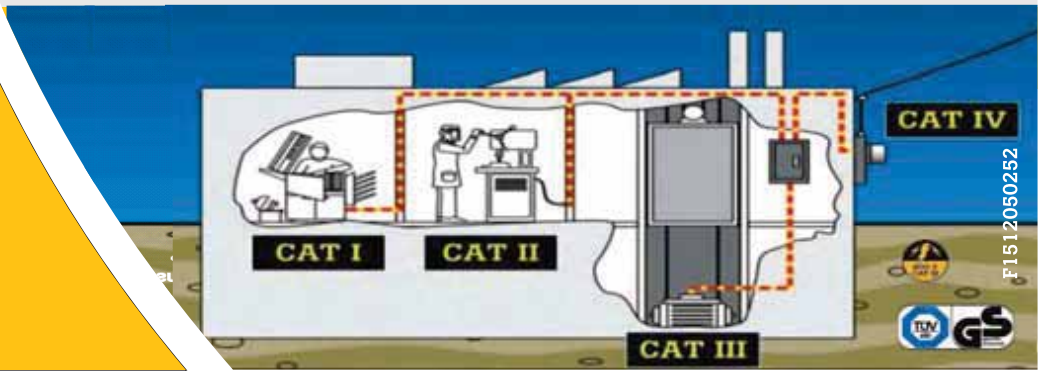

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ENGINE CONTROL

Thrush Aircraft, GE Aviation to develop new electronic engine control

Thrush Aircraft and GE Aviation are planning to develop a new H85-powered version of the current Thrush 510G. The H85 engine upgrade will feature more power and a new Electronic Engine Control (EEC) system designed to reduce pilot workload with a single-lever control for both engine and propeller operation.

The H85 with EEC system will be offered as an optional engine upgrade to the standard H80-powered 510G. The new H85-powered 510G aircraft is expected to enter service in 2017.

In 2009, Thrush selected the H80 to power an improved version of its 510-gallon, 10,500-pounds gross weight Thrush aerial applicator (crop duster), becoming the first ever application for GE's H Series, which now includes the H75, H80 and H85 engines.

The new 510G's EEC will automatically prevent engine overtemping and overtorquing, leading to longer engine life and easier maintenance.

The new EEC provides true single lever power control and full auto-start capability to help ease pilot workload for H Series-powered aircraft.

Initial flight testing of the EEC system will begin in the first quarter of this year (2016) on the Nextant G90XT with certification expected the following quarter.

"We joined with GE to offer this engine upgrade because of their strong reputation delivering game-changing performance and reliability through innovative technologies like the electronic engine control," said Payne Hughes, President of Thrush Aircraft.

"The additional horsepower and increased temperature margin of the H85 engine will enable Thrush 510G operators to carry larger loads in hot weather. The electronic engine control offers complete exceedance protection for the engine and also lowers pilot work load dramatically, which is critical for our customers," he added.

BUSINESS

Schneider Electric sells off Juno Lighting

Following the October 30th, 2015 announcement regarding the sale of Juno Lighting, LLC (Juno), Schneider Electric – the global specialist in energy management and automation, has recently announced that it has obtained all required regulatory approvals – and subsequently finalised the sale of Juno to Acuity Brands, Inc., for a consideration of approximately $385m (approximately € 350m). The transaction will generate a capital loss of up to $300m (€ 270m). Such loss will be excluded from the basis of calculation for Schneider Electric's 2015 dividend. Schneider Electric had earned revenues of € 25 billion in FY2014.

CSR

Toshiba India supports 'Swachh Bharat Abhiyan'

In order to support the union government's Swachh Bharat Abhiyan (Clean India mission) and Toshiba Corporation's global initiative – "Simultaneous Social Contribution Action by Toshiba Group's 200,000 Employees 2015," Toshiba group companies in India organized a cleanliness drive at a community park in Mayur Vihar Phase III, New Delhi.

As a follow-up to the last year, this year's cleanliness drive envisaged 60 employees from eight Toshiba group companies, along with the support and guidance of Delhi Parks and Gardens Society (DPGS). The eight participant companies belonging to the Toshiba Group were Toshiba India Private Limited, Toshiba JSW Power Systems Private Limited, Toshiba Software (India) Private Limited, TPSC (India) Private Limited, Toshiba Johnson Elevators(India) Private Limited, Toshiba Transmission & Distribution Systems (India) Private Limited, Toshiba Logistics India Private Limited and UEM India Private Limited.

Kenji Urai, MD, Toshiba India Pvt. Ltd. participated in the activity and shared his views on everyone's responsibility towards environment. He said, "It's very important to continue cleanliness activities and I'm very glad to join the drive again. I thank everyone for their participation in making this day successful. I hope that people who play in this park will also come forward and would continue to take care of the park and keep it clean as a follow-up activity to our cleanliness drive. We will continue to conduct such kind of activities which would help in further upkeep of society."

The photo was taken when employees from 8 Toshiba group companies were in cleaning action at a community park in Mayur Vihar…

"We believe that business groups like Toshiba have a key role in helping the country achieve 'Swachh Bharat Abhiyan'. Toshiba has been partner to India's growth for over 50 years and enhancing people's live directly and indirectly. This gives us the responsibility to make a meaningful difference to the community through our contributions", he further added.

Toshiba is celebrating December as CSR month, and encourages participation in voluntary activities by all of the Group's 200,000 employees. Held every December since 2006, CSR Month reminds employees and stakeholders around the world of the importance Toshiba attaches to turning its guiding principles – committed to people, committed to the future – into real engagement with society, thorough events and activities that raise personal awareness and contribute to the community.

R&D CONTRACT

GE Aviation bags contract for SiC Power Electronics R&D

GE Aviation has received a contract for the research and development (R&D) of silicon carbide-based power electronics supporting the high-voltage next generation ground vehicle electrical power architecture for the U.S. Army.

"GE continues to invest in electric power technologies and specifically in Silicon Carbide, which enables significant improvements in size, weight and power. Our electric power team has successfully demonstrated various types of power conversion products that have led to high temperature applications of silicon carbide technology. We're taking this to the next level to deliver prototypes that demonstrate these improved capabilities in the field," said Vic Bonneau, president of Electrical Power Systems for GE Aviation.

The $3.4 million contract consists of an 18-month development programme that will demonstrate the benefits of GE's Silicon Carbide MOSFET technology in two critical systems: a 35 kW main engine cooling fan controller and a 3kW coolant pump controller. The hardware will be more efficient than present day silicon-based systems and will allow better management of the vehicle's available on-board power, increasing mission capability.

The silicon carbide technology enables integration of the SiC Controller electronics onto the engine cooling fan. This integration eliminates what is typically a separate liquid-cooled, Motor Drive Line Replaceable Unit (LRU) and related cooling hoses and interconnecting cables, thereby simplifying vehicle installation. EI

BUSINESS

Gamesa Electric bags new contract in Honduras

Gamesa Electric has been awarded with its biggest Solar Photovoltaic project to date, involving the supply of Solar Power Stations and Control for a 53.31 MWp project in Honduras. This project is signed two and a half months after their former 50 MW DC plant in Philippines and adds to the 32 MWp in Panama, 23.5 MWp in UK and 10 MWp in India recently announced by the company, which joins to a total accumulated order backlog of more than 275 MWp in the last one and a half year. The company will deliver the Solar Power Stations to Honduras in Q1-2016 and the project will be commissioned in early Q2-2016.

The company's scope of supply for this project includes: 9 Solar Power Stations 2.8 MVA (each of them formed mainly by 2 PV Inverters 1.4 MVA, step transformer and MV protection switchgear in a 40 ft ISO container); 7 Solar Power Stations 2.2 MVA (each of them formed mainly by 2 PV Inverters 1.1 MVA, step transformer and MV protection switchgear in a 40 ft ISO container); 3 Solar Power Stations 1.4 MVA (each of them formed mainly by 1 PV Inverter 1,4MVA, step transformer and MV protection switchgear in a 20ft ISO container); 1 Power Plant Controller (PPC).

Gamesa Electric will be the supplier of the Power Plant Controller to ensure the fulfilment of the Honduras Grid Code requirements of the complete PV plant. The main requirements are: P-Q commands, Voltage and power factor regulation and LVRT (Low Voltage Ride Through).

The PPC will receive commands from the Honduras National Grid Operator, and through a real-time controller, will send communication signals to the Gamesa PV inverters to fulfill the received command in the Point of Common Coupling (PCC).

With this operation, Gamesa Electric reinforces its presence in LATAM, with a new supply contract in a country in its first development stages for PV renewable energy, and with a new customer with an interesting future portfolio of projects. EI

JOINT VENTURE

TEPC, Chubu Electric go for implementing the JVA

Tokyo Electric Power Company, Inc. (TEPC) and Chubu Electric Power Co., Inc. (Chubu Electric) have been moving forward with the comprehensive alliance, covering the entire energy supply chain, from upstream investments and fuel procurement through power generation in accordance with the Joint Venture Agreement (JVA) signed on February 9, 2015, starting with the areas that will have a high impact and are easier to undertake.

They have recently announced the integration of both companies' existing fuel businesses (upstream/procurement) and existing overseas power generation/energy infrastructure businesses (Subject Businesses) to JERA Co., Inc. (JERA) in July 2016.

By integrating the Subject Businesses of both companies' to JERA, necessary framework will be established for JERA to integrally and optimally manage the business fields, from upstream investments and fuel procurement to overseas power generation and development of new domestic thermal power plants and scrap and build of obsolete domestic thermal power plants, as agreed in the Joint Venture Agreement.

With predictions of an ever more rapid changes in the business environment and customer needs, TEPCO and Chubu Electric will endeavour to serve the public interest by securing the stable supply of energy, such as electricity and gas, on internationally competitive basis and also to realise an increase in their enterprise values, through JERA's global business activities. EI

LEADERSHIP

American Council On Renewable Energy chooses new President

The Board of Directors of The American Council On Renewable Energy (ACORE) has unanimously selected Gregory Wetstone to become the organisation's President and Chief Executive Officer, effective January 1, 2016. "Greg's experience, vision and history of leadership promoting renewable energy equip him well to take ACORE to new levels," commented Dan Reicher, Chairman of ACORE's Board of Directors and Executive Director of the Steyer-Taylor Center for Energy Policy & Finance at Stanford University.

"Over the breadth of his career," Reicher added, "Greg has been successful in government, private sector and non-profit positions, demonstrating strong leadership, a talent for consensus-building, and a proven ability to advance key national policies at the highest level. We are thrilled to have him on board."

Most recently, Wetstone oversaw government affairs as Vice President for Terra-Gen Power LLC, a renewable energy company with utility-scale wind, solar and geothermal energy facilities. Prior to his 6-year term with Terra-Gen, he served as Senior Director for Government and Public Affairs at the American Wind Energy Association (AWEA) and Director of Programs at the Natural Resources Defense Council (NRDC), where he founded the legislative program. Earlier, Greg was Senior Counsel to the House Energy and Commerce Committee, and played an important role in crafting the 1990 Clean Air Act Amendments.

"I am honoured by the Board's confidence and enthusiastic about leading ACORE at such an important time." Wetstone said. "It is increasingly clear that our energy policies will be the subject of intense national debate in coming years. I believe that ACORE, as a common voice for the large and diverse collection of businesses in the renewable energy and energy efficiency sectors, has a critically important role to play as we look to move the nation towards a lower carbon economy. I look forward to working with ACORE's staff, Board and member companies, and our allies across the renewable space, to address the challenges of this vital transition." EI

CLEAN ENERGY

New initiative comes to foster clean energy investment

A new multi-million dollar initiative to promote clean energy investment in developing countries has been announced on 7th December 2015 at the COP21 climate talks in Paris. The Global Environment Facility (GEF) will provide $2 USD million in initial funding to help kick-start the formation of the 'Climate Aggregation Platform' (CAP) in 2016. The CAP is expected to leverage over $100 USD million in co-financing from different partners, including from the Inter-American Development Bank (IDB).

The announcement was made by Naoko Ishii, GEF CEO and Chairperson, during Energy Day at COP21. The CAP aims to help build pipelines of standardised, low-carbon energy assets in developing countries and to develop low-cost sources of financing for these assets, tapping new and diverse investor bases.

The United Nations Development Programme (UNDP), together with the Climate Bonds Initiative (CBI), will implement the CAP programme. The IDB will be a core partner in demonstration transactions. The CAP will be structured around three core activities: 1) A global working group, to promote engagement and coordination amongst key finance and industry stakeholders, 2) Promoting the standardisation essential to aggregation, and 3) In-country demonstrations and providing technical support for pilot transactions, to build pipelines and achieve scale. EI

NEW TECHNOLOGY

FLYPRO launches XEagle UAV controlled by mouth

On January 6, 2016, the world's most prestigious science and technology industry event - the International Consumer Electronics Show (CES) opened in Las Vegas, attracting more than 3,600 exhibitors from 150 countries and regions. This CES, UAVs have become one of the highlights of the show's many sectors, with DJI, FLYPRO UAV exhibiting its most innovative UAV products.

At a press conference at CES, FLYPRO released a smart flying drone controlled by mouth, that is voice control, - the XEagle, a 'smartwatch UAV with one key control, quick automatic obstacle avoidance, intelligent gimbal follow recording and multiple intelligent security protection.

According to the product information, XEagle is operated differently than other consumer drones. Mainly for sporty people, the functionality of the drone was a highlight as an unprecedented innovation allowed for freedom of movement of both hands making full range of motion possible while recording each wonderful sports moment.

Real photo of XEagle…

XEagle does not require a remote control or smartphone to control. You can fly the UAV by mouth, that is by voice control. It relies on its accurate speech recognition to follow user voice commands. In addition, all the features of this UAV have been integrated into a smartwatch. Simply pressing a function key on the smartwatch makes 'one key control' of such tasks as landing, following, 360° circles and other manipulations possible. EI

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Sanjeev Sharma takes over as Managing Director of ABB India

Sanjeev Sharma

He brings extensive experience in industrial automation and electrification across market segments and geographies...

ABB India Limited has appointed Sanjeev Sharma as the Managing Director, with effect from January 1, 2016, to continue the path of next level of growth across utilities, industries and infrastructure in the country. Sharma takes over from Bazmi Husain, who will be the global Chief Technology Officer for ABB Group.

Sharma first joined ABB in 1990 and since then has held a number of global senior management roles. He brings extensive experience in industrial automation and electrification across market segments and geographies – and has led several successful change management initiatives across global operations. Prior to this appointment, he was the global Managing Director for ABB's Low Voltage Systems business unit, when he was based in Malaysia. He started his career working for ABB in India – and has also lived and worked in Germany and Switzerland.

"Sharma brings over 25 years of experience in ABB in diverse roles across various locations and functions, where he has most notably been responsible for running successful global business units," said Frank Duggan, Chairman of the Board, ABB India Limited.

Kazarin becomes Director of Enel Russia's Sredneuralskaya GRES

Dmitry Kazarin

Kazarin has been working in the energy sector for about 20 years. He has obtained a number of industry certificates and recognitions...

Dmitry Kazarin has been appointed Director of Enel Russia's Sredneuralskaya GRES as of 18th December 2015. In this position, he succeeds Krassimir Nenov, who moved to the position of Head of Gas Generation of Enel Russia as on November 25, 2015.

Kazarin has been working in the energy sector for about 20 years. He began his career at Nevinnomysskaya GRES in 1996 as a CCGT Boiler and Turbine Auxiliary Operator – and held a number of positions till he became Head of Boiler-and-Turbine Shop № 2. In February 2012, he was appointed Deputy Director for Production and Chief Engineer of Sredneuralskaya GRES. His native language is Russian, however, he also speaks English.

Kazarin has obtained a number of industry certificates and recognitions. In 1992, he graduated from the Nevinnomyssk Energy College as a specialist in steam generators and turbines at thermal power plants. In 1996 he got a diploma of higher professional education at Novocherkassk State Technical University as a thermal power plants engineer. In 2001, he received a second degree in Law at the North Caucasus Social Institute (Stavropol).

Frost & Sullivan appoints Robin Joffe as Partner

Robin Joffe

Robin will advise and influence the company's decision on the needs and expectations of Japanese companies...

Frost & Sullivan has reinforced its commitment in Japan through appointing Robin Joffe as Partner. "Robin has led Japan to be one of Frost & Sullivan's fastest growing markets. In five years, his team has helped over 100 leading Japanese companies with their domestic and overseas growth strategies. His appointment reinforces Frost & Sullivan's commitment to expanding the Japanese market," said Aroop Zutshi, Global President and Managing Partner at Frost & Sullivan.

He added that Robin, as the newest member of the global leadership and partners network at Frost & Sullivan, will advise and influence company's decision on the needs and expectations of Japanese companies. "We are positive that Robin's new role will help Frost & Sullivan to continue delivering relevant and consistent high-quality research and consulting services to our Japanese clients," added Aroop.

"I am delighted to be named Partner at Frost & Sullivan and continue the mission of helping Japanese companies to grow. This would not have been possible without the support of my whole team in Japan. A big 'thank you' to all the employees in our Japan office," said Robin.

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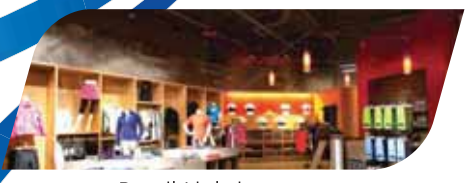

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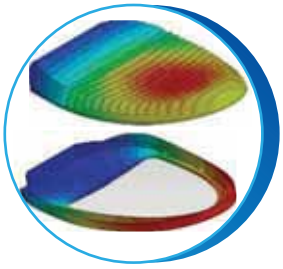

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Adrianna Ma joins the Board of Directors of Applied Materials

Adrianna Ma

She brings valuable experience in global growth investing, capital markets and M&A...

Applied Materials, Inc.; globally known for materials engineering solutions for the semiconductor, flat panel display and solar photovoltaic industries; has appointed Adrianna Ma to serve on its Board of Directors. Ma has also been appointed to serve as a member of the Audit Committee of the Board.

"Along with a wealth of financial expertise and a strong technical background, Adrianna brings valuable experience in global growth investing, capital markets and M&A to our Board of Directors. She has a unique perspective that will contribute to our team and we warmly welcome her to Applied Materials," said Wim Roelandts, Chairman of the Board of Applied Materials.

Adrianna Ma has been a Managing Partner at the Fremont Group, a private investment company, since May 2015. At the Fremont Group, she oversees BF Global, the flagship portfolio of funds, including investment strategy, asset allocation, manager selection and risk management. From 2005 to 2015, Ma served as a Managing Director at General Atlantic LLC, a global growth equity firm, where she invested in and served on the Boards of Directors of a number of technology-enabled growth companies around the world. Prior to joining General Atlantic, she was an investment banker in the Mergers, Acquisitions and Restructuring Department at Morgan Stanley & Co., Inc. She received both her BS degree in electrical science and engineering, and ME degree in electrical engineering and computer science from MIT, and holds an MBA from Harvard Business School.

Anthony Varga becomes CEO and GM of Endress+Hauser, Canada

Anthony Varga

"I'm excited to work with the clients and employees of Endress+Hauser, Canada," he said...

International measurement and automation equipment firm Endress+Hauser has appointed Anthony (Tony) Varga as CEO and General Manager of its Canadian operations. Varga has officially taken over the charge in January 2016, coinciding with the retirement of Richard Lewandowski, CEO and General Manager, who successfully led the Canadian business unit through tremendous growth over 20 years as CEO.

Employing more than 150 people in offices across the country, the company has become a leading provider of complete solutions for industrial measuring technology and automation in Canada. The group is the largest independent manufacturer of instrumentation in the world, with global manufacturing facilities, over 12,000 associates, and net sales of over $2 billion CAD.

Varga joins Endress+Hauser from Rittal Systems, most recently serving as the President of Rittal Canada and Senior Vice-President of Rittal's North American Sales.

"I'm excited to work with the clients and employees of Endress+Hauser Canada. It is an international leader in its field, and I have already seen how that culture of excellence is reflected in the Canadian team members I have met. We have a great deal to offer the Canadian marketplace," said Varga.

R Castelino takes over as BDM of Cofely Besix Facility Management

Richard Castelino

"I'd like to ensure that CBFM strengthens its position even further as the top facility management company in the UAE region," he said...

Cofely Besix Facility Management (CBFM), Dubai's leading integrated facilities management company has inducted Richard Castelino as Business Development Manager (BDM).

Castelino is a qualified MBA Marketing professional, with more than four years' experience working in Sales and Marketing within the Facilities Management industry.

Prior to joining Cofely Besix Facility Management, Castelino worked at Farnek Services as Business Development Executive for four years, and was later promoted to Business Development Manager in 2015.

"Facilities management in the UAE is growing at such a fast rate, and I would like to ensure that Cofely Besix FM strengthens its position even further as the top Facility Management company in the region," said Castelino.

He is a firm believer in continuous improvement, and he focuses predominantly on service delivery and customer satisfaction. "We are very pleased to welcome Castelino to Cofely Besix FM. He is young and dynamic, with an excellent track record, and we welcome his fresh approach and ideas that will further assist CBFM in strengthening our position in the UAE FM market," said Ian Harfield, CEO of CBFM.

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TATA POWER Receives National Energy Conservation Award, 2015

The award was presented by the Hon'ble Minister of State for Power, Coal and New & Renewable Energy, Piyush Goyal...

Tata Power has been honoured with the 2nd prize (DISCOM Sector) at the prestigious National Energy Conservation Award, 2015 in recognition of the Energy Conservation and Demand Side Management initiatives in Mumbai Distribution Area.

National Energy Conservation Award is a prestigious award given annually by Ministry of Power, Government of India, in appreciation of the energy conservation achievements in various sectors.

The award was presented by the Hon'ble Minister of State for Power, Coal, and New & Renewable Energy, Piyush Goyal at a ceremony held at Vigyan Bhavan, New Delhi on the National Energy Conservation Day (14th December 2015).

In line with the centenary year commitment of the company, Tata Power continues to undertake efficient and sustainable business strategies for the holistic growth and development of its business and its communities. Tata Power, the largest integrated power company of India, believes in the importance of conserving energy for better tomorrow and is committed to energy conservation in all spheres of its operation and delivering consumer service by adopting the following principles:

- Create awareness amongst employees, consumers and public at large about energy conservation and its accrued benefits
- Adopt energy efficient technology and increase investment in all cost effective energy saving measures
- Conduct and arrange energy audits to identity energy conservation opportunities for continual improvement on a sustained basis
- Ensure speedy execution of energy conservation projects in its areas of operation
- Comply with energy legislation and national regulations
- Promote energy efficient products and services while protecting human health, safety and environment
- Provide knowledge support for energy conservation to consumers
- Promote 'Demand Side Management (DSM)' and other energy conservation initiatives for its consumers.

Speaking on the occasion, Anil Sardana, MD and CEO, Tata Power, said, "We are honoured to receive this prestigious award because it recognises our endeavour to introduce and promote energy efficiency in India. We are delighted to be recognised for our good work and acknowledgements like these serve as motivation to calibrate our approach, raise the bar and surpass the increasing expectations around sustainable performance. I would like to take this opportunity to thank the National Energy Conservation Award team, and all our employees for their exceptional work."

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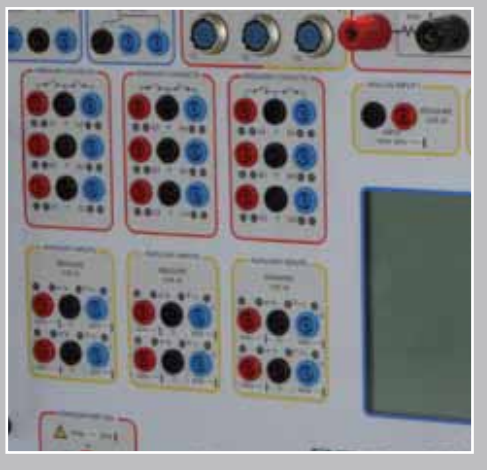

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Kingfisher Wind Wins Platts Financial Deal Of The Year Award

All together 18 awards were bestowed upon companies and individuals ...

Founded in 1909, Platts is a leading global provider of energy, petrochemicals, metals, and agriculture information and a premier source of benchmark prices for the physical and futures markets. Every year, the organisation distributes Global Energy Awards (GEAs).

Hosted by Platts, a part of the McGraw-Hill Financial, Inc, the annual awards programme honours exemplary achievements in the energy industry, recognising corporate and individual performance, innovation, and entrepreneurship. The awards are often described as the 'Oscars' of energy.

In 2015, Apex Clean Energy, First Reserve, Gulf Power Company and Morgan Stanley Commodities Group (MSCG) were named joint recipients of the Financial Deal of the Year award for the Kingfisher Wind project.

"This award underscores the ground breaking aspects of the Kingfisher transaction, and recognises the dedication, leadership and strategic vision of all the deal's counter parties. This was a unique agreement structure that we see becoming more standard in the wind industry, and we're very pleased that the broader energy industry has acknowledged the innovation this deal represents," said Mark Goodwin, President of Apex.

Apex is the first clean energy company to win in the Platts GEA Deal of the Year category.

Kingfisher Wind is a 298-megawatt wind farm located in Kingfisher and Canadian Counties in Oklahoma. Project originator Apex, project owner First Reserve, power hedge provider MSCG, and power purchaser Gulf Power Company collaborated on an innovative contract and financing structure for the energy and environmental attributes produced by the project. Once the project begins commercial operation in early 2016, it will generate enough electricity to power more than 100,000 homes.

Apex Clean Energy is an independent renewable energy company focused on building utility-scale generation facilities.

Apex is constructing one of the nation's largest, most diversified portfolios of renewable energy resources, capable of producing more than 12,000 MW of clean energy.

In 2015, Apex was bringing five new U.S. wind energy facilities online, comprising 1,161 MW of capacity. The company was to provide asset management services on four of these facilities.

First Reserve is the largest global private equity and infrastructure investment firm exclusively focused on energy. With over 30 years of industry insight, investment expertise and operational excellence, the firm has cultivated an enduring network of global relationships and raised approximately USD 31 billion of aggregate capital since inception. Putting these to work, First Reserve has completed more than 550 transactions (including platform investments and add-on acquisitions) on six continents.

Announcing the awards, a Platts publication has stated that the judges "were captivated by the project's mitigation of the inherently variable nature of wind energy generation through the energy hedge, as well as the involvement of expert players who are uniquely positioned to optimise the agreement."

Energy companies from seven countries and three continents received honours for leadership, innovation, and exemplary performance at the 17th annual Platts Global Energy Awards. Eighteen awards were bestowed upon companies and individuals at Cipriani Wall Street in lower Manhattan before an audience of 400 energy executives hailing from 15 countries.

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Climeon AB Bags F&S's Technology Innovation Award

A view of the ceremony where Climeon AB team is receiving the award...

Climeon's technology provides customers with superior operating efficiency...

Climeon AB has been awarded the 'Technology Innovation Award' at the 'Excellence in Best Practice Award Banquet' hosted by Frost & Sullivan (F&S) in Frankfurt, Germany. F&S also released a report on Marine Waste Heat Recovery Solutions rating Climeon as #1 with a scoring of 9.2 (excellent) on a scale from 1 to 10.

In their report, the F&S team concludes that the technology 'provides customers with superior operating efficiency' and that Climeon delivers 'a high return on investment' to its customers.

"It's a great honour for us winning such a prestigious award," says Climeon CEO Thomas Öström. In their conclusion Frost & Sullivan states that they '...fully expect this system to take off within the marine industry.'

Key benefits from the system include:

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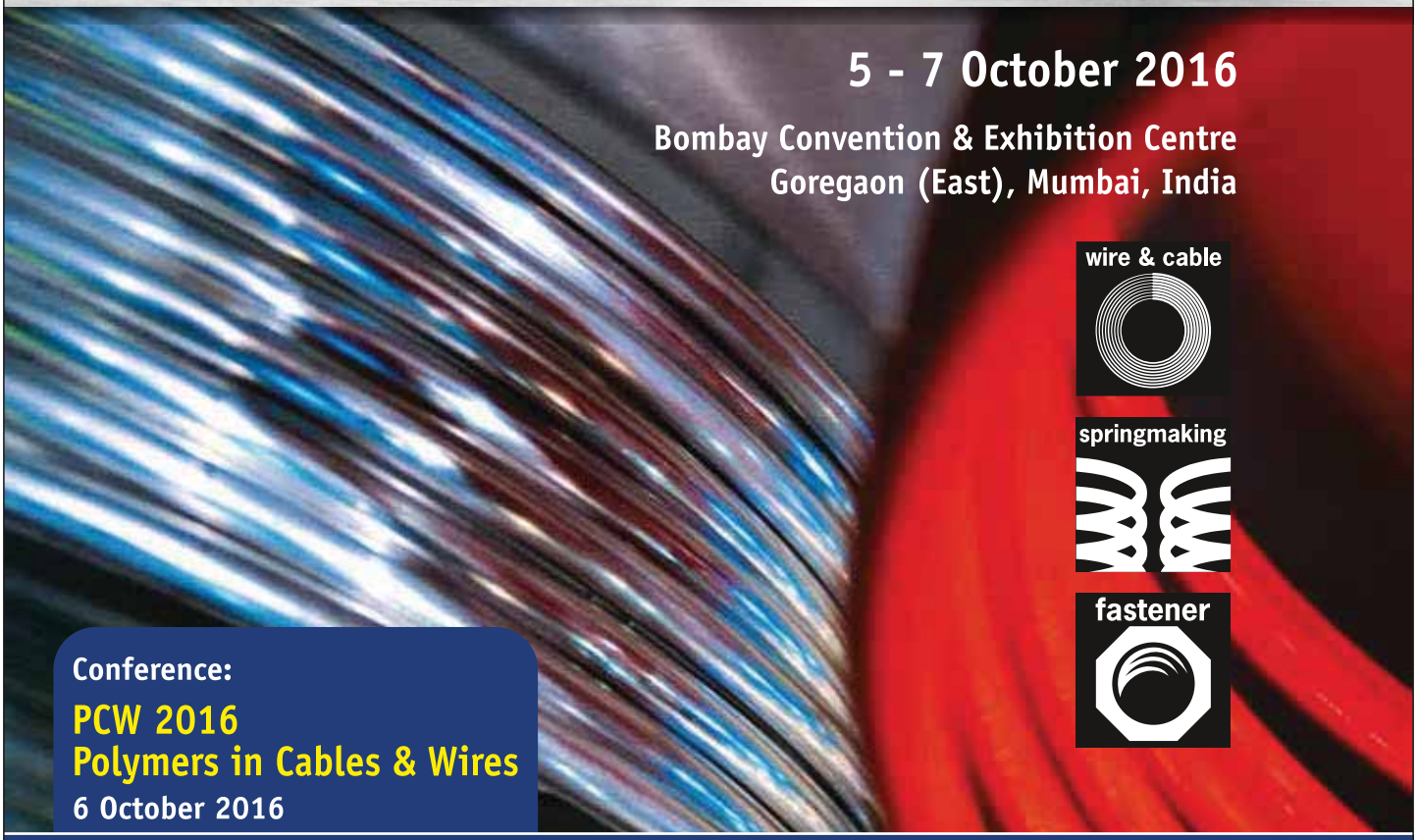

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Schneider Electric Wins Datacenter Dynamics Leaders Award

To meet unique customer needs, Schneider Electric designed and manufactured a customised prefabricated data centre that can easily be moved when necessary…

(L2R) Davide Ortisi Product Marketing Manager, Prefabricated Data Center Modules, Schneider Electric, and Fernando Villa, CIO Sagrada Familia…

Schneider Electric, the global company in energy management and automation, has received a prestigious Datacenter Dynamics Leaders EMEA Award in the Modular Deployment category for the state-of-the-art customised prefabricated data centre installed at Sagrada Familia, Barcelona, Spain.

Receiving the award, Fernando Villa, CIO for Sagrada Familia said, "The security of our IT operations is vital. To ensure adaptable and scalable infrastructure in a period of transformation meant we needed to think laterally. The Micro data centre supplied by Schneider Electric fully meets our requirements in terms of portability and adaptability with no inconvenience to tourists, construction work or the way we function as an active church. I am delighted with the award!"

Hal Grant, Executive Vice-President, IT Business, Schneider Electric, said, "Since their launch, the Datacenter Dynamics Leaders Awards have become the 'Oscars' of our industry. We're very pleased therefore to receive this accolade – it is a great credit to the team of people who worked on this project both at Sagrada Familia and within Schneider Electric. The award comes at a great time, as we are seeing increased interest for our Micro data centre solutions to meet emerging IoT and edge computing applications."

The Schneider Electric integrated prefabricated data centre solution enables site operators to manage the church's security and effectively control the millions of visitors that come to the site each year. A UNESCO (United Nations Educational, Scientific and Cultural Organization) World Heritage Site, Sagrada Família is the most visited tourist attraction in Barcelona.

To meet unique customer needs, Schneider Electric designed and manufactured a customised prefabricated data centre that can easily be moved when necessary. The facility requires minimal installation on site, preventing any disruption to tourists or the construction.

The module was delivered to site with racks, UPS, power distribution, cooling and management pre-installed and ready for deployment. The module enclosure was designed for durability and security, with electrical and mechanical connections that can be easily disconnected for mobility services for the data centre module and interior infrastructure components.

Off Grid Electric Receives New Fund From USAID

In Tanzania, approximately 40 million people lack access to electricity. Off Grid Electric currently provides affordable, reliable light and energy services to 10,000 new households per month to families faced with an expensive grid, an unreliable grid, or no grid access at all. Off Grid Electric borrows from the telecom industry's business model: rather than purchasing costly solar systems, customers pre-pay for electrical services using 'mobile money' and are able to access small-scale, radically efficient solar home systems with integrated appliances.

The U.S. Agency for International Development's U.S. Global Development Lab has recently announced $5 million in follow-on funding to Off Grid Electric. The award, funded through the Development Innovation Ventures (DIV) programme, will allow Off Grid Electric to test its model at scale and catalyse additional investments to reach more than one million households.

"Access to clean and reliable light and electricity can empower vulnerable communities to escape a cycle of extreme poverty. Through our DIV program, we are proud to support Off Grid Electric's innovative approach to tackling this critical global challenge," said Ann Mei Chang, Executive Director of the U.S. Global Development Lab. Off Grid Electric will use this latest DIV award to power more than 200,000 Tanzanian households. DIV works to source, test and scale innovative development ideas that are evidence-based, cost-effective, and have the capability to deliver greater results. DIV's tiered-funding model, inspired by the venture capital experience, invests comparatively small amounts in relatively unproven concepts and continues to support only those that can prove they work.

By demonstrating its ability to positively impact the lives of its customers and scale to reach hundreds of thousands of people, Off Grid Electric is the first DIV-supported program to receive three rounds of tiered funding, beginning in 2012. Off Grid Electric is a founding member of Power Africa's Beyond the Grid initiative, which focuses on unlocking growth for off-grid and small-scale energy solutions on the African continent.

To date, Off Grid Electric has used DIV grants to test and prove its operations in Tanzania. These tests have been catalytic in attracting private and public sector investment. In early 2015, Off Grid Electric partnered with the Government of Tanzania to bring access to affordable electricity to one million Tanzanian homes - five million people - by 2017. Building on its DIV grants, Off Grid Electric received $25 million in equity from Solar City and DBL Investors, and an additional $40 million in debt from the Packard Foundation, Calvert Foundation, Cenairth, and other family offices.

The Structure Of The Future INDIAN POWER SECTOR

In the traditional coal fired sector, a deviation in the traditional thinking of putting up of 350 MW and 660 MW plants is called for. Rapid capacity addition is possible by increase of unit size to 800-1200 MW and by going in for ultra and advanced ultra supercritical plants...

While conventional coal fired generation is the work horse of the Indian power sector, the future is for the new technology- rooftop solar PV plants and solar concentrator based thermal power plants. Roof tops account for nearly 80% of the solar PV power in Germany and Australia and 50% in USA. Rooftop solar power plants are a typical model of inclusive power development with the participation from the LT and HT end users. There is no upfront requirement for land unlike in large plants, no upfront capital costs to the utility (as the end user would financially participate) and the transmission and distribution losses are negligible since the generation is at a decentralized level. Solar concentrating collectors can boost up the capacity utilization of sugar mill power plants (8-15 MW) by providing steam to the existing turbo generator set up.

In the conventional fossil sector – coal fired generation R&D is required in the area of advanced ultra super critical material development and heat transfer and hydrodynamic design data development through computational or experimental validation.

The future generating sector is likely to be dominated by high efficiency coal based fossil generation using the ultra supercritical and advanced ultra supercritical cycles power on one hand and roof top solar PV based distributed generation and solar concentrator based augmentation of cogenerating plants.

1. POWER SECTOR OUTLOOK

The installed capacity in India which was 1362 MW in 1947 has steadily increased currently to around 275 GW in 2015. The electrical generation has increased from 4 TWh/year in 1947 to 750 TWh/year in 2015 [In comparison, the present US generation is 3,900 TWh/year. During the period 1947 to 2014, the growth rate was 8.5 % The growth rate of hydro is only 4.4 % while the growth rate of thermal is 11.6 % during this period.

Figure 1: Growth in power generating capacity in India

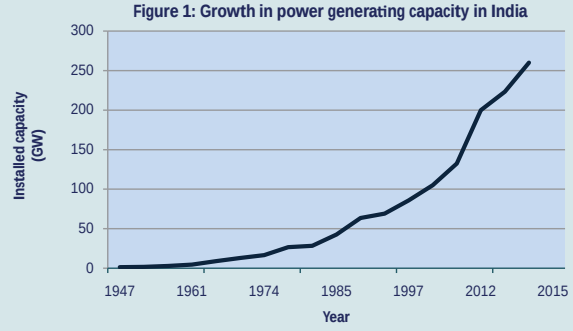


Figure 2: Installed capacity of coal/lignite plants in India

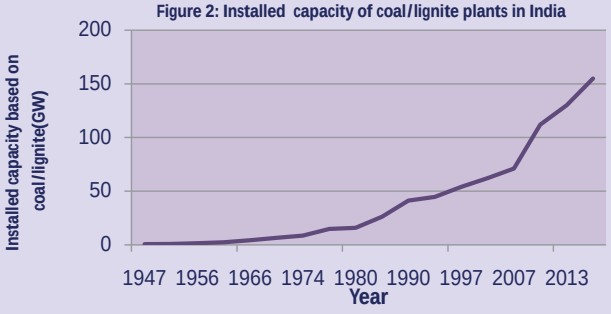


Figure 3: Installed hydro generating capacity (>25 MW) in India

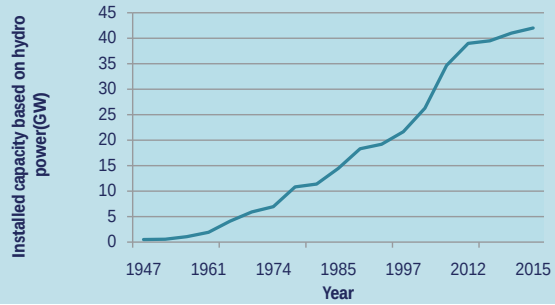


Figure 4: Installed generating capacity of gas power plants in India

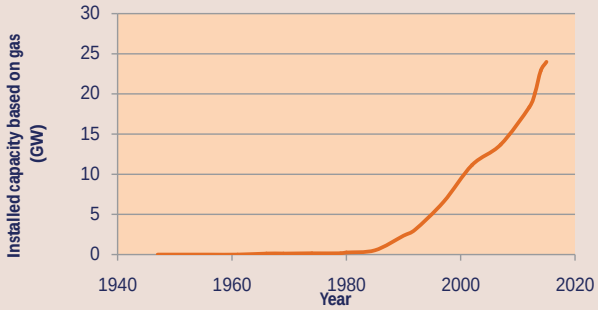


Figure 5:Installed generating capacity diesel engine plants in India

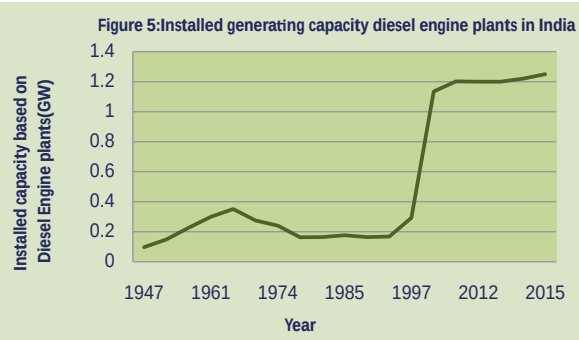
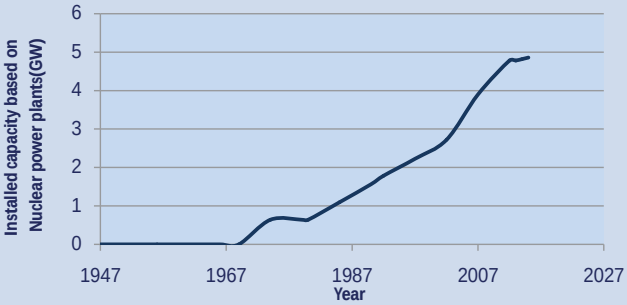


Figure 6:Installed generating capacity of nuclear power plants in India



2. APPROACH TO CONVENTIONAL GENERATION

Hitherto, planning focused on installation of coal fired thermal units of 210 MW and 500 MW as the main ingredients of capacity addition. Around 2005 these were replaced to 350 MW and 660 MW units. It is now clear that by this repetitive process we will soon reach the limits of growth and it would be very difficult to sustain growth over 10% (adding around 35 GW/year) by these measures alone. The time has now come to look at the scene with fresh vigour. It is proposed here to discuss some of the ideas for achieving the capacity growth to provide energy security to the Indian power sector.

Figure 7:All India PLF (%) of coal fired thermal power stations

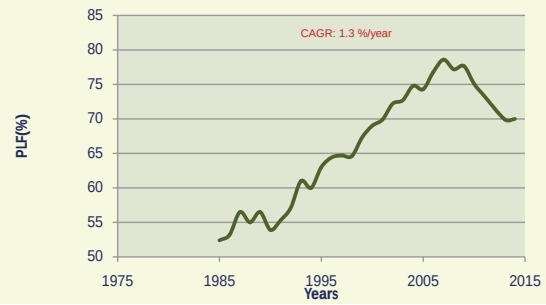
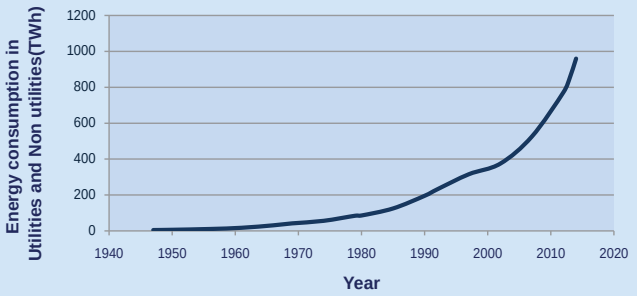


Figure 8: All India electricity consumption utilities & non utilities



2.1 Unit size

The most common unit size has been 250 MW and 500 MW, which have around 2005 increased to 300 MW and 660 MW (supercritical) respectively. When individual grids existed and when grid sizes were small, then the maximum size was controlled by the fall in frequency by loss of one of the units on bars. Now, this is not a limitation.

China has been adding approximately 20 GW/year since 1990s which is nearly equivalent of our Plan capacity of 100 GW. They have been installing 3 x 350 MW units at a time.

Russia, the world's largest supercritical power producer has many pit head (mine-mouth) power stations with unit ratings of 300 MW, 500 MW, 800 MW and 1200 MW. In these plants the steam is not condensed but used for district heating conveying the water/steam at 135^{0}C to distances up to 25 km.

In UK and Japan unit sizes of 400 MW, 600 MW and 800 MW are common.

Turkey has built 1300 MW coal fired units using German technology. The turbine for plant consists of double reheat with one HP cylinder, one IP cylinder and two LP cylinders.

Siemens is offering modular units of 300 MW, 700 MW and 900 MW.

Hence globally, besides units of 660 MW, units of 800 MW and 1200 MW are in vogue. It is time we start opting for either larger sized unitsor groups of smaller units (such as 500 MW x 3), so that capacity addition can be rapid.

2.2 Technology

The prevalent international combustion technology for coal fired boilers is gas re-burn, staged combustion systems for low NO_X burners firing into tangential firing (pulverized fuel) or spiraling fireball (non-pulverized lump/chunk coal) combustors.

On the thermodynamic power cycle side, the standard working fluid of a coal fired is water which operates on the Rankine power generating cycle for most of the existing plants. The common parameters of the main steam entering the steam turbine are 15.0 MPa (150 kgf/cm^2) and 560^{0}C. When the main steam parameters exceed the critical point of water (point at which water directly flashes into steam with no latent heat of vaporization), viz., 22.09 MPa (220.9 kgf/cm^2) and 374.14^{0}C, the operating regime is said to be super critical. Operation below these limits are said to be sub-critical. Plants with operating steam cycle parameters of 31.0-34.5 MPa (310-345 kgf/cm^2) and 566/566/566 ^{0}C (main steam/1st reheat/2nd reheat) in Benson type once-through circuits are generally referred to as ultra supercritical plants since the operating pressures are 50% higher than the critical pressure of water.. These are the favoured base load and peak load solutions the world over because they are capable of delivering gross overall efficiencies as high as 44-46% (gross unit heat rates of 1869 or better), better load response, low level of make up water requirements, reduced carbon emissions and economic justification over the life cycle of 35 years.

Energy efficient technology will result in reduction in coal consumption of the units.

The various technologies in the horizon are: super critical (SC), ultra super critical (USC) and advanced ultra super critical (A-USC).

Besides the power block, improvement in usage efficiency of coal and ash are possible through:

- On site washing of coals
- Energy generation from rejects for auxiliary steam.
- Total evacuation of fly ash (for cement) and bottom ash (for brick kilns) to ensure water, power and land (pumping of ash slurry to ash pond) is conserved. A case in point is Parli TPS of Mahagenco where total evacuation of ash is being achieved.

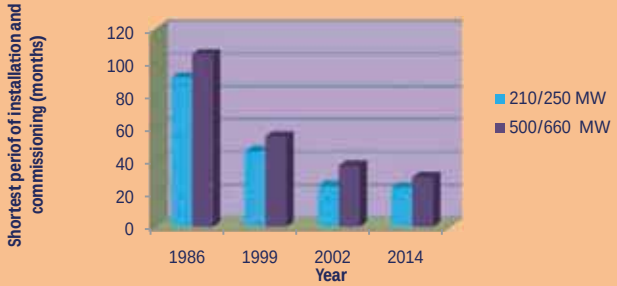
The deterioration in coal quality and its continuance over the years is a factor which is burdening the coal logistics. Import to the tune of 15-20% is highly helpful especially when coal prices are high and will continue in the future too.

2.3 Project planning for green field coal based projects

Setting up of bench marking of the project, planning, control and management is required for power projects especially for the coal fired units if we have to ensure a capacity addition of around 35 GW /year as compared to the present 10 GW/year.

Here, we must congratulate many power projects on breaking the

Figure 9: Decrease in installation and commissioning time over months in India



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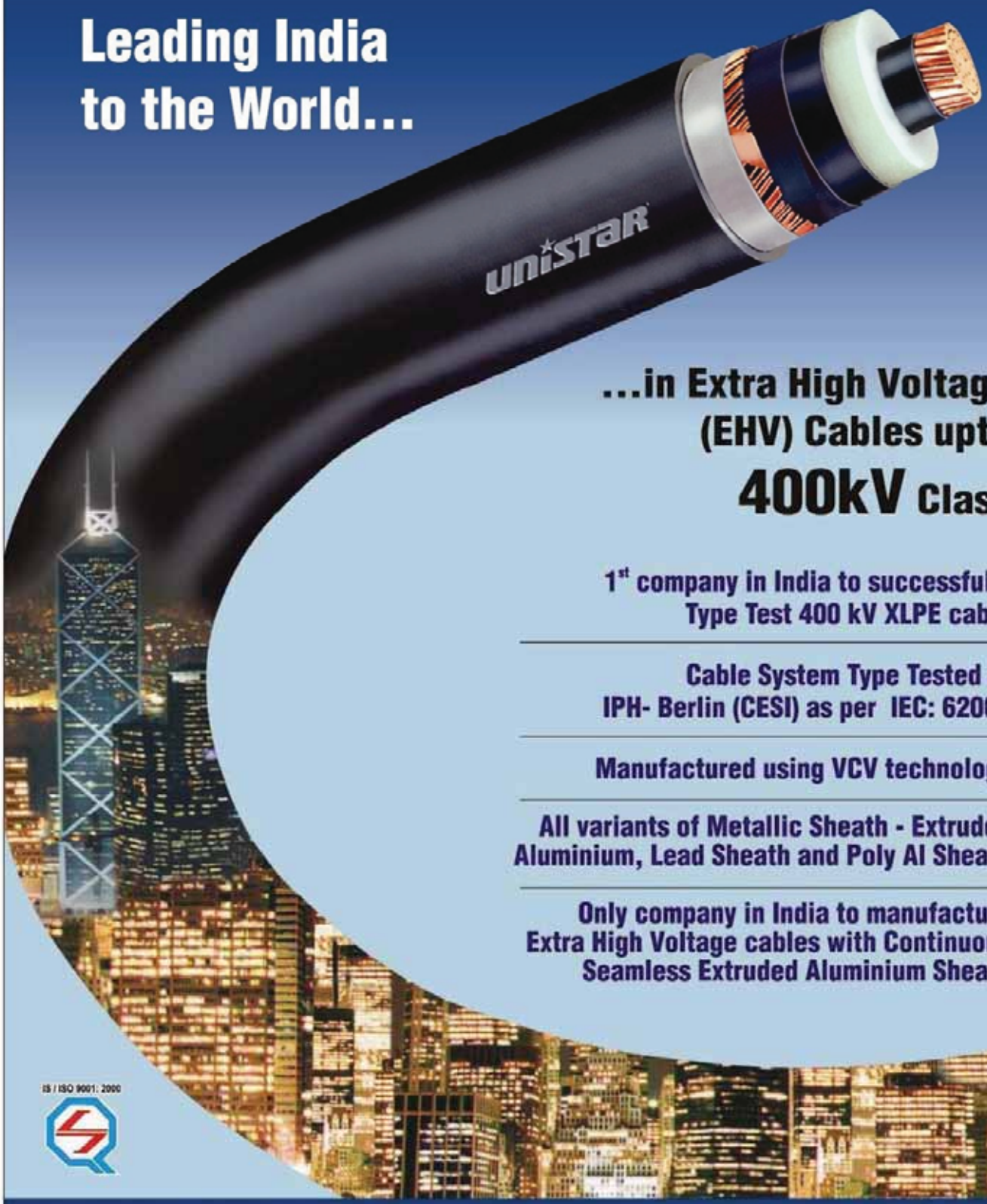

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national record in commissioning of a green field project in an unprecedented record time of below 25 months.

The concepts of project planning, control and management that need to be changed to achieve rapid project implementation are:

- Good vendor development to assess the different technologies, players, etc.
- Single window system of a project manager who reports directly to the CEO thereby cutting across internal protocol.
- Co-ordination for reduced delay due to movement of papers between HQ and site.
- Implementation of different packages through different parties rather than through single EPC (Engineering, Procurement & Construction) contractor.
- Control of project time through advanced management tools for project monitoring.

Some of the critical issues, which lead to long lead time are:

- Organizing of timely supply and achieving of sufficient indigenous inventory of alloy/stainless/super alloy steels required for manufacture of boiler and turbine components. Here the prior planning process plays a major role in reducing the actual lead time.
- Providing O&M back up support to imported sets of power blocks over the prime life time (25-30 years).
- Making provision for the other critical infrastructure, i.e., supply of waterfrom ground or river source; or its manufacture from sea water conversion, sewage conversion, etc. Next to fuel, water becomes the most critical input and will be even more critical in future.
- Ensuring transmission capacity at the point of injection is ready for power evacuation.
- Ensuring railway operational availability of capacity for transfer of coal from mines/ports. The railway requirements are much more stringent with one 660 MW unit requiring 3 rakes/day against 1 rake/day for a 210 MW unit.
- Ensuring availability of site construction and erection related machinery such as cranes (150 T/350 T), vibration compactors, etc.
- In many of the GENCOs, there is no incentive for early completion. Hence there is no motivation to the supplier/service provider for completion of work before schedule. Introduction of incentives for early completion (0.5 % per week), inspection reports within 7 days, payment within 30 days help in early implementation.
- Common capital infrastructure such as roads that would also benefit other entities as well needs to be created instead of leaving it to the utility in question.
- Minimizing individual time constants like time between synchronization to commissioning reduced from 3 months to within one month.

It is also important that the manufacturing sector must be geared up for manufacturing increased size of individual machines in a unit (boiler portions, turbine blocks, generators, transformers, pumps, pump-motors, fans, blowers, etc.) through capacity addition by up gradation of manufacturing capacity and capability- machine tools; and absorption / assimilation of manufacturing methods, technologies, procedures and design tools for larger machine sizes with automation.

In conclusion a shift in focus from procedure orientation to performance orientation among the employees, organizational structure and financial rules is essential for reducing project down time.

The fundamental criterion of funding for powergen infrastructure is security and adequate return. Both these must be ensured by minimizing risk factors by measures such as:

- Risk sharing must be equitable between the supplier and the power plant owner rather than being heavily weighted towards the supplier.
- Timely sharing of the owner's infrastructure with the supplier for meeting the deadlines of installation and commissioning.
- Providing far more clarity in the Power Purchase Agreement (PPA) by inclusion of details/scope of risk sharing by each player.
- Sufficiently adequate funding for infrastructure power plant production - for technology absorption, production of quality steels, power plant equipment manufacture for units of higher ratings and newer designs and concepts. Otherwise new technology will be slow in getting adopted into the Indian power sector and will retard the capacity addition growth rate.

R&D is required in the area of new material development and evaluation of their creep rupture, fatigue, thermal stress and properties for A-USC materials typically of ferrous alloy steels, non ferrous nickel based super alloys for boiler and turbine components. Since there is a major initiative to go in for sea water cooling schemes, R & D is required for advanced condenser tube and shell; and cooling water pump materials along with the coatings.

Besides it is required to develop through R&D the design data in the form of heat transfer coefficients, heat flux rates, forced convection flow friction coefficient, hydrodynamic flow patterns through computational or experimental validation of the new configurations involving newer materials and larger unit sizes.

R & D in the area of erosion and corrosion resistant materials is also required to contain the metal loss between capital overhauls and over the life time.

In the absence of cost economic energy storage technology, the daily

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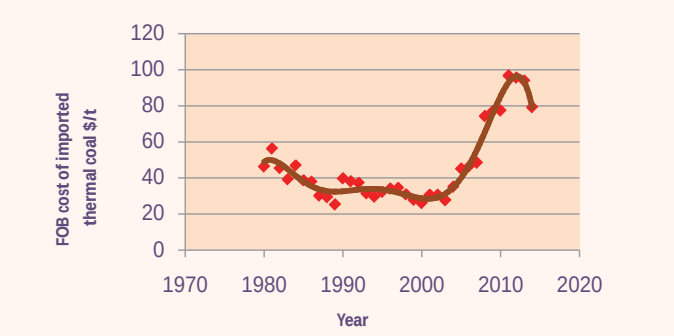
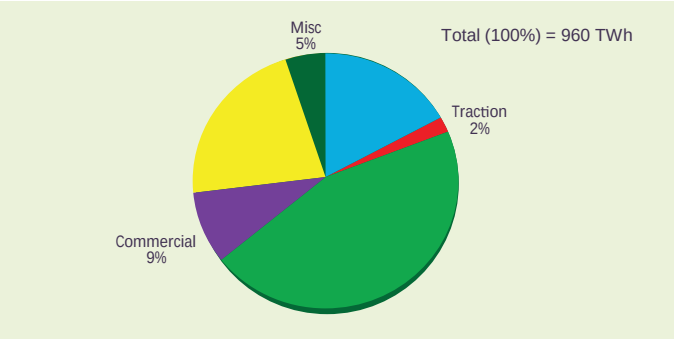


cycling of thermal sets is going to be a common phenomenon when the penetration of SPV exceeds 30-40% of the total grid capacity, as there will be no margin for managing the load curve. The R & D is also required for development of super alloy steels and non ferrous alloys which can withstand a very large number of cycling operation in a normal lifetime of 35 year or 3 lakh operating hours.

Fuel alternatives to coal

Figure 10 shows the trends in Freight On Board (FOB) cost of imported coals in the international market. A decrease in coal cost is in sight during 2013 and 2014. This can be used to advantage by the Indian power sector as a short term measure.

The worldwide use of natural gas has increased in preference to coal and has recorded a consistent CAGR of 9-10% for past 5 years. The same trends are seen in the Indian market and the growth is occurring due to expansion of the power generating sector (through public and private sector routes), deterioration in coal quality and uneven growth in the coal supply sector, which has been the traditional source for power sector growth. Major fraction of the natural gas goes towards power generation. As on date the indigenous production has not been able to keep pace with



the growth and increased import of natural gas is inevitable. However, the open market cost of imported gas is going beyond the normal supply-demand dynamics because of the continuously widening market and superiority over coal as an environmentally friendly fuel.

3. RENEWABLE ENERGY

3.1 Solar photovoltaic- the sunrise technology

Solar PhotoVoltaic (SPV) is the most upcoming and promising of the energy resource for a secure power option for India. With 90% crystalline silicon cells (mono and poly) and 10% amorphous silicon (thin film) an annual world capacity addition of 50 GW/year and a total of world capacity of 150 GW, has been achieved. SPV is now accounting for 1% of the world's power demand. This is because of both the drop in module prices as well as the feed-in tariff mechanisms in place.

The Indian renewable energy capacity is 32 GW which is around 12% of the national installed capacity. Of this, wind accounts for around 22 GW and SPV is 3 GW. SPV accounts for over 25% of the installed capacity in countries like Germany. Both SPV and wind have low project gestation periods as compared to coal fired units and do not need water for the power generation operation.

The break up of the electrical energy consumption is given for indicating the trends in usage patterns.

Rooftop systems as the main capacity adding units

The world wide developments have been in two areas:

- Grid connected Roof tops or Green tops
- Grid connected utility SPV plants

While utility SPV plants occupy land, the roof tops use the existing roof top space for installation of systems. The active land use varies between 10 % to 35 % of the total land used for SPV plants and it is highly land intensive. This is overcome by going in for roof tops in the Western countries. Some of the largest roof tops in USA and Europe are of 20-22 MW. A large number roof tops are of capacities above 1 MW. There are also roof tops of 3-5 kW used over cottages. Roof tops account for nearly 80% of the SPV power in Germany and Australia. They account for nearly 35% of the installed capacity in USA. Germany is using a per capita SPV power of 433 W/person and Italy is using a SPV power of 289 W/person. The household penetration rate of SPV in Australia is 25% with average sizes of 4.3 to 5 kW. The world over 69% of all SPV installations are roof tops.

The scenario is contrastingly different in India where the thrust is on installing utility plants. Roof tops have not picked up in India because of three reasons:

- It involves integration at the tail end. This limitation needs to be overcome with the efforts of distribution utilities.
- The clarity on feed-in tariff needs to be generated and the feed in tariff must be sufficiently incentive for users to invest into roof tops.
- Technology demonstration is generally in low key.

If we take the roof top areas of major cities like Delhi, Kolkata, Chennai, Bengaluru, Hyderabad, etc., 10% of the residential roof top area is sufficient to meet the city's total power requirements. If the focus is shifted on roof tops in another 2-3 year time roof tops will be able to add significant capacity to the grid. The roof top system is well suited to Indian conditions especially in the rural areas with weak utility grids.

3.2 Solar concentrator based power for biomass based co-generation-another sunrise technology

Solar thermal concentrating collectors have come of age and the solar concentrator based power generation is now a viable option in some of the hot and dry weather zones. Concentrating Solar Thermal (CST) plants blend well with already existing power cycles using water as the working fluid such as Combined Heat And Power (CHP) plants and bagasse based cogeneration. While integrating concentrating collectors

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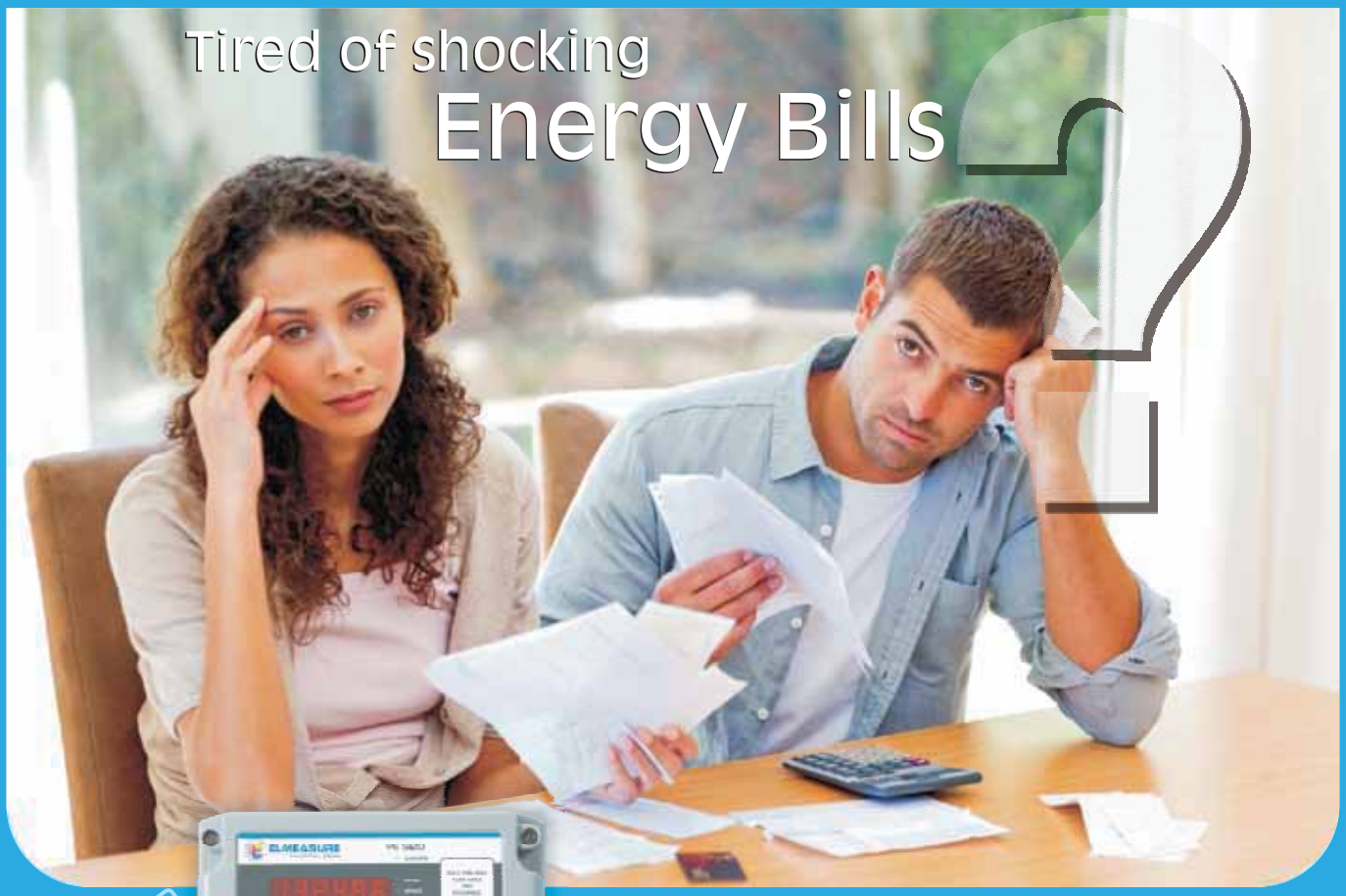

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with bagasse based plants there is no need for installation of the turbo-generator and other power block components as they are already present in the plant. The output of the concentrating collectors can directly be integrated into the exit of the bagasse based boilers. Therefore, it will lead to considerable cost reduction in integrating the technologies.

The PLFs of CHP plants (30 to 70% are not comparable to that of utility plants (which are in the range of 80+ %) because of the seasonal nature or demand based production of the former and also the consideration that power is a by-product (secondary derivative) and not the only end goal. Nevertheless they are preferred because of their low carbon foot print and low specific pollutant generation rates. Though the tapped potential for CHP is rather low there is good untapped potential for CHP in India of around 42 GW. Hospitable environments such as open access, obligatory renewable tariff, tradable performance, etc., will help in unlocking of the untapped potential. The outlook for CHP in the Indian horizon is quite bright in the near future.

While the utility power sector is almost exclusively based on power only generation, the presently tapped potential for cogeneration from sugar plants is very low (1.7 GW).

There is good untapped potential of around 8 GW from the sugar sector itself. Bagasse based cogeneration in sugar projects is an area of prime potential in terms of automation and technology up gradation.

The optimal level of turbo-generator size is 8+ MW per 1000 tcd (tonnes crushing per day) capacity, which is ideal for energy efficient cogeneration projects. This is in contrast with present values of 3-5 MW per 1000 tcd in most sugar mills. For optimal efficiency and heat rate in sugar plants, both internal steam and electric demands have to be minimized to very low levels by energy efficiency measures. Present in-house auxiliary steam and power levels are unusually high in most sugar processes.

The use of high pressure boilers (> 11 MPa and 550 °C) and 3-d stage optimized steam turbines will ensure low heat rate and maximum energy efficiency of the process besides reducing the specific water consumption of the process. Sugar process and power block automation enhance energy efficiency through reduced auxiliary steam and increased turbo-generator efficiency.

3.3 Hybrid power plants

The policy for stand alone (off grid) and grid connected hybrid power plants- roof tops (wind-solar pv), diesel replacement for telecom (wind-solar pv), biomass-solar pv, solar pv-gas turbine, wind-gas turbine is not available. Encouragement for hybrid power plants could reduce the dependence on cycling of thermal sets which could happen due to use of SPV.

3.4 Strengthening of the state level renewable energy development agencies

Many of the state level renewable energy development agencies with the exception of a few are acutely understaffed and have a shortage of skilled manpower with skillsets in the area of understanding of tenders, technology and implementation. Many staff are deputed from the power departments of the distribution sectors where the skill sets are entirely different. A review and audit of the skillsets and induction of trained manpower or training of existing manpower can reduce the lead time and enhance the efficiency of renewable penetration projects in the various states.

Concluding remarks

The future generating sector is likely to be dominated by coal based fossil generation using the ultra supercritical and advanced ultra supercritical cycles power on one hand and roof top solar PV based distributed generation and solar concentrator based augmentation of cogenerating plants.

To achieve the capacity addition envisaged targets a multi-pronged integrated approach is required with intensified investment in the following areas:

- Fossil generation: Ultra supercritical and advanced ultra super critical coal based generation.
- Fossil mix: Combination of coal and gas based generation.
- Renewable: Solar roof tops & solar concentrator based co-generation for increasing the load factor for bagasse based sugar mills.

In the traditional coal fired sector, a deviation in the traditional thinking of putting up of 350 MW and 660 MW plants is called for. Rapid capacity addition is possible by increase of unit size to 800-1200 MW and by going in for ultra and advanced ultra supercritical plants.

CPRI as the R&D organization under the Ministry of Power, Govt. of India, is gearing up to meet all challenges in providing support in the transition to new technology and processes through testing and evaluation; inspection and R&D.

M. Siddhartha Bhatt
Additional Director and Divisional Head of Energy Efficiency and Renewable Energy Division of CPRI, Bangalore

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Over 19 Projects: Over USD 1.5 Billion Needed

Ali Mirmohammad, Senior Consultant and Business Development Manager, Frost & Sullivan.

Iran is on an aggressive growth path to develop renewable energy to manage with capacity shortages, notes Frost & Sullivan...

Frost & Sullivan, the Growth Partnership Company, works in collaboration with clients to leverage visionary innovation that addresses the global challenges and related growth opportunities that will make or break today's market participants.

"The electricity market in Iran grew at a Compound Annual Growth Rate (CAGR) of 6.5% over the past 10 years, which is far beyond its Gross Domestic Product (GDP) growth rate, which is currently not more than 3%," said Ali Mirmohammad, Senior Consultant and Business Development Manager, Frost & Sullivan.

"Iran has witnessed the emergence of new participants in the manufacturing and agricultural sectors. Additionally, every year, almost 1.4 million new consumers are added to the electricity market. These developments require an additional capacity of 5,000 MW for each year and enhancement or new investments in the distribution and transmission network," he added.

Power generation plants in Iran are the main consumers of natural fuel resources and consume over USD 30 billion/annum of various fuels including Natural Gas (36 billion cubic metres), Gas Oil (12 billion litres), and Fuel Oil (15 billion litres). Poor efficiency in the power generation and transmission infrastructure results in a huge loss to the economy (over USD 200 million per 1% loss during transmission) that needs to be urgently addressed through new investments.

"Installing new generation high-efficiency turbines, design and construction of new GIS sub-stations, construction of high-voltage transmission lines, as well as inclusion of renewable and green technologies into the energy mix are major plans expected to be implemented by the Iranian Government in the post-sanction era. In addition, biomass from rural waste is the other key investment opportunity in Iran," noted Ali.

The renewable energy industry in Iran is at a nascent stage. Located on the earth's solar radiation belt and having a high potential has created scope for expanding solar technologies in Iran. In the geothermal field, Iran is located on the active geothermal belt and, according to the exploration studies done in this field the country is gifted with 15 potential geothermal areas.

Currently, less than 1% of the total energy in Iran is supplied through renewable energies. However, the Government plans to boost investment in the 6th Development Plan. The target is to install over 5,000 MW renewable energies, which include 4,500 MW of wind power and 500 MW of solar power. Currently, the potential for installing over 15 GW wind energy in areas such as Manjil, Zahedan, Zabol, and Nishapur has been recognised by the Renewable Energy Organisation of Iran.

Mostafa Rabeie, Head of International Affairs, Renewable Energy Organisation of Iran, states, "Iran can supply over two-thirds of its energy through wind power. The long-term policy within the next decade (2015-2025) is to supply over 50% of required energy through renewables, biomass, as well as other green technologies.

Renovation and Modernisation of existing Thermal Power Plants with green technologies is also part of the plan. To reach the capacity of 5,000 MW of renewable energies, Iran requires investment of over USD 10 billion while project financing is a key restraining factor in this sector as of now. To meet the challenge, Iran aims to attract foreign financing to ease investment across the country. However, this is not possible unless sanctions are lifted. Currently, over 19 projects, which require over USD 1.5 billion, have been proposed." EI

A Necessity Of Hybrid AC/DC
Microgrids In Indian Electricity Sector

The grid collapse can cause half of the population to face darkness focusing a need of reliable well monitored supply system. Hybrid AC/DC microgrid can be the answer to resolve this problem of energy scarcity and uncertainity of supply – particularly for remote, sparsely geographically rural population...

In India, 300 million i.e. quarter of the country's population do not have access to electricity. About 70% energy generation capacity of India is from fossil fuel, with coal accounting for 40% of India's energy consumption followed by crude oil and natural gas respectively. India is largely dependent on imports of fossil fuels.

Due to rapid economic expansion, India is world's largest energy market and going to be second largest in global energy demand by 2035. About 10-15% of villages in India are still to be electrified.

The grid collapse can cause half of the population to face darkness focusing a need of reliable well monitored supply system. Hybrid AC/DC microgrid can be the answer to resolve this problem of energy scarcity and uncertainity of supply particularly for remote, sparsely geographically rural population. Hybrid AC/DC microgrids have high reliability, high efficiency, low emissions and affordable cost.

Therefore, a universal access to energy services through Hybrid microgrid systems can be India's enduring contribution to human development.

In past several years India has seen significant growth in the renewable energy generation. At present, 12% of energy in Indian Electricity sector is from renewable energy sources. With the financial assistance from MNRE, solar power plants in coordination with bio power plants have been installed at some locations. As India is having the world's highest solar intensities with annual solar energy yield of 1,700 to 1,900 kilowatt hours per kilowatt peak of the installed capacity, the Jawaharlal National Solar Mission has set the ambitious target of deploying 20,000 MW of grid connected solar power by 2022 and aims at reducing the cost of solar power generation in the country through (i) long term policy; (ii) large scale deployment goals; (iii) aggressive R&D; and (iv) domestic production of critical raw materials, components and products. It has been envisaged to achieve grid tariff parity by 2022. Many Private players like Softbank, Airtel, Foxconn are investing $20 billion for grid tied solar, wind power and other renewable power projects. Also, entrepreneurs like Mera Gao Power, Gram Power, Minda Next Gen Tech, Sun Edison have electrified many households in the state like Uttarpradesh, Bihar and Madhya Pradesh. Although a rise in renewable energy generating sources have been observed, due to the dependency on solar power projects the grid experiences the sudden drop in the supply at certain hours that have to be met by conventional fossil fuel based power plants.

This phenomenon is called as 'duck curve.' This shortage of power for only certain hours can be overcome using storage in the grid or system typically by using batteries or a flywheel. Such storage helps to quickly restore the supply, but are costlier.

A system therefore consisting of Solar-Biogas Mix or Solar-Wind-Diesel generation mix or sometimes Solar-Hydro power generation mix called as 'Hybrid AC/DC Microgrid' is the need of the hour.

Nearly all microgrids in India run on power from photovoltaic panels. Few Hybrid AC/DC

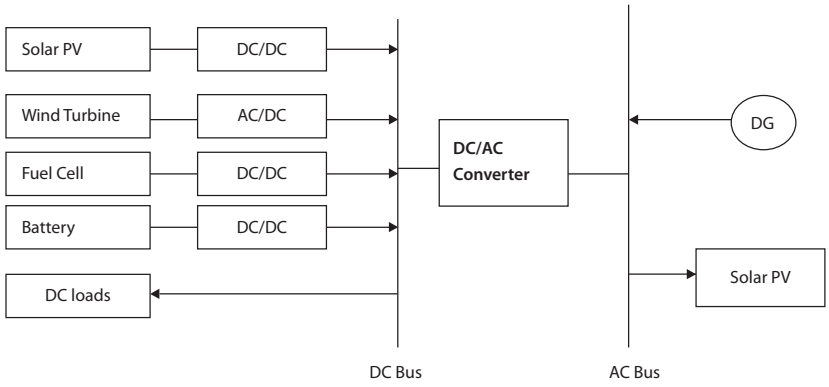

Fig 1: Block diagram of Hybrid AC/DC Microgrid...

Microgridsare installed in Karnataka and Uttarakhand which are networks based on Solar-Hydropower generation mix; in Bihar and Uttarpradesh these Hybrid microgrids are Solar-Biomass based. All these cover only a tiny part of the overall power needs of rural India.

A study has revealed that with DC Load and AC Source or AC load with DC source, many power conversion stages are to be incorporated which contribute to the total losses of the system. Therefore, instead of having only DC microgrid with Solar panel as the source and only the LED lamps and Solar fans as the load, one can have a combination of AC microgrid and DC microgrid with variety of linear and non-linear load i.e., the 'Hybrid AC/DC Microgrid'. Hybrid AC/DC microgrids have separate supply lines and reduce the total conversion losses of the system. There are benefits and limitations for both DC and AC systems when considered as a supply system alone.

In order to incorporate the advantages of both the systems the pairing of AC output source and DC output source i.e., Hybrid AC/DC microgrid is necessary. Fig 1. shows the basic block diagram of Hybrid AC/DC microgrid. This 'Hybrid AC/DC microgrid' system uses Solar with Gas or Wind or Hydro or Biomass as a source of energy in combination with each other with a battery or flywheel as storage, this can address the issue of variability, uncertainty and intermittent characteristics of these renewable energy sources giving a continuous and reliable electric supply.

With a combination of AC electric system that is already existing and a low voltage DC system i.e., nearly less than 50 Volts when considered, it can simplify the setup process, reduce the cost – and will be also safer for the user for operations.

Typical loads like lighting, charging phones, powering fans, Laptops, LCD TVs etc. are either DC System loads or can be converted to DC, and there are some non-linear loads like pumps motors etc. a separate AC supply line and a DC supply line can prove to be beneficial to reduce the tremendous conversion losses. In this condition, with a separate Biomass,Hydro, Wind or Biogas (AC source) in combination of Solar panel (DC source) and a battery as an energy storage system, a continuous and reliable supply to this type of load is possible. For this, a group of customers can contribute towards the initial installation and setup charges which can be recovered soon.

Hybrid AC/DC Microgrids are very essential for sustainable energy required for human development with a robust economy. Due to Hybrid AC/DC Microgrids installations in near future, it will be possible to (1) supply electricity to 300 million Indians without the access to the electricity grid. This will help them, not only to increase their working hours, but also to run schools and colleges, hospitals and small scale industries. Improve their standard of living; (2) load management not only in rural areas but also in urban areas, university campuses, hospitals; (3) improve energy efficiency; (4) help with the existing grid stability, with renewable proportion increases in generation mix; (5) increase self-sufficiency of the customers, which can become 'Prosumers' (producers and consumers of electricity) in future; (6) reduce transmission and distribution losses by increase in number of microgrids.

Due to these manifold benefits of Microgrids, the technological cost will also be reduced, which will cause lowered initial investment and decreased operational cost to the market, entrepreneurs and government.

This will enable the investors to include more and more resources and create modern infrastructure.

Even when Microgrids are essential, there are various 'Economic', 'Technical' and 'Social issues' to be addressed for the deployment of microgrids in India.

Economic issues i.e., prepaid or postpaid metering system, which may lead to debts to the private player.

This is because collection becomes a top challenge, also investment in technology optimally and cost recovery with maintenance comes under economic issues.

Technically: Tariff mechanisms, government policies for volume scale deployment of these technologies, joint optimization of heat and electric supply, connection charges, joint optimization of demand and supply, quality and reliability of supply are the major challenges – and in addition to this there are also many social barriers.

'Hybrid AC/DC Microgrids' reflect a new way of thinking about designing and building sustainable grids, leading towards 'SmartGrids'. Hybrid AC/DC Microgrids can have a faster implementation and can create a power system with redundancy, distributed generation and storage, cogeneration, heat and power efficient utilisation, with better consumer control.

This will help work together with bulk power grid or system as an integrated whole to provide its consumers with maximum economic and environmental benefits. In future, the microgrids will be 'Smart' to make decisions about what clean energy source to run at what time and regulate the energy demand using power management technologies.

The Smart Hybrid AC/DC Microgrids will be able to optimize the cost reductions,energy savings and CO_2 emission reductions. The integration of multiple 'Smart Hybrid AC/DC microgrids' will lead this country towards Smart Grid contributing to sustainable human development..

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Status Quo Of maharashtra

Maharashtra State Power Generation Company Limited (MAHAGENCO) has the highest overall generation capacity and the highest thermal installed capacity amongst all the state power generation utilities in India...

India is the world's fifth largest electricity generator with total installed capacity of 2, 75,911.62 MW. Out of this, 40% is from state owned utilities, 32% is from privately owned utilities and 28% is from central owned utilities. The pace of investment from private players is considerable, which shows an encouraging environment for the electricity sector. Currently, India has total 1,91,663.56 MW of installed capacity on thermal, 41997.42 MW of installed capacity on hydro, 36470.64 MW of installed capacity on Renewable Energy Sources (RES) and 5,780 MW of installed capacity on nuclear. Thermal sources contribute 68% in the total capacity.

Fig-1 shows Indian top ten states have largest installed electricity capacity. The state of Maharashtra is at the top position in installed electricity generation capacity in India. The state of Gujarat is on second position of installed electricity generation capacity followed by Tamil Nadu, Rajasthan and Madhya Pradesh etc.

Maharashtra is a state in the western region of India and is the nation's third largest state and also the world's second-most populous sub-national entity. Its population makes Maharashtra one of the largest energy users of country. The high electricity demand of the state constitutes 13.91% of the total installed electricity generation capacity in India.

By 31July 2015, Maharashtra has 38,372.83 MW of installed capacity. Out of this, 28,145.20 MW generate from thermal (coal & gas) plants, 690.14 MW from nuclear plants, 3,331.84 MW from hydro plants and 6,205.65 from Renewable Energy Sources (RES) like solar, wind etc. Fuel-wise installed capacity in Maharashtra is given below. The fig-3 shows percentage of energy generation in Maharashtra by different sources.

Power Generating Utility Of Maharashtra

In the past, electricity provided to the state of Maharashtra by Maharashtra State Electricity Board (MSEB). MSEB was set up in the year 1960 to generate, transmit and distribute power to people in Maharashtra, except Mumbai. Maharashtra State Electricity Board (or MSEB) is a state-owned electricity regulation board operating within the state of Maharashtra in India. On June 6, 2005 Maharashtra State Electricity Board (MSEB) has been restructured into four companies. These companies include- MSEB Holding Company, Maharashtra State Electricity Distribution Company (Mahavitaran), Maharashtra State Electricity Transmission Company (Mahapareshan) and Maharashtra State Electricity Generation Company (MAHAGENCO). The state of Maharashtra forms a major constituent of the western grid of India, which now comes under North, East, West and North Eastern (NEWNE) grid of India. Fig-4 shows the Structure of Maharashtra Electricity Scenario.

Maharashtra State Power Generation Company Limited (MAHAGENCO) has the highest overall generation capacity and the highest thermal installed capacity amongst all the state power generation utilities in India. In terms of installed capacity, it is the second highest generation company after National Thermal Power Corporation Limited (NTPCL). MAHAGENCO is the only State Utility having a very well balanced generation portfolio involving thermal, hydel and gas stations along with solar power plant.

The first 500 MW plant to be installed in any State Utility belongs to Maharashtra. Maharashtra Power Generation Company (MAHAGENCO) operates thermal power plants in the state. In addition to the state government owned power generation plants, there are privately owned power generation plants that transmit power through Maharashtra State Electricity Transmission Company, which looks after transmission of electricity in the state.

MAHAGENCO has an installed capacity of 12,237 MW. This comprises Thermal (nearly 73%, i.e., 8,980 MW) and a gas-based generating station at Uran, having an installed capacity of 672 MW. The Hydro-lectric projects in the State of Maharashtra have capacity of 2,585 MW.

MAHAGENCO is simultaneously implementing capacity additions programmes of about 9,320 MW. Project execution works of 3,230 MW are in full swing and 6,090 MW projects are in advanced stage of planning. It is also working in the area of power generation from non-conventional energy resources, and has clear vision for Green Power for the consumers of Maharashtra. Table-2 shows the power plant installed in Maharashtra by MAHAGENCO and table-3 shows the ongoing projects in Maharashtra.

MAHAGENCO is the largest power generation utility in Maharashtra under state government. Private sectors have also installed

Sector	Thermal (MW)				Nuclear (MW)	Renewable (MW)			Total (MW)
	Coal	Gas	Diesel	Sub-Total Thermal		Hydel	Other Renewable	Sub-Total Renewable	
Central	48,880.00	7,519.73	-	56,399.73	5,780.00	11,491.42	-	11,491.42	73,671.15
State	59,200.50	6,974.42	438.57	66,613.49	-	27,482.00	1,919.31	29,401.31	96,014.80
Private	59,627.38	8,468.00	554.96	68650.34	-	3,024.00	34,551.33	37,575.33	106,225.67
All India	167,707.88	22,962.15	993.53	191,663.56	5,780.00	41,997.42	36,470.64	78,468.06	275,911.62

Table-1- Installed Power Station Capacity in India (as on 31-07- 2015)...

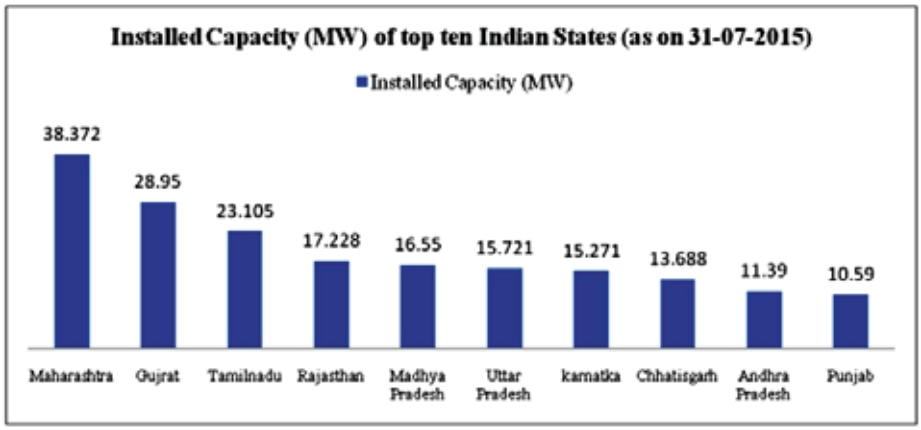

Fig-1- Installed Capacity of top ten Indian States (as on 31-07-2015)...

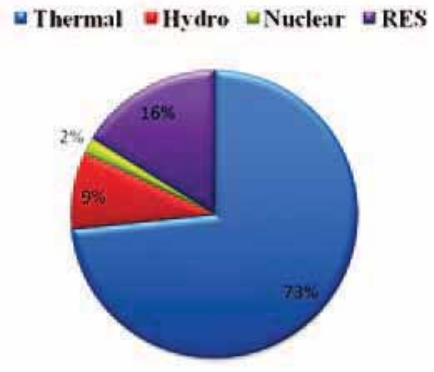

Fig-3- Maharashtra Power Generation (Fuel wise)...

Fig-2- Maharashtra State...

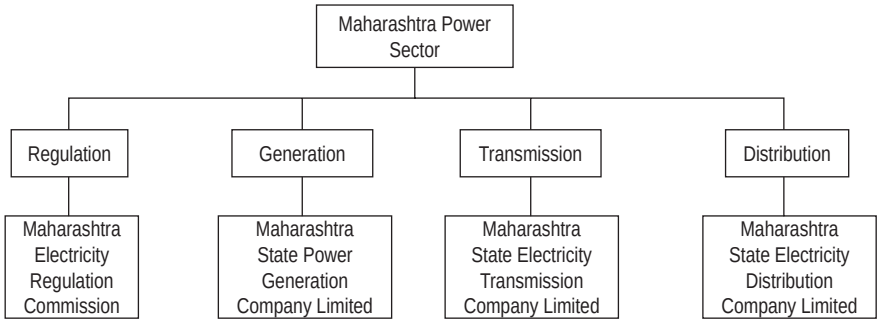

Fig-4- Structure of Maharashtra Electricity Scenario...

their power generating units in Maharashtra like TATA Power, Adani Power and Reliance Infrastructure etc. Table-4 shows the list of installed power plant by private companies.

Renewable Energy Scenario Of Maharashtra

Maharashtra is one of the leading industrialized states in the country. Maharashtra's economy is growing very fast and so its energy needs are continuously increasing. In the past few years, the state has been facing a grim power demand supply scenario. Government has increased power generation by addition in thermal capacity in last few years – and work in progress to improve capacity of thermal plants. Now the government has aware about renewable energy sources, so state government has been taking various initiatives to increase the power generation through renewable energy. Maharashtra state government established Maharashtra Energy Development Agency (MEDA) to undertake development of renewable energy. MEDA did lot of work in the field of renewable energy focusing on rural areas.

Project	Location	Installed Capacity (MW)
Chandrapur Super Thermal Power Station	Urja Nagar/ Chandrapur	3340
Bhusawal Thermal Power Station	Deep Nagar/ Jalgaon	1420
Khaperkhera Thermal Power Station	Khaperkhera/Nagpur	1340
Parli Thermal Power Station	Parli/Beed	1130
Nashik Thermal Power Station	Nashik	630
Koradi Thermal Power Station	Koradi/Nagpur	620
Paras Thermal Power Station	Vidyut Nagar/Akola	500
Uran Gas Turbine Power Station	Bokadvira/Raigarh	672
Koyana Hydro	Satara	1956
Ghatghar Pump Storage	Ghatghar	250
Small Hydro		379

Table-2-Installed Capacity of MAHAGENCO (as on 31-July-2015)...

Name of the Project	Unit No.	Unit Capacity (MW)
Koradi Thermal Power Station	8	660
Chandrapur Super Thermal Power Station	8	500
Parli Thermal Power Station	8	250
Chandrapur Super Thermal Power Station	9	500
Koradi Thermal Power Station	9	660
Koradi Thermal Power Station	10	660
Total		3230

Table-3- Ongoing Projects (3230 MW): Capacity Addition in 12th Plan (2012-2017)...

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Currently, total installed Renewable Capacity in the state of Maharashtra is 6,145 MW. Maharashtra is one of the top states in India in term of the installed renewable electricity capacity. The state has conventional electricity capacity of 24,105 MW. Renewable energy has 14% share in total electricity generation capacity of the state. Fig-5 shows installed renewable energy capacity on the basis of resources. Wind energy dominant in all form of renewable energy in the state followed by bagasse, solar and small hydel.

Table-4 shows the potential of renewable energy in Maharashtra. Wind power potential in the country is about 49,130 MW, while in Maharashtra it is 5,439 MW. Sites with Annual Mean Wind Density above 200 W/m^2 are considered suitable for wind power projects. 339 such sites have been identified in the country, of which 40 sites are in Maharashtra. Maharashtra is one of the prominent states considering the installation of wind power projects second to Tamil Nadu in India. As on 30/09/2014, installed capacity of wind energy is 4167.26 MW. As of now there are 50 developers registered with state nodal agency "Maharashtra energy Development Agency" for development of wind power projects. All the major manufacturers of wind turbines including Suzlon, Vestas, Gamesa, Regen, Leitner Shriram have presence in Maharashtra. According to Maharashtra Renewable Energy Policy 2015, target of 5000 MW wind energy plants installation in state.

Among the renewable sources of energy, solar energy has a huge potential for power generation in Maharashtra. There are 250-300 days of clear sun with an available average radiation of 4 to 6 kWh/sq. metre over a day. There is a capacity to generate 1.5 million units/ MW/year through solar photovoltaic systems & up to 2.5 million units/MW/ year through solar thermal systems. MAHAGENCO has commissioned 130 MWp Solar Power Projects till date. MAHAGENCO aspires to increase its solar portfolio from current 130 MWp to 450 MWp by end of the year 2015-16. Currently, installed capacity of solar energy plants in Maharashtra is 378.7 MWp, which is 9.2% of total installed capacity of solar plants in india.

As per MNRE the potential of small hydro power in India is 10,071 MW and in Maharashtra potential is 732.63 MW. The installed capacity in Maharashtra by the year 2013-14 is 278.40 MW. Till date all projects are developed by Water Resource Department, GOM through private developers. Target of small hydro plant installation as per Maharashtra Renewable Energy Policy 2015 is 400MW. There is a large potential in the non-conventional energy sources sector, out of which biomass is one of the major sources of energy. Maharashtra is having agricultural / agro-industrial surplus biomass with a potential of about 781 MW distributed through the state. This distributed potential can be harnessed to meet increasing power demand and to improve the techno-economic scenario.

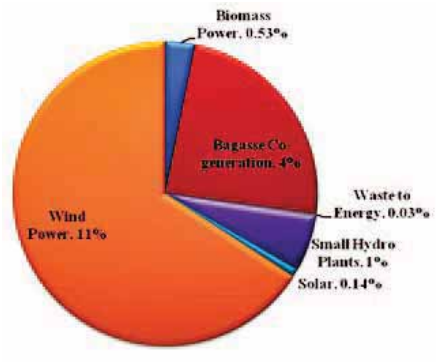

Fig- 5- Resources base installed Renewable Energy capacity (as on 31st July-2015)...

Fig-6- Renewable Energy...

Operator	Project	Location	Installed Capacity (MW)
Adani Power	Tirora Thermal Power Station	Tirora/Gondia	3300
Indiabulls	Amravati Thermal Power Station	Nandgaonpeth/ Amravati	2700
TATA	Trombay Thermal Power Station	Trombay/ Mumbai	1400
KSK Energy Ventures	Wardha Warora Power Plant	Warora/ Chandrapur	540
TATA Power	Trombay Gas Power Station	Trombay/ Mumbai	108
TATA Power	Mulshi Dam	Pune	300
Reliance Infrastructure	Dahanu Thermal Power Station	Dahanu/Thane	500
CESC	CESC Chandrapur Thermal Power Station	Chandrapur	300

Table-4-Installed Capacity by Private Sector (as on 31-July-2015)...

	Wind (MW)	Small Hydro Plant	Biomass (MW)	Bagasse Co-generation	Urban Waste (MW)	Industrial Waste (MW)
Potential in Country	49130	10071	1600	5000	1700	1700
Potential in Maharashtra	5439	732.63	781	1250	287	350
Percentage of total potential	11.07%	7.27%	4.90	25%	16.90%	20.60%

Table-4- Renewable Energy Potential in Maharashtra...

Nitin Goel
Assistant Professor (Electrical Engineering) at YMCA University of Science and Technology, Faridabad

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"We pride ourselves on being knowledge providers..."

OMICRON Energy Solutions Pvt. Ltd. is the Indian wing of OMICRON, which was founded 30 years ago at a small town in Austria. The company has been offering different kinds of innovative testing, diagnosis and monitoring solutions to the Indian power sector. Whether it is a power transformer or circuit breaker or rotating machine or cable system, the company is ever ready to cater to the need for its test and measurement. In an exclusive interview with **Electrical India, Willam Kibart, Regional Sales Manager, MESA (Middle East & South Asia),** of the company, is talking to **P K Chatterjee** on the company's Indian business. Excerpts…

How is the Indian power industry transforming ?

The Indian government's promise to have electricity in all houses by 2022 is a very ambitious target. In order to meet it, the indigenous industry is continuing to develop, but it cannot do this in isolation. The growing international presence of some Indian companies has given them access to new technologies, whilst the presence in India of the major global manufacturers ensures the cross-fertilisation of ideas.

What is the driving force that has kept your company in forefront globally ?

OMICRON reinvests a very high proportion of its turnover into its development process, which has resulted in many innovative ideas helping it to keep one step ahead of its competition.

How can you broadly classify your wide array of products and services ?

OMICRON's products are mainly intended for the accurate and efficient testing of power system assets such as transformers, rotating machines, switchgears and protection relays. Some of the technologies used, lend themselves to continuous monitoring of the equipment, allowing the user to identify problems on-line before they become too severe. The company's services are built around training, to ensure the effective use of the equipment, and the diagnosis of results.

What kinds of products or services are in maximum demand and how is that (the demand) growing ?

Testing remains important both as an essential part of commissioning new installations and as a periodic health check on existing equipment, however it is monitoring which is seeing particular growth in the market as it allows a switch from time-based to condition-based maintenance resulting in savings in time and the early identification of symptoms that may lead to eventual failure.

Today Omicron is present in 140 countries...

Please tell me something about your R&D department.

As already mentioned, R&D consumes a large proportion of the company's revenue. Although it is primarily based in the development centres in Austria and Germany, great care is taken to ensure that it has a global focus through the use of a global network of applications specialists. These team members have the task of monitoring the needs of the industry in their regions such that they are fed back in to the development process.

How do you generate awareness about your products in the industry ?

The key to keeping the market aware of our products is our local presence. We have an office in New Delhi with a team of experienced technical sales people and applications engineers. They can assist our customers with their technical queries and ensure that they are offered the best solutions to meet their needs. The OMICRON team is supported by a network of distributors, known to us as Sales Partners, providing even more local support both geographically and linguistically.

Please share some estimation about your market share in the Indian power industry.

It is difficult to estimate the precise market size for our equipment, but we are confident that we are a market leader amongst the overseas companies operating in India.

Please tell me something about your training and skill development ventures for the customers.

We pride ourselves on being knowledge providers and training is a key part of our service portfolio. Our training programme is organised under the banner of the OMICRON Academy. The engineers who run our courses receive training in Europe to ensure their knowledge is at a high level and their presentation technique is in line with our global company standards.

What are the emerging areas in India where you are eyeing on ?

The potential growth of the Indian power market based on the government's commitment is enormous – and therefore we are considering the whole market, rather than any particular segment.

What kind of after-sales services do you offer ?

As previously mentioned, our after-sales service is primarily concerned with training and the diagnosis of results. We see the provision of services as a way to maintain and grow our relationship with our customers.

Dubai Decides To Walk On The Green Path

While many around the world talk about adopting a green economy, Dubai is among the firsts to have joined with the world to curb its carbon footprint and combat climate change...

Launch of the State of Green Economy Report 2016 (Dubai)...

Through a recent communiqué, Saeed Mohammed Al Tayer, MD & CEO of Dubai Electricity and Water Authority, has revealed that to implement the Dubai Integrated Energy Strategy 2030, they have worked on major programmes to diversify their energy mix and manage the demand for electricity.

By 2030, 15% of Dubai's energy mix will be generated from solar power, 7% from nuclear, 7% from clean coal and 71% from gas. Their Smart Grid initiative is making progress with the launch of the first electric-vehicle charging stations in the UAE, among many other high-impact programmes, such as smart meters and smart applications.

According to him, these initiatives intend to make Dubai the smartest city in the world. They have been successful in encouraging sustainable development (socially, environmentally and economically) of Dubai in particular and the UAE in general.

Their planned Research and Development Centre at the Mohammed bin Rashid Al Maktoum Solar Park will support the UAE's and Dubai's innovation strategy in countless ways and strengthen their efforts to be ahead of the curve in a period of considerable change for the utility sector.

In the presence of Ólafur Ragnar Grímsson, President of Iceland, and Dr. Sultan Al Jaber, Minister of State and Special Envoy for Energy and Climate Change, Saeed Mohammed Al Tayer, Vice Chairman of the Dubai Supreme Council of Energy has launched the State of Green Economy Report 2016 in the World Climate Summit 2015, Paris. Al Tayer handed a copy of the report to the President of Iceland. The report demonstrates the commitment of the United Arab Emirates (UAE) and Dubai to develop and implement green initiatives across all sectors, making a strong case for a green transition to a robust low-carbon economy that is strongly aligned to the UN Climate Agreement 2015.

To mobilise the UAE's transformation into a green economy, The State of the Green Economy Report 2016 provides an overview of initiatives that promote innovation and policy tools that help accelerate the process. The UAE wants to become a model of transformation into a green economy, demonstrating that growing without eroding natural resources is feasible.

The report underlines the efforts made to encourage and enable different sectors to participate in the transition towards a green economy.

It serves as a roadmap to establish new, impact-based and market-driven paradigms to decarbonise the power sector – and stimulate the market for energy efficiency. The report emphasises that knowledge leads to lasting impact and helps refine strategies. It provides cutting-edge information to both policymakers and practitioners.

"I am honoured to address you today. We are here together, united in our desire to make a positive impact for the betterment of our planet and nations. To add our support to this important cause, I would like to share with you our success story in the development of a sustainable green economy. Like many of you here today, we believe in collaborating to facilitate a binding agreement in Paris 2015, to achieve the 2030 UN Sustainable Development Goals to end poverty, protect the planet, and ensure prosperity for all," said Al Tayer.

"Thanks to the vision of His Highness Sheikh Khalifa bin Zayed Al Nahyan, President of the UAE, and His Highness Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai, the United Arab Emirates is working to achieve the UAE Vision 2021 to become one of the best countries in the world by 2021. The UAE has named 2015 as the Year of Innovation, with a dedicated National Innovation Strategy and a budget of USD 2.2 billion for innovation, of which 50% is for research and development. Last month, His Highness Sheikh Mohammed bin Rashid Al Maktoum, announced the Dubai Clean Energy Strategy 2050, to make Dubai a global centre for clean energy and green economy. The strategy has a target of 75% of all Dubai's total power output being sourced from clean energy by 2050," he added.

A strategy with ambitious goals and clear pillars, Dubai Clean Energy Strategy aims to provide 7% of Dubai's energy from clean energy sources by 2020. This target will increase to 25% by 2030 and 75% by 2050. It consists of five main pillars. The first, Infrastructure, includes initiatives such as the Mohammed bin Rashid Al Maktoum Solar Park, which is the largest single-site project to generate electricity from solar energy in the world, with a planned capacity of 5,000 MW by 2030, and total investment of USD 13.6 billion (AED 50 billion). The remaining pillars cover legislation, funding, building capacities and skills, and an environmentally-friendly energy mix. The Green Economy for Sustainable Development initiative of His Highness Sheikh Mohammed bin Rashid Al Maktoum demonstrates our commitment to a greener tomorrow."

"While many around the world talk about adopting a green economy, Dubai is among the first to have joined with the world to curb its carbon footprint and combat climate change, and is already leading by example. Our strategy involves moving from a carbon-intensive economy to a greener one, by the Dubai Green Fund, which is worth USD 27 billion, encouraging green investment and green growth. We are here today, to reinforce our commitment to forming a combined declaration, calling for commitment to a series of concrete actions within the framework of the Road to Paris 2015. Dubai remains firmly committed to these actions and that of the UAE to provide real value to the world. In 2011 we launched Dubai's Integrated Energy Strategy 2030, which focuses on energy security by diversifying the energy mix, to decrease our dependence on natural gas. The strategy also focuses on reducing electricity and water demand by 30% by 2030, with a dedicated Demand Side Management Strategy, and the region's first dedicated Carbon Abatement Strategy to reduce carbon emissions by 16% by 2021. The UAE is one of the first countries to have endorsed the extension of the Kyoto Protocol in 2005, to limit greenhouse gas emissions in industrialised countries. We are the first in the Arabian Gulf to sign the Copenhagen Accord at COP15, to support a long-term agreement to reduce emissions. In the same year, we established The Dubai Carbon Centre of Excellence in collaboration with the United Nations Development Programme. Dubai Carbon specialises in the Clean Development Mechanism, and applying best practices in reducing emissions in the Emirate of Dubai."

"We need to encourage collaboration between the public and private sectors to achieve a green economy, while mobilising new strategies and innovative solutions to achieve our goal of sustaining green growth. Public-Private Partnerships are key to this, as is the goal to make Dubai a global hub for Green Finance, to accelerate green projects by using public and private capital. Reiterating our commitment to Sustainable Development goals, The UAE Water Aid Foundation (Suqia) was launched by His Highness Sheikh Mohammed bin Rashid Al Maktoum in 2015, to help millions of underprivileged people, who are in desperate need of drinkable water around the world. This initiative also has an annual US$1 million global award to find sustainable solutions to water scarcity around the world," added Al Tayer.

"Today, I am pleased to launch the State of the Green Economy Report 2016, which reflects our vision to build a green future for generations to come. This report is the first knowledge product, which was developed to collate best practices that will contribute to knowledge sharing for the global good. The subjects in this report are likely to be discussed at the World Green Economy Summit (WGES) on the 5th and 6th of October 2016 as well as at the Water, Energy Technology and Environment Exhibition (WETEX 2016) on the 4th to the 6th of October in Dubai in the United Arab Emirates, and I would like to take the opportunity to invite everyone to attend these important events as well. The UAE is contributing to a future that is closer than we think. We envision a better, brighter future. We are all working to realise this brighter world that our children can be both proud of and love to live in. All these efforts are towards that goal and the vision of our leadership. Our promises for tomorrow are based on our actions today."

"The UNDP, as part of its global efforts to attain sustainable development and a green economy, is proud of its enduring and fruitful partnership with the Dubai Supreme Council of Energy and the Dubai Carbon Centre of Excellence, as demonstrated by today's launch of the 2nd edition of the State of Green Economy Report, which showcases the vital role of innovation in all areas of the green economy," said Frode Mooring, Resident Representative of the United Nations Development Programme (UNDP) in the UAE.

"We are honoured to be partners in the production and launch of this report in Dubai, a city pioneering the global transition to a green economy as a result of its commitment, clear vision, and innovative approach to development," added Mooring. EI

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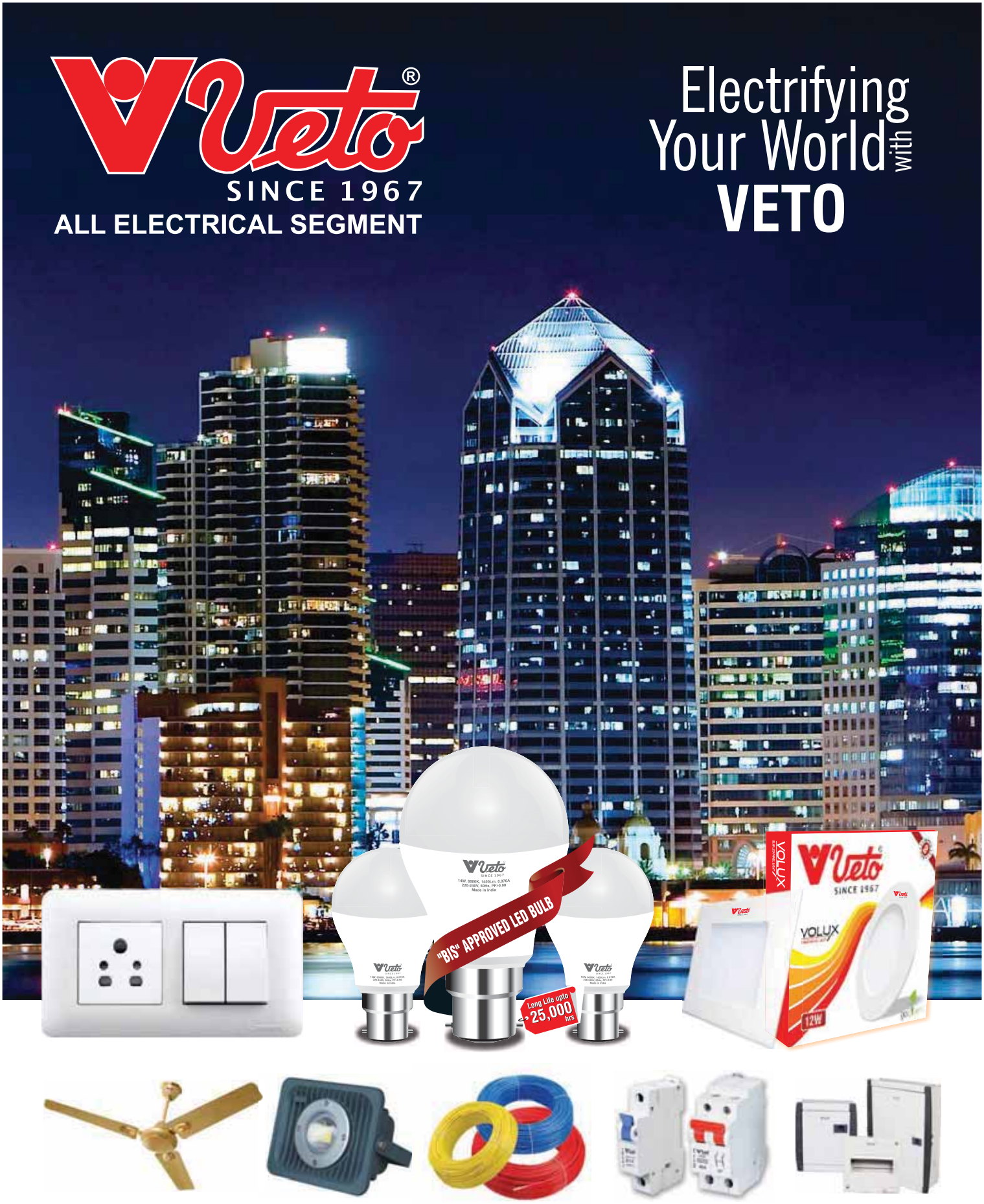

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Need And Challenges Of **Smarter Power Systems**

With the advancement of technology in both computation and communication, the conventional power grids undertook a major revolution to become smarter power grids...

Electrical power system is not a simple thing, but a complex man made system. It should supply electrical energy to the consumers. In the view of increasing probability for outages due to the system overloads, which are caused by ever increasing demand for electrical power, utilities are examining what modern information technology can contribute to improve the situation. Now-a-days, Wide Area Measurement Systems (WAMS) are being built around the world and will be an important necessary tool for the reliable operation of power systems in future. In order to have continuous monitoring Synchrophasors have become a vital part of WAMS. With the adaptation of recent developments of information technology, Phasor Measurement Units (PMU) are widely used in the day to day operation of contemporary power systems. PMU gives phasor values of voltage and current which are GPS time stamped. Grid monitoring in real-time is essential for ensuring stable operation of the grid. The grid must be completely observable, i.e., the voltages, currents and power flow at each and every bus must be available for complete analysis of the power system. Number of PMUs were installed across the world for different applications such as post fault analysis, state estimation and protection of power system. Since the cost of PMUs are very high, they are placed optimally in the power system such that complete power system is observable.

In power system, different type of harmonics rides on the fundamental sinusoidal waveform, which results in the non-sinusoidal waveform.So, in order to eliminate higher order harmonics, analog signal is passed through the Anti-aliasingfilter (AAF).

With the advancement of technology in both computation and communication, the conventional power grids undertook a major revolution to become smarter power grids.

Unlike conventional power grids, smart power grids are incorporated with synchrophasor measurement units like PMUs, distributed generation system and SPC. SPC is included with Intelligent Energy Management System (IEMS), Main Control Centre (MCC), data servers and Phasor Data Concentrators (PDC). SPC monitors the grid in real time and undertakes necessary control and protection actions through wide area control systems. There are two DFT algorithms to estimate phasor: Recursive DFT algorithm and Non recursive DFT algorithm. Non Recursive DFT algorithm is most frequently used algorithm since it is more stable than the Recursive DFT algorithm.

Consider a sinusoidal signal as given below

$$v(t) = v_m \cos(2\pi f_0 t + \varnothing)$$

where f_0 is fundamental frequency, and is sampled at a sampling frequency of Nf_0. The sampling angle θ = (2π/N), where N is the number of samples per cycle.

$$v_n = v_m \cos(n\theta + \varnothing)$$

The phasor estimate for the consecutive window of samples is given as

$$(N-1)^{th}\ phaser\ \ V^{N-1} = \frac{\sqrt{2}}{N}\sum_{n=0}^{N-1} v_n e^{-j\theta n}$$

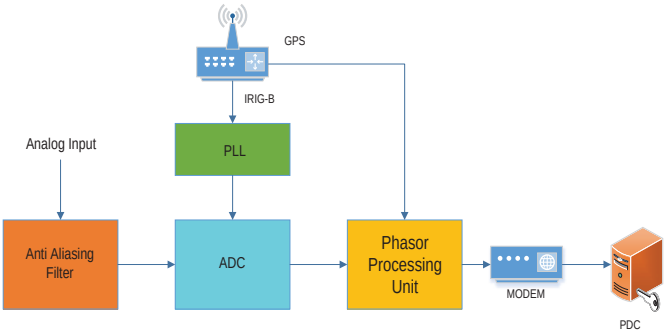


Fig. 1. Architecture of Phasor Measurement Unit...

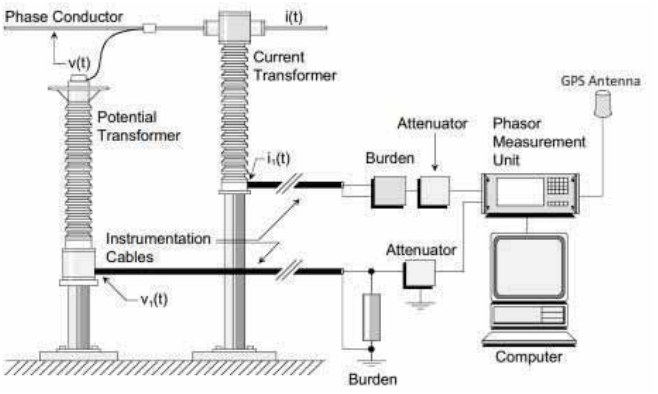


Fig. 2. Connection of PMU to the Grid...

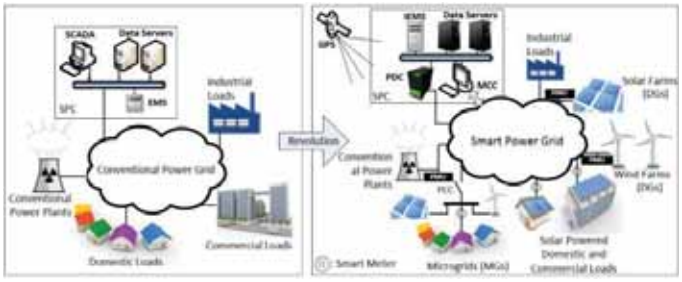


Fig. 3. Revolution in conventional power grid to smart power grid...

Implementation of PMU in Laboratory

PMU can be implemented by different software packages. The following design of PMU is developed using NI LabVIEW software package. The steps involved in the development of PMU using LabVIEW are demonstrated in Figure 5.

The data is stored in .csv (Comma separated value) format. The sample of data being stored is shown in Table I

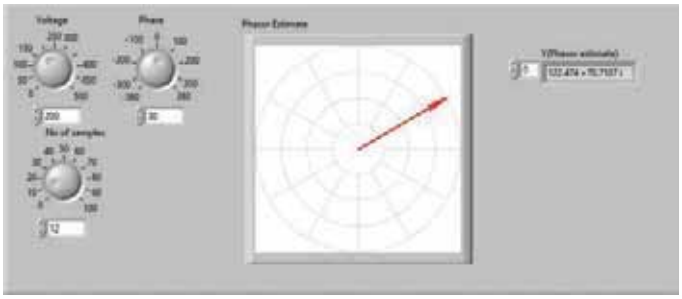


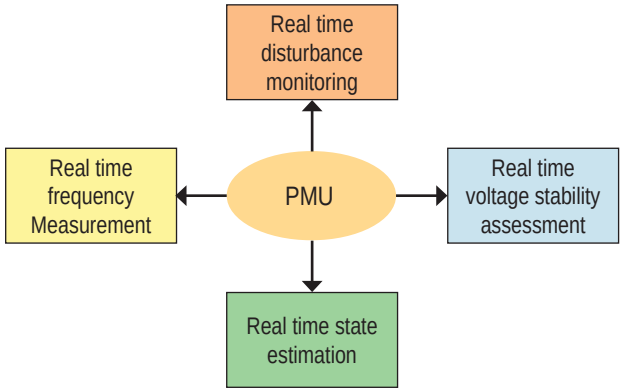
Fig. 4. Implementation of PMU by using NI LabVIEW...

Fig. 5. Development of PMU using LabView...

Time Stamp	Magnitude V1 (v)	Angle1 (degree)	Frequency1 (Hz)	Magnitude V2 (v)	Angle2 (degree)	Frequency2 (Hz)
23:26:03	79924.90	120.18	49.98	40.80	-10.12	50.02
23:26:04	79930.64	119.89	49.98	40.81	-9.91	50.02
23:26:05	79933.17	119.60	49.98	40.82	-9.70	50.02

Table I Data of PMU stored in .csv format...

Applications of PMU



Synchrophasor Technology vs SCADA

Before the revolution of PMU, SCADA became vital part in the power systems. But SCADA has primarily two major drawbacks namely asynchronous scanning and phase angle calculation. In SCADA, RTUs (Remote Terminal Units) transfer data to master. In other words, master collects data from all the RTUs sequentially, this is called data pooling. Let us consider a case that there are 100 RTUs, master is polling data from 72nd RTU. In this time suppose there is a disturbance or fault near 25th RTU, but master will not poll data. After completion of data polling from all 100 RTUs, master will come back again from RTU 1 and so on. So, the data we are getting from the SCADA is not live data. Hence, in state estimator, operation is not accurate. This drawback is called Asynchronous scanning.In SCADA the phase angle will not be obtained. So, angle has to be calculated separately by using different algorithms proposed in the literature. Therefore, it adds additional delay.

The above two drawbacks can be easily overcome by the PMU because all the PMUs are synchronised to GPS, hence data obtained at PDC is live data. PMUs give phasor values of voltages and currents, so the phase angle calculation delay is also overcome.

Nowadays, most of the power grids are equipped with the digital relays for increasing the reliable and fast protection. The PMU also has to be installed for improving the situational awareness conveyed to the power system operators. Instead of installing PMU and digital relays separately the digital relay can be implemented using PMU and that will lead to decreasing the number of devices in power systems and economics of designing. While doing improvement in monitoring by installing PMU we can enhance the operation of the digital relay also.

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SMART MOTORS

Market Is Growing Substantially

The implementation of smart motors in the industrial, automotive, commercial and consumer electronics sectors of China, Japan, India and the Rest of APAC (RoAPAC) is increasing at a substantial rate...

According to a recent report titled, "Smart Motors Market by Component (VSD, MCC, Motor), by Application (Industrial, Commercial, Automotive, Consumer Electronics, and Aerospace & Defense) and Geography - Analysis & Forecast to 2020," the global smart motor market is expected to grow from USD 989.0 Million in 2014 to USD 1.38 Billion by 2020 at a CAGR of 6.19% between 2015 and 2020. The market is expected to grow substantially because of factors such as requirement of less on-site and wiring space, and cost reduction while increasing the overall effectiveness of the equipment.

The growth of extra peripherals such as communication buses, and mechanical and electrical components integrated in a motor are majorly responsible for this segment to hold a large market share. Considering the large application of electric motors such as servo and stepper, the overall growth of motors and its related components is the reason for this component segment to witness the fastest growth rate during the forecast period.

Over a period of time, smart motors are expected to be widely used in various industrial plants carrying out processes such as manufacturing, testing, assembling operations, tooling processes, and load controlling operations among others because of their ability to provide energy efficiency, reduced cabling and the associated cost, and the ease of installation. These benefits are driving industries to switch from traditional motors to smart motors and in turn garnering spurring the market growth.

The Americas held the largest market in 2014, followed by Asia-Pacific and Europe. The American Smart Motor Market is dominated by market leaders that are boosting their smart motor offerings by developing more efficient, convenient, and economic smart motors as well as broadening their distribution. The implementation of smart motors in the industrial, automotive, commercial and consumer electronics sectors of China, Japan, India and the Rest of APAC (RoAPAC) is increasing at a substantial rate –.making APAC the fastest growing smart motor market.

Major companies in the global smart motor market that have been included in this report are Rockwell Automation, Inc. (U.S.), Moog, Inc. (U.S.), Fuji Electric Co. Ltd. (Japan), ABB Ltd. (Switzerland), General Electric (U.S.), Siemens AG (Germany), Schneider Electric SE (France), Technosoft SA (Switzerland), Robot Shop, Inc. (Quebec) and Robeteq, Inc. (U.S.). (Source: Markets and Markets) EI

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Market Dynamics Indicates Growth

Asia-Pacific region; owing to the fast growing automotive industry in developing countries such as India, China and South Korea; is expected to show a significant growth in the vehicle electrification market...

Future Market Insights (FMI); a premier provider of syndicated research reports, custom research reports, and consulting services; has published a research report titled, "Vehicle Electrification Market: Global Industry Analysis and Opportunity Assessment 2015-2025."

As per FMI, electrification of a vehicle is considered as one of the best ways to reduce carbon emission, increase vehicle efficiency and reduce dependency over oil. Vehicle electrification generates new opportunities for consumer engagement along with various environmental and economic benefits. We can replace various hydraulic or mechanical systems with electric systems: hydraulic power steering with electric power steering and mechanical or hydraulic pumps with electric pumps.

As per the report, "Increasing prices of conventional fuels, growth in the sales of electric vehicles will enhance the growth of vehicle electrification. Growing demand for fuel efficient vehicles, stringent emission norm along with increasing environmental awareness among the consumer are also expected to fuel the growth of vehicle electrification market. Governments of various countries such as the USA are actively supporting vehicle electrification by providing tax exemption and subsidies.

FMI finds Asia-Pacific region; owing to the fast growing automotive industry in developing countries such as India, China and South Korea; is expected to show a significant growth in the vehicle electrification market.

Strict laws in Western & Eastern Europe for vehicle efficiency will drive the vehicle electrification market in this region. North America is also anticipated to a moderate growth with credits to the strong fuel efficiency norms and support from government in the region. With rapid technological advancement and growing automobile industry, vehicle electrification market is expected to increase at a double CAGR during the forecast period.

FMI communicates, "Some of the players in the market we identified includes, Continental AG, Robert Bosch GmbH, TRW Automotive Holdings Corp., Denso Corporation, (Japan), Nexteer Automotive, JTEKT Corporation, Mitsubishi Electric Corporation, Mando Corp, Borgwarner Inc and ZF Friedrichshafen AG." EI

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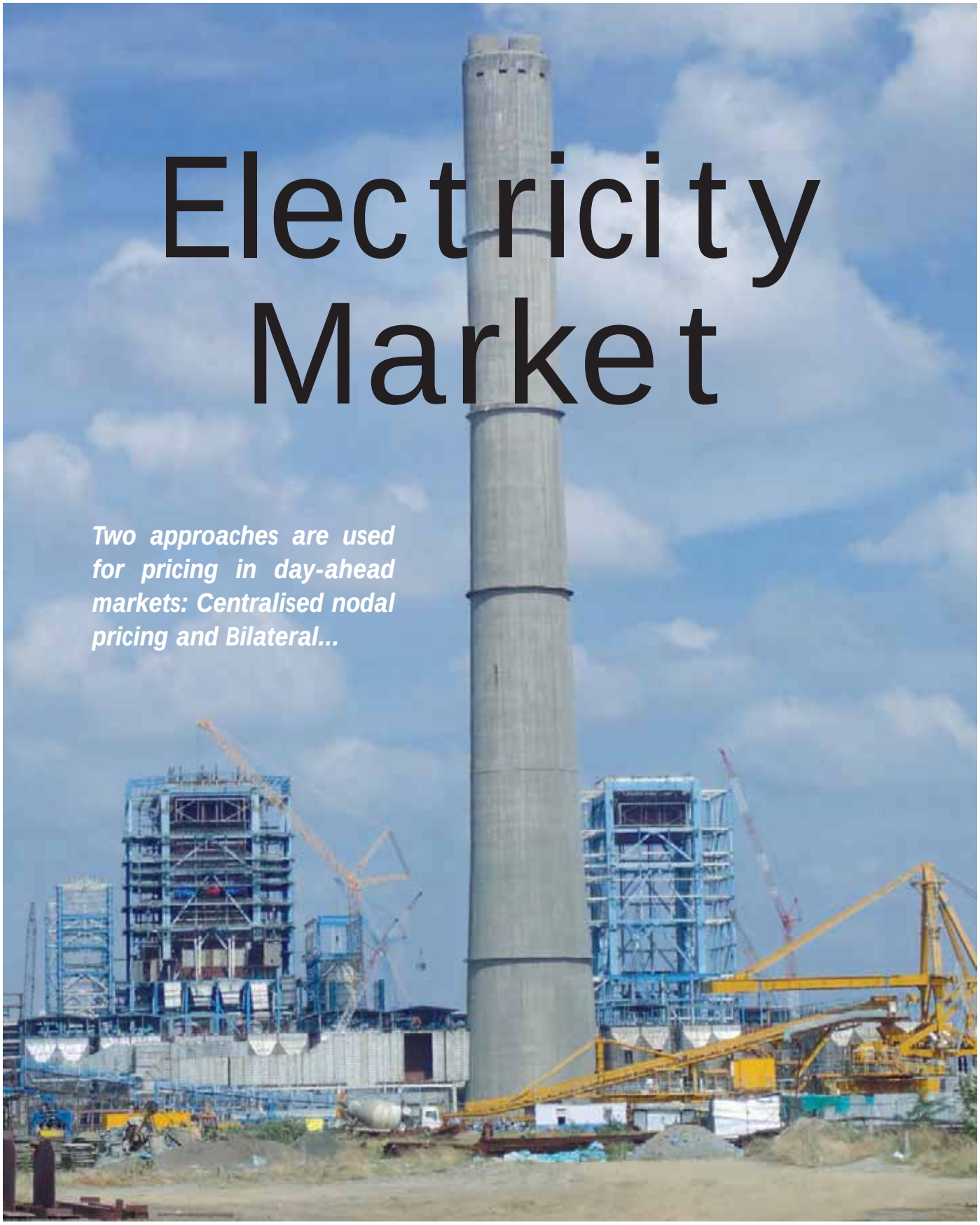
Electricity Market



Two approaches are used for pricing in day-ahead markets: Centralised nodal pricing and Bilateral...

Electricity market, in India, started evolving with enactment of Electricity Act 2003, and now it is almost two decades since the transaction of electricity is going on in India under marketing mode. It has been observed that the market has generally functioned quite smoothly over these two decades. No abnormally high price spikes were seen for electricity traded through power exchanges. Also, there was near absence instances of exercise of market power by any of its constituents like generation, transmission, distribution.

During these years, the capacity addition has taken place at appreciable pace – especially in private sector, as expected under competitive marketing environment, obviously. Investment in transmission assets has also shown a similar trend. The generation technology mix has undergone desirable change with increase in share of renewable energy, a favourable outcome of appropriate policy and regulatory initiatives towards creating a market for economic, reliable in real time mode.

In the present market environment, price of electricity is being determined by market forces of demand and supply for the electricity that is being traded on exchange. Parallely sale and purchase of electricity is also taking place, under bilateral mode, at price discovered through competitive bidding route. Transaction of electricity is going on at regulated tariff for State and Central Power Generating Units.

The investment, growth and operational features of market speak good about the Indian electricity market, in terms of its design and development.

Towards bringing the electricity sector under umbrella of competitive market, the sector has been put under an Independent Regulatory Body; disintegrated into generation, transmission and distribution segments; markets for providing different services at competitive prices have been introduced; and different trading arrangements have been put in place. Seeing at the activities going on in the sector, it can be expected that discovery of prices is not a distanced phenomenon in Indian Electricity Sector.

This paper discusses about the various types of sub markets of an electricity market, their functions and price setting mechanisms for the services provided by them.

Delivered power is a bundle of many services like transmission, distribution, frequency control, voltage support, generation. Transmission & Distribution (T&D) services are responsible for delivering the power, frequency control, and voltage support services maintain the power quality, and generation services provide reliablity.

Each service requires a separate market, and some require several markets. Each service can be provided by free markets, by the state, by regulsted suppliers or by some hybrid arrangement.

The most critical service in a regulated or deregulated market is that provided by the system operator. This is coordination service. For a deregulated market, it typically includes operation of real-time markets and day-ahead market to provide scheduling and balancing services.

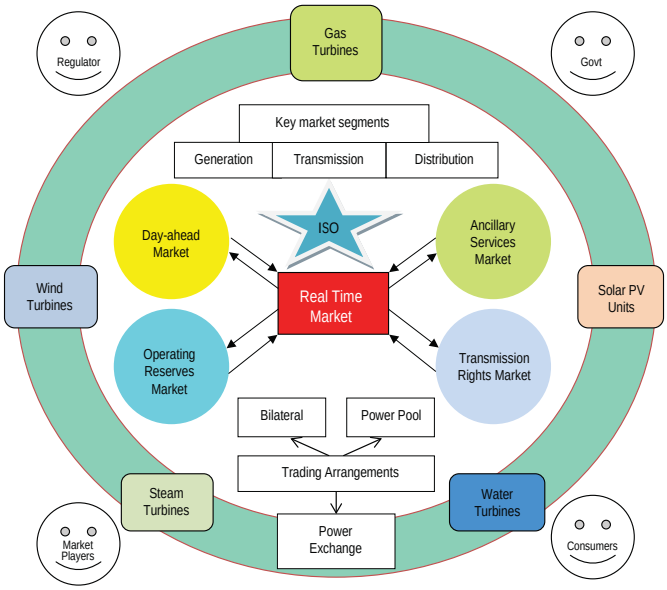


Exhibit 1 : Arrangement of an electricity market...

Three stages of acution

1. Submission of bids
2. Acceptance of some bids & determination of price
3. Settlement of accepted bids at the determined prices

While the optimisation problem determines which bids are accepted, the pricing rules determine the price.

Pricing approaches

Centralised nodal pricing	Bilateral
The auction is for : a) different energy prices at every node (bus) & b) unit commitment The bids are complex.	The auction is for sell of transmission rights by system operator *

** As the energy trades take place between two parties and not between exchange & the individual parties. The private parties require use of transmission system to trade energy...*

Exhibit 1 depicts arrangement of an electricity market pictorically.

In each of the market segment, some services have been deregulated, some are still under the umbrella of regulation. Also, even within a service, one side – either demand or supply – has been regulated while the other side has been deregulated.

For example, the supply of transmission rights is determined by the system operator, but the demand side of this market is competitive. In contrast, the demands for ancillary services are determined by the system operator while the supply sides of these markets are competitive.

Day-ahead market

Day-ahead markets are run by system operators as auctions either in the form of exchanges or pool. They are designed either as bilateral or centralised.

The bids are selected to maximise total surplus. Locational energy prices are set equal to the marginal change in total surplus when free power is injected at various locations. Each auction is specified by three sets of conditions : bidding rules, bid acceptance rules, and settlement rules. Power exchange uses one-part bids. Power pool uses multi-part bids. It has been found that a single-price day-ahead auction is efficient.

Reat-Time Power Exchange works like a classical Walrasian auction.

A price is announced and suppliers and consumers respond. If the market does not clear, a new price is announced.

An RT exchange is usually supplemented with another exchange or operating-reserve market in the form of pool because it may so happen that there is no price that balances supply and demand due to situations arising out of nonconves production costs attributable to starting and no-load running of generating units.

Price determination in day-ahead markets

Two approaches are used for pricing in day-ahead markets: Centralised nodal pricing & Bilateral.

The price determined by supply and demand is the highest of all the accepted supply bids or lowest price of an accepted demand bid. To determine the price, first the price is set equal to marginal surplus, which is nothing but the change in total surplus with an unit increase in costless supply.

Price setting mechanism is explained through for both unconstrained as well as constrained maekets.

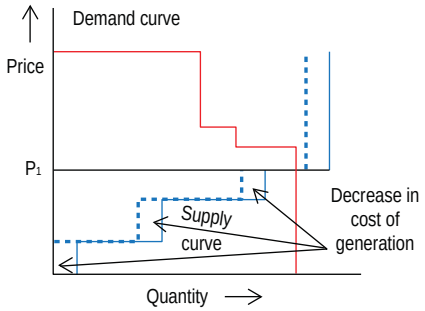
In unconstrained market, the free unit of supply shifts the entire supply curve left while the amount produced and consumed remain unchanged. The result is a production cost saving of P*1kW, so the marginal surplus is P. The consumption is limited by the high cost of next available generator, but of 1kW of free supply were available, consumption would increase by 1kW. The value of consumption increases by P*1kW, and the cost of production stays constant, so total surplus increases by the same amount. In bith cases marginal surplus equals price.

In constrained market, all the suppliers are one side of the transmission constraint and all the consumers are on the other, and the free kW of supply can be introduced at either location. At the consumer end, the kW increases consumption PD. at the supplier end, the kW decreases the cost of supply, so the marginal surplus is the marginal cost of supply Ps. Because the prices are different, the system operator captures part of total surplus, but in spite of this, total surplus still equals gross marginal surplus. Setting of the market price equal to the marginal surplus is justified because it gives the competitive price and thus induces efficient behaviour. It clears the market and the trade is voluntary at these prices.

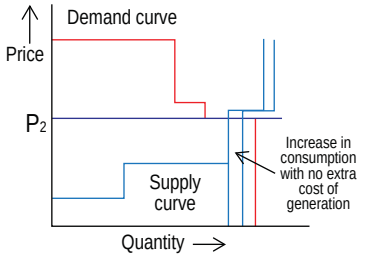
Real-time market

A real-time (RT) market primarily provides the balancing and transmission security

Price determination in unconstrained market

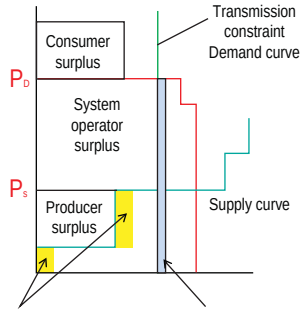


A free unit of supply shifts the entire supply curve to left, with amount produced and consumed remaining unchanged. This results into saving of production cost of P1*1kW.



From a free unit of supply, when available, consumption increases by 1Kw and value of increases by P2*1kW. As the production cost stays constant, the total surplus increases by the same amount.

Price determination in constrained market



P_s = Decrease in producer cost from 1 kW of free power at supply end of constraint

P_D = Increase in gross consumer surplus from 1 kW of free power at consumer end of constraint

When all suppliers on one side of the transmission constraint & all consumers are other side, prices differ at producer and consumer ends when free kW of supply is introduced at either location. This is because marginal value and marginal cost are different at two ends of constraints. Introduction of free kW of supply

At the consumer end it increases consumption so marginal surplus is the marginal value of consumption P_D	At supplier end it decreases cost of supply, so marginal surplus is marginal cost of supply P_S

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Operating Reserves Types		
Spinning reserves Or "Regulation"	Ten-minute non-spinning reserves	Thirty-minute non-spinning reserves
Provided by units that are already in service (operating)	Provided by units that can start delivering power within 10 minutes from start, typically gas (combustion) turbines	Provided by units that take 30 minutes to deliver power after starting
Highest quality	Medium quality	Lowest quality
These are 1) used continuously not just for contingencies 2) bought separately but not as operating reserves	These are 1) used for contingencies 2) bought separately but not as operating reserves	These are 1) used for contingencies 2) bought separately as operating reserves
Most expensive	Moderately expensive	Least expensive

Clearing the operating reserves market

The three operating reserve markets are tightly linked to each other and to the energy market. So, these should be cleared simultaneously using a single set of bids that can be allpied to any of the market.

California demonstrated the folly of pretending differently and landed to pay $9999/MWh for a class of reserves lower than 30-minute non-spin at times when the highest quality reserves were selling for under Rs 50/MWh.

Spinning Reserves

Spin is typically defined as the increase in output that a generator cab provide in ten minutes. Spin can also be provides by load that can reliabily back down by a certain amount in ten minutes

Spinning reserve requirement of a system is roughly equal to the largest loss of power that could occur due to a single line or generator failure ie a single contingency.

Spin can range from free to expensive. Providing spin from generators that would not otherwise run is costliest.

"Incidental spin"is provided by marginal generators whose maximum output is not required but more often by those in the process of ramping down. Generators in the process of ramping up at full speed are given credit for "Morning ramp".

Steam units can typically ramp up (increase output) at a rate of 1% per minute which allows them to provide spin equal to 10% of their capacity.

requirements of power market. It consists of trades that are not under contract-power that shows up, or is taken, in real time and accepts the spot price. Trading takes place all the time, there is no waiting time to trade until the right price is discovered.

This centralised market can take the pool approach, exchange approach or something in between to achieve a supply-demand balance, but not the bilateral approach, which are too slow to handle real time balancing and transmission security, as traders must find partners.

RT trade takes place at RT prices and not at contract price. Thus, deviations from quantities specified in forward contracts comprise the transactions of the RT market. RT price is determines by the total actual (RT) supply & demand, whether traded under forward contracts or in RT market.

Operating reserves market

In power market there are situations when the cheap generators are required to be asked to produce less and also expensive ones to keep spinning (running) to increse reliability and moderate price spikes.

Operating reserves come in various types. Market for operating reserves has to pay the generators to behave differently from the regular energy market. Capacity-bid scoring is optimal for spinning reserves and with perfect information it is efficient.

Suppliers are asked to bid a capacity cost, energy cost and opportunity cost (for not maximising profits). Bidders with lowest capacvity bids are selected to supply spin, and from these, the ones with the lowest energy bids are selected to run when energy is needed. Accepted bids are pand the market-clearing capacity price and energy price.

Providing spin from non-spinning generators run is costly due to following reasons:

1. Generators usually have a minimum generation limit below which they cannot operate and remain stable.

2. Generators have to incur no-load costs on start up and shut down, as these are unrelated to their output.

Providing spin from inframarginal generators, ones with marginal costs below the market price, is also expensive. If a cheap generator has been backed down slightly from full output and other generator has been asked to provide the backdown quantity, due to reason like too little spin available from a marginal or extra-marginal generator, the cost of providing spin will go up.

It is because marginal cost of operating generator may be less than the competitive price as compared to the one which has been asked to spin. This is typically the case when the market price is above the variable cost of most generating capacity.

Ancillary services market

Power is the primary service but six ancillary services are needed to ensure reliable, high-quality power, efficiently produced. Of the six ancillary services system operator directly

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provides transmission security and trade enforcement and to some extent economic dispatch. The other services, balancing, voltage stability, and black-start capability can be purchased from competitive market.

The system operator keeps the system in balance by keeping the supply equal to demand (consumption). As many as five markets are required to accomplish this : one for 'regulation' which works minute to minute and other four to handle larger deviations and emergencies.

Ancillary services benefit the entire market and are either public goods or have large external effects. Consequently, all the markets have a fully regulated demand side, but some can be regulated on supply side. The system operator service, which coordinates these markets and provides the regulated demand for ancillary services, is a natural monopoly service and can be provided for by a nonprofit or for-profit entity.

To supply balancing services the system operator can purchase the necessary services in a market and assign the cost to either loads or generators on pro rata basis, or it can assign each supplier a fraction of the physical requirement. The later approach is called 'self-providing' and is less regulated one.

Frequency stability cannot be provided by individual system operator, but each is required to balance the real power flow in its control area taking into account a frequency correction. When every system provides this balancing service, they collectively provide frequency stability.

Voltage support is provided passively by capacitor banks and actively by generators. Provision is by the supply of 'reactive' power which is difficult to transmit. This makes it difficult to purchase under competitive conditions, but long-term contracts that permit competition through entry should be helpful.

Transmission security can be provided initially through the control of transmission rights or operation of day-ahead energy markets with locational prices. In real time, a locational balancing market is be used.

Economic dispatch refers to using the right generators in the right amounts at right times in order to minimise the total cost of production. This service is provided by scheduling and dispatch services.

Three basic approaches are used to keep the system balance. Small random fluctuations are handled by 'regulation,' which utilises generators that receive a control signal directly from the system. Predictable daily fluctuations like 'morning ramp' are handled by scheduling generation and in unregulated system, by the balancing market. Unexpected generation and transmission outages are handled by operating reserves of various types starting with 10-minute spinning reserves.

Regulation and operating reserves are generally purchased by the system operator in the market. Tracking the more predictable and larger-scale fluctuations in demand can best be handled by a DA market, on hour-ahead basis and an RT market.

The system operator can purchase long-term contracts for the provision of reactive power. Transmission security service is provided by the system operator by selling transmission rights or by controlling the acceptance of energy bids in a DA auction. For economic dispatch 3 basis approaches are used.

1. Bilateral trading
2. A centralised DA power exchange
3. A centralised DA poer pool

Under the bilateral trading arrangement suppliers and power traders ensure economic dispatch. Under the centralised DA power exchange appraoch the system operator helps by running a DA exchange.

The exchange provides a public price which is either used by the exchange to select the generators that should start up or could be used by suppliers to self-select during several rounds of bidding.

In the centralised power pool approach power pool would require generators to submit bids and the system operator would optimize the dispatch using all available bid information. That optimisation would be used to control the actual dispatch through prices and start-up insurance.

Transmission rights market

The impact of transmission-price risk on the market are reduced by making use of financial transmission rights and physical transmission rights. The financial transmission right pays to transmission line owner the RT cost of transmission on a given path, while the physical transmission right gives its owner the right to use the path. Both types of rights make good hedges.

If a 200 MW trade from P to Q is accompained by a matching financial right, it can proceed with confidence that its transmission costs will be paid in full. All risk is eliminated. If the same trade is accompained by matching physical right, the trade is permitted to execute without charge.

Conclusion

For providing power to consumers at competitive prices through a transparent and reliable mechanism, various steps have been taken right from unbundling of vettically integrated utlitties to creation of markets for providing various services through healthy competition. These markets provide services through three main trading arrangements viz bilateral, pool, exchange. It is expected that these arrangements would ultimately lead towards discovery of price as well as clearing of the market through healthy competition.

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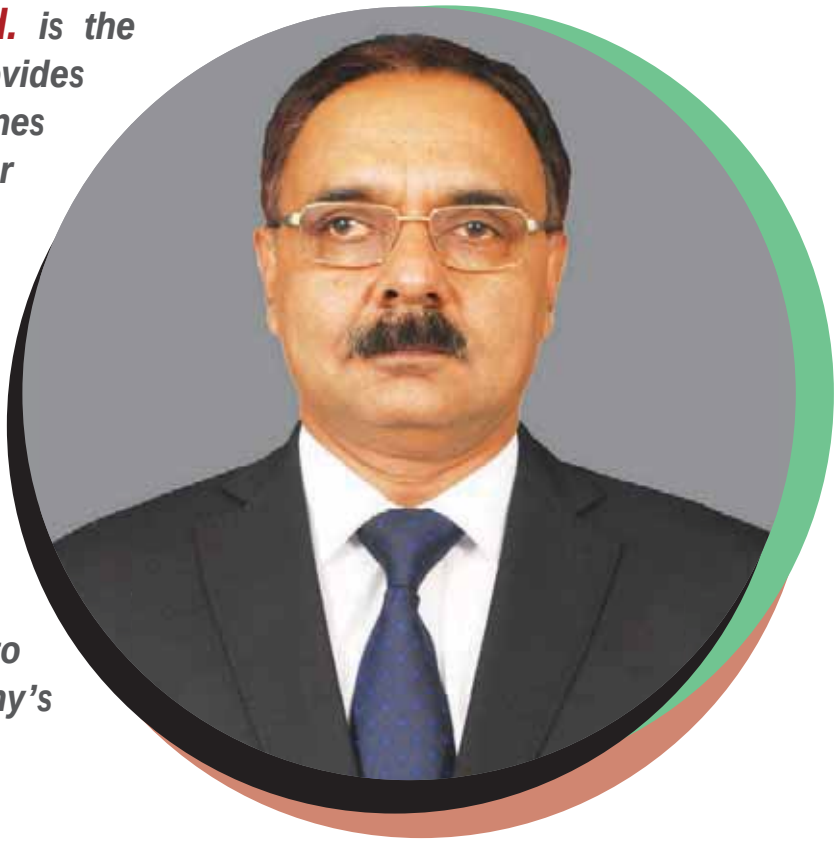

Q

How are the demands for rotating machines and their control systems increasing in India?

A

WEG in India is manufacturing larger power rotating machines mainly above 2 MW, Synchronous and Induction both. The demand for these machines have not really grown the way it was expected in past few years.

In some segments the demands have gone up by about 5 to 10% but in others the growth is very marginal. Yes, some positive indications are there, and we are optimistic about the same and hope 2016 will be better.

Irrigation sector showed some improvements lately with some states reinforcing their commitment to optimise water resources, where WEG has a significant presence. But other sectors like Oil and Gas, Power and Steel have shown a dismal growth. Also, sectors; such as Hydro generation, Turbo; have shown growth of about 10% – because of indirect exports as OEMs have started focusing on external markets – and products manufactured in India with global technology tie-ups have better acceptance than before. Overall the situation looks optimistic and with 'Made in India initiative' the trend looks promising for export.

As far as control systems are concerned, with focus on optimising operating efficiency and better utilisation of electrical energy and other resources – the requirement of 'drives' and other control systems is increasing day by day with a robust growth potential. For larger machines though the cost of drives is a deterrent.

Q

What are the emerging priorities as far as the sourcing of these devices is concerned?

A

The emerging priorities not exactly is in sourcing, I would say but is in competitive manufacturing. It is to wade through the competition within India and that too specifically from the Chinese manufacturers – who are walking in and trying to establish into the market aggressively.

With the world economy in subdued state and Indian market not opening up to the expectations – and on the other hand surplus capacity available in India, the challenge is to optimise costs and stay ahead of the competition, the challenge is to innovate and make globally acceptable products, which will boost the 'Made in India' initiative for a sustainable growth.

Q

Are you manufacturing all the products and their components in-house?

A

WEG in India is one of the most vertically backward integrated facility for Rotating machines. Like its parent company in Brazil, where even the wood for packing cases is produced in its own forest, WEG India has fully self-contained facility in Hosur, Tamil Nadu, where from sheet metal cutting, fabrication and machining to testing and final painting, packing is done in-house.

The most critical of all even stampings are punched in-house. With well-trained manpower and large CNC machines for various machining operations, the state-of-the-art facility is equipped to cater to any component manufacturing and process requirements to produce large rotating machines.

This 100% in-house manufacture facilitates better process and quality control and helps WEG drive towards 'Total Customer satisfaction.'

Q

What kind of solutions do you provide including the post-sales services?

A

WEG has a well-established post sales and service department with highly trained team poised to attend any service within India in 48 hrs within India – duly supported by authorized service centres spread across the country and other parts of the globe for various other needs. WEG India service team is also providing service outside India to all South Asian countries, South Africa, Russia and Gulf region. Being a large machine manufacturer, WEG India service team also provides commissioning services to all its clients as and when desired.

With about 40% of its produce being exported, WEG in India with support from its parent in Brazil is best equipped to design and manufacture Rotating machines for various applications...

Q

Which are the major sectors where WEG Industries (India) finds most of its customers?

A

In India, Irrigation, Power and Steel are the major sectors where WEG has a significant presence.

WEG in India is predominantly very active in irrigation sector and has one of the largest population of synchronous machines in southern region. Almost 250 plus very large machines have been manufactured and supplied to various irrigation projects.

Globally, WEG Industries (India) has significant presence in Oil & Gas and Mining Segment, as well. WEG has also created a decent footprint in Hydro-generation and Turbo generation segment supplying generators to various OEMs for the domestic and international markets.

Q

With the changing scenario in the electrical sector, what are the new potential segments for you?

A

With the changing scenario in electrical sector, the potential segment will be Power and Steel, Oil and Gas, Sugar and Municipal water resources. The thrust will also be on exports in select markets for Hydro and Turbo generators. Machines in Nuclear power sector is also a segment that we are looking into.

Q

Have you taken any specific measure to reduce your carbon footprint?

A

WEG globally as well in India is an ardent promoter of carbon footprint reduction initiatives. As I told you earlier, WEG Brazil has its own forest for packing wood. To contain forest cover erosion, WEG plants their own trees as replenishment. Similar initiatives are taken in WEG India to reduce greenhouse emission. Some of the initiatives are recycling sewage and effluent waste water for gardening, rain water harvesting, replacing conventional CFLs with LED, continually improving and conserving electrical energy through various projects, waste segregation, recyclable packing material plus other initiatives to reduce consumption of hydraulic oil, coolants and other lubricants.

Q

What would you like to communicate to your potential customers?

A

We would like to communicate to our potential customers that WEG in India has set up a state-of-the-art facility, a facility to be proud of to cater to domestic and international customers, wherein the machines are truly made to global standards.

With world-class manufacturing processes and machines, a dedicated global design centre, an enviable talent pool of human resource and a robust after sales service support – we commit to deliver quality machines with a desire to move from Total customer satisfaction to Customer delight.

With about 40% of its produce being exported, WEG in India with support from its parent in Brazil is best equipped to design and manufacture rotating machines for various applications, and can supply and support in commissioning rotating machines anywhere across the world through its 50 plus branches and offices spread all over the world.

WEG India is committed not to just make machines but make Good reliable machines – and offer them at competitive prices. WEG Industries (India) has international statutory certifications required for global projects.

HV & MV Motors and Generators

WEG Industries (India) Private Limited

ELECRAMA-2016
THE WORLD ELECTRICITY FORUM
13-17 FEBRUARY 2016, BIEC, BENGALURU, INDIA

VISIT US AT ELECRAMA

STALL NO: H1 B2 • HALL NO: 1A

WEG India, Hosur, Tamil Nadu

Certifications:

ISO 9001:2008, ISO 14001:2004, OHSAS 18001
CSA - General Location and Division 2,
ATEX - Zone 2, IECEX - Z one 1 and Zone 2
CCOE - Zone 1 and Zone 2

Our Product Range

Type	Maximum Range
Induction Motors - Squirrel Cage	50 MW
Induction Motors - Slip Ring	50 MW
Synchronous Motors	50 MW
Hydro Generators	50 MVA
Turbo Generators	62.5 MVA

Segment	Why WEG
Lift Irrigation & Water Supply	High Quality Products
Power	Global Accreditations
Steel	Best Performance
Cement	Wide Range
Petro-Chemicals	High Efficiency
Sugar & Many More	World Wide Approval

WEG Motors

Slip Ring Induction Motor

Squirrel Cage Induction Motor

Squirrel Cage Induction Motor

Synchronous Motor - Vertical

WEG Generators

Hydro-generator - Horizontal

Hydro-generator - Vertical

Hydro-generator - Vertical

Turbo-generator

H.Q BRAZIL: WEG EQUIPAMENTOS ELETRICOS S.A
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Jaraguá do Sul - SC - Brazil

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Phase II, Morganapalli Village, Hosur, Tamil Nadu, India,
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Tel.: +91 80-4128 2006/2007, Fax.: +91 80-2336 7624
E-mail: info-in@weg.net

India Leaps Forward To The Uncharted Territory

Solar thermal plants that have storage capacities can drastically improve both the economics and the dispatchability of solar electricity...

Recent events in the renewable energy sector demonstrates Government of India's determination to install 175 Gigawatt of renewable energy capacity in the country by 2022, of which solar energy alone is nearly 100 GW followed by wind energy of 60 GW (see Table- 3). Of the total 100 GW capacity of solar power, 20 GW will come from solar park and 40 GW each from rooftop and distributed generation projects. Govt has declared 55 cities as solar cities in India; Maharastra is having higest number of cities 6.

Currently India has installed capacity of 275.911 Gigawatt comprising of thermal 191.664 GW, Nuclear 5.780 GW, Hydro 41.997 GW and Res 36.470 GW. If we do not include Hydel projects, share of renewable capacity is 13.22 of the total ; inclusion of hydel will take it to 28.44% This installed capacity is divided among state sector as 96.015 GW; central sector 73.671 GW and private sector 106.226 GW. Generation of power has achieved a growth rate of 8.43%, which increased from 967.15 Billion Units in 2013-14 to 1058.673 Billion units in 2014-15. In the renewable sector, capacity wind energy is 23.762 GW; Biomass/Cogeneration Power 4.419GW; Solar 4.060 GW; Small hydro 4.102 GW and Waste to energy 0.127 GW.

After Sri Narendra Modi took over the responsibility to lead the country, with his experience in mind of solar park in Charanka village in Gujarat, he wanted to address a few issues of India's power sector by giving boosts to solar power which is now dream of the country for 24x7 power for all. In addition, he also wants clean fuel should drive India's progress in the coming days.

This dream, to set up solar energy capacity around 25 times of the existing capacity in the next seven years by 2022, is unpreedented in the history of the world.

India is poised to make an evolutionary change in the areas of generation and consumption of non-conventional energy and solar power will be the pivot. EY's Renewable Energy Country Attractiveness Index (RECAI) has ranked India at 3rd place in the current year. India has advanced a notch over Germany and US has surpassed China this year to be ranked as first. The comment of the report about India was : A plethora of federal and state auctions are already underway as part of the Government's push to deploy 100GW and 60GW of solar and wind respectively by 2022. At least 20GW of solar is due to be procured under the country's long standing National Solar Mission, though numerous more state-based tender programs are expected over the next 5 years.

Solar and Renewable Energy

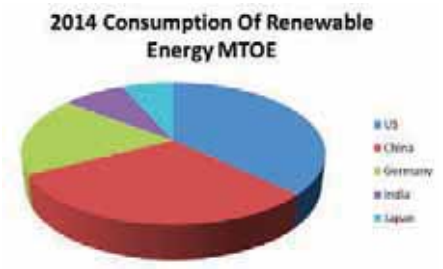
The country is endowed with a very vast solar energy potential. Most parts of the country have about 300 sunny days. Solar energy can be utilised through solar photovoltaic technology, which enables direct conversion of sunlight into energy and solar thermal technologies. It is important to understand that solar thermal technology is not the same as solar panel, or photovoltaic, technology. Solar thermal electric energy generation concentrates the light from the sun to create heat, and that heat is used to run a heat engine, which turns a generator to make electricity. The working fluid that is heated by the concentrated sunlight can be a liquid or a gas. Different working fluids include water, oil, salts, air, nitrogen, helium, etc. Different engine types include steam engines, gas turbines, Stirling engines, etc. All of these engines can be quite efficient, often between 30% and 40% and are capable of producing 10's to 100's of megawatts of power. Photovoltaic, or PV energy conversion, on the other hand, directly converts the sun's light into electricity. This means that solar panels are only effective during daylight hours because storing electricity is not a particularly efficient process. Heat storage is a far easier and efficient method, which is what makes solar thermal so attractive for large-scale energy production. Heat can be stored during the day and then converted into electricity at night. Solar thermal plants that have storage capacities can drastically improve both the economics and the dispatchability of solar electricity. Over the last three decades, several solar energy-based systems and devices have been developed and deployed in India, which are successfully providing energy solutions for lighting, cooking, water heating, air heating, drawing and electricity generation. The research and development in this sector have also helped in better efficiency, affordability and quality of the products. As a result many solar energy systems and devices are commercially available with affordable cost in the market.

Recent Developments

The scaled up installation targets for solar power and the intent of creating conducive manufacturing environment under the 'Make in India' initiative has opened up immense opportunities for investment in RE in India. In first such Global Investors Meet & Expo in February, 2015, nearly 3,000 delegates including representatives from 41 countries participated in this 3-day event. Key among these participants included ministerial delegations from Germany and the UK, industry delegations from several countries including China and about 200 global investors. Over 200

Current Rank	Previous Rank	Market	RECAI Score	Technology Specific Indices Ranking							
				Onshore Wind	Offshore Wind	Solar PV	Solar CSP	Biomass	Geo thermal	Hydro	Marine
1	2	US	75.0	2	8	1	1	2	2	3	8
2	1	China	74.2	1	2	2	6	1	12	1	16
3	4	India	65.9	3	16	3	5	15	14	9	11
4	3	Germany	65.7	6	4	6	27	8	13	15	27
5	5	Japan	63.2	18	9	5	26	4	4	4	10

Table –1: EY's Renewable Energy Country Attractiveness Index...



speakers including more than 40 international speakers shared their perspectives on various aspects of renewable energy. The event concluded with 387 global and domestic investors/ project developers/ companies/ PSUs submitting 'Green Energy Commitment' letters to the Government of India to develop and set up RE projects aggregating to more than 272 GW surpassing our initial target of 100 GW. Similarly, 30 major Banks/ financial institutions committed to finance over 70GW of renewable energy projects. 17 companies have submitted Green Energy Commitment letters for setting up manufacturing facilities aggregating to more than 62 GW.

Tariff Phenomenon

One of the important constraints was high unit cost of renewable energy compared to conventional sources like coal or gas. Government aims to boost solar power capacity 30 times in seven years. If one resorts to some basic statistics on the renewable energy sector especially solar sector, there is reason to be jubilant on the various development taking place in the sector.

Tariff for solar power, so far perceived as constraint seems to be getting over. In a recent tender for 500 megawatts capacity offered under the national solar mission in Andhra Pradesh, investor bid for a tariff of Rs. 5.00 pwer kilo watt hour tariff (kWh). In response to tenders for setting up 10 projects of 50 MW each bids totaling around 5,000 MW has been received. These bids were submitted for solar photovoltaiv projects under the new phase of NSM. According to India Ratings and Research, as Mint daily has quoted in its 16th September, 2015 edition that solar tariff has declined in Nehru National Solar Mission phase I batch II from Rs 10.95 to Rs12.76 per kWh in 2011 to Rs 7.49 to Rs 9.44 per kWh in 2012. In pahase II batch I when viability gap funding was introduced, the tariff further declined to Rs 5.45 per kWh.

Below presented (see Table -2) regional distribution of different renewable energy soucres the country wants to achieve.

	Solar Power (MW)	Wind (MW)	SHP (MW)	Biomass Power (MW)
Northern	31120	8600	2450	4149
Western	28410	22600	125	2875
Southern	26531	28200	1675	2612
Eastern	12237		135	244
North Eastern	1205		615	
Island	31	600		120
All India	99533	60000	5000	10000

Table –2 : Tentative Region-wise break-up of Renewable Power target to be achieved by the year 2022...

Global Scenario

World energy consumption has increased from 10919.6 MTOE in 2004 to 12928.4 MTOE in 2014 (see Table 3). During the same period, renewable energy consumption has increased from 75.7 MTOE to 316.9 MTOE. The CAGR (given in the last column) of renewable energy consumption growth is much higher during this period than the growth of world's primary energy consumption. Further growth of consumption of renewable energy was much higher than world average during this period in the Asia Pacific region; and consumption in India is higher than Asia Pacific region also. China has however surpassed India's growth in renewable consumption during the same period.

Conclusion

Our sun produces 400,000,000,000,000,000,000,000,000 watts of energy every second and the belief is that it will last for another 5 billion years. The United States reached peak oil production in 1970, and there is no telling when global oil production will peak, but it is accepted that when it is gone the party is over.

The sun, however, is the most reliable and abundant source of energy. Given the current state of focused approach, initiative taken by the government in the areas of renewable energy in general and solar energy in particular, successful implementation of renewable projects will not only change the energy mix in the country and dependence on fossil fuel would reduce drastically.

It is not an easy task but India is determined to make it happen.

	2004	2014	CAGR 2004-14
World Primary Energy Consumption	10556.6	12928.4	1.70
World Renewable Energy Consumption	75.7	316.9	14.08
Asia Pacific	15.1	94.2	18.54
US	19.6	65.0	12.74
China	1.1	53.1	47.35
Germany	8.3	31.7	14.33
India	2.3	13.9	19.70
Japan	6.5	11.6	5.96

Table-3 : Consumption of Primary Energy and Renewable Energy (MTOE)...

Dr. Ahindra Chakrabarti
Professor, Great Lakes Institute of Management

LARSEN & TOUBRO

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- 11 kV VCB Outdoor Kiosks
- 22 & 33 kV VCB / GIS Panels
- CRP Panels

L.T. PANEL

- PCC
- MCC
- APFC
- PDB
- S.S. Panel
- Synchronizing Panel
- VFD & Automation Panels
- Instrument Panel

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info.vidhyutpower@gmail.com

We're Great At Imitating But Poor At Innovating

(L2R) Dr. R. K Pachauri, Prem Shankar Jha, Dr. Chandan Mitra and others...

Contrary to the popular belief that fossil fuel is indispensible; there are alternative clean, low-cost technologies available that can help the world give up fossil fuels...

The Energy and Resources Institute is an independent, not-for-profit research institute focused on energy, environment, and sustainable development and devoted to efficient and sustainable use of natural resources. At the 14th Darbari Seth Memorial Lecture to commemorate the Foundation Day of TERI; Dr. Chandan Mitra, MP (Rajya Sabha), Editor and MD, The Pioneer; who presided over the lecture said that climate change can be compared to the threat of terrorism, with no imminent solutions. He highlighted the recent Chennai disaster caused by extreme rainfall and a similar experience in Mumbai a few years ago. He said these are evident examples of climate change, along with other factors causing these incidents.

Indicating the critical times that we are in, he said that 'drastic measures' need to be taken and the introduction of the new proposed policy of Delhi government of plying odd and even numbered cars on alternate days, is one such measure. The success of this measure is yet to be determined, but the necessity of dealing with climate change and pollution has 'jolted us out of [our] cocoon of complacency.'

Addressing the gathering, Dr Mitra said that while climate change is a challenge it also provides an opportunity 'to think innovatively.' Referring to the limited success of primitive solar cookers, and the much applauded Solar Alliance announced by Prime Minister Modi, he said that innovation will improve itself but an initiation of that process is critical at this juncture.

Prem Shankar Jha, Senior Journalist & Author, the guest speaker at the lecture said that Paris talks may fail, as despite the current targets set by developing countries, absolute emissions will continue to rise at an unprecedented rate.

However, taking forward Dr Mitra's point on opportunity and innovation, Jha said that contrary to the popular belief that fossil fuel is indispensible; there are alternative clean, low-cost technologies available that can help the world give up fossil fuels. Jha was delivering a lecture on "Climate Change is an Opportunity and not a Threat."

He said, "Two of these technologies for harnessing solar power and biomass have over the last 40 years matured to a point where they can reliably produce both electricity and transport fuels, cheaply enough to compete with existing sources and therefore to be profitable to private investors." These are concentrated solar thermal energy and transport fuels by gasifying biomass, not fermenting biomass.

He cited several instances in India where this is attainable – the solar reserve in Rajasthan earmarked by the State Government that has a 350,000 MW of generating capacity.

He said, "This is double the present coal-fired capacity of the nation. If the people who live on this barren land today are awarded a fraction of one percent of its annual revenues – they will become the richest people in the country."

Talking about the feasibility of biomass in transport fuels, he said that there are even greater benefits of using this technology. It will support the government's 'Swachh Bharat Abhiyan' as garbage, which is the primary input required for this kind of technology, will immediately assume great importance and will disappear off the dumping grounds. Citing another example, he said, "A second immediately available source of biomass is bagasse and sugar cane waste is from the sugar industry, which is in crisis. It can meet 2.5 times of the total transport fuel consumption requirements of India."

"We are great at imitating, but poor at innovating," said Dr Mitra. While he emphasised that 'inculcating scientific temper' by the government is essential at this juncture.

Jha said that "We do not even have the system to identify the technology available abroad. We must be tech-savvy. The difference today, between a nation that fails and the nation that rises to greatness, is going to be in technology." He proposed that governments in India should take the pioneer's risk, which is typically taken by venture capitalists in the West.

On the occasion, TERI's Director General, Dr. R. K Pachauri, said, "Mr Darbari Seth's legacy inspires all staff at TERI at every stage of our exciting journey. There is no more compelling an example for TERIers to draw encouragement from than the ideals, accomplishments and actions of our illustrious founder. On every Darbari Seth Memorial Lecture, we not only benefit from the knowledge and wisdom imparted in this session, but also revive and strengthen the pride and confidence that we derive from Mr Seth's life. His life was truly his message."

The event also marked the felicitation of 22 employees who had completed 20 years of service at TERI. It also marked the announcement of the 'Roll of Honour' for 21 research professionals for exemplary contribution to the organisation in their respective fields. EI

Lowering Energy Intensity Makes Country Economically Strong

India faces an enormous challenge if it is to meet her energy requirement over the coming 25 years and support a growth rate of eight percent...

Energy intensity is the energy required for making a product and also for extending services in any country, around the globe. Lowering energy intensity is the main objective of the developed and developing countries.

Energy efficiency and energy conservation are required for all the countries for better environment of the world. Energy poverty for one billion people of the globe has to be eradicated quickly.

Recommendations of Integrated Energy Policy

India faces an enormous challenge if it is to meet her energy requirement over the coming 25 years and support a growth rate of 8 percent.

This challenge can be met with a coherent approach, which includes development of all available energy resources. The main area of action, for which detailed policy recommendations have been made, is as follows.

Reducing energy requirements through energy efficiency and conservation:

- Augmenting energy resources and supply
- Rationalization of fuel prices to mimic free market prices that promote efficient fuel choice a substitution
- Promoting coal imports
- Accelerating power sector reforms
- Cutting cost of power

Encouraging renewable and local solutions:

- Enhancing energy security
- Promoting and focusing energy R&D
- Promoting household energy security, gender equity and empowerment through targeted entitlements for the poor
- Creating an enabling environment and regulatory oversight for competitive efficiency.

Energy intensity indicators for the years 2003, 06, 09 & 2012 are given below

Energy Intensity for U.S., has come down from 0.22 Kgoe (Kilogram Oil Equivalent) / $ GDP in PPP (Purchasing Power Parity) Terms for 2003 to 0.15 Kgoe / $GDP in PPP Terms for the year 2012. There's a very good reduction by observing energy conservation measures very effectively. In case of India Energy Intensity has come down from 0.16 Kgoe / $ GDP in PPP Terms for 2003 to 0.14 Kgoe / $ GDP in PPP terms for the year 2012. This indicates Energy Conservation measures in India are at very slow level in the last 10 years compared to U.S. The excess energy is calculated taking the difference between Denmark and India and assertaining excess energy consumption in Million Ton Oil Equivalent.

Taking the Barrel Oil value at $100 in 2012 on an average and $ Value at Rs. 60 for a population of 120 cr has been calculated. China is earning only $2.81 for every unit of electricity in 2012 against Mexico at $6.39

For 2006, excess energy	=114*	= Rs. 2,55,424 cr.
Energy saving,	20	= Rs. 48,991 cr.
For 2007, Excess energy	= 134*	= Rs. 3,20,929 cr.
Energy saving	25	= Rs. 64,239 cr.
For 2008, excess energy	= 141*	= Rs. 4,62,730 cr.
Energy saving	16	= Rs. 39,782 cr.
For 2009, Excess energy	= 149*	= Rs. 2,87,271 cr.
energy spent more	- 19	= Rs. 41,519 cr.
For 2010, Excess energy	= 169	= Rs. 4,27,661 cr.
Energy saving	= 27	= Rs. 68,324 cr.
For 2011, Excess energy	= 200	= Rs. 8.00,000 cr.
For 2012, Excess energy	= 244	= Rs. 10,74,600 cr.
*Mtoe (Million Tonne Oil Equivalent)		

Excess Energy Spent in India 2006 on words, w.r.t. to Denmark

Mexico	6.39 $	$1571 B / 246 B kWh
INDONESIA	5.80 $	$ 1049 Bil / 181 B kWh
U.K.	5.96 $	$ 2069 Bil / 347 B kWh
INDIA	5.92 $	$ 5567 Bil / 940 B kWh
U.S.	3.50 $	$14232 B / 4069 B kWh
CHINA	2.81 $	$ 13289 B / 4737 B kWh
World	3.96 $	$ 82901 B / 20915 B kWh

Earnings For 1 Unit (kwh) In G-20 Countries - 2012 Ref. www.iea.org

Sl. No.	Country	GDP (PPP) Bil 2005 US $	TPES Mtoe	Elec. BU	CO2 MT.	Pop. Mil
1	China	13289	2909	4737	8251	1358
2	Australia	872	128	236	386	23
3	Brazil	2532	281	498	440	198
4	Denmark *	180	17	33	37	5.59
5	Germany	2851	312	584	755	82
6	India	5567	788	940	1954	1236
7	Indonesia	1048	213	181	435	246
8	Canada	1291	251	542	533	34
9	S-Arabia	1280	200	247	458	28
10	Russian Fed	2178	756	947	1659	143
11	U.K.	2068	192	347	457	63
12	U.S.	14231	2140	4069	5074	314
13	Japan	3993	452	988	1223	127
14	France	1959	252	482	333	65
15	Mexico	1571	188	245	435	117
16	Argentina	658	80	124	188	41
17	S-Korea	1400	263	517	593	50
18	S-Africa	558	140	230	376	52
19	Turkey	1015	116	206	302	74
20	Italy	1605	158	321	374	60
	World	72901	13371	20915	31734	7037

SELECTED INDICATOR FOR 2012 www.iea.org

** Not a G-20 Country*

Sl. No.	Country	TPES/GDP Kgoe/$ in PPP 2003	TPES/GDP Kgoe/$ in PPP 2006	TPES/GDP Kgoe/$ in PPP 2009	TPES/GDP Kgoe/$ in PPP 2012
1.	China	0.225	0.216	0.183	0.2189
2	Australia	0.199	0.194	0.186	0.1468
3	Brazil	0.149	0.152	0.145	0.1113
4	Denmark	0.133	0.123	0.115	0.0960
5	Germany	0.167	0.167	0.142	0.1104
6	India	0.161	0.154	0.148	0.1416
7	Indonesia	0.237	0.225	0.215	0.2094
8	Netherlan	0.184	0.157	0.149	0.1286
9	S-Arabia	0.465	0.400	0.424	0.1561
10	Sweden	0.206	0.177	0.158	0.1502
11	U.K.	0.145	0.132	0.1129	0.0928
12	U.S.	0.221	0.206	0.190	0.1504
13	Japan	0.152	0.149	0.139	0.1132
	World	0.2145	0.2039	0.1897	0.1834

ENERGY INTENSITY INDICATORS for YEARS 2003. 06, 09 &12 Ref. www.iea.org

more than double to that of China taking very less energy. The earnings of India also $6 per unit of electricity in that year. A very good sign. This is the minimum data required to make a presentation on any G-20 Country on Energy conservation studies collected from International Energy Agency, Paris websites. This is one of the best websites presenting information on energy – taking the data from World Bank and IMF. The other websites eia.doe.gov (Energy International Administration, Department of Energy, Government of U.S. give more on energy studies.

S Ganapathi
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Utilities Getting Affected By Extreme Weather Events

Findings of a survey presented to key stakeholders during the 21st Conference of the Parties (COP21) by GEI Executive Chair Philippe Joubert...

A recent survey by the Global Electricity Initiative (GEI) of electric power utilities reveals that their CEOs consider a global agreement on GHG emissions vital to their businesses' sustainable success.

The GEI, led by the World Energy Council and the World Business Council for Sustainable Development, aims to enhance electrical utilities' efforts to ensure reliable electricity supply, improve access and mitigate or adapt the impacts of climate change. The utilities participating in the GEI are from countries that together account for more than 80% of global installed generation capacity – and those CEOs having completed the survey come from five continents.

Altogether 94% of CEOs participating in the survey confirmed that their companies are already being affected by extreme weather events. All of them responded that they are regularly consulting and working with governments on the development of energy policies, strategies and regulations.

The survey presented to key stakeholders during the 21st Conference of the Parties (COP21) by GEI Executive Chair Philippe Joubert found that:

- 89% of utility CEOs consider a global agreement on GHG emissions vital to their business sustainable success
- 94% of CEOs say that their companies have recently been affected by extreme weather events
- 40% of utility CEOs need a price over US$100 per tonne CO_2 emissions to make them change their business model
- Nearly two thirds of utility CEOs agree that the CO_2 emissions price should be determined globally and by the market, whereas the other third would prefer a price introduced by mandatory fiscal measures on a national level
- 72% of utility companies have already introduced voluntary measures to limit GHG emissions
- Access and security of supply rank among the highest business priorities
- 63% of utility CEOs say they are planning to participate in COP21, whether directly or indirectly through a representative.

Philippe Joubert, Executive Chair of the Global Electricity Initiative, said, "Utilities consider the introduction of a meaningful agreement on GHG emissions reduction a priority. For them the real price of CO_2 is a fundamental to trigger a shift in utilities' business models. What will be decided at COP21 in Paris will thus be fundamental to the future direction utilities choose."

The great importance electricity utilities attribute to COP21 is also reflected in the preview results of the World Energy Issues Monitor 2016 Report. As it indicates a global climate framework is one of the most critical uncertainties for the participating utilities, in terms of uncertainty and impact, to an even greater extent than for energy leaders at the global level.

Joubert referred to almost three quarters of companies having already introduced voluntary measures to limit GHG emissions. As nearly all utilities indicated they were already being affected by extreme weather, he also highlighted the willingness of utilities to improve infrastructure resilience in implementing adaptation measures and collaborate with governments and the finance sector. EI

Turning Around A Loss Making STEEL PLANT

Steel Plant, WEST INDIES

Iron & Steel Company of Trinidad & Tobago (ISCOTT), a Steel plant belonging to the Govt. of Trinidad & Tobago, West Indies, had become Sick & was undergoing serious financial losses of almost US$100,000 a day, and the local govt. was eagerly looking forward to foreign entrepreneurs to take over the sick plant & operate it. Despite a consortium of German Companies who took over this plant, yet the operations of the Steel Plant (ISCOTT) could not be improved.

The local Electrical power supply company had imposed restrictions on the operation of the Electric Arc Furnaces, four hours in the morning peak period and four hours in the evening peak period. That means, effectively the Electric Arc Furnaces, which were the main steel producing units, were operating for 16 hours only/day. The major issue concerned was the restrictions imposed on the no. of operating hours on the main steel producing units, viz. Electric Arc furnaces, which had made the Steel Plant Sick.

At this point we need to look into why this restriction was imposed by the local electricity supply company.

ISCOTT's Background

Early 1980's the Govt. of Trinidad & Tobago, West Indies, had envisaged to build & operate a large steel complex in Trinidad, to convert Iron ore into finished steel products and export. In view of the local availability of natural gas, the facility envisaged, direct reduction of iron ore into pellets and subsequently converting pellets into steel through Electric Arc Furnaces route, and Rolling Mills into exportable finished products. The melt shop consisted of 2 Nos. 40 MW each Ultra High Power (UHP) Electric Arc Furnaces (EAF) with nominal melting capacity of 90 MT per heat with electrical power being supplied by the local utility company. UHP arc furnaces are large single power consuming loads for any power supply system. When a furnace trips during melting operations a large amount of active power, in this case 40 MW, is thrown 'off' from the grid resulting in power frequency variations. A similar phenomenon will occur during the initial boring stage of the scrap / DRI pellets when the arc power will be fluctuating rapidly. These fluctuations had serious impacts on the stability of the power system, more so during the peak periods.

The local electrical power supply company imposed restrictions on the operation of the Electric Arc Furnaces, 4 hours each in the morning and evening peak periods. The plant was in loss...

Fig (1) shows the plant's electrical layout. The available local electric power was from an isolated weak grid consisting of 365 MW generation capacity, which was not able to cater the envisaged steel plant's power requirements. In view of the large steel complex coming up, the local utility company decided to double its capacity by an addition of 365 MW Gas Turbine Generators.

Operation of Large UHP Electric Arc furnaces call for a grid having a Short Circuit Current (SCC) level of at least 50 to 100 times the total MVA rating of the Electric Arc Furnaces in the plant. Unfortunately, despite doubling the capacity of the power generation, the available SCC on the grid was only around 10 times the furnace capacity, which was very low and the poor response of the gas turbines would not be able to cope up with the fast changing dynamic effects of the arc furnace loads, which would certainly affect other consumers hooked up onto the grid. One solution is to strengthen the SCC capacity of the grid by installing more generators, which calls for a huge capital investment, which the power company cannot justify. The other solution was to limit the operation of EAF's in such a way that at any one point of time only one furnace can be in steel melting operation & another furnace used for only refining process in which case, it would severely affect the productivity of the Steel Plant. Hence, the utility company imposed certain stringent technical requirements to be met by the steel plant in terms of Reactive power demand, Flicker voltage, Power factor, permissible Real power variations, Frequency variations, harmonic Distortions and system unbalanced loads.

Steel plants similar to ISCOTT, are in operation all over the world and they have not encountered such severe restrictions, because these plants are getting power from relatively strong grids. Thus, ISCOTT has become a unique case in view of its weak power grid and had to provide proper compensating equipments to counter the following:

- Poor power factor,
- Unbalanced loading of the phases,
- Harmonics generation,
- Flicker production.
- System frequency variations

As far as the other consumers connected to the grid are concerned, Flicker is the most important disturbance. But utilities which are using Gas Turbines for power generation, large Active Power swings lead to system frequency changes as well as cause mechanical oscillations in the gas turbines. Rest of the problems like poor power factor, unbalanced loading, harmonics & flicker production which are the result of the reactive power interchanges between the furnace and the grid, are taken care of by the use of conventional static VAR equipments (SVC). ISCOTT installed 65 MVAr Static power compensation equipment (SVC) for each of the EAF. Fast acting thyristor switching used in the SVC is able to compensate within the same half cycle, the requirement of the continuously variable reactive power, thus minimising the generation of flicker voltage. Further the SVC provided were able to filter the 2nd, 3rd, 4th, 5th, & 7th harmonic generated during the furnace operation. Similar Steel plants all over the world use SVC as a standard compensating equipment to take care of the above disturbances.

The other critical requirement of the utility was to compensate the sudden shock loadings imposed on the grid, such as Active Power reduction caused by the tripping / switching 'off' of the arc furnaces,

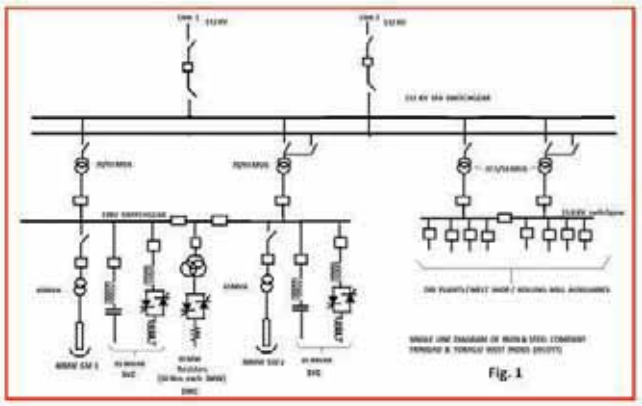

Fig. 1

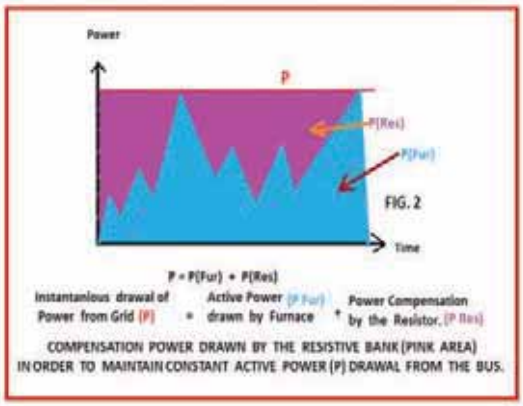

FIG. 2

COMPENSATION POWER DRAWN BY THE RESISTIVE BANK (PINK AREA) IN ORDER TO MAINTAIN CONSTANT ACTIVE POWER (P) DRAWAL FROM THE BUS.

Electrode breakages, scrap collapse during melting, emergency switchings etc., which cause sudden frequency variations beyond the prescribed limit of 0.24 Hz. Load vs Frequency controls or the governors provided for the Generators, were slow in response & could not handle such rapid Active Power (Real) fluctuations of the furnace operation. These sudden real power changes of the furnaces had other detrimental effects such as causing unusual mechanical stresses on the alternator windings, gas turbine blades and gas turbine shafts etc., affecting their lives. To avoid this situation ISCOTT had to think of providing a specially designed control system, which would ensure a constant Real Energy flow of power from the generators and at the same time allow normal operations of the furnaces with rapid real power fluctuations. This is a unique requirement faced by ISCOTT, which other similar steel plants around the world are not facing (due to their strong utility grids from where they get the power).

Static Watt Compensation (SWC)

In order to meet the above requirement of the utility, ISCOTT had approached Siemens Germany, who supplied a specially designed Thyristor controlled "Static Watt Compensator (SWC)" consisting of total 30 MW Resistor Bank, (30MW comprised of ten nos. banks each having a resistor capacity of 3 MW), connected in parallel. (See Fig.1). The function of this static watt controller is to ensure a fairly constant active load on the generator, i.e., if there is a tripping or sudden decrease in the active load of the furnace in any instant, the differential active load required in order to maintain a constant active load on the generator bus bar, is drawn by the thyristor modulated resistor banks instantly, thus the generator bus bar would not see the decrease / sudden changes in the active loads demanded by the furnace. In the event of the furnace tripping, 40 MW of load suddenly goes out on the generator bus bar, which is not desired. At the instant of the furnace switching 'off', the entire 30 MW load in the form of resistor banks will automatically be switched 'on' to the bus instantaneously and over a period, resistor banks in steps of 3 MW each is taken out of the grid, thus ensuring that the load on the generators are gradually reduced without harming the generators or the system frequency.

If the max. real load on the grid is P and the instantaneous drawal of power by the furnace at any instant is say P(Fur) and the instantaneous compensatory power drawn by the resistance bank is, say P(Res), then

P = P(Fur) + P(Res) is the requirement to be met out by the Static Watt Controller (Fig.2). The Thyristor controlled Resistor bank is shown in Fig.3.

With the successful commissioning of the Static Watt Compensation (SWC) specially designed for ISCOTT as well as the Static VAR (SVC) Compensation equipments installed, the much apprehended problems of the weak electricity grid were all overcome and ISCOTT was allowed to operate round the clock.

This was the vital requisite, which LNM (Lakshmi. N. Mittal) was looking for, before deciding to take over this sick Steel Plant in 1989. This was his first acquisition of a sick steel plant.

The plant operating round the clock increased the productivity of the plant. Adopting innovative practices and cutting edge technology, LNM managed to turn ISCOTT into profitability in the very first year of its takeover. Turning around ISCOTT, a sick steel plant, in to profitability in the very first year, also became a turning point in the career of LNM. Looking at his success, the Mexican Govt. handed over its sick steel plant (Sicartsa II) in 1991.

Thereafter, series of acquisition of 'Sick Steel Plants' all over the world and adopting 'Thinking out of the box'-strategy, coupled with business acumen and excellent financial management, supported by his own hand picked management team helped him in forging his own Steel Empire. LNM had a clear vision that building a new steel plant from green field would not only involve huge capital, but also the gestation period, which is around 7/8 years for the plant to stabilise, would also cost additionally. The govts of sick steel plants were eager to handover a ready plant with experienced manpower on a platter at prices sought by him. That is why LNM chose brown field strategy over green field strategy, and the results were spectacular. Today, he is the world's largest steel producer.

C V Govinda Raju
(Former) Executive Director, Karnataka Vidyuth Karkhane Ltd.,
(Former) President, ISPAT group of Companies.

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Electrical Steel Market To Witness Growth Up To 2025

Looking forward towards region, Asia Pacific, Eastern Europe and Latin America are expected to be the growth engines of global electrical steel market in the near future...

According to a report by Future Market Insight (FMI), the global electrical steel market is expected to register a favourable growth for the period 2015 to 2025. Depending on geographic regions, the global electrical steel market is segmented into seven key regions: North America, Latin America, Eastern Europe, Western Europe, Asia-Pacific, Japan, and Middle East & Africa.

Looking forward towards region, Asia Pacific, Eastern Europe and Latin America are expected to be the growth engines of global electrical steel market in the near future. Asia-Pacific is anticipated to dominate the global electrical steel market. The key countries mentioned in the Asia-Pacific region are India, South Korea, and China as an outcome of growth in infrastructure sectors. Also, the region is expected to generate higher revenue as compared to North America. In Latin America, Brazil is expected to be the largest opportunity in terms of revenue of the global electrical steel market. The remaining regions are expected to grow at a steady rate over the forecast period.

Electrical steel, also known as transformer steel or silicon electrical steel is a specialty steel tailored to produce assured magnetic properties such as low core loss along with high permeability. It has specific proportion of silicon that is responsible for its unique properties. Electrical steel material is generally manufactured in the form of cold-rolled strips (less than 2mm thick), these strips are called lamination (finished shape) when stacked together to form a core. Once gathered, they form the laminated cores of transformers and rotor parts of electric motors.

Looking ahead, electrical steel is considered as one of the most valuable magnetic materials available today. Of all the soft magnetic core materials, electrical steel is used more. It is ideal for high efficiency transformers, generators, motors, small transformers and ballasts. Besides, increasing demand from the power sector is escalating the growth in the global electrical steel market. The global electrical steel is predicted to expand at an encouraging CAGR during the forecast period (2015-2025).

Some of the key market participants in global electrical steel market are ThyssenKrupp, ArcelorMittal, Posco, Nippon Steel, China Steel Corporation, Tata Steel, JFE Holdings, AK Steel, ATI, Tenaris, Baosteel, Anshan Iron & Steel Group, Wuhan Iron & Steel Group, among many others. EI

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Robotics in India

Research into the functionality and potential uses of robots did not grow substantially until the 20th century. Since the turn of the 20th century, research into the functionality and potential uses of robots has seen a lot of actions...

Robot means a mechanical device, which performs all or more works for human with maximum efficiency and low cost even in hostile environments under the command of the masters. Living organism on the earth other than trees are the best examples of natural robots. Human and animals also act as robots throughout their life with a brain control whose activities are governed by many seen and unseen forces around.

There are examples that human or animals perform activities very much under the command of their masters e.g., terrorists or their sleeping cells, and many more such activities which we perform on daily basis on others' commands. The difference between manmade robots and natural robots is that they do whatever they are made to do without any complaint, with desired accuracy,
honesty, low cost, punctuality, less time consuming, in hostile environments and untiringly. There are many examples in Indian mythology highlighting the existence of human or animal robots from classical times.

In Ramayana, acting of Maricha as a deer on the orders of King Ravna to attract the attention of Lord Rama is one of many such examples – where human has acted on the command of their master's even by changing disguise.

Therefore, today's robotics is an advanced inspiration by nature contributing to the field of robotics to bio-inspired robotics.

Scientifically, robotics is a mix of many engineering disciplines like mechanical engineering, electrical engineering, electronics and computer science that deals with the design, construction, operation, and application of robots, as well as computer systems for their control, sensory feedback, and information processing. These technologies deal with automated machines that can take the place of human in dangerous environments or manufacturing processes, or resemble human in appearance, behaviour, and/or cognition. Robots can replace human to do any monotonous, dirty or dangerous tasks in any industry. The concept of creating machines that can operate autonomously dates back to classical times, but research into the functionality and potential uses of robots did not grow substantially until the 20th century. Since the turn of the 20th century, research into the functionality and potential uses of robots has seen a lot of actions. Throughout history, it has been frequently assumed that robots will one day be able to mimic human behaviour and manage tasks in a human-like fashion. Today, robotics is a rapidly growing field, as technological advances continue; researching, designing, and building new robots serve various practical purposes, whether domestically, commercially, or militarily. Many robots do jobs that are hazardous to people such as defusing bombs, mines and exploring shipwrecks.

Robots can also be effective in areas where there are skill shortages. Significant application opportunities exist in the emerging service robotics sectors, whose products will impact on our everyday lives by contributing high-value-added services and providing safer working conditions. In the fields of medical diagnosis, therapy and rehabilitation, robot-based systems will assist health workers performing novel procedures, thereby increasing their effectiveness. The aging population will drive the application of robotic technologies that improve the quality of life

and assist people to live longer and more comfortably in their own homes. Robotic technologies, such as navigation, motion control and sensing and cognition, will enable a broad range of innovations in today's products resulting, for example, in more flexible, environmentally friendly transport systems and intelligent household appliances. Eventually, these technologies will reach levels of sophistication, which will enable widespread use of intelligent robots and robotic devices to perform a variety of tasks in homes, offices and public places. Driven by the increased security needs of Indian citizens and the higher workload resulting from extended monitoring of our everyday environments, robots already play an increasing role in the security market. Tele-operated mobile systems are now being used in a number of security applications including bomb disposal.

In the future, robots will autonomously assist with the protection of offices and homes, and will help secure borders or monitor the environment in both routine and emergency operations. In space, the use of robots has become almost obligatory.

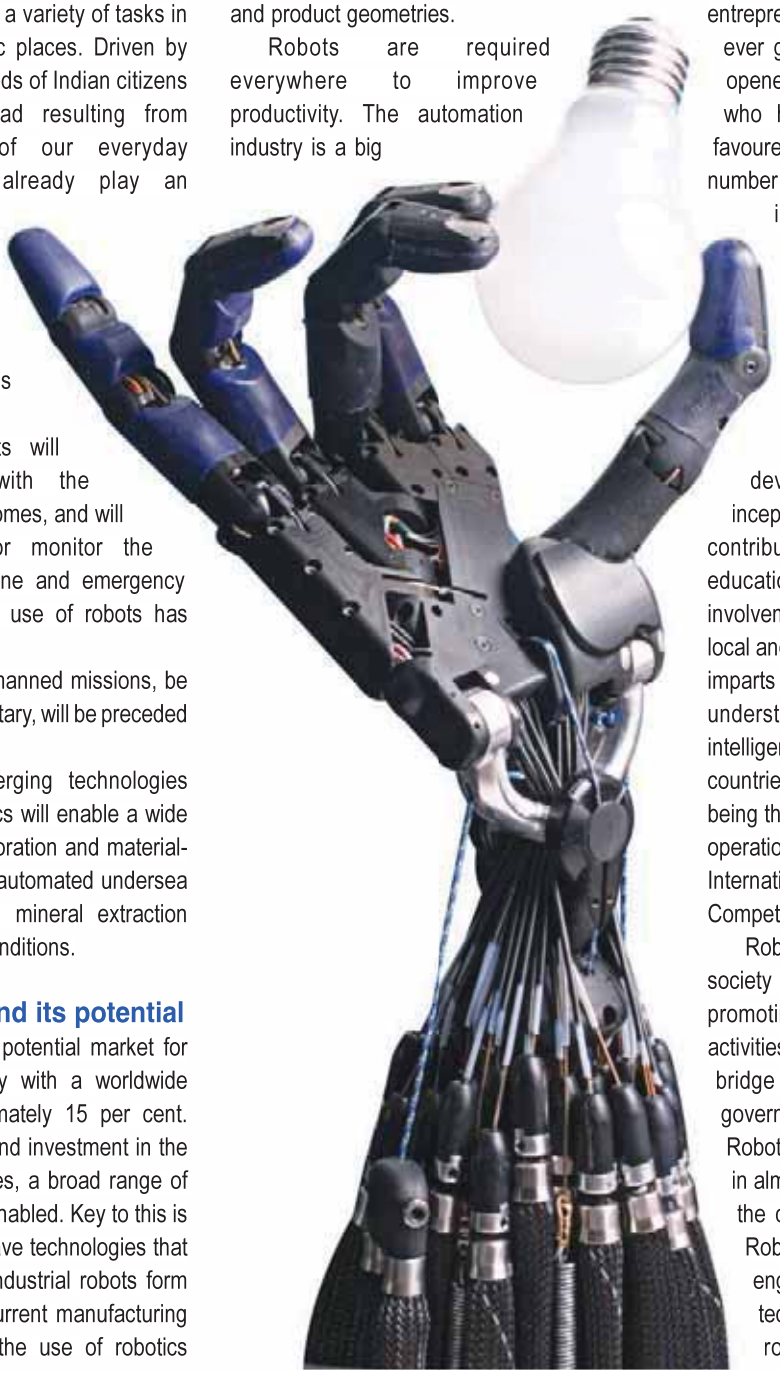
Both unmanned and manned missions, be it in earth orbit or interplanetary, will be preceded or augmented by robots.

In addition, the emerging technologies applicable to space robotics will enable a wide range of earth-based exploration and material-processing activities from automated undersea inspection to mining and mineral extraction under highly hazardous conditions.

Robotic activities and its potential

India is an upcoming potential market for industrial robotics industry with a worldwide market share of approximately 15 per cent. With suitable stimulation and investment in the key underlying technologies, a broad range of robotics activities can be enabled. Key to this is the identification of first-wave technologies that will drive early markets. Industrial robots form an essential part of the current manufacturing sector of India. Without the use of robotics technologies or cost-effective production, a pillar of emerging Indian wealth would not be possible. Furthermore, robot-based production increases product quality, improves work conditions and leads to an optimized use of resources. The miniaturization of robotic technologies and newly developed sensing capabilities mean that these benefits are becoming applicable to an even wider range of manufacturing industries, including those with small and varying lot sizes, materials and product geometries.

Robots are required everywhere to improve productivity. The automation industry is a big



technology, the quality of products and processes improve considerably. Industries across a range of sectors such as automotive, atomic energy, defense, space, metals, textiles and manufacturing use Robotic technologies very extensively. Robots are also being used in operation theatres and rehabilitation centres to augment the quality of life. Developed countries like Japan and America have been using robots to clean rooms, entertain etc. Robotics has opened up a plethora of opportunities for both entrepreneurs and students. Therefore, it is an ever growing field and many avenues have opened up in recent past. Therefore, students who have the required skill sets will be favoured by such industries. There are a number of people, institutes/universities and industries working in the field of robotics.

The Indian Underwater Robotics Society or IURS (registered as Intelligent Unmanned Robotics Society) is India's first and only non-profit research organization for the advancement of low-cost robotics and intelligent systems research in developing countries. Ever since its inception in 2004, IURS has made many contributions towards furthering robotics education and research in India through involvement with government, universities and local and international organizations. IURS also imparts education in it is focus areas to improve understanding of and representation in intelligent systems research within developing countries. IURS has held the distinction of being the first Indian team to design India's first operational AUV to compete at the AUVSI's International Autonomous Underwater Vehicle Competition.

Robotics Society of India is an academic society founded on July 10, 2011 aimed at promoting Indian robotics and automation activities. The society hopes to serve as a bridge between researchers in institutes, government research centers and industry. Robotics has established an attractive place in almost all student technical events all over the country. There is an Indian Institute of Robotics in the country and is run by young engineers who are equipped with latest technological advancements in the field of robotics and automation industry.

Besides, almost all top notch technological institutes/colleges in the country have laboratories especially dedicated to robotics and many departments are particularly related to the branch of robotics or it is an integral part of other disciplines like mechanical, electrical, electronics and computer science and engineering. Many new projects on robotics are being displayed by the students of all level in such activities throughout the country. There are good efforts in IIT's and other engineering colleges being funded and supported by many institutes and government science and technology departments to work on robotic related projects which shall provide the spark for home grown entrepreneurs.

In industries, most of the tasks are being considered as dull, dirty and dangerous for human beings and as such utilizing Robotics and automation in these sectors would improve productivity, safety as well as the quality of the end product. Human operators can then take up more value added roles in the industry. Robotics and automation has the potential to revolutionize the industrial scenario. It promises to bring the same result as computer systems have brought in services and other sectors. However, many developing nations including India are still to adopt robotics and automation in a big way. Considering the gap and opportunity, industries are rapidly going for automation with its different advantages and thus have given a great stress on robotics as an integral part of their innovation centers in the industries itself. They are investing huge amount on the design and development technologies associated with robotics. Industries like Thinklabs, robosoftsystems, iRobot, PARI robotics and many more are actively pursuing the innovation, developments and implementation projects in the field of robotics.

Future of robotics

There is no denying that Robotic technologies are all set to change the way things are done in the industries in which they are being implemented. All the entrepreneurs are clearly optimistic about the use of Robotics in various industrial segments and its future in India. Robotics will capture industries like manufacturing, pharmaceutical, packaging and inspection. A bit of Robotics would also be seen in the healthcare sector primarily in the form of assistive and skill development technologies. The other promising sectors are defense and education. Robotics has opened the burgeoning opportunities but there are still many challenges that this field faces in an Indian scenario. In India, need is to come up with a world class product in the Robotics industry with deep specialization in server engineering, electrical, embedded programming and mechanical engineering (with focus on design, manufacturing and materials). Someone wishing to get into the Robotics industry must have a wide variety of skills and a thorough understanding of system control along with system integration and those who are passionate about Robotics from any field of engineering can be a part of a team working on a particular Robotics project. Talking about the sectors that are best suited for the adoption of Robotics are those with large volumes, frequent demand spikes or are prone to frequent audits/ quality checks. Also industries where the volumes are huge enough to occupy large real estate are also prime candidates for Robotics. This makes automation ideal for sectors like retail, pharma, e-commerce, automobile spares and engineering tools. Having said that, Robotics is applicable in almost all sectors that need to store, assemble and transport physical products. DIY robots and UAV research platforms are the need of the hour to make robotics more popular in India. Forecasting the adoption of Robotics in India in the future, due to globalization and high industrialization, Robotics in India is poised for a bright future. Considering that India is already a manufacturing hub catering to the whole world, the use of robots in every aspect of manufacturing will provide the necessary edge to companies. In turn this will propel the requirement of skilled manpower for this technology. Modern robotics engineers are confronted with the task of developing machines that interact with their creators in modes of increasing compatibility.

Challenges ahead

A good way to illustrate the state of robotics in India would be to say that we are today where China was 4 years ago and Europe approximately 10 years ago. The use of robotics in developed countries has grown even in the domain of autonomous robots and service robots but in India even industrial robots are still to really come of age. Despite having numerous challenges, the robotics industry in India is confident of higher growth with States like Gujarat, Haryana and Maharashtra are attracting more investments from the automotive industry. Among the many challenges that plague the Robotics field in India, the primary ones among them have to do with the high cost of adoption, availability of skilled talent and procurement of hardware components. The cost of adopting Robotic technology is very high due to the cost of procuring imported hardware components as well as training personnel. As Robotics is a multidisciplinary field, acquiring and retaining quality talent is a big issue. The capital-intensive nature of Robotics adoption when compared to the low cost of human labour clearly tips the scale in favour of the latter. From an academic perspective, some of the challenges coming in the way of Robotics in an Indian scenario are as:

- As Robotics is multidisciplinary in nature, barring students in the top schools in India, the others lack the knowledge required in four to five engineering disciplines to become an expert in this field. Also most of the students develop projects that already exist in the public domain.
- Scarcity of good faculty to teach the subject
- Barring a few regions and technological/ engineering institutes in India, Robotics as a subject is not taught well to the engineering students
- There is the absence of hardware companies that can cater to the industry and the dependence on countries like China, USA and Europe to procure the necessary components is a major stumbling block.

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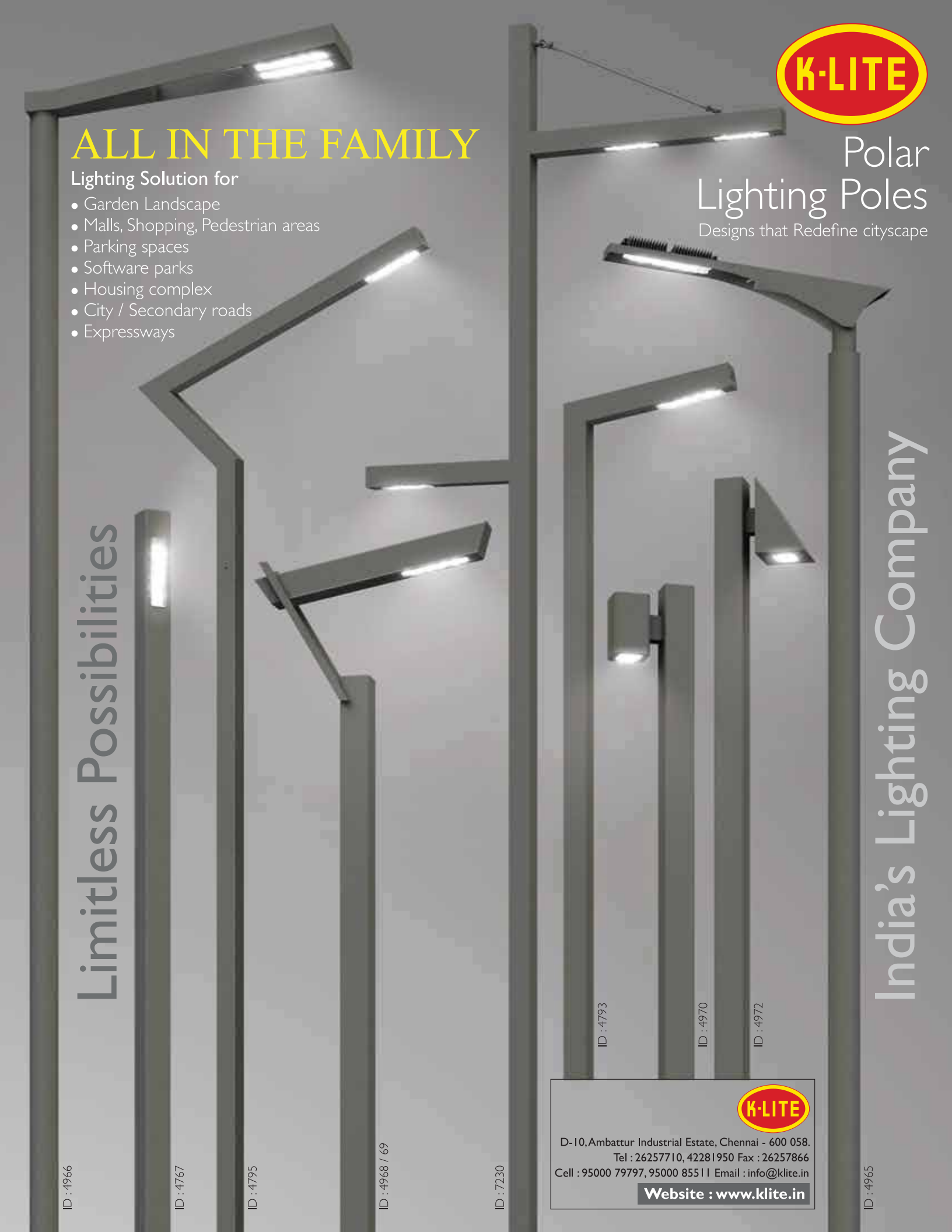
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Sumitomo Electric Group Demonstrates Their Integrated Technologies

An artist's impression of Sumitomo's stall…

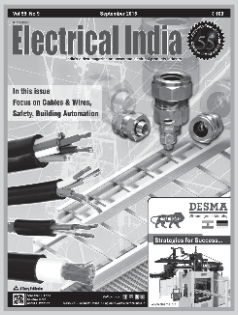
At CES 2016, the Sumitomo Electric Group participated in the Smart Home category, showcasing the group's strengths in mobility, energy and communications technologies, along with products and technologies that combine these to contribute to present and future environments and society.

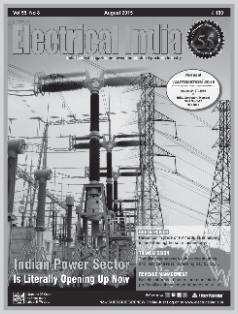
Sumitomo Electric has developed the world's smallest full-colour laser module [6 (H) × 13 (W) × 11 (D) mm] comprising red, green and blue semiconductor lasers. This new module product is based on the company's experience in materials and component mounting technologies. Its stable optical and electrical characteristics make the module suitable for a variety of applications, such as illumination, small projectors, and various sensors. At the trade show, Sumitomo Electric demonstrated an illumination system incorporating this full colour module.

The term 'services gateway MR5172' refers to equipment that connects home networks to various cloud services, in compliance with the OSGi (formerly known as the Open Services Gateway initiative) specification. A single piece of this equipment makes management of the power supply and demand visible and controls various services such as security and health care in homes, offices and stores. Sumitomo Electric featured a demonstration of practical connections of different sensors and electric appliances.

In the exhibit category of Smart Home, Sumitomo Electric displayed panels that portray Smart Home-related products and technologies of the Sumitomo Electric Group used to implement energy infrastructure.

In recent years, factories, offices and other heavy power consumers have been increasingly using distributed power systems incorporating renewable energy to help create an energy-efficient society. Sumitomo Electric's products shown on panels at the venue included the sEMSA energy management system, which enables optimal use of power from a system of varied distributed power sources including renewable energy to ensure efficient use of energy, reduced environmental burdens and minimized costs.





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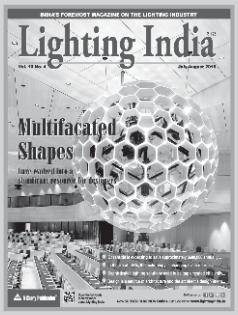

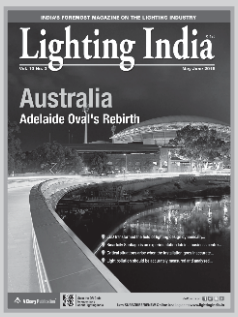

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- **Thermal Sensitivity :** 0.15°C
- **Measuring Mode :** Infrared focal plane measuring temperature.
- **Temperature Range :** -20°C ~ 300°C (-4°F ~ 572°F)
- **Image Frequency :** 6Hz
- **Focus Mode :** Fixed
- **Palette :** Iron red, rainbow, rainbow high contrast, Gray scale (white glow) & Gray scale (black show).
- **Image Storage :** SD card (4GB)
- **Battery Type :** AA battery x 4.

Model - LT3

FEATURES :

- **Display :** 2.7" TFT LCD
- **Resolution :** 160 X 120
- **Total Pixels :** 1.3 million pixels day light camera.
- **FOV/min focus distance :** 25° X 19° / 0.1m
- **Thermal Sensitivity :** £ 0.08°C@30°C
- **Measuring Mode :** Upto 4 movable spots. Upto 3 movable areas (Max. Min & Avg. temperatures). Upto 2 movable lines. Line profile. Isotherms. Temperature difference. Alarm (voice, color)
- **Temperature Range :** -20°C ± 350°C
- **Frame Frequency :** 50Hz
- **Focus Mode :** Manual
- **Palette :** Color palette 11 palettes changeable.
- **Image Storage :** 2G SD card, Max 16G
- **Battery Type :** Li-Ion, rechargeable battery.
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Interview

"Most of the our products are of unmatchable quality..."

***Next Gen Equipments Pvt. Ltd.** (NGEPL) is an active organisation in the Indian power sector with its strong technical know-how. Management team of the company has over thirteen years of experience in the Indian power industry. In an exclusive interview with **Electrical India, Ather Salim, Director, NGEPL,** is talking to **P K Chatterjee** about their business.Excerpts...*

Q ***What is the latest global trend in the HV Testing & Measuring Equipment industry?***

A Currently the Global Testing and Measuring Equipment market is growing at 25% CGAR and this would go to 28% over the period 2016-2017. Asia-Pacific accounted for majority of market share in 2014-15. China and India are major contributors – and expected to grow rapidly till 2020.

One of the key factors contributing to this market growth is the increased demand in power and electronics products. Electrical Test & Measurement Instruments' demands are predominantly driven by the power sectors and their reforms.

The energy management system includes energy saving by monitoring as well as by controlling the energy losses. Also, industrialisation with more process oriented high energy industries is the key driver for the growth.

Q ***How is the demand for HV Testing & Measuring Equipment growing in the Indian power industry?***

A There is a lot of excitement among investors here about 'Make in India' and the ambitious target that our Prime Minister Narendra Modi and the Government of India have set to ensure 24x7 power for all households as also for the industry and the farmers.

Investments are expected across diverse areas of the energy sector including in renewable as well as transmission and Distribution (T&D) segments. New investments will definitely give the boost to the Indian Power Sector, and will further translate into new business opportunity in T&M segment .

Also, with Indian power sector now focused on setting up 1,200 kV AC and HVDC transmission line apart from strengthening 765 kV & 400 kV lines across the country, the High Voltage Testing & Measuring industry is going to have a phenomenal growth in the coming years – as all the OEMs need to strengthen their testing facilities for meeting the demand of the Power Generation, Transmission & Distribution companies in India.

Q ***To what extent, are we still depending on import in this field?***

A We are heavily dependent on imports as these are very specific instruments, and domestic demand is not at such scale that indigenous manufacturing becomes feasible. Also, the reliability and customer acceptance is very important for most of the customers to still focus on imported equipments.

Moreover, major testing equipments like Impulse Generators, Resonance Test Systems, Loss Measuring Systems, Static Frequency Convertors, Online DGA etc.; apart from other small portable equipments like Cable Fault Locators, IR Tester, WRM, TTR etc.; and for many other producs our industry is still heavily dependent on Imported High Quality products.

Q ***How are the Testing & Measuring equipment manufacturers of Indian origin faring?***

A In the recent times, many companies have set up the manufacturing facilities for 'Make in India' products. But they are heavily dependent on the imported raw material or parts. Quality and Reliability are still big issues with many indigenous products, and customers are facing major after sales service issues.

As India has a price sensitive market, and products of the Indian origin are finding their places mainly in the PSU and the government sector, where the tenders with L1 criteria of pricing is major weightage, most of the private entities still prefer to buy the technologically advanced and reliable products imported from Europe and the USA.

Q ***What are the organisations that mainly buy these Testing & Measuring equipment?***

A In a span of five years, we have established ourselves as a major player for Sales & Service Support of T&M equipments in Transformer Industry. Our customers are mainly Transformers OEMs like ABB, ALSTOM (NOW

GE), SIEMENS, Transformers and Rectifiers (India), Schneider, EMCO, CG GLOBAL, TELK, PRIME, TOSHIBA, TESLA, and IMP. They are our major clients apart from ERDA and CPRI.
Also, companies like NTPC, POWER GRID, SEBs and many captive power plants buy these testing equipments – apart from world renowned labs like NPL, ERTL, NTH etc.

Q *Which are the internationally famous brands that are being represented by you in India?*

A We are representing four major companies namely Raytech Switzerland, EPRO Austria, EMJAKPOWER Switzerland & M/s Risatti Instrumensts Italy – with wide range of products used for T&M sector. We also supply equipments from M/s Midtronics, USA for battery testing and Stanhope SETA, UK for Oil Tetsing Equipments.
We are also adding new products like C&Tan-Delta Test Set, CT Analyser and Transformer Loss Measuring System in our portfolio to increase our reach. Also, with Motor Testing Equipments from Risatti, we are sure of increasing our customer base to many major motor/ rotor manufacturing companies in India.

Q *How wide is your presence in the Indian power sector?*

A We are not very big as far as the market share is concerned, however, we have strong presence in entire transformer industry in India. All major transformer manufacturers are using our equipments.
Most of our businesses originate from existing customers, which show that they have confidence in our products and services. We are now focusing to increase our market share with small transformer manufacturers as well as motor Industry.

Q *What kind of post-sales support do you provide to your customers?*

A Over a period of time, our focus has shifted from a trading organisation to one point solution for all T&M business with highly reliable and rugged products. We have enhanced our team in the back office for better customer experience – for new as well as existing customers. We provide prompt and full on site service support to our customers and opened a Lab at Vadodara, to ensure a hassle free and prompt after sales services for products, which were earlier required to be sent to the principals for up-gradation and rectification, thereby we are reducing the waiting time for the customers.
We carry stock of all the critical spares for providing very quick and reliable service support to all our customers. We believe in holding our old customers through their satisfaction. They are our best promoters in the industry.

Q *What are the new types of equipment that you are planning to bring to India?*

A We have added Capacitance & tan Delta Test Set, CT Test Set, Transformer Loss Measuring System as well as motor Testing Products. Raytech products are in itself unique in the Industry and our new 2.5 KV C & Tan Delta Test System is the first Battery Power C & Tan Delta Test Set. We are soon coming with 10-12 kV Tan Delta Test Set as well. Also, the Loss Measuring System from EPRO GmbH is unique – as we expanded our Standard CTs' & PT's of 0.005% accuracy to a highly accurate Loss measuring System even at very Low Power Factor.
The accuracy is backed by certification form PTB Germany. Also, the Eectronic Power Supply (Static Frequency Convertors) are an excellent replacement to the MG Sets and customers should understand the advantage it has over the traditional MG Sets used in the DVDF Testing. Also, the new products from Risatti for Motor, Stator & Rotor Testing is having its own advantage and uniqueness in the Industry.
We will be showcasing many unique products Including CT Tester, ROTOR Testers etc. in the upcoming ELECRAMA 2016 at our stall H3A2.

Q *What would you like to communicate to your potential customers?*

A Most of the our products are of unmatchable quality, reliability and are very user friendly. After experiencing the performance of our units, end users don't wish to use any other make. We along with our principal's are committed to provide best of class service support and quick response to customer needs across country.
Next Gen and its principals are known for excellent products and best service support across the industry. We wish to provide best products in the market on affordable cost.
We deliberately work with world class companies whose products and supports are up to a level – where all the customers feel satisfied after experiencing the products' unique features we offer to them.

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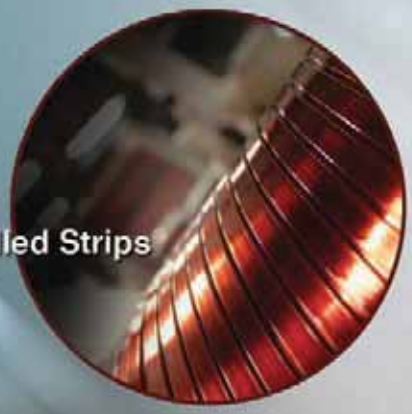

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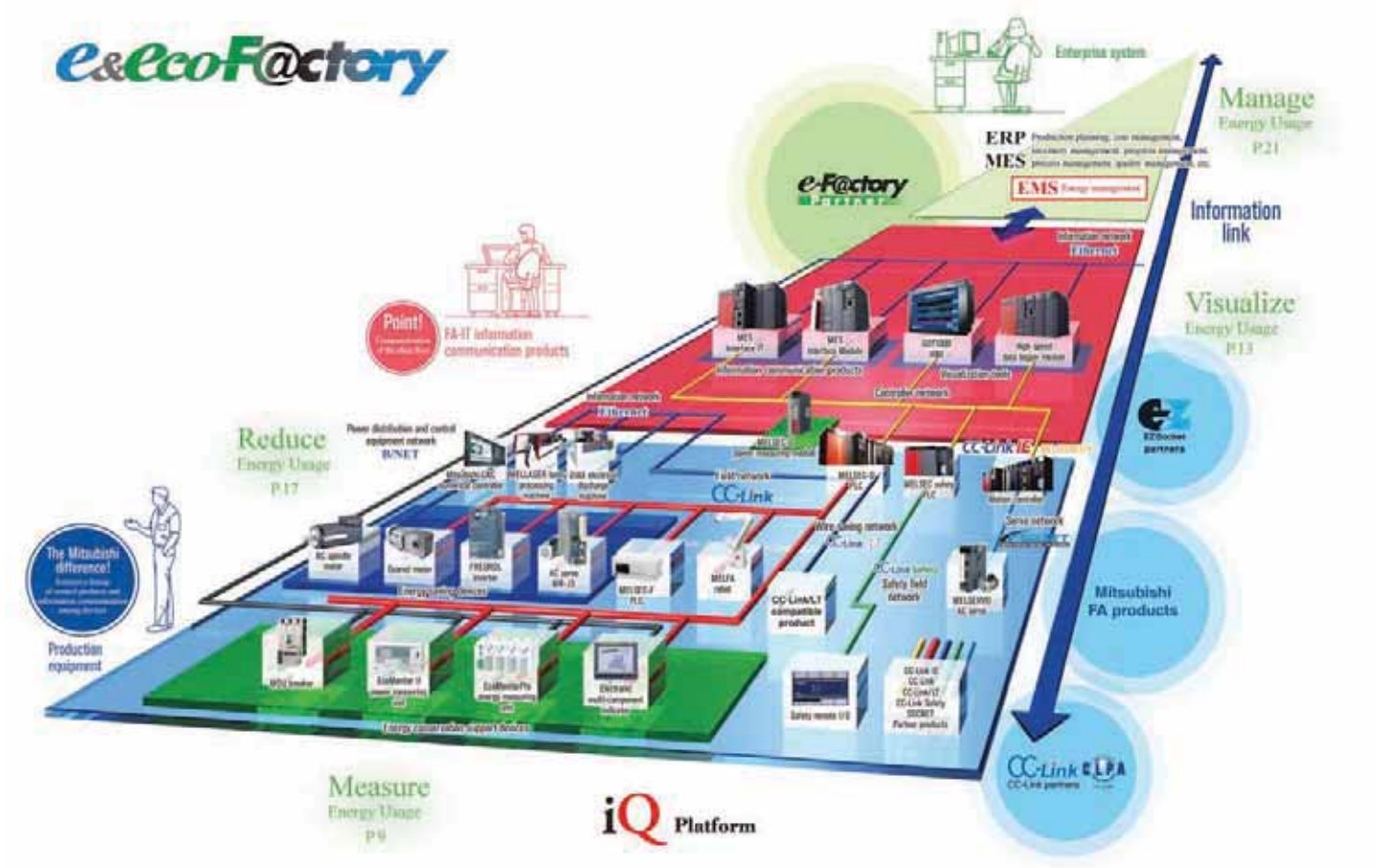


Experts see four major areas of influence that are likely to determine business models in future factories: integrated enterprise ecosystems; sustainability; lifecycle assessment; and eco-efficiency analysis.

Driven by the need for greater productivity and efficiency it is not surprising to see that organisations have already started adopting technologies like Cloud computing, Cyber-security and Mobile communication and are coupling them with Asset management and Flexible manufacturing, to drive factory integration with enterprise.

We will see a growing demand for increase in equipment operating rates, increased productivity and reduction in system construction costs. The factory automation industry will be pushed into overdrive mode to develop new innovative and customized solutions to meet these demands. Thus, we see the emergence of new cutting edge models like the e-Factory and eco-Factory concepts.

The dawn of the age of e-factories

The e-Factory model: The e-Factory model is based on productivity improvement through 'visualization' of the manufacturing floor. The model makes complete use of leading-edge control and network technologies. It is now possible to visualize production information (both qualitative and quantitative data) and equipment information. This is then linked to higher manufacturing execution systems to be incorporated into production plans and ensuring quality traceability.

The Eco-Factory model: On the other hand, another model, the Eco-factory technology model allows 'visible' management of power usage. This is achieved through measuring equipment and technologies that support energy conservation by meticulously measuring

power usage. It also provides for effective installation of inverters and other energy-saving devices to eliminate wastefulness and surges in energy consumption, thus reducing overall power usage.

Complete cost reduction model by merging concepts: To survive global competition, manufacturers must improve not only productivity but also energy efficiency in order to reduce production costs. Meanwhile, in emerging countries with high economic growth rates, automation of manufacturing processes is making rapid progress accompanied by increasing use of electric power, although sufficient power supply is not secured. Therefore, a new concept is also emerging which combines the e-Factory and eco-Factory models for realizing both production efficiency and energy efficiency.

While production efficiency and energy efficiency both aim at achieving the same goals of total cost reduction, merging the two models brings large advantages to factories from two perspectives as depicted below:

Keeping this concept in mind, Mitsubishi Electric's offers a total factory automation solution called "e&eco-F@ctory". This concept not only helps in improving productivity by using network technology and information systems, but also helps achieve energy efficiency and productivity simultaneously.

The module enables these actions by using measuring technology developed in the field of electric power receiving and distribution, which is one area of Mitsubishi Electric's power distribution control equipment business.

With e&eco-F@ctory, energy saving is achieved in four steps: "measurement," "visualization," "reduction" and "management" of energy. An important factor of energy "measurement" is the collection of energy data in connection with production information such as quantity, not simply gathering energy use data from the shop floor. On the shop floor, the production information is stored in the PLC, and thus by providing the energy data to the PLC, it is possible to measure the energy that is interrelated with the production conditions and the operating status of the equipment.

In the "visualization" step, the energy and production information collected in the "measurement" step and provided to the PLC

We will see a growing demand for increase in equipment operating rates, increased productivity and reduction in system construction costs...

are analyzed using IT technology, and then that information is "visualized" in various ways such as by part, by product, and by equipment. The MES interface supports the "visualization" step by transmitting the energy and production information to the information systems. For the successful "reduction" of energy, it is necessary to introduce energy-saving equipment with high energy efficiency. One example is to optimize the energy consumption of the facility and equipment by using inverters, motors and other drivers with high efficiency. In the "management" step, which pursues improvement by interrelating energy information and production information, it is important to monitor the specific consumption and energy used by the facility and equipment. Specific consumption refers to the amount of energy consumed to produce one unit of a product. The e&eco-F@ctory provides various types of management solutions to improve productivity and energy efficiency by smoothly driving the Plan-Do-Check-Action cycle for better energy efficiency.

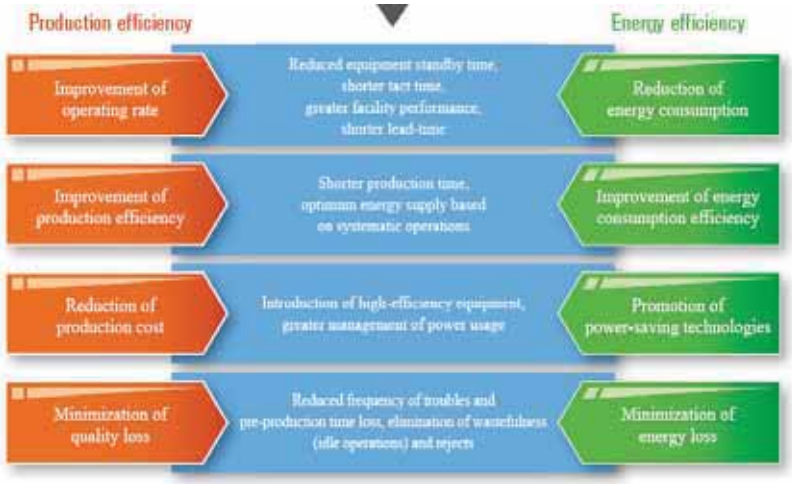
New indicators of factory optimization

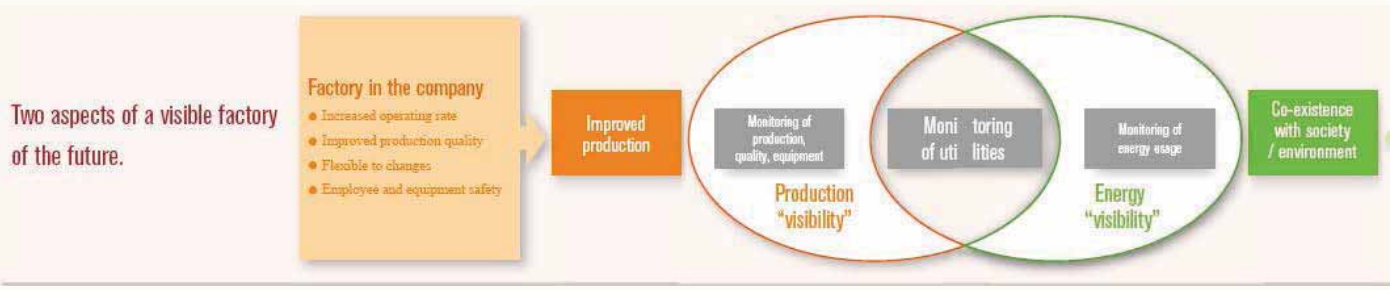
Production equipment in factories is responsible for a particularly large percentage of energy consumption in manufacturing industries. For proper assessment of energy usage, precise measurements and the installation of numerous measurement points along the path from the power- receiving end to production equipment are required.

A new indicator of factory optimization should also be established based on the amount of energy consumption per product, or in other words, on specific energy consumption. The solutions lies in merging the control and network technologies with measuring technologies developed through energy conservation activities in the power receiving and distribution sector.

Manufacturing factories, as high-volume energy users, are required to promote further energy saving, and thus focus is placed on the Factory Energy Management System (FEMS), which manages the energy throughout the factory. The energy usage areas in the factory are largely divided into two categories: the "production system" where the actual production takes place using production equipment, and the "utility system" that functions as a part of the factory's infrastructure.

In the production system, productivity improvement and energy saving are closely related to each other. Mitsubishi Electric's Factory Automation (FA) energy solution is a subset of FEMS that contributes to energy saving in the production system. It is aimed at reducing the total cost of ownership and establishing a low-carbon society by integrating IT systems into production equipment to achieve higher productivity and energy saving in factories around the world.





Improvement of the equipment utilization rate reduces unnecessary energy derived from equipment waiting time and downtime, while reducing the takt time also saves energy by decreasing the equipment operation time while keeping the same production quantity. In addition, quality (yield) improvement helps reduce unnecessary energy consumed for producing defective products.

Examples of system configuration with e&eco-F@ctory

To better understand the application of the e&eco-F@ctory concept, the examples below describe system configuration with, for three of its four steps, namely: "measurement," "management" and "visualization."

Visualization system interconnected with production information.

For simultaneous achievement of the goals of e&eco-F@ctory, productivity improvement and energy saving, it is necessary to identify the improvement points for production and energy use. For this purpose, it is necessary to interrelate and manage information about the production and energy. As an example, by managing the energy consumption in response to the operating condition of each production equipment (operating, standby, or breakdown), wasted energy during standby and breakdown can be found, and the time spent waiting for parts and for set-up change resulting in standby time can be reduced. This type of management can be achieved by linking the MES that manages the production information and the EMS that manages the energy information. The production information as well as the energy information acquired by the energy measuring module is transmitted via the MES interface from each equipment to the MES and EMS. In addition, the energy information for the whole line is collected from the multimeters, MDU breakers, etc., in the power receiving and distribution equipment and on the panel board, and then transmitted to the EMS via the MES interface.

Visualization system for specific consumption

"EcoWebServer III" is an embedded data acquisition server that visualizes energy on a Web browser using its Web server function. The main functions of "EcoWebServer III" are as follows:

- Measurement data acquisition (current, voltage, power, energy, leak current, etc.) from the CC-Link compatible measuring instruments (CC-Link is the global standard FA network "Control & Communication Link").
- In addition to the measurement data from CC-Link instruments, production information is collected from the PLC and accumulated in the built-in Compact Flash1 memory.
- The embedded Web server function enables the status of energy use and specific consumption to be browsed via a local area network (LAN).
- Without constructing a genuine EMS (Energy Management System) based on the server environment, a setting-only programless system can be quickly constructed.

Two aspects of a visible factory

Transforming a factory into an e-eco factory means optimizing the unit from an energy perspective.

In an e-eco factory, production and energy information is "visualized" and linked together for thorough energy management.

Furthermore, the different situations of energy use by different production lines are accurately assessed and analyzed to ensure factory wide optimization.

Once detailed measurements for each device and piece of equipment are available, the way to increased productivity is clear. The important thing to comprehensively "visualize energy" is, of course, to measure the amounts of energy being used in the shop floor in real time and collate the data, but also to keep an accurate grasp of specific energy consumption, with linkage to production volumes and other manufacturing information. E-eco-Factory aims to improve equipment working efficiency through detailed work analysis. It measures the specific energy consumption by production equipment and devices for every takt time, every product type, and every process. It links to work monitoring of production lines, preventive maintenance of equipment and improved productivity.

Visualizing the future

The "visualization" of energy and production information serves as an indicator of improvement. Solutions that make energy use 'visible' are powerful tools for an Energy Management Program. Real time monitoring of the equipment's total and specific energy consumption is critical to linking production information and energy information and making improvements. This lets one discover problems and tune the system hence, focusing on reducing consumption. EI

Rajeev Sharma
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SIEMENS TO INFUSE MORE FUND FOR R&D

Siemens is making up to €100 million available over the next three years - in addition to the €300 million in increased R&D investment in the current fiscal year. The company is also launching a bundle of measures to further increase its power of innovation...

In the current fiscal year 2016, Siemens will invest around €4.8 billion in Research and Development (R&D) – some €300 million more than last fiscal year. R&D investment has thus increased about 20% since fiscal 2014. A major part of the additional funds is earmarked for automation, digitalization and decentralized energy systems. In fiscal 2015, research intensity - defined as the ratio of R&D expenditures to revenue - was 5.9%, an increase of 0.3 percentage points over the prior year. The company is also launching a bundle of measures to further increase its power of innovation.

"Our company's success and its long-term future lie in our power of innovation. The motivation and creativity of our highly expert employees have a key role to play in this connection. Our company needs good ideas - and we're creating the conditions that will enable clever minds both inside and outside our company to implement their ideas quickly and effectively," said Joe Kaeser, President and CEO of Siemens AG.

To achieve this aim, Siemens is establishing a unit that will provide space for experimentation and growth in a startup environment. Under the working title 'Innovations AG,' the unit will also serve as a consultant, a promoter and a kind of risk capital provider for business and project ideas. Working independently of Siemens' core businesses – that is, like a founder's company – the unit will supplement and consolidate Siemens' existing startup activities.

To strengthen the innovation and technology expertise of the company as a whole, Siemens has also established a scientific council. The Siemens Technology & Innovation Council (STIC) closely supports the Managing Board in systematically analysing and monitoring strategic topics in the areas of technology and innovation. The STIC comprises Siemens' Chief Technology Officer Siegfried Russwurm and seven internationally experienced and respected experts from the research and scientific communities.

As agreed upon with its employee representatives in Germany, Siemens is also launching an investment fund to strengthen its employees' power of innovation in a targeted manner. For this purpose, the company is making up to €100 million available over the next three years – in addition to the €300 million in increased R&D investment in the current fiscal year. In the first year, around €10 million will be paid into the fund in Germany

Siegfried Russwurm
Chief Technology Officer, Siemens

Joe Kaeser
President and CEO of Siemens AG

alone. This money will be used to foster creative employee ideas with an economic benefit. Unlike the projects financed by Innovation AG, these ideas do not have to focus exclusively on new technologies or new businesses in order to be worthy of support – they can also target improved processes, services or better customer retention.

Siemens has also honoured nine particularly ingenious researchers as Inventors of the Year 2015. The scientists – from Germany, the U.S., the UK and Norway – are together responsible for some 650 inventions and 309 individual patent grants. Siemens has been presenting the Inventors of the Year award annually since 1995 to the organization's outstanding researchers and developers whose inventions have made a major contribution to its success. In the year ahead, researchers outside the company will also be eligible for the award.

"In the 21st century, research isn't – and can't be – conducted only in an ivory tower," says Chief Technology Officer Siegfried Russwurm. "Times have changed. Inventors no longer develop ideas for the future in isolation. Today, innovation requires a new, open style of cooperation. Taking inspiration from crowdsourcing and software hackathons, engaging in cooperative projects with universities, research institutes and small, flexible startups – all this is what we at Siemens are now doing every day."

As part of a move to expand its R&D collaborations with top universities, the company is establishing a new research center on the campus of the Technische Universität München (TUM) in Garching, a suburb of Munich. Research at the center, where over 100 Siemens scientists will work side-by-side with TUM researchers, will focus on everything from IT security to autonomous systems. In 2016, Siemens will also establish a new innovation center in China. Cooperating across Division boundaries, the center's more than 300 employees will conduct research in new digitalization solutions for both the Chinese and international markets.

But Siemens is not only cooperating with universities; it is also intensifying its collaboration with startups. For example, the company is opening a new liaison office in Tel Aviv to establish close contacts with Israeli startups. Siemens already maintains three such offices worldwide – in Berkeley, Shanghai and Munich. To find the best ideas, Siemens scouts contact more than 1,000 young companies a year.

To tap new business opportunities in the area of digitalization, Siemens is driving the related services under the name Siemens Digital Services. The company expects growth in the digital services market to average 15% a year. Leveraging both new and conventional services, Siemens generated revenue of some €16 billion in this area.

To provide the technological basis for its digital services, Siemens has created a company-wide software platform, Sinalytics, which combines a variety of established and new technologies in the areas of remote maintenance, data analytics and very important cyber security.

The platform makes it possible to aggregate, securely transfer and analyse the vast amounts of data generated by sensors in machines.

Siemens' business units can then use this valuable data to offer customers new services that can, for example, improve the monitoring of gas turbines, wind turbines, trains, buildings and medical imaging systems. Today, some 300,000 devices are already linked to Sinalytics. Extensive cyber security technologies that can be used to securely transfer, store and analyse confidential data are one of the platform's key components. EI

Siegfried Russwurm
Chief Technology Officer, Siemens

Joe Kaeser
President and CEO of Siemens AG

alone. This money will be used to foster creative employee ideas with an economic benefit. Unlike the projects financed by Innovation AG, these ideas do not have to focus exclusively on new technologies or new businesses in order to be worthy of support – they can also target improved processes, services or better customer retention.

Siemens has also honoured nine particularly ingenious researchers as Inventors of the Year 2015. The scientists – from Germany, the U.S., the UK and Norway – are together responsible for some 650 inventions and 309 individual patent grants. Siemens has been presenting the Inventors of the Year award annually since 1995 to the organization's outstanding researchers and developers whose inventions have made a major contribution to its success. In the year ahead, researchers outside the company will also be eligible for the award.

"In the 21st century, research isn't – and can't be – conducted only in an ivory tower," says Chief Technology Officer Siegfried Russwurm. "Times have changed. Inventors no longer develop ideas for the future in isolation. Today, innovation requires a new, open style of cooperation. Taking inspiration from crowdsourcing and software hackathons, engaging in cooperative projects with universities, research institutes and small, flexible startups – all this is what we at Siemens are now doing every day."

As part of a move to expand its R&D collaborations with top universities, the company is establishing a new research center on the campus of the Technische Universität München (TUM) in Garching, a suburb of Munich. Research at the center, where over 100 Siemens scientists will work side-by-side with TUM researchers, will focus on everything from IT security to autonomous systems. In 2016, Siemens will also establish a new innovation center in China. Cooperating across Division boundaries, the center's more than 300 employees will conduct research in new digitalization solutions for both the Chinese and international markets.

But Siemens is not only cooperating with universities; it is also intensifying its collaboration with startups. For example, the company is opening a new liaison office in Tel Aviv to establish close contacts with Israeli startups. Siemens already maintains three such offices worldwide – in Berkeley, Shanghai and Munich. To find the best ideas, Siemens scouts contact more than 1,000 young companies a year.

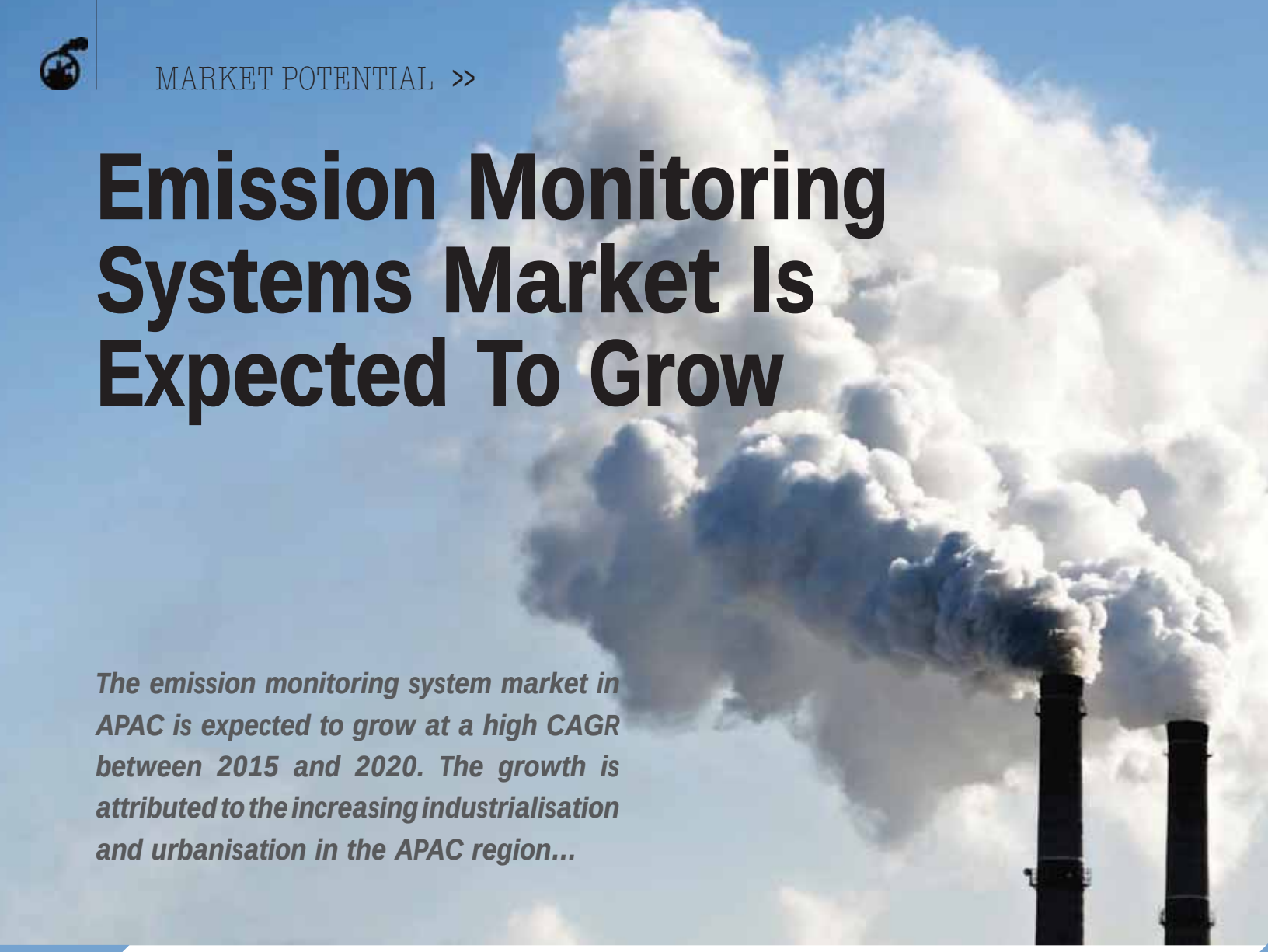
To tap new business opportunities in the area of digitalization, Siemens is driving the related services under the name Siemens Digital Services. The company expects growth in the digital services market to average 15% a year. Leveraging both new and conventional services, Siemens generated revenue of some €16 billion in this area.

To provide the technological basis for its digital services, Siemens has created a company-wide software platform, Sinalytics, which combines a variety of established and new technologies in the areas of remote maintenance, data analytics and very important cyber security.

The platform makes it possible to aggregate, securely transfer and analyse the vast amounts of data generated by sensors in machines.

Siemens' business units can then use this valuable data to offer customers new services that can, for example, improve the monitoring of gas turbines, wind turbines, trains, buildings and medical imaging systems. Today, some 300,000 devices are already linked to Sinalytics. Extensive cyber security technologies that can be used to securely transfer, store and analyse confidential data are one of the platform's key components. EI

Emission Monitoring Systems Market Is Expected To Grow



The emission monitoring system market in APAC is expected to grow at a high CAGR between 2015 and 2020. The growth is attributed to the increasing industrialisation and urbanisation in the APAC region...

The emission monitoring system market in APAC is expected to grow at a high CAGR between 2015 and 2020. The growth is attributed to the increasing industrialisation and urbanisation in the APAC region informs a recent research by Reportlinker.

The market is expected to grow at a CAGR of 10.4% between 2015 and 2020. A key driving factor for the growth of the emission monitoring systems market is stringent legal and environmental regulations. Besides, several other factors such as increased awareness about environmental protection needs, increasing health and safety issues, and growth of oil & gas and petrochemical industries.

The emission monitoring systems market for the oil & gas vertical is expected to grow at the highest CAGR.

The market in the oil & gas vertical is estimated to grow at a high CAGR during the forecast period. Oil & gas companies worldwide prefer CEMS or PEMS to not only minimise emissions but also to measure them continuously. Further, they use emission monitoring systems to meet the increasingly stringent gas turbine emission regulations.

APAC is the fastest-growing market for emission monitoring systems. The stringent air pollution regulations and growth in power, cement and mining industries in emerging economies are some of the factors responsible for the increasing adoption of emission monitoring systems. Further, the developing countries in APAC are also focused on addressing environmental issues and improving their environmental regulations.

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MAINTENANCE FREE HERMETICALLY SEALED TRANSFORMER

Since oil does not come in contact with external air, there is hardly any deterioration of oil over a period of time and hence such transformers are virtually maintenance free...

While purchasing equipment Total Ownership Cost (TOC) plays a very important role. TOC includes not only capital and operating cost but also indirect cost towards maintenance & upkeep of equipment throughout its operating life for trouble free performance. Maintenance of equipment, upkeep, its servicing, procuring and maintaining spares and related overheads increases TOC. Hence while deciding purchase of equipment this cost needs to be evaluated and factored in to arrive at optimum TOC. In any running plant this is a big challenge. Equipment and gadgets which require no maintenance or minimum maintenance and where TOC is lower are always preferred.

Hence the concept of zero maintenance or minimum maintenance is fast catching up. This trend is growing and is quite evident as we already have products such as batteries which are practically maintenance free; LED lights due to its long operational life are virtually maintenance free. The success of maintenance free product is because of the concept of "FIT IT & FORGET IT". Customers are willing to pay premium if there are no headaches and also operating cost towards maintenance of assets is lower. Technological advancement had made this possible for transformer.

General

The question which naturally arises is what maintenance free transformer is & what is the need for it? Conventional vacuum impregnated or cast resin dry type transformer is also maintenance free! But these transformers have limitations that these are not intended for installation in outdoor atmosphere which are directly exposed to heat, sun, rain, humidity, dust, corrosive and harsh environment. At the most such dry type transformers can be installed in covered location either in basement of building, inside substation or under a covered roof.

Similarly conventional oil filled transformer though can be installed in outdoor atmosphere directly exposed to sky, but suffer from the limitation that these are not maintenance free. Oil leakage from joints, valves, radiators, conservator etc. is quite common. Besides this since these transformers are equipped with breather they inhale and absorb certain amount

Sr. No.	Parameter	Conventional Oil filled	Hermetically sealed-Maintenance free oil filled	Benefit
1	Construction	Fabricated tank with detachable(bolted) radiators and equipped with breather & conservator	Welded tank design with corrugated fins(instead of radiators) and without breather & conservator	Compact & space saving
2	Cooling	Oil need to undergo flow process through radiators to achieve cooling	Corrugated fins are welded to tank to increase surface area thereby enhancing cooling process	Higher surface area leads to better heat dissipation which in turn enhances efficiency.
3	Oil contamination with air	Yes, since transformer is equipped with breather which leads to oxidation and reduction in BDV of oil	Not possible since there is no breather and oil is filled inside tank in factory under vacuum and after which the tank is sealed	Oil BDV is maintained throughout the life. Oil properties are unaffected & hence requires no maintenance
4	Oil filtration & Top up	Oil filtration is required during pre-commissioning and Top up is required during preventive maintenance	Not required	Since no filtration & preventive maintenance required operation is trouble free, without interruption and does not require any shutdown.
5	Oil leakage possibility	Yes, due to conventional design	Not possible since it is hermetically sealed and fabrication is welded (without joints)	No need for oil top-up due to leakage
6	size	Bulky due to conservator & radiator and other fittings	Relatively compact with space saving by almost 30%	Less foot print and hence requires less space at site
7	Losses	Losses increases with its operational life	Losses remains constant throughout its operational life	This results in improved efficiency
8	Expected life	15-20 years	25-30 years	Due to negligible maintenance it enhances product life.
9	Insulation	As oil comes in contact with air(moisture) which in turn comes in contact with insulation material, life of the insulation material deteriorates with the passage of time	Since oil is not in contact with external atmosphere, no such deterioration takes place	This helps in reduction of mechanical and voltage stress on insulation preventing failure
10	Total Ownership cost (TOC)	High: Relatively low capital cost but high operating cost & losses over a period of time	Marginal high initial cost but less operating cost due to negligible maintenance & no deterioration of oil property(virtual maintenance free)	Initial high capital cost makes the transformer TOC economical and hence ROI (return on investment) are quickly realized.
11	Failure chances	More since it requires oil filtration, top up and regular maintenance	Less as it is highly reliable	High reliability as it is maintenance free
12	Protection	For protection & measurement separate devices such as OTI, WTI, PRV and bucholz relay are to be mounted	One single integrated device can provide protection against gas, pressure and temperature	Only one cut-out for mounting is required instead of four(4) in conventional transformer

Transformer installed outdoor...

Oil filling in totally controlled atmosphere in a vacuum condition...

of moisture. Oil comes into direct contact with the air as a result, oil needs regular filtration to check & ensure that its BDV & dielectric strength is maintained. Is it possible to get best of both worlds? i.e., maintenance free and at the same time it can be installed outdoor (open to sky)!. Yes, hermetically sealed maintenance free transformer is the solution to this. The next question that arises is: what hermetically sealed means and in what way it is different from conventional oil filled transformer?

Hermetically sealed transformer in appearance wise does not differ much from conventional one. However its design and construction is different.

Construction

The construction of tank for such transformer is extremely simple. The bottom, corrugated fins side wall panels and plain wall panels are fabricated separately and mounted on especially designed welding tables and welded together. This forms the tank structure. The skill and workmanship of highly experienced and qualified welders and leak tests during production ensure that the finished tank is leak free. The reliability of tank design is proven by stringent fatigue and over pressure tests. These tanks are also subjected to expansion and contraction cycle which simulate the mechanical load on a tank over its service life. The tank design and corrugated fins takes care of expansion and compression cycle due to variation in temperature of oil. Hence, such transformers are not equipped with conservator and breather. Corrugated fins increase the surface area and take care of dissipation of heat. Corrugated fins once welded become integral part of tank structure.

Once the active part (Core and winding assembly) is dried for a specific time in an oven to remove moisture from the insulating material, it is placed inside the tank. Oil is separately pretreated in a vacuum chamber which involves filtration, drying and degassing to remove moisture and impurities. The transformer is placed in a vacuum chamber and filled with pre-treated oil under full vacuum condition.

This ensures complete impregnation of the insulating material by oil, for maximum dielectric strength. The core is completely immersed in oil and the space between top of oil and tank cover is without any gas cushion, thus preventing built-up of pressure and reducing chances of explosion. The top cover is bolted and assembly is completely hermetically sealed. After a specific stabilization period the transformer is subjected to various tests as per codes and standards.

Since oil does not come in contact with external air, there is hardly any deterioration of oil over a period of time and hence such transformers are virtually maintenance free.

Comparison

The table on the previous page analyses and evaluates conventional oil filled transformer vis a vis hermetically sealed oil filled transformer.

Delivery period

Delivery period depends upon the rating and can vary from typically 6 to 12 weeks, which is much lesser than the conventional oil filled transformers.

Application

Such transformers can find application in industry and installation which are exposed to dust, rain, humidity, moisture & harsh in nature. Typical example can be Utility & distribution companies where transformers are installed outside, by the road side in cities, pole mounted transformer in case of rural electricity distribution, distribution transformer of higher ratings in case of process, chemical, cement & steel plants.

Conclusion

In our country where failures of distribution transformer are quite alarming and where skilled workforce is required to maintain assets the Total Ownership Cost (TOC) is very high. It is prudent that we take into account the technological advancement made globally and introduce, adapt & promote new technology. With the advantages of hermetically sealed maintenance free transformer mentioned above, I am sure industry will wake up to the ground reality and encourage installation of hermetically sealed transformer which are not only energy efficient and have low losses but also makes optimum use of material.

As we are embarking upon our mission of creating SMART CITIES to address the serious issue of urbanization & infrastructure, these transformers are best suited for such applications.

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Interview

"Creating technical competitive edge over global players is a must for a win..."

***Raychem RPG (P) Ltd.,** incorporated in 1989, is a 50:50 Joint Venture between TE Connectivity, USA and RPG Enterprises, India. The company is involved in technologies strengthening the infrastructure segments of economy under four Strategic Business Units (SBUs), namely: Energy Products, Transformer, Oil & Gas and International (exports). In an exclusive interview with **Electrical India, Himanshu Sharma, Head of Sales & Marketing – India & Exports** from the company is explaining their business environment and strategy to **P K Chatterjee**. Excerpts...*

What kind of transformation do you observe in the Indian power sector in the last one year and going forward?

Indian power sector is transforming at a respectable pace especially in last one year. The industry is growing at a CAGR of 15% as a result of growth in power and infrastructure segment. Further to meet the objective of meeting power for all, the government has announced an investment worth $ 250 billion over next five years. Railways, Solar, Mining, Smart-cities and Defence have all given us a reason to step forward and unleash our capabilities to the fullest.

The recent biddings in solar parks have witnessed unprecedented enthusiasm from players. In utilities, we have also seen a downward trend in financial losses from Rs 769 bn in FY12 to Rs 600 bn in FY15, though encouraging, but still a lot is desired to be done further.

This throws some amazing opportunities at players like us. This augurs well with recent UDAY (UjwalDiscom Assurance Yojna) scheme which aims at reducing stressed utilities their interest costs, improving operational efficiencies, reduction of cost of power and enforcing financial discipline through state finances. This gives utilities an opportunity to breakeven in next 2-3 years.

Further the Deendayal Upadhyaya Gram Jyoti Yojana (DDUGJY) is an ambitious feeder separation programme that aims to provide 24x7 power supply to rural households.

The Integrated Power Development Scheme is aimed at improving the quality and reliability of power supply for urban and semi-urban consumers. Average AT&C losses stands at 23.6% in FY15 with 13 utilities reporting an increase.

Reduction in coal prices internationally and allocation of coal mines in India on aggressive bidding rates will ensure low cost of power. All this throws up ample opportunities in Indian power distribution sector. In recent times utilities have started focusing on improving performance by enhancing customer service and increasing customer satisfaction, though some of the old age challenges still prevail at large.

The key focus area going forward shall be renewable energy integration and efficiency improvement through effective load management, data capturing and analytics. Another interesting field of supplementing renewable power generation with storage technology to mitigate both variability and system imbalance is throwing immense opportunities.

What are the priority areas that must be addressed to achieve the development agenda in the power sector?

First challenge that must be addressed is to upgrade its existing rudimentary T&D equipment. Not only we have to improve the last mile distribution connectivity, we also need to make sure that the quality of connectivity is top notch. For plants to run much above the sub-optimal level of 65% in FY 15, we need to decongest our T&D network. Long term PPAs need to be discussed again to accommodate variations in power demand. A move towards single-window project clearance approval, though complex considering wide Indian scenario and diverse stakeholders, will improve private participation.

Tweaking open access policy can help in establishing a true competitive playing field and will bring out the best in the sector. There is a definitive need of political will and urgency from DISCOMs to reduce various commercial and technical losses.

We need to address power evacuation and intermittency for renewable industry growth. Inefficient tariff schemes must be addressed with fair political will. As a result government must try to create an environment where private participation in transmission and distribution is encouraged and smooth functioning is guaranteed via reasonable independence.

How are you gearing up to grab the emerging opportunities?

We have identified smart cities, railways, solar and loss reduction in utilities as key focus segments. There is a lot of impetus within our product development programs to bring upefficient product innovations in various connector technologies. Our study of existing connector installations have thrown us the possibility of reducing I^2R losses by over 80%

Our range of connectors encompass all voltage levels from 1.1 kV till 1200 kV and provide maintenance free operations throughout its lifetime with impeccable reliability. We are also looking at much improved designs of feeder pillar boxes for both over-ground and underground applications. The main philosophy behind our contemporary designs is to have a theft free operations, an easy maintenance, compactness, safety and exceptional reliability.

We have recently acquired one of the best international technology in the field of feeder pillars and are launching our range of feeder pillars under the brand name of 'Rayfeed.'

Our world class Raychem Innovation Center (RIC) at Halolwill soon launch product range to address the requirements of an intelligent distribution network. The well trained sales team and diverse dealer network will provide us the required tailwinds.

What are your latest innovations as far as reliable joints and terminations are concerned?

We have come out with some exclusive designs to improve the reliability of a cable joint system. Our 'Rayfit' type of joints come equipped with specially designed mechanical connectors with shear head bolt technology. These connectors provide best in class electrical connections and ensure error free & tool free installation. These joints also have an innovative hybrid coextruded 3-layered tubing, which combines the functionality of insulation and screen into one. This results in significant reduction in partial discharges and improves the life of a joint by several years.

In terminations, we have come up with 'uniterm' which combines the functionality of stress control with non-tracking tubing – thereby significantly reducing the installation time and providing trouble free operation. In low voltage, we have come up with 'Rayvolve' range of joints where we are

using the combination of rollover-tube technology and mechanical connectors to ensure long life of joints under demanding conditions.

What are your contributions for enhancing safety in the power industry?

Our 'Raysulate' brand of insulation enhancement products are well known and are being used by the industry since long. We were encouraged by the industry to further extend the range to provide PPE for personal safety. We recently launched 'elecsafe' range of PPEs, which are specific to electric safety. We provide electrical safety shoes, electrical safety gloves, helmets, arc-suits, electrical mats and electrical insulation tools which ensure personnel safety.

What are the various types of service that you provide to the power industry?

In addition to the installation services of our products, we also look at safety audits and loss reduction audits for our customers. We run world class call centers where we provide excellent data management along with restoration of faulty feeders. Additionally we provide services for survey, diagnostics, consultancy and annual maintenance contracts. Our service segment is growing at a brisk pace of 30% YOY basis and some of our major clients include DMRC, BRPL, BYPL, TPDDL, HVPNL and various other industries , EPC contractors and DISCOM's.

How are you serving the emerging renewable energy players?

The target of achieving 175 GW (100 GW in solar, 60 GW in wind, 10 GW in small hydro and 5 GW in biomass) has been advanced now by 2 years to 2020 and would require an investment above $150 billion. This humongous task will put pressure on our research and development capabilities to improve reliability of the products and improve efficiency of PV cells to 30-40% levels. Accordingly, we have aligned our product offerings and strategy for the sector. We are focusing on products which will help customers improve the reliability of solar parks or wind parks which are normally located far away and any breakdown would cause huge financial implication. We offer joints and terminations, polymeric insulators, trouble free connectors, protection against wildlife overhead line accidental flashovers, composite lightning arrestors etc., which are key to providing reliability in power evacuation.

What would you like to communicate to the Indian power engineers?

Let's innovate, change and strive for better tomorrow. We have one group of the best talents in the power sector, but somehow we have contained ourselves within our systemic boundaries. We have a distance to go and lot of innovative thinking is required to achieve the desired results. Creating technical competitive edge over global players is a must for a win.

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Sulphur Hexa Floride Circuit Breakers

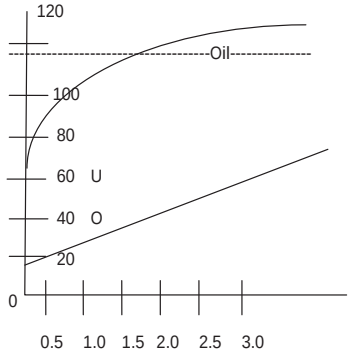
There are attractive possibilities of the combination of SF_6 insulation with vacuum interrupters. Another recent suggestion is to use liquid SF_6 in a container much like oil...

Sulphur Hexa Fluoride (SF_6) is the recent development in the field of high voltage switchgear circuit breaker. In this a gas called sulphur hexa flouride is used as the medium of insulation and arc interruption. SF_6 is about 5 times heaver than air. It is chemically very stable, odourless, inert, non-flammable and non-toxic, The gas has a high dielectric strength and outstanding arc quenching characteristics.

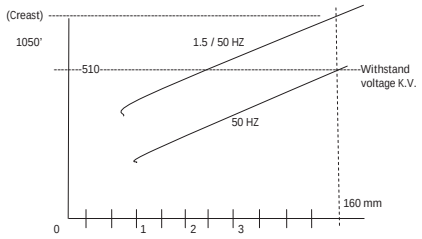
In SF_6, the arc voltage remains low until immediately before current zero so that arc energy does not attain high value. Moreover, the arc time constant for SF_6 is also very low. Furthermore, SF_6 and decomposition products are electronegative permitting electron capture at relatively high temperature.

Thus, the dielectric strength rises rapidly and enables the breaker to withstand the recovery voltage, even under extreme switching conditions. In air blast circuit breakers, air is allowed to escape following the quenching operation.

This obviously would be uneconomical in the case of SF_6 breakers. Actually, sealed circuit breaker chambers are therefore developed in which even the gas pressure remains practically constant over long periods. Owing to low contact erosion in SF_6 and almost negligible decomposition of gas in arc, the breaker can be operated for several years without having to be opened for the purpose of overhauling.



Dielectric strength vs pressure for air, oil and SF6…



an insulator with an overall height 160 mm the impulse and power frequency withstand voltages are shown…

Dielectric properties of SF_6

At atmospheric pressure the dielectric strength of SF_6 is about 2.5 times that of air. Actually speaking, this value will depend on the nature of the field existing between the electrodes, which in turn will depend on the shape and configuration of electrodes and the gap between the electrodes. The dielectric strength may actually increase to about 5 times depending upon the non – homogeneity of the field. The graph shows the relation of dielectric strength vs pressure.

It may be seen from curves that dielectric strength which is 30 % less than that of oil at atmospheric pressure increases rapidly with increase of pressure. It attains a value equal to that of oil at pressure of 650 gm/cm^2 – and at a pressure of 1.25 kg/cm^2, it is about 15% higher.

For an insulator with an overall height 160 mm the impulse and power frequency withstand voltages are shown in figures as a function of SF_6 pressure. At pressure of 3.5 atmosphere the withstand voltages are almost equal to those for outdoor post insulators measuring 2100 mm.

This gas is strongly electronegative, which means that free electrons are rapidly removed from discharge by the formation of negative ions through process by which a free electron is attached to neutral gas molecule. The attachment may occur in two ways:

(A) As direct attachment – $SF_6 + e^-$

(B) As dissociative attachment

$SF_6 + e^- = SF_5 F^-$

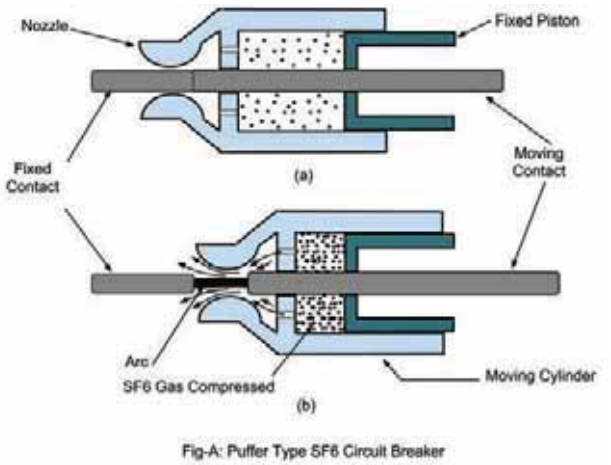


Fig-A: Puffer Type SF6 Circuit Breaker

Fig-A: Puffer Type SF_6 Circuit Breaker...

The resulting ions, which are heavy and relatively immobile are thus ineffective as current carriers – so that ionized SF_6 has as high an electric strength as unionised gasses such as N_2 at equal density.

Quenching Properties of SF6

The extinction of AC arc at the instant of current zero is primarily influenced by the speed with which the dielectric strength in the contact gap regenerates immediately before and after the passage of current zero. Its efficiency as an arc quenching medium can be explained by the low dynamic time constant (about 1 micro sec compared with about 100 microsecond in N_2) of arcs drawn in it. In the case of cylindrical arc, the time constant (H) is a function of temperature, the thermal conductivity is low.

The low time constant of SF_6 is due to its ability for free electrons to be captured by molecules of SF_6 gas, These SF_6 ions surround the arc and form an insulating barrier. This reduces the diameter of arc column, and hence results in reduction of time constant, which aids arc quenching. Figure shows time constants of SF_6 and air as functions of pressure.

Condition is much less favourable where the arc burn in N_2. No thin core forms in the critical temperature range between 3000 and 7000K because of good thermal conductivity of N_2.

The diameter of the arc approaching extinction remains considerably larger and its time constant which varies as the square of the radius, is therefore very much greater. The bounty regions below the ionization temperature does not have the same dielectric strength as SF_6, because nitrogen is not electronegative. SF_6 and almost all its decomposition products are electronegative and have an affinity for electrons. During cooling, the dielectric strength of the breaker, therefore, rises more rapidly than, for example, with air. The influence of low arc time constants on circuit breakers can be seen as follows.

Meyer's equation for the limiting value of recovery voltage after current has passed through zero above which arc restrikes is given by

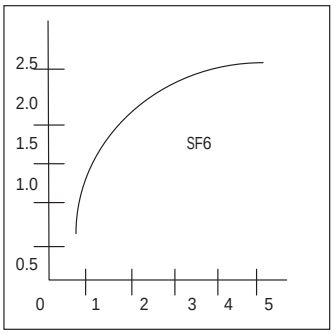
$$E = \frac{Ea}{2\sqrt{3}\ (HW_0)^2}$$

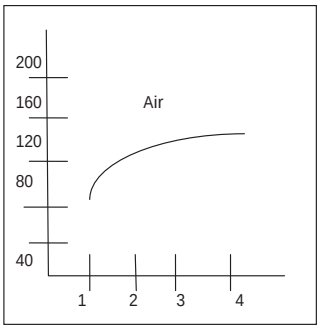
Where Ea = arc voltage.

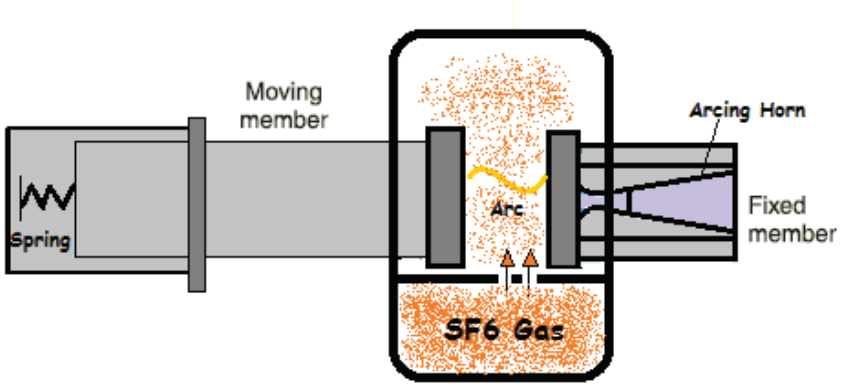
Wo = 2 πf0 where f0 is the natural frequency of the mains.

H= arc time constant.

Since H is 100 times smaller for SF_6 than air, for the value of limiting voltage the natural frequency of mains may be 100 times greater. In other words SF_6 breakers can withstand severe RRRV, and thus are most suitable for shot line faults without switching resistors and can interrupt capacitive currents without restriking.







Essential parts of SF_6 gas in arc

The essential parts of a SF_6 breaker are :

- The tank
- The interrupter unit
- The operating mechanism
- The bushing
- The gas system

Tank: The distance between line and earth parts inside the tank is very much reduced due to better insulating properties of SF6 . As already illustrated in figure, the dielectric withstands 510 kV at 50 hz and a kV BIL Test. Even at atmospheric pressure the insulation distances are sufficient to withstand nearly twice the rated voltage to earth. No large pressure rises are caused due to the operation of SF6, the tanks being designed for pressure of nearly four times and tested at six times the pressure

Interrupter Units: Organic insulation like fibre or micarta should not be located in the

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arc path since they will be decomposed thus diluting the gas:

The arc is extinguished by SF_6 gas under a pressure of 14 kg/cm^2 which reduces the mechanical energy for operation of the breaker. The important parts of the interrupter are:

- Main reservoir containing gas at 14 kg/cm^2
- Blast valve and control mechanism
- Piping for the gas under pressure
- Axial flow Interrupter
- Tripping spring.

Capacitor units are placed across each break to ensure equal voltage distribution. Metallic parts are surrounded by electrostatic shields, which provide correct distribution of electric field between the intrupter and tank. The various parts are supported by two insulating bars running the whole length of the interrupter.

Operating mechanism: In operation the tripping spring drives the moving contacts and simultaneously opens the valve of the pressure reservoir. The gas under pressure flows into the breaking chambers and extinguishes the arc. At the end of the operation, the mechanism releases the valve of pressure reservoir, which is closed by the action of a set of springs.

Bushings: These contain SF_6 at a pressure of 2 kg/cm^2 and are much simpler than the condenser bushings. They contain a hollow conductor, a fixing flange. the upper and lower porcelain insulators and the springs, which hold the assembly together. The SF_6 gas in bushings communicate with that in the tank through small holes in the upper part of the hollow conductor. The gas in the bushings is thus unaffected by any disturbances in the tank at the instant the current is broken. A filter containing activated alumina is placed at the bottom of the hollow conductor delaminating all chance of contamination of SF_6 inside the bushings .

Gas system: A compressor sends the gas back after each break to the high pressure reservoir. Being a closed circuit, no gas escapes to the atmosphere.

An auxiliary reservoir of SF_6 at 14 kg / cm^2 is located below each tank, containing enough gas for 4 consecutive breaks without the need for starting up the compressor.

Recent results and prospects for future development

Whether these techniques based on new principles will succeed is more difficult to estimate. It is not probable that a better multiautomic gas than SF_6 gas will be found , but perhaps a better liquid than oil is feasible. There are attractive possibilities of the combination of SF_6 insulation with vacuum interrupters. Another recent suggestion is to use liquid SF_6 in a container much like oil in minimum oil breakers. This may provide a solution to the problem of higher speed of operation, on the basis of the results obtained so far, and in view of the fact that future development looks promising.

Prof N S Gorhe
B.E. (EE) from Walchand Collage of Engineering Lecturer in Electrical Dept. of K K Wagh Polytechnic Chandori

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A Glimpse Of The Scenario In The USA

A recent analysis from Frost & Sullivan, 'North American Combined Heat and Power Generation Market', finds that the market earned revenues of $1.50 billion in 2014, and estimates this to reach $1.95 billion in 2021...

Combined Heat and Power (CHP) accounts for 8% of the United States' (US) electricity generation capacity, but 12% of its annual power generation. This reflects the longer operating hours of CHP plants compared to plants involved in conventional forms of power generation.

In addition, as an efficient and clean method of generating electric power and thermal energy from a single fuel source, CHP is used in a broad range of sectors.

Approximately 87% of CHP units supply heat and power to industries such as chemicals, paper, refining, food processing and metals. The remaining 13% is employed for commercial, institutional and residential purposes.

A recent analysis from Frost & Sullivan, North American Combined Heat and Power Generation Market, finds that the market earned revenues of $1.50 billion in 2014, and estimates this to reach $1.95 billion in 2021.

"Strong government support in the form of tax credits and incentives gives impetus to the use of CHP systems in North America," said Frost & Sullivan Energy & Environment Industry Analyst Mahesh Radhakrishnan.

"The market will also get a boost from legislation such as the Energy Policy Act of 2005 and Energy Independence and Security Act of 2007, which mandates incentives for CHP and waste energy recovery," he added.

As per the executive order issued by the Federal Government in 2012, 40 Giga Watts (GW) of cost-effective CHP capacity will be added by 2020. This will take US CHP capacity up to 130 GW, with additional potential for 65 GW each for the industrial and commercial or institutional sectors.

Nevertheless, unclear utility value proposition, limited supply infrastructure and inadequate end-user awareness regarding the benefits of CHP systems are hampering deployment rates.

Apart from these challenges, the price of input fuels will play an important role in deciding the growth of the CHP market in North America.

"As more than 67% of Combined Heat and Power (CHP) facilities in the US use natural gas as the input fuel, any volatility in its prices could prove detrimental to the market," noted Fellow Frost & Sullivan Energy & Environment Research Analyst Rasholeen Nakra.

"Natural gas prices are, however, expected to increase only moderately compared to electricity prices, resulting in positive spark spread and high investments in the CHP market," he added further. EI

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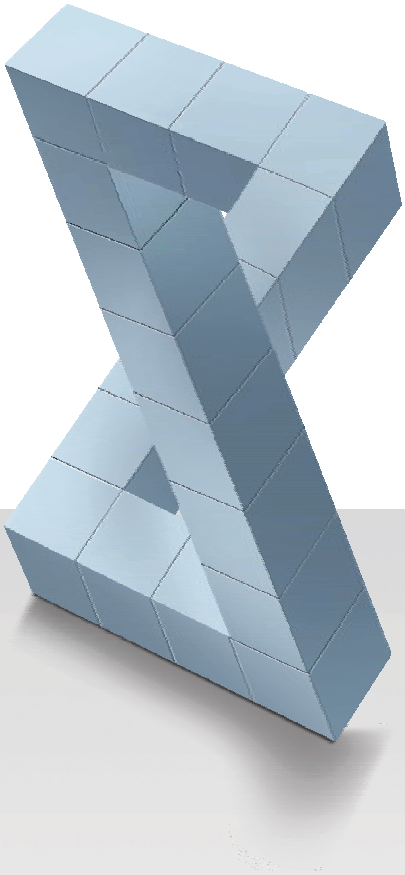
The impossible, is often the untried



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Ecological Concerns In Hydroelectric Power Development

One thing must be kept in mind that everything can be generated but water cannot. Once it is lost it will be lost forever, it cannot be generated. So, the need of the hour is to use this wonderful gift of god to meet our need not our greed...

Dams have had serious impacts on the lives, livelihoods, culture and spiritual existence of indigenous, tribal and illiterate people, and on the physical environmental conditions and biodiversity. As far as the dam related developmental activities in Himachal Himalayas are concerned, they got momentum during 5th five year plan and at present there are more than 400 power projects in five perennial river basins spread over 55,673 sq. km geographical area. Every basin is being excessively exploited which has a considerable impact on environment and threatening the lives and livelihood of the mountain inhabitants by creating ecological imbalance. The present article is based on the primary research carried out in Ravi basin. There are more than 50 rivulets in the Ravi catchment which have been earmarked for the planned development. At present, more than 80 power projects are either proposed or generating electricity. Speaking specifically, series of power projects i.e. Shahpur Kandi (125 MW), Thein Dam (600MW), Baira-Suil (198), Chamera-I (540MW) and Chamera-II (300 MW) on ravi basin have unintentionally produced weather and climate changes on a larger scale and threatening the existing biodiversity and sources of livelihood by interfering with the ecosystem. These activities have started way back in 1980s with the installation of BairaSuil Power Project and today it has covered almost whole basin starting from inter-state border of Jammu & Kashmir and spreading to Punjab and Himachal Pradesh which has engulfed the green cover of the area. More than 100 km reservoirs and 25 km dried patches are responsible for tremendous increase in the temperature, untimely and unusual rain in the basin after the installation of power projects.

In the present article, the responsibility of hydroelectric power projects for threatening the livelihood will be analyzed, which is based on original micro field research carried out in the lower Himalayan Region by using exploratory and descriptive method. To analyse the impacts on climatic conditions and its consequences on ecosystem services and livelihood, metrological data of Ravi basin from 1984 to 2004 have been used and the article will also report the viewpoint of the respondents belonging to different age groups.

Throughout human history natural resources have been exploited to sustain growing human populations. Over the last few decades, rising economic growth rates in most developing countries have contributed to increasing levels of exploitation of natural resources and environment degradation, which unchecked could have detrimental effects on future growth patterns.

Environmental degradation as a consequence of resource exploitation is a global phenomenon which is evident from the increasing levels of deforestation, polluted water, air and land resources. According to the United Nations report, 1.1 billion people live without clean drinking water; net deforestation rates have fallen since 1990-2000, but some 13 million hectares of the world's forests are still losing each year; carbon dioxide, one of the major greenhouse gases that contributes to the global warming phenomenon, is 27% which is higher than at any point in thelast 650,000 years. The Intergovernmental Panel on Climate Change (IPCC) projects that atmospheric carbon dioxide levels could reach 450-550 ppm by 2050.

In the modern times because of imminent challenges to our environment, natural resource management; along with conservation, restoration of environment is becoming a central topic in the development planning objectives of every developmental project.

As far as the natural resources in Indian subcontinents are concerned, they are available in abundance, particular in form of sources of energy, which are being used enormously for all sorts of power generation.

In the present developing state of country's economy, there is a great requirement of electrical power for both industrial and agricultural use. The power requirement during March-April '03 for Northern Region was 156,610 MU (million units) against the availability of 144,218 MU.

Thus, there was a deficit of 7.9% As per the anticipated power supply position in 2006-07 (10th plan), this deficit will increase in future even after accounting the contribution of the upcoming power projects in the northern region. As per this report, in the year 2006-07, total energy and peak energy demands in the northern region shall be 220,820 MU and 355,540 MU against availability of 181,468 MU and 29,667 MU respectively. Thus, there shall be deficit of 17.8% and 16.5% for total energy and peak energy respectively, in the northern region. These deficit figures for all India are 12.9% and 12.3% respectively. Further, the Report of the Group on Power for 10th Plan estimated the need based capacity addition of 62,213 MW during 11th Plan. Thus, it is necessary to commission projects to generate power to bridge the ever-increasing gap in demand and supply scenario.

To bridge up this gap Govt. of India has launched a massive plan known as "Mission-2012, Power for All", under which 50,000 MW hydroelectric power is to be added in the existing generation capacity. Out of estimated potential capacity of 1, 50,000 MW, only 15 per cent has been commissioned so far and 7 per cent is on the way of its commissioning.

The installations of power projects in the river basins have definitely detrimental effects on the bio-diversity as well as on the climatic conditions of the area concerned. Moreover it has definitely a vital role to play to change the environmental conditions of the area concerned where such types of activities have been installed.

The present article is based on the first hand information by using descriptive research design and using convenient sampling technique in the Ravi basin of Himachal Pradesh as well as some secondary information. To see its impacts at minute level, three commissioned power projects installed by NHPC in Ravi basin have been studied.

Through this article, an attempt has been made by the researcher to highlight the role of these commissioned power projects in the climate change in the catchment area at micro level and in the whole region at macro level. The article is further important because the first power project was commissioned way back in 1990s, second in 2000s and third was recently commissioned in 2003, and ill effects as well as impacts of these power projects are visible and have been analyzed.

Hydroelectric power development in Himachal Pradesh has got top priority from sixth five year plan i.e., 1980-85 onwards. During tenth five year plan i.e., 2002-2007 besides completing the ongoing projects as early as possible, the state government has

prepared an ambitious plan to accelerate hydro power generation of identified potential capacity of 25,000 MW.

Ravi has total catchment area of 5,451 sq. kilometers and 154 sq. km in Himachal Pradesh. This basin lies between the PirPanjal and Dhauladhar ranges of lower Himalayas. The potential capacity of Ravi has been assessed 2301.5 MW; out of which 1038.5 MW has been commissioned so far through four commissioned power projects in Chamba district i.e. Bairasuil (198 MW), Chamera-I (540 MW), Chamera-II (300 MW). In other words it can be stated that this basin has been excessively targeted (table 1) for the hydroelectric power development since 1980s with the installation of NHPC's first hydroelectric power generation plant with the name of BairaSuil Hydroelectric power project. After this power project Chamera series of projects have been started. In 1990s Chamera stage–I and in 2000s Chamera-II, and Chamera-III have contributed considerably and change the ecology and climatic conditions of the whole basin. Along with these, this basin has experienced a major jolt of development named as Thein Dam, which situated at the border of Himachal Pradesh, Punjab and Jammu and Kashmir. A number of power projects in Ravi basin either installed or proposed to be installed. The following table is presenting a clear picture of such of developmental activities in Ravi basin:

The catchments area of Ravi basin is experiencing drastic climatic changes, because of 100 kilometers reservoirs of Shahpur Kandi (125 MW), Thein Dam (600 MW, with Catchment area of 6086 sq. km & reservoir of 87 sq. km), Chamera-I (540 MW) and Chamera-II (300 MW); and tunnelization of Ravi in 19.38 kms with a dia of 7 to 9 meters and 102 meters high surg shafts with 15.5 meters dia and underground power houses of Chamera-I (89x22x42 meters) and Chamera-II and dry Ravi in almost all its natural route (27 kilometers in Chamera I and Chamera-II). And upcoming Chamera-III with a head race tunnel of 19.98 kms with 7 metres dia and which would led Ravi to be dried at a stretch of 35 kms, affecting the lives of thousands of people living in the downstream as well as of the flora and wild animal; broadly can be called as bio-diversity.

On the basis of above citation it can be stated that the installation of power projects in

Sr. No.	Name of Power Project	Name of River/ nallah	Classification	Installation Capacity (in MW)
1	Chamera-I*	Ravi	Large	540.00
2	Chamera-II*	Ravi	Large	300.00
3	Chamera-III	Ravi	Large	231.00
4	BairaSuil*	BairaSuil	Large	198.00
5	Bhuri Singh*	SaalNala	Micro	000.45
6	Tundah-I	Tundahnallah	Small	015.00
7	Tundah-II	Tundahnallah	Small	030.00
8	Bharmour Micro	Budhil	Micro	000.02
9	Garola	Garolanallah	Micro	000.05
10	Holi	Holi nallah	Small	003.00
11	Sal Stage –I	Saalnallah	Small	008.25
12	Sal Stage –II	Saalnallah	Small	002.25
13	Budhil	Budhilnallah	Medium	081.00
14	Bharmour	Budhilnallah	Medium	045.00
15	Harsar	Budhilnallah	Medium	060.00
16	Kugti	Budhilnallah	Medium	045.00
17	Kutehr	Ravi	Large	360.00
18	Sindi	Ravi	Medium	120.00
19	Bara Bangal	Ravi	Medium	160.00
20	Thein Dam	Ravi &Sewa	Large	600**

Table 1: Showing power projects in Ravi basin...
**Indicates power projects in operation in Chamba district.*
***Thein dam (Maharaja Ranjeet Singh HE Power project with 600 MW Capacity at Shahpur Kandi near Pathankot (Punjab) situated at interstate boarder of Jammu & Kashmir, Himachal Pradesh and Punjab.*

Item	In Chamera-I	In Chamera-II
People Affected	1554 families	230 families
People Displaced	1174 families	030 families
Village affected	55	15
Village Submerged	07	01
Height of the dam	140 meters	40 meter
Length of the Head Race Tunnel	6.4 km	7.83 km
Length of Tail Race Tunnel	2.45 km	3.46 km
Underground power house	74x71x82 meter	100x22x39.5 meter
Reservoir	29 km	3.6 km
Forest affected area	982.50 hectare	78.78 hectare
Trees affected (officially and increased manifold unofficially).	40,000	1380
Total area afforested (according to NHPC)	2,000 hectare	172.58 hectare
Total trees planted by NHPC	39, 81,186	2,30,000
Money spent on plantation	322.06 lakh	37 lakh

Official data of Power Projects in Ravi basin...

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Ravi basin are largely responsible for the climatic changes, unseasonal rain, recent cloudburst in Sarol and Rajpura village, just 1/2 kilometer away from the top head of the Chamera-I reservoir, dry Ravi, large water body of 32.6 kilometer, underground blasting which has dried all vegetative cover and natural sources of water, above all tunnelization of Ravi (19.38 kilometer) are some areas of major concern which are disturbing the people of the area, therefore, people are not satisfied with the installation of power projects. The executing agency is claiming the restoration of affected vegetation cover, by planting compensatory forest in the catchment area, but today not a single tree is visible.

Because of which the dry portion of the catchment is experiencing extreme hot on the one hand and the vegetative cover situated over the HRTs, TRTs, edits, underground power houses, shrug shafts is drying and dying on the other.

People feel concerned about the environmental hazards in form of earthquakes, in the most geologically weak region, Chamba falls in seismic zone V, which is the most sensitive zone, they think that trespass in nature to this extent may be resulted into havoc consequences anytime. The whole catchment area has experienced unusaual and infrequent rain fall after the installation of these power projects, which led to the problem of low crop production and aggravate the existing poverty in the area. The following table is highlighting the amount of decadal rainfall (1996-2006).

As it is clear from the above table that the area has experienced drastic fluctuations in the climatic conditions particularly in the rainfall, which led to numerous problems. The total number of rainfall in a particular year has experienced a fluctuations in 1996 it was 1054 mililitres (ml), goes upward in 1997 to 1103 ml while again in 1998 it goes up to one ml while in 1999 it goes down to 826 ml and again in 2000 it arose to 1706 ml, in 2001 it again goes down to 1275 ml and remain continuously down in the next year to 1187 ml. The area has experienced 1298 ml rainfall in the year 2003 and in the next year it goes down to 1157 ml. The rainfall has gained upward mobility from 1157 ml to 1174 ml in the year 2005 and remained continue and touched 1245 ml point in 2006.

Ravi in Tunnel	19.38 KM
Ravi in reservoir	32.06 KM
Total area tunnel ⊩ eservoir	51.44 KM
Road distance from TRT Khairi to Bagga dam	73.00KM
Ravi in its natural route 73-51.44 (Now left or occasionally seen)	21.57 KM

Present Status of Ravi...

On the basis of above description it can be stated that during the course of past ten years the climatic conditions of the area had experienced a lot of weather jolts. Along with this it is also stated that the whole has undergone many geological and metrological changes. The area experienced many minor earthquakes jolts and newly erupted phenomena of cloud burst and unusual rain in this span of ten years, these all are the signs of climate changes, which has increased after the installation of power projects.

The number of days of the rain in a year has also experienced a lot of ups and down. Number of days of rain remained between 44 days in a year to 76 days in the year from 1996 to 2000. In the second half of the data i.e., the number of days of the rain remained between the range of 77 days and 149 days in a year. In other words it can be stated that the number of days of rain has not remained the same in some cases. It was 44 days and in the other cases it goes to the maximum level of 149 days in a year, which is of serious concerns. To a sizeable extent it can be stated that the first five years can be called as the geological and climatic settlement period. In this period these settlements have been taken place and in the second half of the data i.e. from 2000-2006 indicated that the settled period, in which all settlements have been settled but the load of water of 29 kilometers long and 143 metres high dam is a matter of serious concern and is responsible for the changing environmental conditions in the area.

Maximum rainfall in a day has also experienced a lot of mobility. In the year 1996 it was 373 ml which has decreased up to 344 ml in the next year and again goes up to 552 ml in 1998 and again goes down to 460 ml in 1999 and this trend remained continued in the next year and reach up to 425 ml. In the year 2001 the area experienced maximum rainfall in a day up to 462 ml and decreased down to 300 ml in the next year then arose up again to 420 ml in the year 2003, in the next year it goes up to 465 ml and surprisingly in the next year it goes down to 247 ml and in 2006 it experienced a little bit upward mobility up to 369 ml.

As it is evident from the above discussion that there are lot of fluctuations in the number of days of rainfall in a year has been received by the area.

Due to the upheaval in the local environment the climatic conditions of the area have been changed to a greater extent after the installation of power projects.

Ecological concerns in power projects- need to be addressed

Ecological simply means concerns related to ecology and ecology on the basis of existing literature can be defined as interactive relationship between living organism and environment.

Man needs development for better livelihood options and wherever such developmental initiative have been planned it affects environment (sum total of biotic and abiotic components) and this triangular relationship has a fundamental role to play in delicate interactive web.

Installation of power projects to produce energy for the development have many ecological concerns, which are affecting physical environment as well as interactive relationship between human beings who are either living in the vicinity of power projects or people who are using it at hundreds of kms away.

Physical environment

The physical environment has been affected by the carving and construction activities for Head Race Tunnels (HRTs), Tail Race Tunnels (TRTs), edits, shrug shafts, underground power houses, pressure shaft and

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Table: Amount of Rainfall in mililitres (ml.) during the year 1996-2006 in Chamera-I Catchment Area...

Year	Item*	Month												
		Jan	Feb	Mar	Apr	Mar	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1996	1	121	--	168	48	71	95	158	290	103	--	--	--	1054*
	2	04	--	08	02	04	08	13	11	04	--	--	--	54**
	3	63	--	60	29	22	20	42	87	50	--	--	--	373***
1997	1	09	79	17	103	76	175	152	132	85	70	90	115	1103*
	2	03	04	02	07	05	16	07	09	07	09	04	03	76**
	3	05	41	15	28	29	34	38	29	25	20	40	40	344***
1998	1	35	245	130	55	15	121	60	85	165	53	--	40	1004*
	2	02	09	06	04	02	03	04	08	07	07	--	08	60**
	3	20	70	40	30	10	80	20	20	60	22	--	180	552***
1999	1	180	25	25	15	15	20	216	135	95	--	100	--	826*
	2	14	02	03	02	02	02	07	06	04	--	02	--	44**
	3	200	20	10	10	10	10	60	40	40	--	60	--	460***
2000	1	240	469	192	78	47	190	394	96	--	--	--	--	1706*
	2	8	11	05	04	03	07	09	09	--	--	--	--	56**
	3	60	67	60	38	25	55	75	45	--	--	--	--	425***
2001	1	100	40	162	103	31	155	405	135	42	1	60	41	1275*
	2	02	03	08	12	11	13	21	11	4	1	04	3	93**
	3	75	20	65	31	11	29	98	60	4	1	48	20	462***
2002	1	107	166	158	131	9	25	90	317	142	--	25	17	1187*
	2	08	09	07	08	03	05	09	15	12	--	02	03	81**
	3	40	40	28	27	05	10	30	50	40	--	15	15	300***
2003	1	42	317	191	98	52	56	150	311	19	--	29	33	1298*
	2	04	10	14	09	05	07	11	16	09	--	02	5	92**
	3	36	80	40	38	28	16	54	16	80	--	17	15	420***
2004	1	154	121	--	128	66	144	108	191	33	139	29	44	1157*
	2	6	05	--	06	03	09	10	10	05	06	01	03	64**
	3	60	48	--	45	50	44	36	63	08	56	29	26	465***
2005	1	71	284	200	30	42	46	354	47	100	--	--	--	1174*
	2	70	12	11	04	11	5	18	07	11	--	--	--	149**
	3	12	50	67	13	7	17	45	13	23	--	--	--	247***
2006	1	202	125	174	33	36	89	122	305	66	16	16	61	1245*
	2	7	5	2	4	8	8	6	19	05	03	05	05	77**
	3	68	52	27	28	17	31	26	40	37	6	08	29	369***

*(Source: Metrological Department of NHPC) *By item in the table means (number wise)*

1) *Total amount of rainfall (in ml)*
2) *Number of days of rain fall*
3) *Maximum rainfall during the day (in ml)*

* *Total amount of rainfall in a year (in ml)*
** *Number of days of rain fall in a year*
***Maximum rainfall during the day in a year (in ml)*

allied construction related activities. The road, which approached the Suil Weir from Dhargala to Suil Weir via Baroti, from Surangani to powerhouse, from Nakrore to Baira Weir has been constructed in BairaSuil hydel electric power project. Along with these construction of roads, the existing road Chamba-Salooni, Chamba-Surangani, Chamba-Tissa roads have been widened, undoubtly the widening of roads has made a good contribution but the physical environment has badly been affected and furthermore the conditions of these roads has become worst as the projects are over. In Chamera-I road from Barangal to Dandi, Khairi to pressure shaft over underground powerhouse, Chohra via- pass has been constructed. In Chamera –II from Rajera to Jarangala via Gagla, from Rakh to Gurad, which is proposed to be extend up to Bindla village then to Lihal village near under-ground powerhouse of under construction Chamera-III. In this regard it is worthy to be mentioned here that all the construction of roads are just to have access to the sites of construction of the projects.

Seismicity

The Ravi catchment area falls in seismic zone V. The geological composition of this area comprises rocks and other components are in formation stage. Such types of hydel electric power developments in the geologically weak zone are not desirable.

As accepted by NHPC, the area of BairaSuil, Chamera-I and Chamera-II are geologically weak. After the installation of power projects in this area the possibility of earthquake has been increased manifold. The World Commission on Dams (2000) in his report has also expressed the possibility of earthquakes measuring 3 to 3.5 Richter scale in the reservoirs as a routine phenomenon. In 2005, after the commissioning of chamera-II, a number of mild earthquake jolts of 3.7 to 4.8 Richter scale have been experienced in Chamba. The earthquake of 1995 measuring 5.4 Richter scale immediately after the commissioning of Chamera-I in 1994 was the first retaliation of the nature with its epicenter at Kiani village, which is situated at the endpoint of 19-kilometer (Ravi side) reservoir of the Chamera-I. Along with earthquakes, the whole area has also experienced the newly erupted phenomena of cloudburst. The cloudburst is happening almost every year and is responsible for the loss of property in form of fertile soil, trees and other forest commodities.

So, it is submitted with conviction that such types of developmental activities are not desirable as well as viable especially in Seismic Zone V.

The Ravi basin is being harnessed very badly from Madhopur to Bharmour (table; 1). Now, the policy makers of state as well as national level must think judiciously before granting permission to install such hydroelectric power projects.

Final comments

The researcher is not against the installation of power projects, but these must be eco-friendly and sustainable in nature and there must be sustainable improvement of human welfare. This means a significant advancement of human development, which is economically viable, socially equitable and environmentally sustainable. If the dams are the best way to achieve this goal, then deserve the full support of the researcher.

The local issues must be taken into consideration properly and with true spirit, not in paper and must not be engulfed by the red tapism of the Indian bureaucracy.

The policies should be framed by visiting local sites and taking local issues into consideration. Before sanctioning any other power project for Ravi basin the World Commission on Dams recommendations must be taken into consideration, which has stressed four fundamental values regarding the dam building, these are; equity, efficiency, participatory decision-making, sustainability and accountability. We all the travelers of one spaceship earth, any trespass even in the name of development may have detrimental effect.

One thing must be kept in mind that everything can be generated but water cannot. Once it is lost it will be lost forever, it cannot be generated. So, the need of the hour is to use this wonderful gift of god to meet our need not our greed. We must keep ourselves away from the natural cycle of the water – and should not disturb it in the name of so called development. We must keep in mind that nature can live without man but man cannot.

Dr Mohinder Kumar Slariya
Department of Higher Education
Govt. of Himachal Pradesh
Govt. PG College, Chamba

Commitment Towards GREEN TOMORROW

Reliance Energy is playing a great role in Energy Conservation & Energy Efficiency (EC&EE) practices. Thus, while the company's business footprint is growing every passing day, its carbon footprint is reducing. What are their best practices...

Energy Management and Environmental Security are the current challenges. Access to reliable electricity for all is one of the key drivers of socio- economic development. However, according to the 2011 Census data, 45 % of Rural Indian Households lack access to electricity supply. The primary reason is power generation lesser than demand. It has been proven time and again that 'Energy Conservation & Energy Efficiency' is the key to bridge the gap between this Demand and Supply.

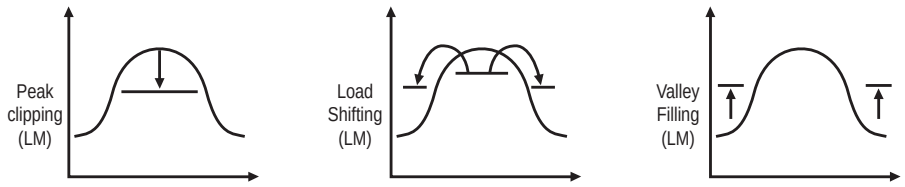
Reliance Energy takes pride in playing a pioneering role in Energy Conservation & Energy Efficiency practices, across its value chain – from Generation to Transmission and finally in its Distribution business.

Our Generation Plant at Dahanu boasts of the several achievements in the field of Energy Conservation. First certification for ISO 50001:2011 – Energy Management System, across the world, Only Power Generation Company in India to enter 'Platts' Power magazine, USA in 2004, First Power Plant, to have been certified for ISO 14001, across the nation, to name a few.

Reliance Energy, the Mumbai power distribution arm of Reliance Infrastructure Ltd., is not far behind and is the first electric supply utility in the country to establish an effective ISO-9001:2008 Quality Management System & one of the few utilities in India which has ISO 14001:2004, EMS certificate which shows the company's commitment for environment protection. With a consumer base of more than 29 Lacs; geographic spread over 400 Sq. Kms. and with a workforce of more than 8500; the company has been serving Mumbaikars since last 85 years with a Quality Power supply having 99.98% reliability & T&D loss near 09 % again one of the lowest in India. While such a humongous geographical and operational spread of activities makes Energy Conservation / Energy Efficiency a challenging task; on the other hand it also magnifies the results and benefits of any process improvement and standardization manifold.

Demand Side Management – Objective & potential

Objective – Any Initiative which will either clip the peak or shift the load to off peak is consider as a positive outcome of Demand Side Management.



Load Management...

As per CEA Report, Sector wise DSM potential identified:

Sector	Conservation Potential
Industrial	25%
Agriculture	30%
Domestic & Commercial	20%
Transport	20%
Economy as a whole	23%

Reliance Energy, therefore targeted Industrial, Commercial and Domestic Sector which in combine has large chunk of conservation potential.

Advantages of DSM over New Capacity Addition...

Focused Approach

Reliance Energy EE/EC/DSM program follows a comprehensive three-prong Approach – Implement, Educate, and Practice!

1.0 Implementation of EE&EC Measures for Consumers!

- **EE Ceiling Fans Program:** As over 80% of the consumers of Reliance Energy are from Residential Category this Program was launched for Residential consumers to replace, old inefficient ceiling fans by BEE 5 star rated Ceiling Fans that save over 30% of electricity. The programme offered up to 50% price discount to consumers with free of cost installation. During Phase I & II, total 25,000 Units were replaced with an estimated savings of 1.25 MU p.a.
- **EE Refrigerator Program:** Load research survey showed that 71% of residential customers are using refrigerator in their homes. Also, 17% of the existing refrigerators were 10 year old and inefficient while 88% are more than 5 year old. Based on Load Research findings, the Program for residential consumers is launched to replace the conventional refrigerator with energy efficient BEE 5 star rated Refrigerator. Till date 6500 refrigerator are being replaced with estimated saving potential of 2.6 Million Units.
- **5-Star Split Air Conditioner (AC) Program for Residential & Commercial Users:** Under this programme the company has replaced the old Window AC units, 770 in numbers, with

energy efficient 5-star rated split AC units. Cumulative estimated saving of 2.16 Lacs Units p.a.

- **AC Automation Programme:** This Program was launched for Commercial and Industrial consumers with an objective of automation in air conditioning for chiller plant, ductable split and cassette and package air-conditioners. The target was the automation of 2,500 tonnes of refrigeration (TR) which would result in annual estimated saving of 1.3 million units. Under this programme, in 2014-15, 3 commercial consumers have participated with automation of 770 TR Air Conditioning system, and has resulted into cumulative savings of 0.15 million units as on date.
- **Energy Audit Scheme:** This scheme was launched by the company with an objective to sensitize its Commercial / Industrial consumers on energy efficiency and energy conservation measures, and to facilitate them in adapting these measures thereby saving electricity and reducing their peak demand. While the Energy Audit Services to small consumers were offered absolutely free of cost, that to the large consumers were offered with an Audit Fee on sharing basis - 75% (Company) & 25% (Consumer). However, even this 25% payment by consumer was refunded as an incentive to those who implemented at least 50% of audit recommendations. More than 120 Audits have been conducted till date with an estimated savings of more than 8 MU.
- **Capacitor Installation Program:** This program was launched by the company for all Commercial and Industrial category consumers. Under this programme, the best quality capacitors at 30% discounted price were offered to consumers combined with special offers like extended product warranty, free site inspection and free cost of installation with wiring. The programme witnessed installation of 2178 kVAR and increased awareness amongst consumers on Reactive Power Management.
- **Street Light Lamp Conversion Project:** Under this program, 36,560 number of High Pressure Mercury Vapour (HPMV) lamps of 125W and 80W were replaced by lower wattage High Pressure Sodium Vapour (HPSV) lamps of 70 W with estimated savings of 16.98 MU.

2.0 Education & Sensitization of People on EE&EC!

- **Young Energy Saver:** YES (Since 2009): The "YES" initiative has started in 2009, aiming to spread message of Energy Conservation through Kids as they have more power to influence their parents. Till date, the campaign has witnessed on-ground activities in 220+ schools covering more than 1,70,000 kids; with 2.6 Lacs+ fan followers on Facebook page (Social Media).
- Now the initiative has entered into Guinness World record for "Largest Gathering of people dressed as trees" in the year 2012.
- **Urja Samvardhan Upakram (Since 2008):** This initiative was launched with an objective to create EE&EC Awareness amongst Colleges, Societies, Slums, offices and across various consumer forums. Over 200 Programmes have been conducted under this initiative reaching to more than 16,000 citizens of Mumbai.

3.0 Practising EE&EC within RInfra: Energy Conservation Day & Week Celebrations (Yearly): Every year, Company celebrates and actively participates on the occasion of National Energy Conservation Day (14th December) and Energy Conservation Week (14th to 21st December). Besides, the seminars and workshops on EE&EC, various other programmes and schemes like “Save & Save” (Discount) offer on EE appliances in tie-up with the Vendors, competitions for employees and their wards, consumer meets, Audio-visual shows, symbolic walk, etc. are organized seeking maximum participation of Company Employees.

- EE Improvement in Company Offices and Quarters: Company has replaced over 8000 conventional bulbs and tube lights with Energy Saving FTLs, CFLs, and LED Tube lights in office buildings and staff quarters thereby saving 0.93 MU p.a.
- APFC Panel Installation: Company has installed 1033 Automatic Power Factor Correction (APFC) Panels in its distribution substations leading to annual energy savings of 2.72 MU.
- EE Technology Pilots: The company has been undertaking various pilot projects since long to test Energy Efficient technology and products like Insulect Coat Paint, Polarized Refrigerant Oil Additive, Light Pipe, SEMS, Motion / Occupancy Sensor, Energy Saver for Air Conditioner, LED Flood light, Illuminator (Electronic Ballast) for street Lighting, Roof top Solar PV plants etc. with an intention to replicate the model on a larger scale, if tested successful.

Future Sustenance Plans

Under EC/EE/DSM Programme, the company is continuously working on new EE Technologies and Strategies besides existing running programmes. Some of our future programmes include:

- 100% Replacement of existing fixtures by LED Fixtures
- Solar Water Heating System
- Micro Renewable Technology Implementation
- Ongoing EE&EC Awareness Drive

Last Word ... aspiring for a New World...

We, at Reliance Energy believe that Energy Conservation is every one’s moral responsibility and through our EE/EC/DSM Program, we have demonstrated a strong commitment to preserve and nurture the environment. Company aims to grow in a manner that is sustainable, by addressing all three tiers of Sustainability - Social, Environmental and Economic.

It is gratifying to note that while the company’s business footprint is growing every passing day, its Carbon Footprint is reducing – thanks to its Sustainability Drive in the field Energy Conservation & Energy Efficiency.

Pramod Deo
Additional Vice President
Reliance Energy

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Historic Paris Agreement On CLIMATE CHANGE

The universal agreement's main aim is to keep a global temperature rise this century well below 2 degrees Celsius and to drive efforts to limit the temperature increase even further to 1.5 degrees Celsius above pre-industrial levels...

A historic agreement to combat climate change and unleash actions and investment towards a low carbon, resilient and sustainable future was agreed by 195 nations in Paris on 12th December. The Paris Agreement for the first time brings all nations into a common cause based on their historic, current and future responsibilities.

The universal agreement's main aim is to keep a global temperature rise this century well below 2 degrees Celsius and to drive efforts to limit the temperature increase even further to 1.5 degrees Celsius above pre-industrial levels. The 1.5 degree Celsius limit is a significantly safer defence line against the worst impacts of a changing climate.

Additionally, the agreement aims to strengthen the ability to deal with the impacts of climate change. To reach these ambitious and important goals, appropriate financial flows will be put in place, thus making stronger action by developing countries and the most vulnerable possible, in line with their own national objectives.

"The Paris Agreement allows each delegation and group of countries to go back home with their heads held high. Our collective effort is worth more than the sum of our individual effort. Our responsibility to history is immense," said Laurent Fabius, President of the COP 21 UN Climate change conference and French Foreign Minister. The minister, his emotion showing as delegates started to rise to their feet, brought the final gavel down on the agreement to open and sustained acclamation across the plenary hall.

French President Francois Hollande told the assembled delegates, "You've done it, reached an ambitious agreement, a binding agreement, a universal agreement. Never will I be able to express more gratitude to a conference. You can be proud to stand before your children and grandchildren."

Following the adoption of the Paris Agreement by the COP (Conference of the Parties), it will be deposited at the UN in New York and be open for signature on 22nd April 2016 – Mother Earth Day.

UN Secretary General Ban Ki-moon said, "We have entered a new era of global cooperation on one of the most complex issues ever to confront humanity. For the first time, every country in the world has pledged to curb emissions, strengthen resilience and join in common cause to take common climate action. This is a resounding success for multilateralism."

Christiana Figueres, Executive Secretary of the UN Framework Convention on Climate Change (UNFCCC), said, "One planet, one chance to get it right and we did it in Paris. We have made history together. It is an agreement of conviction. It is an agreement of solidarity with the most vulnerable. It is an agreement of long-term vision, for we have to turn this agreement into an engine of safe growth."

"Successive generations will, I am sure, mark the 12th December 2015 as a date when cooperation, vision, responsibility, a shared

UN Photo/Mark Garten

UNFCCC's Christiana Figueres (left); UN Secretary-General Ban Ki-moon (2nd left); French Foreign Minister Laurent Fabius and President of the UN Climate Change Conference in Paris (COP 21); and President François Hollande of France (right), celebrate historic adoption of Paris Agreement with others...

humanity and a care for our world took centre stage," she said.

"I would like to acknowledge the determination, diplomacy and effort that the Government of France have injected into this remarkable moment and the governments that have supported our shared ambition since COP 17 in Durban, South Africa," she said.

Agreement captures essential elements to drive action forward

The Paris Agreement and the outcomes of the UN climate conference (COP 21) cover all the crucial areas identified as essential for a landmark conclusion:

- Mitigation - reducing emissions fast enough to achieve the temperature goal
- A transparency system and global stock-take - accounting for climate action
- Adaptation - strengthening ability of countries to deal with climate impacts
- Loss and damage - strengthening ability to recover from climate impacts
- Support - including finance, for nations to build clean, resilient futures.

As well as setting a long-term direction, countries will peak their emissions as soon as possible and continue to submit national climate action plans that detail their future objectives to address climate change.

This builds on the momentum of the unprecedented effort, which has so far seen 188 countries contribute climate action plans to the new agreement, which will dramatically slow the pace of global greenhouse gas emissions.

The new agreement also establishes the principle that future national plans will be no less ambitious than existing ones, which means these 188 climate action plans provide a firm floor & foundation for higher ambition.

Countries will submit updated climate plans – called Nationally Determined Contributions (NDCs) - every five years, thereby steadily increasing their ambition in the long-term.

Climate action will also be taken forward in the period before 2020. Countries will continue to engage in a process on mitigation opportunities and will put added focus on adaptation opportunities. Additionally, they will work to define a clear roadmap on ratcheting up climate finance to USD 100 billion by 2020.

This is further underlined by the agreement's robust transparency and accounting system, which will provide clarity on countries' implementation efforts, with flexibility for countries' differing capabilities.

"The Paris Agreement also sends a powerful signal to the many thousands of cities, regions, businesses and citizens across the world already committed to climate action that their vision of a low-carbon, resilient future is now the chosen course for humanity this century," said Figueres.

Agreement strengthens support to developing nations

The Paris Agreement underwrites adequate support to developing nations and establishes a global goal to significantly strengthen adaptation to climate change through support and international cooperation.

The already broad and ambitious efforts of developing countries to build their own clean, climate-resilient futures will be supported by scaled-up finance from developed countries and voluntary contributions from other countries.

Governments decided that they will work to define a clear roadmap on ratcheting up climate finance to USD 100 billion by 2020, while also before 2025 setting a new goal on the provision of finance from the USD 100 billion floor.

Figueres said, "We have seen unparalleled announcements of financial support for both mitigation and adaptation from a multitude of sources both before and during the COP. Under the Paris Agreement, the provision of finance from multiple sources will clearly be taken to a new level, which is of critical importance to the most vulnerable."

International cooperation on climate-safe technologies and building capacity in the developing world to address climate change are also significantly strengthened under the new agreement.

Signing the Paris Agreement

Following the adoption of the Paris Agreement by the COP (Conference of the Parties), it will be deposited at the UN in New York and be opened for one year for signature on 22nd April 2016 – Mother Earth Day.

The agreement will enter into force after 55 countries that account for at least 55% of global emissions have deposited their instruments of ratification.

Cities and provinces to companies and investors aligning

The landmark agreement was reached against the backdrop of a remarkable groundswell of climate action by cities and regions, business and civil society.

During the week of events under the Lima to Paris Action Agenda (LPAA) at the COP, the groundswell of action by these stakeholders successfully demonstrated the powerful and irreversible course of existing climate action.

Countries at COP 21 recognised the enormous importance of these initiatives, calling for the continuation and scaling up of these actions, which are entered on the UN-hosted NAZCA portal as an essential part in the rapid implementation of the Paris Agreement.

The LPAA and NAZCA have already captured climate actions and pledges covering:

- Over 7,000 cities, including the most vulnerable to climate change, from over 100 countries with a combined population with one and a quarter billion people and around 32% of global GDP
- Sub-national states and regions comprising one fifth of total global

land area and combined GDP of $12.5 trillion

- Over 5,000 companies from more than 90 countries that together represent the majority of global market capitalisation and over $38 trillion in revenue
- Nearly 500 investors with total assets under management of over $25 trillion.

Christiana Figueres said, "The recognition of actions by businesses, investors, cities and regions is one of the key outcomes of COP 21. Together with the LPAA, the groundswell of action shows that the world is on an inevitable path toward a properly sustainable, low-carbon world."

Governments will work to define a clear roadmap on mobilizing private climate finance to USD 100 billion by 2020 while also beginning setting a new goal on the provision of finance from the USD 100 billion floor.

More details on the Paris Agreement

- All countries will submit adaptation communications, in which they may detail their adaptation priorities, support needs and plans. Developing countries will receive increased support for adaptation actions and the adequacy of this support will be assessed
- The existing Warsaw International Mechanism on Loss and Damage will be significantly strengthened
- The agreement includes a robust transparency framework for both action and support. The framework will provide clarity on countries' mitigation and adaptation actions, as well as the provision of support. At the same time, it recognises that Least Developed Countries and Small Island Developing States have special circumstances
- The agreement includes a global stocktake starting in 2023 to assess the collective progress towards the goals of the agreement. The stocktake will be done every five years
- The agreement includes a compliance mechanism, overseen by a committee of experts that operates in a non-punitive way
- The COP also closed on a number of technical issues
- Under the Kyoto Protocol, there is now a clear and transparent accounting method for carry-over credits for the second commitment period, creating a clear set of rules
- The first round of international assessment and review process (IAR) that was launched in 2014 was successfully completed
- A number of technical and implementation issues related to the existing arrangements on technology, adaptation, action for climate empowerment and capacity building were also successfully concluded in COP 21.

Interview

"We see the upward trends in T&M sector..."

Domestic manufacturers do compromise even at the small things, which can highly boost the product image...

RPP Engineering & Consulting Pvt. Ltd. has been dealing with a very wide range of products; in fact they offer equipments for all sorts of calibration, test and measurement requirements in the power industry. In an exclusive interview with Electrical India, Y K Nama, Managing Director of the company is talking to P K Chatterjee on the evolution of the Indian power T&M market and his company's business. Excerpts...

Q How is the focus changing in India as far as Electrical Testing and Measurements (T&M) are concerned?

A The T&M sector can be seen from various angles like Govt. Policy & Regulations... In Indian electricity act 2003 and other subsequent acts & guidelines special thrust was given to ensure that all energy meters installed at the consumer premises should be tested before installation, and at the site after two years of use.

Some of the utilities have already installed and some on the stage to go for advanced meter testing facilities. Earlier utilities were relying on their own facility – but now some of the tasks related to meter & Instrument transformer testing are being outsourced to private accredited laboratories, to meet the huge challenging task. Further, policies and incentives related to energy efficiency are inspiring users to find root causes, solve the problems and attain the high energy efficient systems. IS/IEC standards are being upgraded regularly to cope with latest technical challenges; and innovations are further enhancing the demand of the latest T&M equipment.

The consumers or users are becoming more aware about their rights and problems as well. Their zeal to improve the things are forcing upward trend for better quality and precision equipment.
Use of smart technology and latest innovations are bringing positive changes in terms of making instruments multifunctional, portable and economical.

Q To what extent, are we still depending on the imported test & calibration equipment?

A India could manage general purpose test and measuring items; but still depending for high precision, quality and reliability on imported T&M equipment.

Q What are the primary differences between India-made instruments and the imported ones?

A High precision, quality, reliability, multi-functionality and aesthetic are the area where Indian manufacturers are still lagging behind. Domestic manufacturers do compromise even at the small things, which can highly boost the product image.

Q What's your observation on the demand of the latest technologies in India?

A As I told you earlier (Refer Q1), we see the upward trends in T&M sector because of new avenue (like renewable energy), new policy, shortage of power supply etc. Thus, need of energy efficient devices and many other areas complementing to each other.
The manufacturers are the early adopters, followed by the test laboratory for the new testing technologies.

Q Who are your prime customers in India and abroad?

A Our equipments are useful for the energy measuring & testing. These are specially designed for utilities (Generation, Transmission and Distribution), independent laboratories and manufacturers of energy meters, panel meters and CTPT manufacturers. Our portable calibrators can be used for aviation industry. High precision power analyser can be used for diagnostic purposes for the compliance of new energy efficiency regulations.
We have so far supplied to Utilities, Manufacturers and Accredited Test Laboratories around the world.

Q What kind of competition do you face in the Indian market?

A More than competitive challenges; very often we face hurdles due to lack of knowledge or exposure, complex purchase process, and aversive nature for new trials that restrict the exposure to the new development. It is often observed that customers land up in purchasing at higher prices due to their self-made hurdles by creating the product specifications & requirements in a way, which do not promote healthy and fair competition.
Recently we have seen both scenarios. The customer who knows real testing needs, and willing to promote the fair competition has got the right products at economical prices.
Also, instances are there, where the customer who made specific brand/ company oriented product specification has paid almost 50 to 60% higher price than market rates for the same product.

Q What are the impacts (on your business) of the new government's plan to speed up electrification in the country?

A We expect positive changes in the business but real impact will be seen during/after implementation.

Q With our focus shifting towards decentralised power generation, how will the demand for test & measuring devices change?

A Undoubtedly, this will minimise the losses because current has to travel for shorter distance as compare to centralized generation. Currently, renewable energy contribution as compared to whole generation is quite low – but as soon it increases; it is going to impose the new challenges and problems related to grid stability, synchronisation and power quality (We can learn from European experience). This scenario will demand lot of special power analysis, monitoring, control and rectification equipment/ system.

Q What are the other emerging areas where T&M equipment will find a good market?

A T&M used in the area of renewable energy, power quality, energy efficiency testing & evaluation will see the good market in coming years.

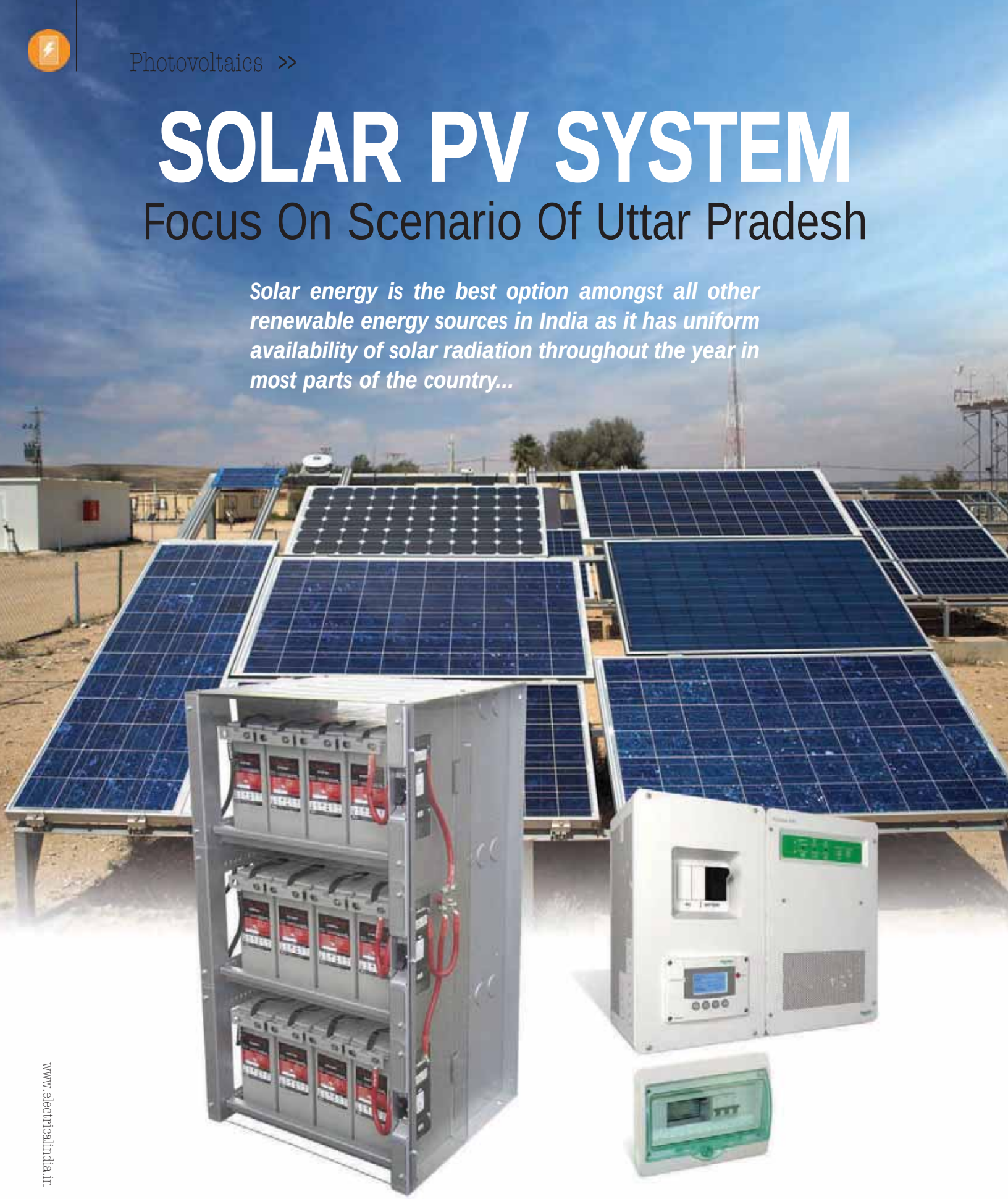
Q What would you like to say to your potential customers?

A We would like to assure them that we have selected our principles very carefully; based on their product quality, high reliability and service support. We offer the high quality 'Precision Reference Standard, Portable Calibrator, Automatic Meter Test System, CTPT Analyser, Power Quality Analyzer".
Our products are designed by using latest technologies, and they are user friendly (on the basis of feedback from several international users). Knowledge sharing and continuous improvement form the key motivation for training and service support.
Stop worrying about your testing and measuring challenges; do let us know. We are confident that we have right technical and innovative solutions to meet out your challenges.

SOLAR PV SYSTEM

Focus On Scenario Of Uttar Pradesh

Solar energy is the best option amongst all other renewable energy sources in India as it has uniform availability of solar radiation throughout the year in most parts of the country...



Development of any country is determined by various factors. Among these factors, the amount of electrical power consumption is the major factor. India is a developing country, so its corresponding power requirement is also increasing with its development. This demand of electrical power cannot be fulfilled solely by conventional sources, so we need to look for some alternative means to fulfil this surplus amount of power requirement. Due to high depletion rate and increasing cost of conventional fossil fuels, we cannot rely on it completely. Import of fuels is not a best alternative for long run. The country must focus on the sources that are available in abundance and renewable in nature. Solar energy is the best option amongst all other renewable energy sources in India as it has uniform availability of solar radiation throughout the year in most parts of the country. The reason for rich availability of solar energy is due to the fact that India is located in the equatorial belt of the earth. About 1600 to 2200 kWh/sq-m/year of solar radiation is received by our country, equivalent to 6000 million GWh of energy / year, which is higher than energy received by the country's conventional energy reserves. But, we are incapable of utilising this energy due to its higher harvesting cost. Till now, we have been capable of harvesting only 0.23% of the total energy received from the sun. Various initiatives have been taken at individual level as well as by the Indian government [1]. The government took the first major step in the field of solar in year 2006 in the form of Rural Electrification Program, which focuses on implementation of off-grid solar photovoltaic (PV) applications [2]. This primarily included solar home systems, solar pumps, solar lanterns, street lighting systems and home lighting systems. Under this policy, at the very early stage, 33.8 MW capacity of solar PV system was installed till Feb. 2012. A lot of technical advancement is still needed in the field of solar PV system in order to optimise its size, setting cost and losses etc. One of the major disadvantages is large area requirement for setting up of the plant. Still it can be overcome by using waste lands.

Micro grid is a newer concept for meeting the local energy demands. It is very helpful at the time of extremity. Nowadays, micro grid can act alone as a complete system for meeting the local demands. Grid connected and stand alone modes are the two different modes of operation of the micro grid. Frequent variation in the solar radiation due to fluctuating weather varies the power generation capacity of the solar PV system. Generation depends upon solar radiation reaching the panel's surface. Maximum power point tracking technique can be used to exploit maximum power generated from the solar panels. To enhance the reliability on power generated by solar panels, we need to have an energy storage system that can store the surplus amount and supply it back whenever required. Among all the technologies of electrical energy storage present today, battery is the most economical option. Block diagram of a solar PV system is shown in Fig.1. About 5,000 trillion kWh per year energy is incident over India's land area with most parts receiving 3-5 kWh/sq.m/day. Based upon the availability of land and solar radiation, the potential of solar power in the country has been assessed to be 750GW. Out of this, the Uttar Pradesh (UP) has potential of 22.83 GW (3.04%, shown in Fig. 2 [3]. Status of Grid Connected Solar Power Projects under various schemes in India is 3883.507 MW till 29-05-15. Out of which total commissioned capacity of Grid connected Solar Power Projects in UP is 71.26 MW till May 29, 2015 [4]. The Ministry has so far sanctioned 361 MW aggregate capacity of grid connected rooftop solar systems in the country, of which 42 MW has been commissioned. Of this, 12MW has been installed in UP under 'Rooftop PV and Small Solar Power Generation Programme' (RPSSGP) Scheme [5].

Ministry of New and Renewable Energy (MNRE) has launched a program on 'Development of Solar Cities.' The program aims at minimum 10% reduction in projected demand of conventional energy at the end of 5 years, which can be achieved through a combination of energy efficiency measures and enhancing supply from renewable energy sources. The cities of UP chosen under this program are Allahabad, Moradabad and Agra [6]. The program assists Urban Local governments in:

- Preparation of a master plan for increasing energy efficiency and renewable energy supply in the city
- Setting-up institutional arrangements for the implementation of the master plan
- Awareness generation and capacity building activities

Govt of India has proposed 1,00,000 MW of Grid Connected Rooftop Solar Project, which is to be installed till 2022 across the country. The state of Uttar Pradesh has a major chunk of this project to be installed in different parts of the state.

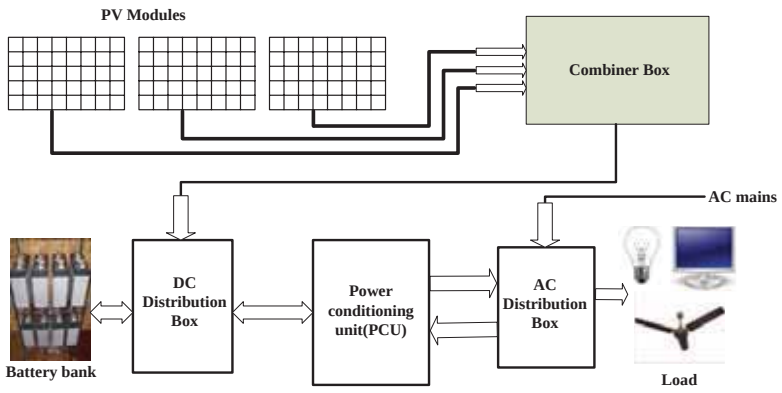


Fig.1: Generalised block diagram of Solar PV system...

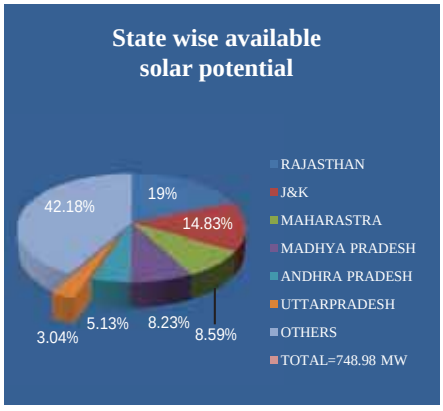


Fig.2: Solar potential available in India [3]...

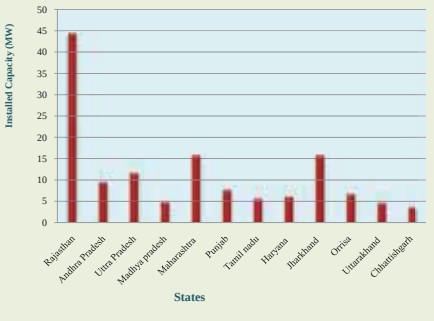


Fig.3: State wise rooftop installed solar capacity [5]...

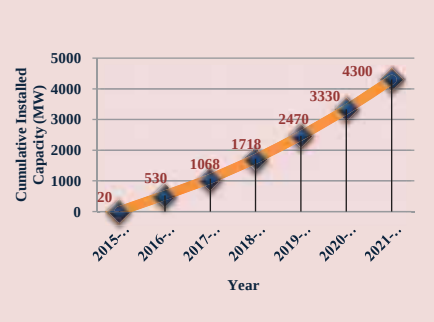


Fig.4: Projected cumulative solar capacity to be installed in Uttar Pradesh till 2022 [7]...

S.No.	Plant name	Capacity (MW)
1	EMC LTD., Naini, Allahabad	5
2	Dhurv Milkose	1
3	Dante energy PVT LTD, Jhansi	2
4	Technical Associates LTD, Barabanki	2
5	Priapus Infrastructure LTD, Bareilly	2

Table 1: List of Solar PV projects commissioned in U.P. [5]...

S.No.	Name of firm	Capacity (MW)
1	Azure Surya Private Limited, Karahara kalan Mahoba U.P.	10
2	Jakson Power Private Limited, Mehrauni Khurd Lalitpur U.P.	10
3	Refex Energy Pvt Ltd, Amarpur Lalitpur, U.P.	10
4	Samavist Energy Solutions Private Limited, Amarpur Lalitpur, U.P.	10
5	M/s. NTPC Ltd., Dadri, Vidyutnagar, Dist-Gautam Budhnagar, U.P.	10
6	NTPC Limited, Unchahar, Raibareli, U.P.	5

Table 2: List of major Solar PV Projects commissioned under State Policy [5]...

S.No.	Firm	Capacity (MW)
1	Shri Colonizers & Developers Pvt. Ltd.	20
2	Moserbaer Clear Energy Ltd.	20
3	Refex energy(Rajasthan) Pvt. Ltd.	10
4	DK Infracon Pvt. Ltd.	10
5	Azure Surya Pvt. Ltd.	10
6	Essel Infraprojects Ltd.	50
7	Jakson Power Pvt. Ltd.	10

Table 3: List of successful bidders of 200 MW Power from Grid Connect Solar PV power projects [8]...

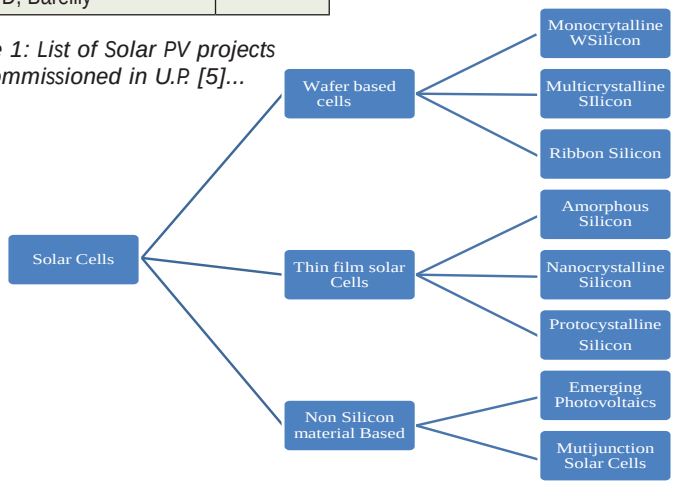


Fig.5: Different types of solar cell technologies [9]...

S.No.	Name of firm	Capacity (MW)
1	Jakson Engineers Ltd.	30
2	K.M. Consortium	5
3	ACME Solar Energy Private Ltd.	30
4	Jatadhari Merchandise Pvt Ltd.	10
5	Sukhbir Agro Energy Ltd.	30

Table 4: List of successful Bidders for 105 MW Power from Grid Connect Solar PV Power Projects [8]...

Fig. 4 shows the year wise growth of installed Rooftop Solar Projects in U.P. Solar PV Projects Commissioned in Uttar Pradesh under Rooftop PV and Small Solar Power Generation Programme (RPSSGP) Schemes established under MNRE projects are shown in table 1 and under state policy in table 2, respectively.

Besides this, under State Solar Power policy, Uttar Pradesh state government has planned to set up a total of 200 MW power plants across different parts of the state. The list of successful bidders of 200 MW power from Grid Connect Solar PV Power Projects is given in table 3. Another 105 MW Solar PV project planned to be set up in UP. List of successful bidders are shown in table 4. There is a provision to install Solar Park and to be implemented by state under solar energy policy 2013.

Installation of total 600 MW solar parks is to be done in Jalaun, Etah, Mirzapur, Allahabad and Jhansi districts of the UP. Development and management of solar parks is designated to state agency Uttar Pradesh New and Renewable Energy Development Agency (UPNEDA) and is to be made by the joint venture with Solar Energy Corporation of India (SECI) of the Government of India.

Solar PV Modules

The source of electrical power in the solar PV system is a solar cell. The solar cells when connected in series form a solar PV module. Generally a group of PV modules connected in series and parallel forms a solar array in a solar PV plant.

Solar Cell Technologies

Different types of solar cells are shown in fig 5 and its comparison is listed in table 5.

Copper Rotors for Pumps & Induction Motors

New Technologies Make Commercial Scale Copper Rotor Die-Casting Viable

The use of copper in place of aluminium for conductor bars and end rings of induction motor rotors results in improvements in motor energy efficiency due to a significant reduction in I^2R losses.

Copper rotor motors are optimum designed for higher efficiencies & with reduced thermal stresses, including those on insulation, which enable them to operate longer.

The major applications of Copper Rotors are Pumps and Induction Motors for achieving IE4 levels of efficiency & other niche applications like EV and geared motors.

In India Copper Die Cast Rotors are commercially viable and are supplied by KITRA Industries, known for supplying good rotors with lowest process cost & in large quantities.

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Cu International Copper Association India
Copper Alliance

KITRA INDUSTRIES (INDIA)

ICA India Head office: 302, Alpha, Hiranandani Business Park, Powai, Mumbai 400 076, India. **Phone:** +91 22 6114 7300 • **website:** www.copperindia.org

S.No.	Property	Mono crystalline	Multi/Poly crystalline	Thin film
1	Efficiency	Highest	Moderate (13-15)%	Lowest
2	Cost	Highest	Moderate	Lowest
3	Area occupied per KW	Lowest	Moderate	Highest
4	High Temperature performance	Poor	Poor	Better
5	Generation in diffused light	Average	Average	Better

Table 5: Comparison amongst different types of material used for solar cells [10] & [11]...

S. No.	Type of load	Wattage (watt)	Quantity	Total kW	Operation hrs.
1	CFL bulb	110	15	1.65	8
2	Ceiling fan	80	6	0.48	8
3	Tube light	55	2	0.11	8
4	Computer	150	2	0.3	8
5	Printer	20	35	0.7	2
6	UPS	150	1	0.15	8
7	Air Cooler	300	2	0.6	6

Table 6: Connected load and power consumption for a residential unit...

Month	Units of Consumption/ day	Q (watt/ m^2/day)
January	19.08	3900
February	19.08	4870
March	22.92	6000
April	22.92	6520
May	26.52	6580
June	26.52	5710
July	26.52	4580
August	26.52	4380
September	26.52	4550
October	26.52	4840
November	22.92	4370
December	19.08	3780

Table 7: Month wise observation of load requirement and available solar electricity for Allahabad city [13]...

Crystalline silicon also known as solar grade silicon is the most accepted choice of material for solar cells. It is categorised into ribbon or wafer depending upon crystal size. Polycrystalline silicon cells are made from large blocks of molten silicon carefully cooled and solidified. They consist of small crystals giving the material metal flake effect. Poly-silicon cells are economical but less efficient, than mono-crystalline silicon. Thin film technologies reduce the amount of active material in a cell. In most of the designs the active material is sandwiched between two panes of glass. They have double weight and lesser conversion efficiency than that of crystalline silicon panel.

Solar PV System Design

Solar PV system design is done for both commercial as well as domestic loads, which estimates the number of panels, batteries and ratings of electrical equipments required for a solar plant. All those loads whose requirement is less than 10 kW is considered to be domestic load and greater than 10 kW is considered as commercial load. System voltage is decided depending on the load conditions. If demand is more than 10 kW, then system voltage is 48 V. For demand less than 10 kW and greater than 1 kW, system voltage is 24 V. For lesser demand it is 12 V. Following analytical study is required for solar PV plant installation purposes:

- Expected energy demand
- Average generation
- Number of PV modules
- Size and number of battery bank
- Losses in system
- Insolation of the geographical area.

Expected Energy Demand

While setting up the solar plant, the calculation for average energy demand is necessary. It is required to first calculate total load connected to the system and its duration of operation. This study is necessary for estimating the number of PV panels required in a PV array. Table 6 shows the power consumption for a residential unit taken as an example. A detailed analysis has been carried out for setting up a solar power plant in Allahabad, India, for a small residential/commercial unit that needs to be operated as a standalone system under all weather condition.

Total load connected to the system = 3.99 kW

Total unit consumption/day = 26.52 Unit/day (1 Unit = 1000 Watt-hour)

Average Generation

After deciding the connected load and its demand throughout the day, average energy generation from the solar panels is calculated, considering the losses occurring in different parts of the system. Calculate the power which needs to be generated from solar panels using the following formula [12],

$$Power\ from\ Solar\ Array = \frac{\text{Unit of electricty} \times 1000 \times \text{D}}{\text{QABC}}$$

Where, Q = Unit of solar electricity in Watt/m^2 in day (varies during different months), D = Solar intensity (1000 W/m^2 at STC), A= Batteries efficiency factor (~ 0.9), B = Heat and other loss factor (~0.9), C = Efficiency of Inverter (θ .93).

Table 7 shows month wise observation of load requirement and available solar electricity for Allahabad city. From table 7,

$$Q_{avg} = \frac{\left(Q_{jan} + Q_{feb} + ... + Q_{dec}\right)}{12}$$

Q_{avg} = 5006.67 watt/m^2/day.

Power of the cell

= 7031.64 watt

$$= \left(\frac{26.52 \times 1000 \times 1000}{5006.67 \times 0.9 \times 0.9 \times 0.93}\right)$$

No. of 250 W Modules/Panels required

= 7031.64/250 = 28

System voltage chosen = 48 V.

Solar panel output voltage

= 30.7 V

No of panels in series connections

= 48/30.7 = 1.56 = 2

No. of panels in parallel connections

= 28/2 = 14

Battery requirement

Battery Capacity: The true capacity of a battery is dependent on the rate of discharge. Faster the rate of discharge, lesser the total Ah capacity can be delivered. This phenomenon was described mathematically back in 1897 by a researcher named Peukert. He formulated the equation [14]:

$$TI^n=C$$

Where, T= duration of discharge, I = Discharge current, n = constant, related to the battery construction (1.05<n<2), C= Capacity due to discharge

For above example, to run the complete load (4 kW) from the battery (for 8 hrs. minimum), ampere hours (Ah) required =

Current drawn from battery at full load

Actual Ah of battery required is = $8\times83.33^{1.1}$

= 1037.5 Ah

No. of batteries required =

No. of batteries, each rated for 12 V, 150Ah required = 40 (for 8 hrs. full load back up condition).

Research is going on a project in USA on

$$\frac{Unit\ of the load}{battery terminal voltage} x_{Hours\ of\ operation}$$

$$=\frac{4000}{48}x8=\ 666.6\ \text{Ah}$$

$$=\frac{4000}{48}=83.33A$$

solar panel with in-built batteries. They have created a battery that is 20% more efficient and 25% cheaper than others. Scientists

$$\frac{Ah\ of\ battery\times total\ battery\ voltage}{Ah\ of\ battery\ available * battery\ voltage * DOD}$$

$$=\frac{1037.5\times48}{150*12\times0.7}=40$$

have conjoined the battery and solar panel into one system.

A company named Novatec Solar, has developed a PV system using molten salt storage technology, which uses inorganic salts to transfer the energy generated by solar PV systems into solar thermal using heat transfer fluid rather than oils. These plants operate at over 500 ^{0}C which results in much higher output. Hence, cost of the plant is also very low [15].

Losses In The System

Significant factors that affect power generation from the solar PV system are discussed below:

Tolerance

This is the range within which a panel manufacturer promises that module can differ from its specified Standard Test Condition (STC) power.

For example: for ±2% tolerance on a 250 W panel, the panel power will vary between 255 W and 245 W. Nowadays 0% negative tolerance panels are available.

Temperature

The output power delivered by the panel decreases with increase in temperature. Effect of temperature can be minimised by putting the solar panel above the rod endings at a height from the roof top.

Dirt and dust

It covers the glass covering of the panel and reduces its output. Hence, these need to be cleaned regularly. It also causes an increase in leakage capacitance.

Shading

It mostly affects the generation during morning and evening hours due to elongated shadows of tree leaves, roofs or any such other objects. This reduces the solar output power.

There is a danger of hotspot effect in the PV panels due to shading. In order to eliminate this effect the solar panels are supplied with bypass diodes which saves the PV panels. However they reduce the power output during shading condition.

Mismatch and wire loss

There are mismatch and wiring losses which are minimised by using special type of DC cables used. Losses occur in inverter during power conversion, which is minimised by using modern inverters, which are efficient up to 98%

Insolation of the geographical area

Position of the solar panels in a geographical location is one of the deciding factors for extracting maximum power from it. Changing the position of the solar panels every time in accordance with the earth's position, with respect to sun is not practical.

In order to have optimum utilisation of the solar panels, it should be mounted at an appropriate angle so that it gives optimum output throughout the year.

Challenges And Opportunities

Land is a meagre resource in India and per capita accessibility is less. Large land requirement of 1 km^2 for every 40-60 MW solar power plant may have to compete with the other necessities. Large setting up cost is also one of the major issues. State governments have taken initiative to counteract with this major issue by installing solar panels on rooftop of the houses, metro stations, etc.

Govt. of Gujarat launched Canal Solar Power Project for the estimated generation of 1 MW, which will save land, reduce overall setting cost and prevent evaporation of water. It is estimated that 2,200 MW of power can be harnessed from over 19,000 km length of canal in Gujarat.

The government is providing subsidies for the installation of PV power system, in which there will be reduction in the cost price and this can promote more usage of solar power in India. The Jawaharlal Nehru National Solar Mission was launched on the 11th January, 2010 by the Prime Minister for deploying 20,000 MW of grid connected solar power by 2022.

This mission aimed at reducing the cost of solar power generation in the country through (i) long term policy; (ii) large scale deployment goals; (iii) aggressive R&D; and (iv) domestic production of critical raw materials, components and products, as a result to achieve grid tariff parity by 2022.

Conclusion

This article presented the current scenario of solar energy in the country with a special focus on Uttar Pradesh. It also mentioned the upcoming solar projects in the state. A complete installation of medium sized off grid solar plant has also been covered.

At present, the main focus of the companies is on reducing the size of solar panel, thereby increasing energy density. With the further advancement in the field of solar energy

trapping and utilisation, it is expected that solar energy harvesting would become more economical in near future.

Future Scope

Research is being carried out for making solar panel transparent, less costly, lightweight, flexible and ultra efficient. In the future, there will be solar panel roads which will be capable of supporting vehicle's force.

Moreover, with the feature of heat radiation from solar road, the problem of snow or ice would be vanished. A 70-metre solar panels cycle path has been installed in Amsterdam, Netherland by an American company Solar Roadways, meant for all types of roads [15].

Since 70% of Earths' surface is covered with water, land concerns associated with installation of solar plants can be solved by using the concept of Floating solar. Some research organisations, including French firm called Ciel et Terre, are experimenting with this technology.

The company has projects, set up in France, Japan, and England and other parts of the world including a project in India [15]. Space based solar technology is being tested by India, China and Japan in which space based satellite capture sunlight and convert it into microwave energy that is then beamed back to earth. The technology promises to capture nearly 90% percent of sunlight.

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Grabbing The Opportunity

Are you aware of the benefits of financial partnership in the solar developments market in the US? The market is quite promising after Investment Tax Credit declaration. Here is an open invitation for partnership. However, every individual or company should weigh the pros and cons before partnering with any solar project opportunity...

View of a project by Innovative Solar...

The market has grown significantly for utility-scale solar developments in the past few years and with the extension of the Investment Tax Credit the potential for future growth is tremendous.

Innovative Solar Systems (ISS), LLC is based in Asheville, NC, and is one of the largest developers of utility scale solar farm projects in the United States.

The company is planning to take its business to the next level in order to accommodate this growth. As a result, a company spokesperson has announced it will seek to raise capital to expand corporate operations.

According to the company, the extension of the Investment Tax Credits (ITC) will enable investors in utility scale solar farms to continue to receive high returns, with the potential of 30 to 50% over a period of 12 to 18 months, if partnered with a qualified developer like ISS.

These returns can be obtained mainly because ISS is an experienced developer, also because of the reliability of ground mount solar PV systems, some of which are built to operate for upwards of 40 years.

Solar Farm project development is complicated. There are particularities to each Utility Company, each Regional Transmission Operator (RTO) and/or each State and County.

For that reason, there is an increased risk associated with early-stage development. Over the past five years, ISS has developed over 520 MW of projects in the US.

The company communicates that investment groups seeking to invest in early-stage development for higher returns should strongly consider an ISS partnership. ISS is looking for partners to invest anywhere from $5M to $100M for the early-stage developments in 2016.

However, a solar farm operating with minimal maintenance over a 40 year span is a very attractive source of stable income. As a result, this has spurred an interest from investors to buy solar projects at the Commercial Operation Date (COD) stage, thus eliminating any risks associated in the development and construction stages.

ISS has a large pipeline of projects with over 2 GW of projects currently under development, and is expected to increase to over 5 GW in the next 12 to 36 months. For this reason, it is also seeking financial partners who will invest from $1 to $5 Bill for the construction financing of many of the company's pipelined projects.

Solar and other types of renewable energies are decreasing the carbon footprint, and strengthening the reliability of the power grid in the US. Now with the extension of the ITC, this industry will flourish. An investment in ISS is a win-win for all parties. ISS will be able to become a major player in the industry and the investor will have the ability to gain full access to ISS projects, and receive and attractive rate of return over the period of its investment.

Supporting Research & Development

ABB is responsible for project execution of the 20-kilovolt and 400-volt grid that will provide power to The European Spallation Source...

Neutron science is a critical tool in (for example) the development of industrial and consumer products worldwide. The European Spallation Source (ESS) will be a multi-disciplinary research centre based on the world's most powerful neutron source, which is still under construction. The new research facility will help study and develop materials with applications in a wide range of industries, such as manufacturing, pharmaceutical drugs, aerospace, plastics, information technologies and biotechnology.

ABB will supply a complete distribution substation solution to the ESS research centre, which is coming up in Lund, Sweden. When completed, ESS will be a world leading facility for materials research using neutrons.

"ABB technologies will play a key role in ensuring optimum power supplies, fulfilling extremely high requirements in terms of quality and stability. We are also proud to support the sustainability vision of ESS by minimising environmental impact," said Claes Rytoft, Chief Technology Officer, ABB Group and Power Systems Division. The annual energy consumption for the research facility is estimated to be below 270 GWh.

ABB is responsible for project execution of the 20-kilovolt and 400-volt grid that will provide power to the facility. This includes the design, supply, installation and commissioning of the primary and distribution substations. The scope of supply includes medium-voltage switchgear, dry-type transformers and ABB's MicroSCADA system, which will monitor the facility in real time and support operators in taking corrective action in the event of any disturbance or fault. All the substations have been designed for maximum safety and reliability.

To support ESS in its sustainability vision, ABB will also deliver the medium-voltage switchgear that deploys an alternative eco-efficient gas mixture to the normally used SF6 gas. The transformers will be oil-free, and halogen-free cabling between the switchgears will be used. Communication will be digitally managed based on IEC 61850 open protocol systems, minimising the amount of cabling and conserving materials.

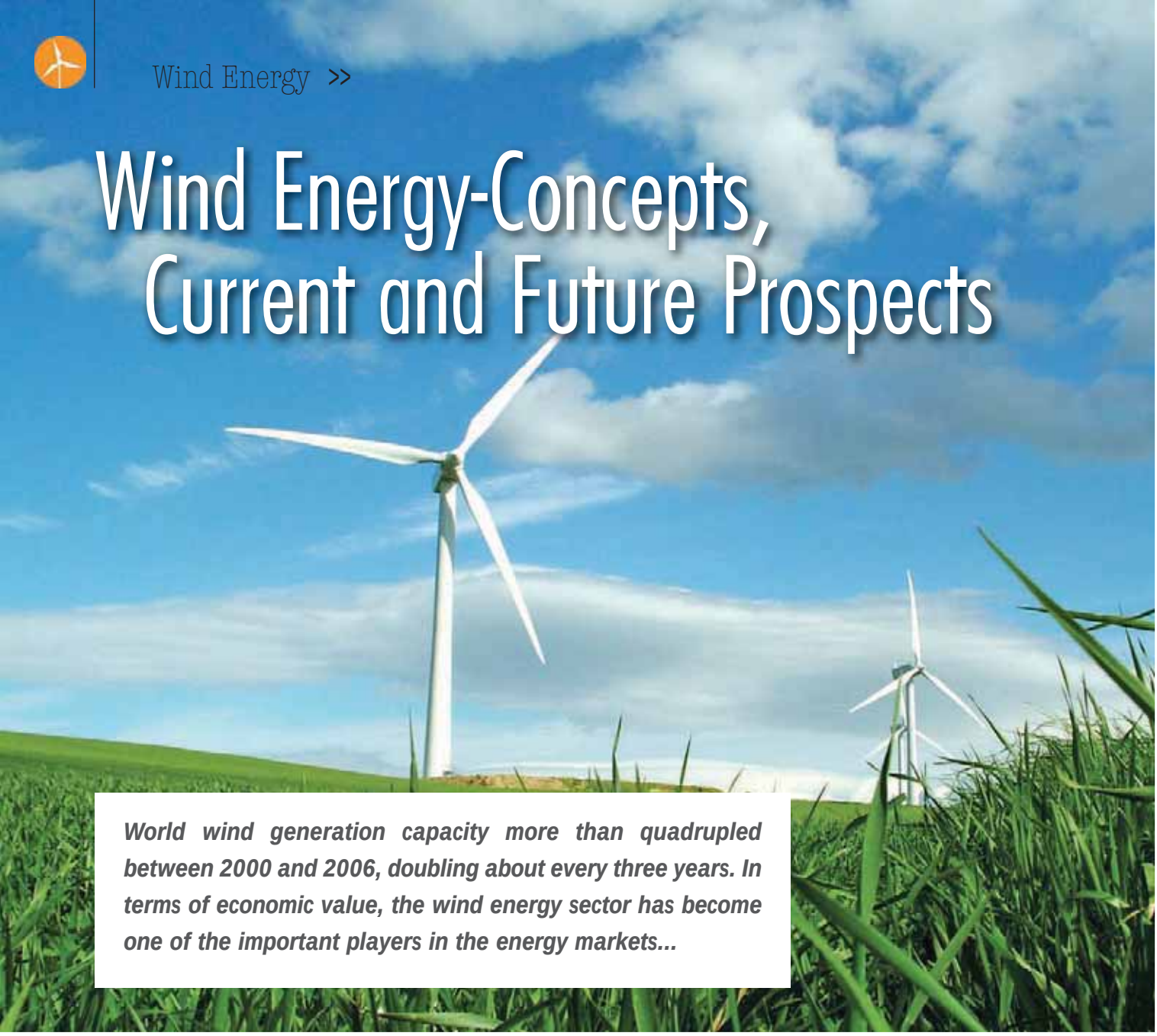
"It is important to design this facility so that the energy system operates optimally and without any disturbances. That's why we've placed extremely high requirements on the power equipment both in terms of quality and stability," said Kent Hedin, Head of Conventional Facilities Division at ESS.

"This is a challenging assignment, and power supply is a critical component. With ABB as a partner, we have a full-range supplier for the entire system and we look forward to this collaboration," said Dan-Magnus Sköld, Project Director at Skanska, the contractor that is building the research facility.

The vision of ESS, a partnership of European nations, is to become the world's first sustainable research facility, and the energy solution provided by ABB is an integral part. The research facility will have 400 to 500 employees when fully operational and approximately 3,000 guest researchers visiting each year. The first neutrons are to be produced in 2019.

Spallation is the process for producing neutrons by means of a particle accelerator and a heavy metal target (in this case, tungsten). Researchers can use neutrons to study different materials and learn more about their composition and how they work. ESS will provide neutron beams up to a 100 times brighter than any existing neutron source, enabling scientists to see and understand basic atomic structures and forces at lengths and time scales unachievable at other spallation sources. ESS will provide researchers with a 'super microscope, which will radically improve their ability to develop materials.

Wind Energy-Concepts, Current and Future Prospects



World wind generation capacity more than quadrupled between 2000 and 2006, doubling about every three years. In terms of economic value, the wind energy sector has become one of the important players in the energy markets...

Wind power is extracted from air flow using wind turbines or sails to produce mechanical or electrical power. Windmills are used for their mechanical power, windpumps for water pumping, and sails to propel ships. Wind energy as an alternative to fossil fuels, is plentiful, renewable, widely distributed, clean, produces no greenhouse gas emissions during operation, and uses little land. The net effects on the environment are generally less problematic than those from nonrenewable power sources.

Wind power is produced by using wind generators to harness the kinetic energy of wind. It is gaining worldwide popularity as a large scale energy source, although it still only provides less than one percent of global energy consumption. Wind turbines operate on a simple principle. The energy in the wind turns two or three propeller-like blades around a rotor. The rotor is connected to the main shaft, which spins a generator to create electricity. Simply stated, a wind turbine works the opposite of a fan. Instead of using electricity to make wind, like a fan, wind turbines use wind to make electricity. The wind turns the blades, which spin a shaft, which connects to a generator and makes electricity. View the wind turbine animation to see how a wind turbine works or take a look inside.

Wind is a form of solar energy and is a result of the uneven heating of the atmosphere by the sun, the irregularities of the earth's surface, and the rotation of the earth. Wind flow patterns and speeds vary greatly across the United States and are modified by bodies of water, vegetation, and differences in terrain. Humans use this wind flow, or motion energy, for many purposes: sailing, flying a kite, and even generating electricity.

The terms wind energy or wind power describe the process by which the wind is used

to generate mechanical power or electricity. Wind turbines convert the kinetic energy in the wind into mechanical power. This mechanical power can be used for specific tasks (such as grinding grain or pumping water) or a generator can convert this mechanical power into electricity. Modern wind turbines fall into two basic groups: the horizontal-axis variety, as shown in the photo to the far right, and the vertical-axis design, like the eggbeater-style Darrieus model pictured to the immediate right, named after its French inventor. Horizontal-axis wind turbines typically either have two or three blades. These three-bladed wind turbines are operated "upwind," with the blades facing into the wind. Single small turbines, below 100 kilowatts, are used for homes, telecommunications dishes, or water pumping. Small turbines are sometimes used in connection with diesel generators, batteries, and photovoltaic systems. These systems are called hybrid wind systems and are typically used in remote, off-grid locations, where a connection to the utility grid is not available.

Horizontal turbine components include blade or rotor, which converts the energy in the wind to rotational shaft energy; a drive train, usually including a gearbox and a generator; a tower that supports the rotor and drive train; and other equipment, including controls, electrical cables, ground support equipment, and interconnection equipment.

Advantages and Disadvantages of Wind-Generated Electricity

A Renewable Non-Polluting Resource

Wind energy is a free, renewable resource, so no matter how much is used today, there will still be the same supply in the future. Wind energy is also a source of clean, non-polluting, electricity. Unlike conventional power plants, wind plants emit no air pollutants or greenhouse gases.

According to the U.S. Department of Energy, in 1990, California's wind power plants offset the emission of more than 2.5 billion pounds of carbon dioxide, and 15 million pounds of other pollutants that would have otherwise been produced. It would take a forest of 90 million to 175 million trees to provide the same air quality.

Cost Issues

Even though the cost of wind power has decreased dramatically in the past 10 years, the technology requires a higher initial investment than fossil-fueled generators. Roughly 80% of the cost is the machinery, with the balance being site preparation and installation. If wind generating systems are compared with fossil-fueled systems on a "life-cycle" cost basis (counting fuel and operating expenses for the life of the generator), however, wind costs are much more competitive with other generating technologies because there is no fuel to purchase and minimal operating expenses.

Environmental Concerns

Although wind power plants have relatively little impact on the environment compared to fossil fuel power plants, there is some concern over the noise produced by the rotor blades, aesthetic (visual) impacts, and birds and bats having been killed (avian/bat mortality) by flying into the rotors. Most of these problems have been resolved or greatly reduced through technological development or by properly siting wind plants.

Supply and Transport Issues

The major challenge to using wind as a source of power is that it is intermittent and does not always blow when electricity is needed. Wind cannot be stored (although wind-generated electricity can be stored, if batteries are used), and not all winds can be harnessed to meet the timing of electricity demands.

Further, good wind sites are often located in remote locations far from areas of electric power demand (such as cities).

Finally, wind resource development may compete with other uses for the land, and those alternative uses may be more highly valued than electricity generation. However, wind turbines can be located on land that is also used for grazing or even farming.

Current Prospects

Worldwide there are now over two hundred thousand wind turbines operating, with a total nameplate capacity of 282,482 MW as of end 2012. The European Union alone passed some 100,000 MW nameplate capacity in September 2012, while the United States surpassed 50,000 MW in August 2012 and China's grid connected capacity passed 50,000 MW the same month.

World wind generation capacity more than quadrupled between 2000 and 2006, doubling about every three years.

The United States pioneered wind farms and led the world in installed capacity in the 1980s and into the 1990s.

In 1997 installed capacity in Germany surpassed the U.S. and led until once again overtaken by the U.S. in 2008. China has been rapidly expanding its wind installations in the late 2000s and passed the U.S. in 2010 to become the world leader. As of 2011, 83 countries around the world were using wind power on a commercial basis.

Wind power capacity has expanded rapidly to 336 GW in June 2014, and wind energy production was around 4% of total worldwide electricity usage, and growing rapidly.

The actual amount of electricity that wind is able to generate is calculated by multiplying the nameplate capacity by the capacity factor, which varies according to equipment and location. Estimates of the capacity factors for wind installations are in the range of 35 to 44%.

Europe accounted for 48% of the world total wind power generation capacity in 2009. In 2010, Spain became Europe's leading producer of wind energy, achieving 42,976 GWh. Germany held the top spot in Europe in terms of installed capacity, with a total of 27,215 MW as of 31 December 2010.

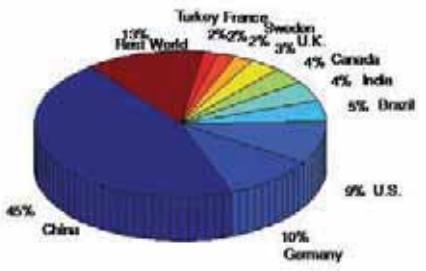


Fig. 1: Worldwide installed capacity, 2014...

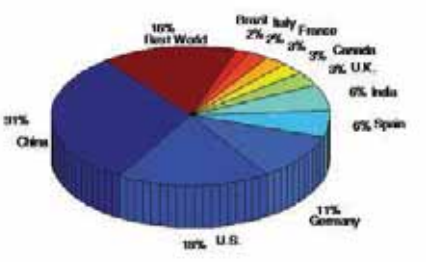


Fig. 2: Worldwide cumulative capacity, 2014...

In 2010, more than half of all new wind power was added outside of the traditional markets in Europe and North America. This was largely from new construction in China, which accounted for nearly half the new wind installations (16.5 GW).

Global Wind Energy Council (GWEC) figures show that 2007 recorded an increase of installed capacity of 20 GW, taking the total installed wind energy capacity to 94 GW, up from 74 GW in 2006. Despite constraints facing supply chains for wind turbines, the annual market for wind continued to increase at an estimated rate of 37% following 32% growth in 2006. In terms of economic value, the wind energy sector has become one of the important players in the energy markets, with the total value of new generating equipment installed in 2007 reaching €25 billion, or US$36 billion.

Although the wind power industry was affected by the global financial crisis in 2009 and 2010, a BTM Consult five-year forecast up to 2013 projects substantial growth. Over the past five years the average growth in new installations has been 27.6% each year. In the forecast to 2013 the expected average annual growth rate is 15.7% More than 200 GW of new wind power capacity could come on line before the end of 2014. Wind power market penetration is expected to reach 3.35% by 2013 and 8% by 2018. Several countries have already achieved relatively high levels of penetration, such as 39% of stationary (grid) electricity production in Denmark (2014), 19% in Portugal (2011), 16% in Spain (2011), 16% in Ireland (2012),United Kingdom (2014) - 9.3% and 8% in Germany (2011). For the U.S. in 2013, the penetration level was estimated at 4.5% Fig. 1 and Fig. 2 show worldwide installed capacity and cumulative capacity respectively for 2014.

Future Prospects

The Global Wind Energy Outlook explores the future of the wind energy industry out to 2020, 2030 and up to 2050. With the International Energy Agency's New Policies scenario from the World Energy Outlook as a baseline, we have developed two scenarios especially for this publication: the GWEO Moderate scenario and the GWEO Advanced scenario. The GWEO Moderate and Advanced scenarios have evolved over the years as a collaboration between the Global Wind Energy Council, Greenpeace International and the German Aerospace Centre (Deutsches Zentrum fur Luft-und-Raumfahrt – DLR). These scenarios for the future of the wind industry have contributed to an ongoing series of broader studies on global sustainable energy pathways up to 2050 conducted by DLR and Greenpeace in collaboration with a number of industry associations including GWEC. The IEA's New Policies scenario shows the global wind market returning to 2012 levels in 2016 and then gradually decreasing and stabilizing at about the 2010 market level after 2020, and only growing very slightly from that level out to 2030.

The Moderate scenario reflects a world which carries on more or less the way it has for the past decade, with wind power continuing to gain ground but still struggling against heavily subsidized incumbents; without a comprehensive or cohesive carbon market, and with those that exist at very low prices. Policy instability decreases, but is still a factor, although the competition in OECD markets for a larger share of a stable or dwindling pie is intense. The Advanced scenario shows the potential of wind power to produce 25-30% of global electricity demand by the end of the scenario period, where there is a strong international political commitment towards

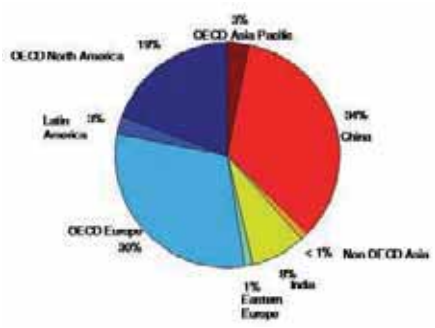


Fig. 3: New Policies Scenario, 2020...

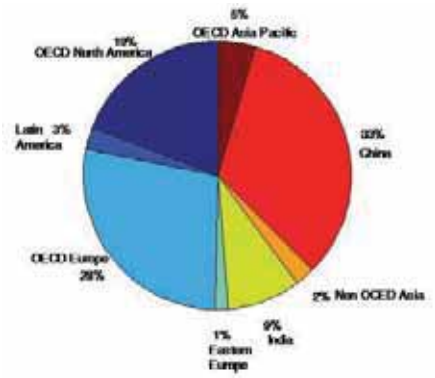


Fig.4: New Policies Scenario, 2030...

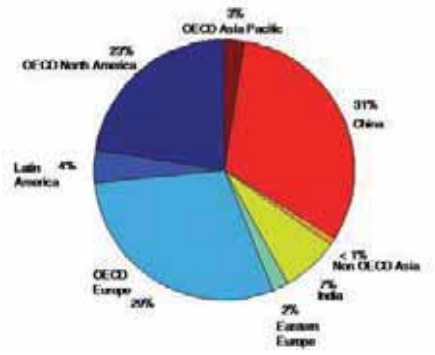


Fig. 5: Moderate Scenario, 2020...

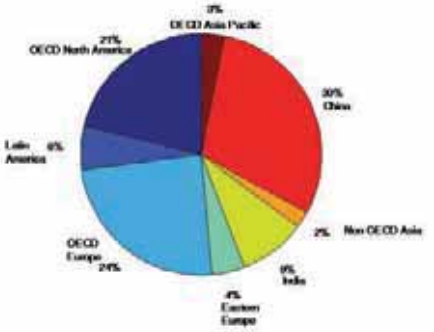


Fig. 6: Moderate Scenario, 2030...

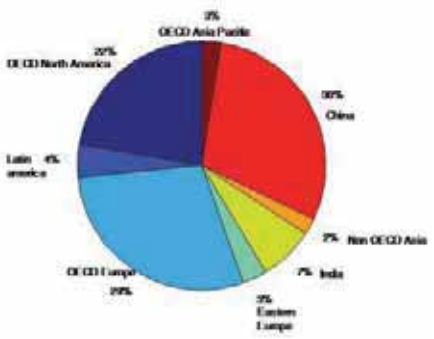


Fig. 7: Advanced Scenario 2020...

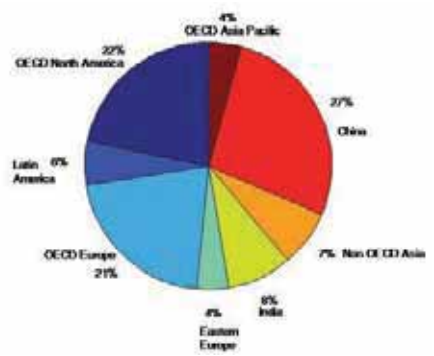


Fig. 8: Advanced Scenario, 2030...

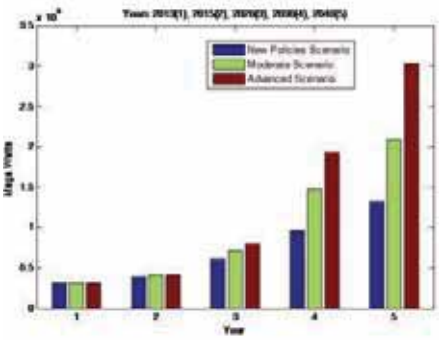


Fig.9 : Yearwise Mega Watt Production...

meeting climate goals and national energy policy is driven by the need for enhanced energy security, price stability, job creation and the need to conserve our precious fresh water resources.

The Moderate scenario starts with about 14% growth in 2014, tapering off gradually to 10% by 2020 and then also to 6% by 2030, while the IEA New Policies scenario starts at 12% in 2014, sinking to 7% by 2020 and then to 4% by 2030.

In the Advanced scenario, cumulative growth rates start off well below the historical average at 15% remain steady in the middle of this decade and then taper off to 13% by the end of the decade, dropping to 6% by 2030. Fig. 3 to Fig. 8 show new policies scenario, moderate scenario and advanced scenario for year 2020 and 2030. Fig. 9 represents yearwise MW production for new policies scenario, moderate scenario and advanced scenario.

Interesting Wind Energy Facts

- The United States currently has 61,110 MW of installed wind project capacity, comprising 5.7% of total U.S. installed electric generating capacity.
- Wind mills have been in use since 2000 B.C. and were first developed in China and Persia.
- Wind power is currently the fastest-growing source of electricity production in the world.
- Iowa and South Dakota generated more than 25% of their energy from wind during 2013.
- A single wind turbine can power 500 homes.
- In 2012, the Shepherds Flat wind project became the largest online wind project in the United States (845 megawatts), breaking the record previously held by the Roscoe Wind Farm (781.5 megawatts).
- In 2013, the roughly 168 million megawatt-hours generated by wind energy avoided 95.6 million metric tons of carbon dioxide (CO_2) — the equivalent of reducing power-sector CO_2 emissions by 4.4% or removing 16.9 million cars from the roads.
- There's enough on-shore wind in America to power the country 10 times over.
- In 2013, 12 states accounted for 80% of U.S. wind-generated electricity: Texas, Iowa, California, Oklahoma, Illinois, Kansas, Minnesota, Oregon, Colorado, Washington, North Dakota, and Wyoming. Source: U.S. Energy Information Administration March Electric Power Monthly report.
- Most wind turbines (95%) are installed on private land.
- Modern wind turbines produce 15 times more electricity than the typical turbine did in 1990.
- At times, wind energy produces as much as 25% of the electricity on the Texas power grid.
- American wind power is a $10 billion a year industry.
- Unlike nearly every other form of energy, wind power uses virtually no water.
- By 2030, U.S. wind power will save nearly 30 trillion bottles of water.
- At times, wind power produces as much as 45% of the electricity in Spain.
- Wind energy became the number-one source of new U.S. electricity-generating capacity for the first time in 2012, providing some 42% of all new generating capacity. In fact, 2012 was a strong year for all renewables, as together they accounted for more than 55% of all new U.S. generating capacity.
- During 2013, California led the nation in new wind installations (with 269 megawatts), followed by Kansas, Michigan, Texas, and New York.
- 70% of all U.S. Congressional Districts are home to an operating wind project, a wind-related manufacturing facility, or both.
- As of May 2014, the United States is home to 46,000 operating wind turbines.
- Right now, 559 wind-related manufacturing facilities produce a product for the U.S. wind energy industry across 44 states.
- Both Nevada and Puerto Rico added their first utility-scale projects during 2012.
- In 2000, more than 60% of U.S. wind power capacity was installed in California, with 17 states hosting utility-scale wind turbines. Today, 39 states and Puerto Rico share 60 gigawatts of utility-scale wind project development.
- Wind is a credible source of new electricity generation in the United States. Wind power comprised 43% of all new U.S. electric capacity additions in 2012 and represented $25 billion in new investment. Wind power currently contributes more than 12% of total electricity generation in nine states (with three of these states above 20% , and provides more than 4% of total U.S. electricity supply. Source: 2012 Wind Technologies Market Report (PDF 3.4 MB)
- Wind energy prices have dropped since 2009 and now rival previous lows. Lower wind turbine prices and installed project costs, along with improved capacity factors, are enabling aggressive wind power pricing. After topping out at nearly $70/megawatt-hour in 2009, the average levelized long-term price from wind power sales agreements signed in 2011/2012 – many of which were for projects built in 2012 – fell to around $40/megawatt-hour nationwide.

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B.Tech in Electrical Engineering from CTAE, Udaipur

"SCOPE has lot of scope in the coming years..."

SCOPE T&M Pvt. Ltd.*, popularly known as SCOPE, was incorporated on 13th January, 1988 to become India's first organisation to design and develop Test & Measurement products working in strong electromagnetic induction environment prevailing at EHV & UHV substations. In e-interview with *Electrical India*, *Sanjay Kulkarni*, *Chairman*, of the company, is telling *P K Chatterjee* about his company's business. Excerpts...

Q *How is the Indian Power Sector's focus changing towards quality and consistency of power supply?*

A Ministry of Power has initiated reforms not only in Power Generation and Transmission – but also in Distribution sector. Lots of funding are coming from centre under the various schemes such as IPDS, DDUGJY, UDAY , NSGM etc. The thrust here is to provide electricity at every remote house in India, maintain continuous availability of power and quality of power to each Indian.

Infrastructure strengthening by the way of changing old equipment such as Circuit Breakers, Isolators, Transformers, and Protection Relays etc., under retrofitting is happening on large scale. IT backbone is getting strengthened by way of putting servers, software and applications such as SCADA, OMS, ADMS, PLM & DR. Substation engineers have been trained to handle such software and use them to ensure quality of power in the grid.

Q *How is the demand for T&M devices increasing in India?*

A When there is increase in substations for transmitting or as they say evacuating electricity from generation plants and distributing to every household, there will be exponential increase in assets such as Transformers, Circuit Breakers, Isolators, Surge Arrestors and Protection Relays.

To maintain the healthiness of these assets, one requires to conduct periodic testing of these assets. So, Testing instruments will be the mandatory requirement. We at SCOPE are envisaging the growth to be almost three fold. Thus, we can say that SCOPE has lot of scope in the coming years.

Q *What are SCOPE's offerings to the Indian power sector including service offers?*

A SCOPE is growing fast not only in terms of turnover, but also in terms of product verticals. Apart from being Test & Measurement instrument manufacturer, SCOPE has added verticals such as Protection, RTU-based Automation and SCADA, OMS and ADMS, Last Mile Communication etc.

Our sister company ISSPL has been doing Testing & Commissioning Jobs for new substations – both AIS and GIS up to 765 kV ratings for last 10 years.

SCOPE is now in:

- Manufacturing & Trading of Test & Measurement Instruments
- Under SCOPE protection, we do the following:
  - Providing CRP & SAS solution up to 400 kV
  - RTU based automation solutions
  - Point on wave solutions for CB of transformers, reactors in EHV, HV & MV side
  - SCADA, OMS and DMS solutions
  - Fiber Optical terminating Equipment (FOTE)
- Substation services through ISOSCELES. We undertake all T&C ac tivities up to 765 kV under this sister concern of SCOPE.

Q *What are the changing trends in design of the electrical T&M instruments?*

A Due to handling generation of 500 MW and more, Transmission of 765 kV and more (1200 kV) and upgrading distribution sector, there is continuous demand on equipment / assets, which are used in these three areas (Generation, Transmission & Distribution) for their performance and availability.

These equipment or Assets are getting more and more accurate in terms of their responses and outputs. This calls for 10 time more accurate testing instruments, which test these assets. SCOPE R&D engineers are ready to face such challenges in measurements due to this changing trends.

Additionally, customer is expecting not only the measurements of electrical parameters – but also gives the meaningful information from the historical data base, which helps operation and maintenance engineers to take quick decisions such as shutdowns and take proactive maintenance of these assets to avoid breakdowns. We at SCOPE develop analytics, which make it possible for users to take timely decisions as mentioned above.

Q *Please tell me in brief about your R&D laboratory and its effective contribution to your business.*

A SCOPE acknowledge the importance of R&D, and we are proud to call ourselves an R&D-based company. Our R&D is situated at different locations, where more than 30 engineers are working on fundamentals of measurement using latest technologies and materials.

We have a separate software team that writes challenging algorithms helping our hardware engineers to validate their circuits in simulated environment before making a final product.

SCOPE R&D gave many breakthrough products to the Indian Power Sector – such as Circuit Breaker Operation Analyser (CBOA), Dynamic Contact Resistance Meter (DCRM), and Leakage Current Monitor for

Lightning Arrestors, Ultra-light Weight Contact Resistance Meters etc. All these products are import substitutes, helping our country to save millions of foreign exchange for last 28 years since lunching of our first C.B.O.A.

Q ***What are the latest offerings of SCOPE to the Indian market?***

A We at SCOPE have always tried to provide a best technology solution at affordable price. Understanding the requirements of the distribution companies to test underground power cables, SCOPE has launched Cable Fault Locator Systems, DC Test Equipment, Wireless Leakage Current Monitor etc.

We have also introduced RTU-based automation to upgrade old substations to latest level of communication protocol IEC 61850. SCOPE is also offering solutions in SCADA, OMS & ADMS to the Smart Grid projects.

Q ***Are you eyeing on any emerging area?***

A Yes, looking at changing power scenario in India, SCOPE has already geared up in offering products and solutions in the following areas…

- Smart Grid, Smart Cities, Demand Side Response, SCADA, OMS and ADMS
- Retrofitting of old substations to bring them in latest level of communication
- Bringing innovative On Line Testing Solutions to substation assets

Q ***How do SCOPE's instruments substitute imported ones?***

A It's SCOPE's approach to bring products and services with 'Innovation and Value Proposition' to the Indian Utilities, which gives them extra mileage, to become preferred Import Substitute in the Indian Market. We are proud to be recognised as a 'Make In India' company. Even today, after 27 years, SCOPE is providing simple solutions for difficult measurements"

Q ***Who are your major buyers in India and abroad?***

A SCOPE has its reach to each and every utility in India. Through our projects division, we were able to reach almost all major EPC players like L&T, Alstom, ABB, BHEL and many others.

We have also entered in international market with the same intention to provide a solution at a right price, and we have been able to sell our products in more than 40 countries. We have also been able to establish our dealers' network outside India.

Q ***What is your advice to the potential buyers of SCOPE's T&M instruments?***

A Focus on necessary and sufficient technical specifications that a Testing Instrument must have. Do not go for exorbitantly high-end specs, which only adds to the cost without giving any benefits for maintaining assets.

- The company from where you are buying T&M products must have local service centres and calibration facilities.
- The supplier should always be open to impart training not only one time – as it is mandatory in contract, but also repeatedly till the user is confident of handling the new T&M instrument.
- The supplier should have its own R&D, so that the costly T&M equipment that you are purchasing receives strong support against technology obsolescence from the manufacturer.

Transforming India Through LED Lighting

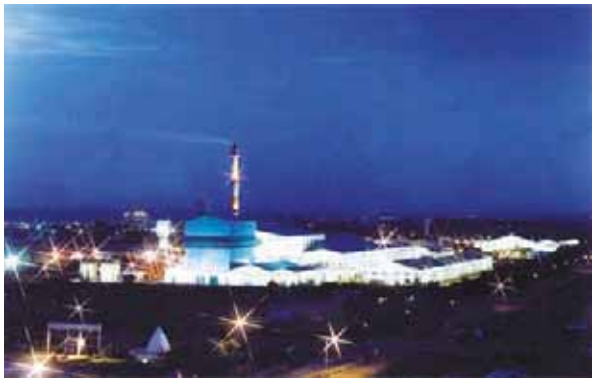
LED technology is widely acknowledged as the future of lighting technology. Surya Roshni presently manufactures almost all the LED products in-house...

Brand Surya is ranked as one of the most respected and trusted brands for lighting products, in India. The Group's width & depth across the lighting solution spectrum has enabled it to establish its presence across all corners of India and globally. By being cost effective without compromising on quality, the company has become the second largest player in lighting.

LED technology is widely acknowledged as the future of lighting technology. At Surya we understand this fact and manufacture LEDs which ensure energy savings, lower maintenance costs and assure an impressive lifespan - distinct advantages which propel the LED revolution forward. Today, Surya's LED product basket adds credibility to the brand's stature as being synonymous to lighting. Surya Roshni presently manufactures almost all the LED products in-house, backed by strategic marketing initiatives and a strong trade channel. The group manufactures quality LED products with a world class manufacturing infrastructure, at its fully integrated plants in Kashipur (Uttarakhand) and Gwalior (M.P), supported by Surya Technology & Innovation Centre (STIC) at Noida – an advanced state-of-the-art lighting laboratory and research centre with specific focus on LED.

Its LED product portfolio has both indoor and outdoor luminaires. The LED lamps save up to 85% energy, when compared with incandescent bulbs and have a long life-span of 25000 hours. Many new products such as High Beam Angle LED Lamps, Color Change LED Lamps, New Range Down lighters, LED Torch with Dry Cell Battery & Rechargeable, Rechargeable Lantern, Spot Lights and LED Wall Light will also be introduced as part of the Group's plan to cater to the growing demand of the customers.

Surya Roshni has registered CAGR of 20% as compared to the Indian lighting market CAGR of 12% And while the LED market is growing at a high speed at the rate of 60% Surya Roshni has registered 300% growth. We



are fired by an ambitious revenue target of Rs. 500 crs. in LED segment by 2016-2017, and at the same time, help the nation save more energy and be more eco-friendly.

Ongoing government initiatives like DELP and the Prakash Path programme for LED street lights, imply that the market is poised to grow substantially in this segment.

Technologically-ready companies like Surya Roshni can help in the government decision of changing all street lights and lights in public spaces to LED. The group MD, Raju Bista says, "The Make in India campaign launched by the government shall provide an extra impetus to both Surya Roshni and the LED Industry to grow faster.

Displaying a firm commitment to stay competitive, we at Surya are committed to the progress of Make in India campaign and are also participating in all tenders of LED Bulbs & LED Street Lights". Compulsory Registration Scheme of Deity/BIS for LED products has been started to take care of safety standards of LED products and group's all manufacturing plants have CRS approval from BIS. Bureau of Energy Efficiency's star rating plan for LED lamps shall further enhance lumen efficacy of lamps.

Since inception the conglomerate has believed in the power of transformation, turning energy into happiness and living up to its promise of achieving brilliance at everything.

This underlying ethos has not only transformed the Surya Roshni of today into a leader in Lighting and Steel Pipes sector, it has also helped it carve a niche in the Home Appliances and Fans segment, enabling it to earn respect & recognition as a credible multinational.

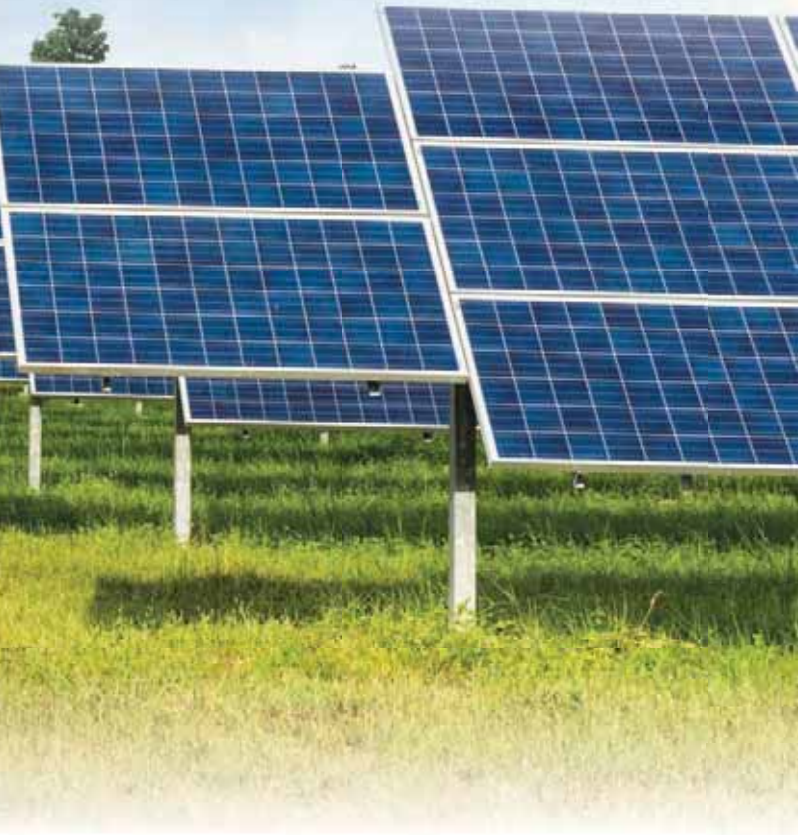
Today Surya has a global footprint with an international presence across 44 countries. Its network of over 2000 distributors and 2 lakh country-wide dealers is its strength, which helps the group to be present in every nook and corner of India. Surya's product range demonstrates the group's relentless commitment to performance, customer satisfaction and superior value.

The group has become one of the most trusted brands in the country today.

SOLAR ENERGY

The Best New Way To Go

With the country said to expect about $250 billion (Rs. 1, 52,500 crore) worth of investments in the electricity and renewable energy sector by 2019, the picture looks good for India...



India has been able to fast track its development with support and guidance from the government as well as the rapidly improving economic posture of the country. Needless to say, we are progressing towards development at lightning speed. For development and innovation to continue and grow at a faster rate, there will be a need for continuous energy supply.

The same is true for businesses, because to have 24x7 access to data, it is vital that they have constant energy supply to function unhindered and efficiently.

The current government is working towards making India a country that provides energy to all. India is today the world's third largest producer of electricity generating a capacity of around 256 gigawatts, despite which the country's demand for power outstrips supply and per capita consumption of electricity is abysmally low. Consequently, India faces a power deficit situation and hence the demand for alternate sources of energy is increasing rapidly.

The India Scenario

As stated, India is a power deficient nation and this is one of the key reasons we will witness a large demand for renewable and solar energy. As a nation facing an increasing demand–supply gap in energy, we now see that the government as well as a lot of businesses are taking critical steps towards tapping the solar potential of the country and this will help us realise India's goal of becoming a country that provides energy to all.

With India looking at achieving 1 lakh Megawatts (MW) of solar energy capacity by 2022, and a lot of domestic companies also looking to add significant green energy capacities, the share of solar and renewable energy capacities is set to rise soon. While this push will help India reduce its dependence on fossil fuels and curb pollution, India's solar push faces hurdles such as affordability and insufficient infrastructure.

Talking of affordability, assuming that there are high tax returns that will be levied on equity, the cost of generation from a solar project can be very expensive and reduce the interest of companies looking to invest in such ventures. Until now the industry has been well supported by the government incentives like lower duties, tax breaks and guaranteed purchases by the state utilities.

But some companies bundle solar energy with large volumes of conventional energy, which results in a marginal rise in tariffs for the end user. This raises an important question on the affordability part. The second issue is that of insufficient infrastructure which becomes another roadblock for the adoption of solar-based technologies. With the existing transmission capacities being insufficient, we witness a lot of inter-state transmission congestion, and a lot of this goes unaccounted for. This has raised another important question as to whether India as a country can provide the required infrastructure for the adoption of solar energy.

Growing Adoption and Benefits of Solar Energy

While India's solar push does face some grave challenges, solar energy does have some concrete advantages.

Abundance of Solar Energy: Being a tropical country, solar energy is produced on a large scale in India. India saw a 14.2% increase in solar power generation from 2013-2015. An interesting insight from the National Institute of Solar Energy (NISE) elaborates that the total solar power potential of the country is 748.92 GWp. Harnessing this energy effectively can help solve the energy deficiency of the country to a large extent. With the country said to expect about $250 billion (Rs. 1, 52,500 crore) worth of investments in the electricity and renewable energy sector by 2019, the picture looks good for India. This also offers a clear picture of where the country is heading in terms of solar energy production and usage.

Large Scale Demand for Solar Products: From a business standpoint, companies are looking at going green and reducing their operational costs and carbon footprints. This will result in a surge in demand for solar inverters and UPS systems that are cost efficient and effective. Another added advantage of such solutions are, they can be customized according to the needs of consumers and business needs. This has also seen many companies including Emerson Network Power invest in central inverters and the off grid solar market.

Environment Friendly and Reduces Carbon Emissions: Solar energy is an excellent alternative for fossil fuels like coal and petroleum as it is practically emission free, therefore, the danger of further damage to the environment is minimized. Also, solar energy used to generate electricity, ensures minimal noise pollution.

Accessibility of Solar Power in Remote Locations: In terms of power generation, solar energy can generate electricity no matter how remote the area is as long as the sun shines. Even in areas that are inaccessible to power, cables solar energy can produce electricity.

Solar Energy Systems are Virtually Maintenance Free: Solar energy systems are mostly maintenance free. Once a solar photovoltaic array is setup and installed it can last for decades as practically zero recurring costs are incurred. If needs increase, solar panels can be added with ease and with no major revamp.

Conclusion

With the government highlighting their openness for large scale PPP initiatives as well as huge solar projects there is still an increasing need to come out with such encouraging policies. In conclusion, one can say that solar energy systems present a smart option to businesses today. Solar panels reduce the amount of electricity coming from fossil fuels, supplying business operations with clean, renewable energy. Many business owners, from hotels to wineries to retail stores, to manufacturing units are making the decision to reduce their electricity bills and are adopting the cleaner and greener option of solar energy, and they save significantly on utility expenses and add high value to commercial properties. Major tax benefits, especifically to businesses, as well as having a green image are some of the other reasons why going solar is a good idea.

Dinesh Dhut
Director - Telecom / Solar Products & Solution
Emerson Network Power, India

ELECRAMA 2016 Beckons You To Bengaluru

ELECRAMA 2016, the 12th World Electricity Forum 2016, will commence from 13th February, 2016 and conclude on 17th February, 2016. The location of the Trade Show, Fair and Exhibition is Bangalore International Exhibition Centre, Bengaluru, India. Besides its all-time features, this time the event is including several new important and engaging sessions...

ELECRAMA, THE WORLD ELECTRICITY FORUM, has now turned into a movement, beyond just an exhibition. It is a premier show of Indian Electrical Sector and is the World's Largest Confluence of the power transmission and distribution community. Held biennially since 1990 in India, the eleventh edition ELECRAMA-2014 hosted 970 exhibitors from India and across the world and also attracted 100,000+ footfalls into the exhibition.

In the last two decades ELECRAMA as an exhibition featured the biggest names in the global electrical T&D industry, to whom it serves as the perfect launch vehicle to introduce latest products and technologies. ELECRAMA showcases products and technology through the entire voltage spectrum, from 220V to 1200kV, conforming to global standards and specifications. A large number of business and technology partnerships are also transacted during the 5-day-period giving it a must attend event status amongst global exhibitions.

ELECRAMA visitors consist of a wide spectrum of industry stakeholders, offering them an international framework for display, discussions and deliberations. It brings together manufacturers and suppliers to interface with key customer segments like private and public transmission and distribution utilities, EPCs, Consultants and specifiers, members of the government and policy makers.

The event also brings together global thought leaders in the electrical transmission and distribution sector consisting of industry leaders, engineering professionals & technologists, professionals and academia, et al through high power panel discussions, premier conferences, technical workshops, tutorials and seminars held concurrently with the exhibition. ELECRAMA also hosts international diplomatic and trade visitor delegations from various countries and large country pavilions from leading manufacturing nations from around the world.

The Government of India's participation is reinforced with the presence of four senior ministers. The ministers who have lent their consent to be present during the event are Suresh Prabhu, Minister of Railways; Kalraj Mishra, Minister of MSME; Anant Geete, Minister of Heavy Industries & Public Enterprises and Piyush Goyal, Minister of Power who would also be inaugurating this grand event. We are thankful for this magnanimous gesture, which has inspired us to deliver a superlative event experience.

ELECRAMA-2014 hosted 970 exhibitors from India and across the world, and also attracted 100,000+ footfalls into the exhibition…

ELECRAMA is a stellar platform for a world view on technology, best practices, new systems and forecasting the trends in the future of electricity, both from technology and a socio-economic point of view. ELECRAMA will, for the first time, feature 'WORLD UTILITY SUMMIT,' a unique global platform like no other.

This 'By Invitation Only', event is 'of the utilities, for the utilities and by the utilities'. CXOs of more than 50 global utilities are being invited to participate in the two-day-summit to interact with CXOs of Indian utilities and share their experiences and best practices.

'Network to Networth' is another new interesting and necessary addition to ELECRAMA 2016. End to end, it is planned for creating awareness about the huge investment and JV opportunities in the Indian electrical sector for both global and domestic investors.

Aaditya Dhoot, Chairman, ELECRAMA 2016...

P. Goyal, Union Minister of Power, with ELECRAMA organisers...

ELECRAMA for the first time features unique experience pavilions displaying, 'Energies of Tomorrow' and 'Evolution of 125 years of Electricity,' in collaboration with IEEE, a coffee table book on this subject is also under preparation. R&D – Railway, Nuclear & Defence pavilion is also planned for the first time at ELECRAMA – to enable interaction between industry and these critical sectors displaying their strengths, capabilities, services and plans in this specially dedicated pavilion.

Renewable Energy pavilion is another addition under planning for displaying the strengths of the Indian Industry in the renewable sector.

Contemporary Events, which have added strength to ELECRAMA over the years, continue to feature:

The third edition of Reverse Buyer Seller Meet, supported by the Ministry of Commerce, Govt. of India continues to generate large scale business opportunities. 8000 + meetings with 600 overseas buyers from 42 countries are planned over two and half days of this event.

'Engineer Infinite' in ELECRAMA 2016 will feature 50 most innovative third year student projects in the electro mechanical segment, for encouraging young budding engineers from across the country.

A subset to this activity is 'Coffee with Sir', where participating students listen and network with industry leaders over all five days. The five best students' projects are awarded by an industry leader at the 'INNOVATION DAY.'

International T&D Conclave, another co-located event has been planned as a half day event in its third edition. It provides a unique opportunity for Indian industry and its stakeholders to listen to and interact with global experts from the energy sector.

NATIONAL

Gujtech Industrial Expo 2016

Venue:
AES Ground, Helmet Circle, Ahmedabad, Gujarat, India

Date:
05 to 07th February, 2016

LED Expo Mumbai 2016

Venue:
Bombay Exhibition Center, Mumbai, India

Date:
12 to 14th May, 2016

Renewable Energy India Expo 2016

Venue:
India Expo Centre, Greater Noida, India

Date:
07 to 09th September, 2016

Light India 2016

Venue:
Pragati Maidan, New Delhi, India

Date:
05 to 07th October, 2016

INTERNATIONAL

Electrotech . Light 2016

Venue:
Minsk-Arena - Football Manege Sport Complex, Minsk, Belarus

Date:
2nd to 05th February, 2016

International Signs & LED Exhibition Guangzhou 2016

Venue:
China Import and Export Fair Pazhou Complex, Guangzhou, China

Date:
24 to 27th February 2016

World Sustainable Energy Days 2016

Venue:
Messe Wels, Austria

Date:
24 to 26th February, 2016

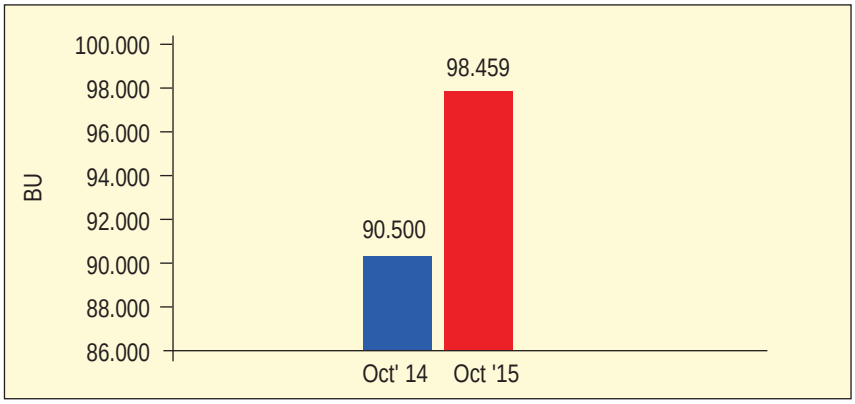
Hong Kong Electronics Fair (Spring Edition)

Venue:
Hong Kong Convention And Exhibition Centre, Hong Kong

Date:
13 to 16th April 2016

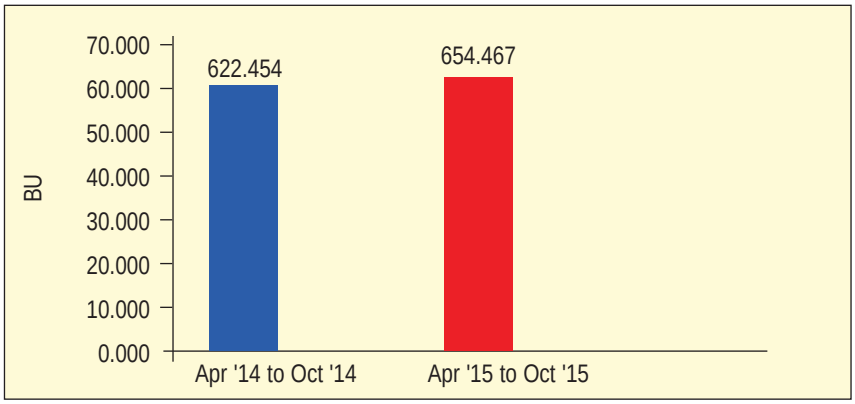
Electricity Generation for October 2015 (BU)

Type	Achievement	Targets	Achievement	% Change w.r.t. 2014
	Oct-14			
Thermal	76.006	81.984	85.941	13.07
Hydro	11.081	11.435	9.059	-18.25
Nuclear	2.831	3.167	2.839	0.28
Bhutan Import	0.582	0.579	0.620	6.53
All India	90.500	97.165	98.459	8.79



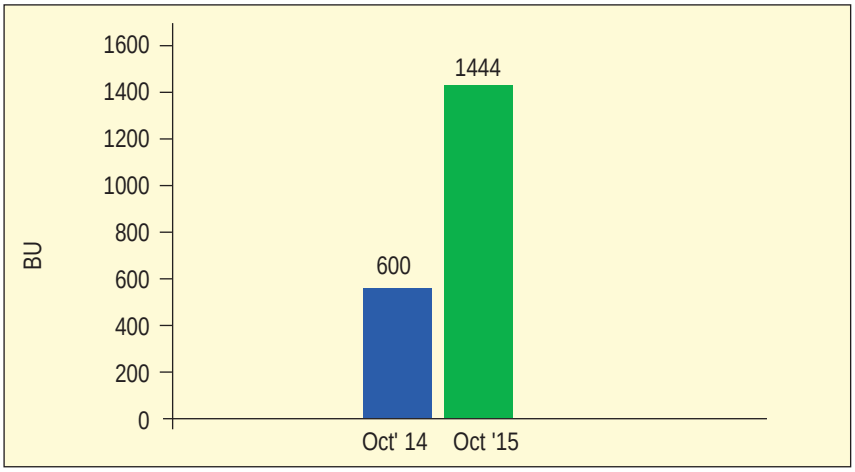
Electricity Generation During April 2014 to Oct 2014 & April 2015 to Oct 2015 (BU)

Type	April '14 - Oct '14	Apr '15 - Oct '15	% Change
Thermal	506.341	538.722	6.40
Hydro	91.978	89.017	-3.22
Nuclear	19.635	21.915	11.61
Bhutan Import	4.500	4.813	6.96
All India	622.454	654.467	5.14



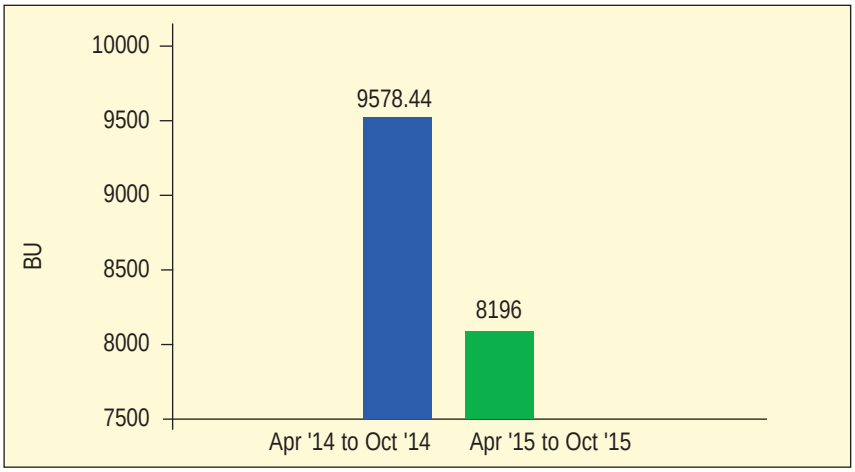
Generating Capacity Addition for October 2015 (MW)

Type	Achievement	Targets	Achievement	% Change w.r.t. 2014
	Oct-14			
Thermal	600	2030	1404	134
Hydro	0	88	40	
Nuclear	0	0	0	NA
All India	600	2118	1444	141



Generating Capacity Addition during April 2014 to Oct 2014 & April 2015 to Oct 2015 (MW)

	Apr '14 - Oct '14	Apr '15 - Oct '15	% Change
Thermal	9311.1	6990	-25
Hydro	267.34	1206	351
Nuclear	0	0	NA
All India	9578.44	8196	-14



List of Projects Commissioned During October 2015

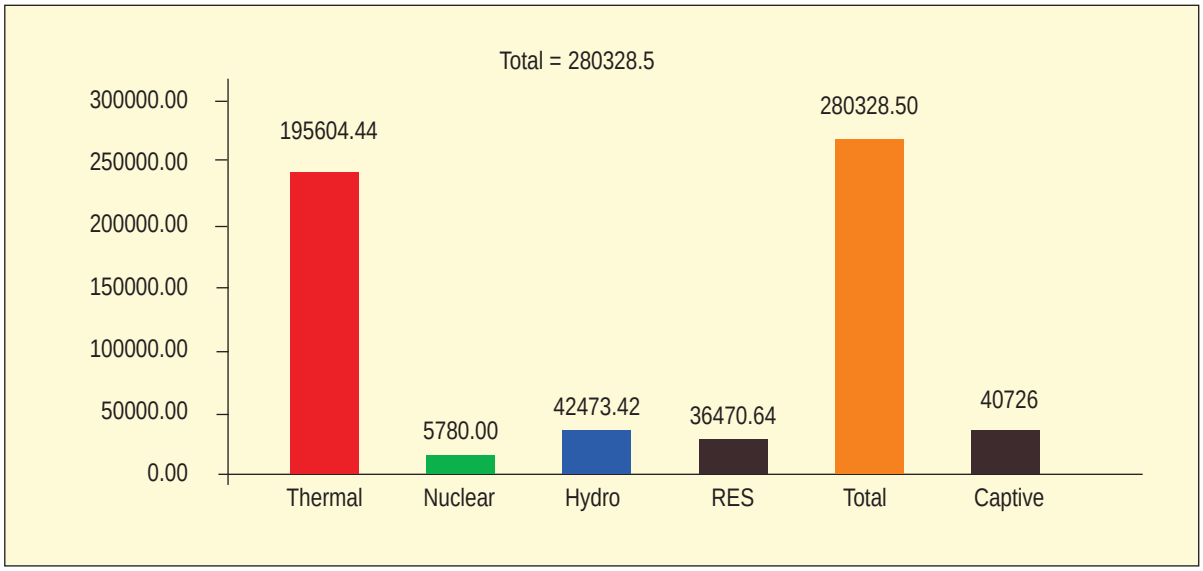
(i) Thermal
1. Talwandi Sabo U-2/ (660 MW) was Commissioned on 25.10.2015.
2. Uchpinda TPP U-I (360MW) was Commissioned on 28.10.2015.
3. GMR Rajahmundry energy Ltd. Block-2 (384 MW) Was Commissioned on 05.10.2015

(ii) Hydro
1. Lower Jurala U-1 (40 MW) Was Commisioned on 14.10.2015
2. Baghlihar St-II U-2 (150 MW) was commissioned on 29.09.2015 (reported in Oct 2015).

(iii) Nuclear Nil

All India Installed Capacity (MW) Region-wise as on 31.10.2015

Region	Thermal				Nuclear	Hydro	RES	Grand Total
	Coal	Gas	Diesel	Total				
Northern	41603.50	5331.26	0.00	46934.76	1620.00	18096.77	7511.89	74163.42
Western	68139.01	10815.41	0.00	78954.42	1840.00	7447.50	13005.62	101247.54
Southern	31502.50	6473.66	917.48	38893.64	2320.00	11478.03	15245.11	67936.78
Eastern	28582.87	190.00	0.00	28772.87	0.00	4209.12	434.54	33416.53
North-East	310.00	1662.70	36.00	2008.70	0.00	1242.00	262.38	3513.08
Islands	0.00	0.00	40.05	40.05	0.00	0.00	11.10	51.15
ALL INDIA	170137.88	24473.03	993.53	195604.44	5780.00	42473.42	36470.64	280328.50

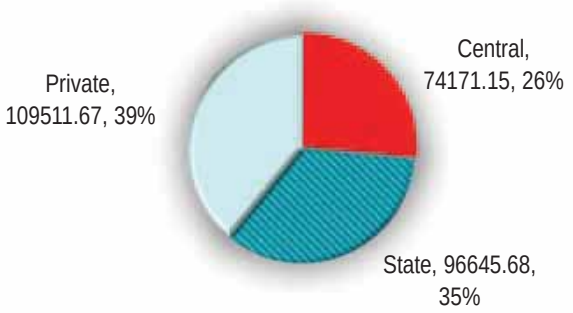


Note: Captive Genaration is not included in the total

All India Installed Capacity (MW) Sector-wise as on 31.10.2015

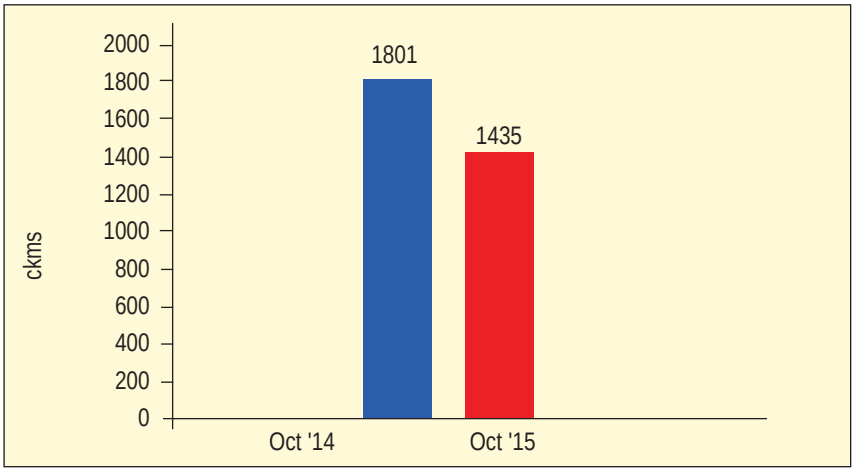
Sector	Thermal				Nuclear	Hydro	RES	Grand Total
	Coal	Gas	Diesel	Total				
Central	49380.00	7519.73	0.00	56899.73	5780.00	11491.42	0.00	74171.15
State	59450.50	6975.30	438.57	66864.37	0.00	27862.00	1919.31	96645.68
Private	61307.38	9978.00	554.96	71840.34	0.00	3120.00	34551.33	109511.67
All India	170137.88	24473.03	993.53	195604.44	5780.00	42473.42	36470.64	280328.50

All India Installed Capacity(MW) as on 31-10-2015 (Sector-Wise)



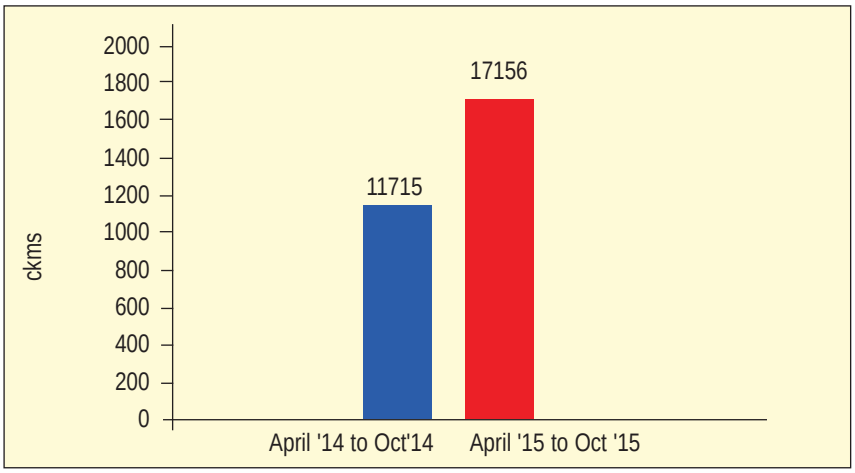
Transmission Lines Added during October 2015 (Ckms)

Voltage Level	Oct-14	Oct-15
⊬ - 800 KV HVDC	0	0
765 KV	970	0
400 KV	753	585
220 KV	78	850
All India	1801	1435



Transmission Lines Added during April '14 to Oct '14 & April '15 to Oct '15 (Ckms)

Voltage Level	Apr '14 - Oct '14	Apr '15 - Oct '15
⊬ - 500 KV HVDC	0	0
⊬ - 800 KV HVDC	0	3506
765 KV	3750	4310
400 KV	6082	5253
220 KV	1883	4087
All India	11715	17156



Lighting Management System

Poor management not only leads to inefficient usage but also increases the expense. LMS helps in analyzing the consumption pattern and thereby reducing the amount of usage and also better ROI...

Light Management System (LMS) is an integrated set of products that are reliably networked. It enables in local and remote monitoring and control system.

The products are non-intrusive and use wireless sensor networks to monitor and control a light module. The products enable easy integration with existing or new light modules for immediate operation.

Need for LMS

- Power consumption by lighting varies between 20 - 25% of the total power.
- Monthly lump-sum electricity bills.
- Occupants have a little insight over their building environment.
- The inability to control brightness is usually a big factor in energy wastage.

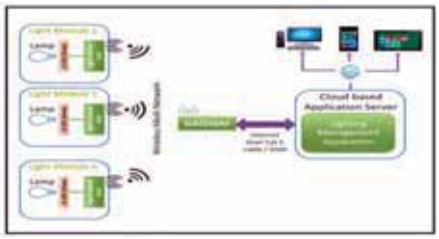
Poor management not only leads to inefficient usage but also increases the expense. LMS helps in analyzing the consumption pattern and thereby reducing the amount of usage and also better ROI.

Benefits of Wireless Lighting Management System

- **Tunable Light:** Tuning of light regulates the brightness of the lights, Set maximum light levels. Customizable as per the tasks and general ambience in a workspace.
- **Daylight harvesting:** Automatic dimming / switching lights in response to the available day light helps in Daylight harvesting. Adjusts indoor light levels according to natural light. Ensures minimum light level by making emergency lights ON and Non-critical lights OFF.
- **Occupancy monitoring:** Turning ON the lights in response to the room occupancy results in more savings. Highly sensitive occupancy sensors detect even the small movements. If the room is unoccupied, lights turn off automatically.
- **Smart scheduling:** Schedule when the lights should turn ON and OFF in any part of the building. All timings can be controlled straight from the dashboard.
- **Personal software control:** Turning ON / OFF the lighting loads right from the PC. Setting of level of light right from the dashboard.
    - Lighting Management Solution
    - Street Light Management System
    - Features
    - Advantages
    - Software Features

ElMeasure provides world class solutions in Wireless Light Management Systems. The main objective to develop a lighting control system that is to reduce energy usage up to 75% using Lighting Management Strategies.

System Architecture



System Requisites

- Lighting Control Unit (LCU) with Zigbee Module.
- Gateway for data transfer.
- Server – PC loaded with MS software.

ElMeasure's Light Control Unit (LCU) will be connected to individual Light driver unit. LCU unit consist Zigbee module, which will transfer and receive the consumption data. This data will be sent to Gateway using which data transfer to Cloud based server.

The data will store in database with scan time. LMS will generate various reports using which consumption analysis and control corresponding light zone can be achieved.

A Technical Note

CALTER's contribution to power cable conductors jointing technology...

CALTER is the brand name of terminals connectors, earthing accessories, conductor crimping tools and wires & cables manufactured by STI Industries.

Power in eruptions in large urban underground power distribution system and industries results in loss of continuity in power supply – causing serious inconvenience to urban population and major loss of revenue in industrial networks. Majority of sources such forced power outages have been attributed to failures of underground joint and over ground terminations.

Connectors are used for joining conductors of two cables in LT & HT straight joints and terminals are used for connecting cables to equipments, such as transformers, switchgears, motors etc.

Long term performance of terminals and connectors depend on the following.

1) Purity of Copper / Aluminium that shall be of EC Grade (Electrical Conductor Grade)

2) Dimensional specifications for each size to ensure that the terminals / connectors have dimensions, compatible with corresponding conductors. International and national standard have been evolved for dimensional specifications.

3) Internationally accepted standards are British Standards abbreviated as 'BS' & 'DIN' standards first develop in Germany & internationally adopted. Selection of the right size of accessory (general term for terminal and connectors) to suit a specific size of conductor is first step to ensure long-term performance of cable accessories. (General term for termination and joints) of which the terminals and connectors are important elements.

4) Proper connections of cable conductor to connectors / terminals are made by means of crimping tools. Crimping tools operate on principle of either 'Simple Machine' or on principle of high hydraulic pressures developed by the tool. The high pressures (up to 700 bars) act on a die designed to De-form the conductor connection device (terminals / connectors) and form bond between the connection device and corresponding conductor, which is contained in barrel of the connection device. The development of high pressure capable of deforming accessories is based on 'Pascal's Law' with state that within an enclosed volume of fluid any increase in pressure is uniformly transmitted throughout volume of fluid. The principle of operation of Hydraulic Crimping Tool is illustrated in the diagram below. The pressure 'p' of fluid is the same in both the small cylinder and large cylinder. The large cylinder develop or high force 'F' (p X A). This force is developed by means of a much smaller force 'f' (p X a), made of manuals effort or small battery power. The high forces develop in large cylinder crimps the connection device through a die. CALTER compliments there conductor connection device with the range of crimping tools. Calter has the technology edge by virtue of capability to design the tools and various forms and sizes of dies.

Crimping tools are classified according to their constructional features as below:

1) Hand operated non-hydraulic tools. These tools based on principle of simple machines having a fulcrum, a die holder and handles for pressing. Such tools find application for crimping small conductor up to 6 sq mm.

2) Hand-operated hydraulic tool minimising crimping effort & use from 25-000 square mm.

3) Battery operated hydraulic crimping tools are characterised by light weight capable of crimping up to 400 mm^2, they find application in windmill towers for crimping. They also find extensive application in cable jointing in networks requiring time bound restoration of power supply.

CALTER is proud to specialise in manufacture of Copper / Aluminium Terminals and Connectors, which are critical elements in cable accessories.

Calter is proud to complement their range of accessories of connection of cables with reliable modern means of jointing the accessories to cable conductors.

Failures of cable accessories (Straight joint / termination) occurring in power distribution system are largely attributed to thermal break down triggered by poor quality of crimps.

Realising the paramount important of conductor bond in cable accessories, Calter has been complementing their range of terminals and connectors by a range of mechanical, hydraulic and battery operated crimping tools , as CALTER'S total commitment to uninterrupted power supply. EI

Glacial Power offers 200ma DALI power supply

Glacial Power, a division of Taiwanese technology manufacturer Glacial Tech supplies the GP-DP004N-16V. A DALI power supply outputting 200mA, the GP-DP004N is enough for a full 64 device DALI network. Compatible with DALI standard IEC62386, the GP-DP004N-16V takes universal AC input from 100 to 240V to provide constant voltage at 16V. With over-current and short-circuit protection, users are ensured safe power.

Features:

- Universal AC input 100–240 V AC
- Constant voltage operation
- Suitable for DALI bus application
- Protections: OCP / SCP
- Compatible with DALI standard IEC62386

For further details contact: Website: www.glacialpower.com

Aim your beam with Syrios (Round) SY600

The 6" and 8" models feature a unique integral tilting mechanism, which allows forward/back adjustability. An optional 360° adjustable rotation allows for maximum flexibility, and precise directional aiming of the light beam without disturbing the position of the luminaire. This unique function is ideal to precisely highlight building features – such as overhang canopies, accentuate wall textures or push light away from the building to light a pathway.

Designed for performance, reliability and durability, Syrios delivers up to 3200 (delivered) lumens and has a L70 lifetime of 130,000 hours. The Syrios housing is made of corrosion resistant aluminium alloy and features an integral LED sealed light module designed for optimal heat dissipation and lighting performance. Top cast ventilation slots allow for air circulation and cooling of the assembly.

For further details contact: Website: www.luminis.com

WAGO offers power supplies for all basic operations

WAGO is expanding its range of EPSITRON ECO Power Supplies by adding a special model that has an even greater price/performance ratio. Thanks to EN 60335 conformity, the new 787-17x2 Power Supplies are open to a variety of non-industrial applications within the scope of the household appliance standard.

The economically priced power supplies offer versatile DIN-35 rail and screw mounting options, making them easy to install in ultra-compact control cabinets and devices. Beyond control cabinets, the 787-17x2 ECO power supplies are ready for a variety of consumer-oriented applications within the scope of the household appliance standard, thanks to EN 60335 conformity.

This enables WAGO to economically bring trusted industrial technology to everyday applications, for example: vending machines, slot machines, coffee machines, as well as heating controls and ventilation systems).

Each single-phase ECO Power Supply has a wide input range for AC voltages from 100–240 V and can be connected to utility grids worldwide. The compact 787-17x2 Power Supplies provide 24 VDC nominal output voltages and models are available from 1.25–10 A.

For further details contact: E-mail: info@wago.com

FLIR CM174 - Imaging 600A AC/DC clamp meter with IGM

The FLIR CM174 Imaging 600A AC/DC Clamp Meter with IGM is the first clamp meter equipped with a built-in thermal imager that can quickly lead you to problems you can't see with a standard clamp meter. Featuring Infrared Guided Measurement (IGM) technology, the CM174 visually guides you to the precise location of a potential electrical problem, identifying dangerous and unknown problem areas safely. Confirm your findings with accurate amperage and voltage measurements, and center-point temperature readings.

The narrow jaw enables greater accessibility, and its compact form-factor fits easily into your back pocket – so you can have thermal imaging at your fingertips everywhere you go. The FLIR CM174 will quickly become your primary electrical troubleshooting tool.

For further details contact: Website: www.flir.com

Ametek offers JEMSTAR II revenue meters

Ametek Power Instruments offers revenue meters for electrical utilities. The company has launched the JEMStar II IEC Revenue Meter; joining the family of JEMStar II ANSI Meters released last year. The IEC version of the JEMStar II is used primarily outside of North America for high-accuracy revenue metering applications.

As per Ametek, the JEMStar II IEC meter; like the ANSI meter, has the highest accuracy in the market at 0.05% of reading for watt hours and is often used to measure hundreds of thousands of dollars of electricity revenue at utility generation and transmission substations.

The JEMStar II IEC features the industry's first colour graphic display for real-time power values, meter status, site conditions and more. The meter has seven communication ports available, including dual independent Ethernet ports. It also offers advanced power quality monitoring to provide quick and easy analysis of system anomalies.

For further details contact: Website: www.ametekpower.com

Gems Sensors & Controls offers subminiature pressure switch

Gems Sensors & Controls has updated its PS61 Pressure Switch Product Family. As part of its commitment to continuous improvement and goals to meet market & customer demands, the company has updated the PS61 product family. The pressure switch family now offers the following key enhancements to their PS61 products:

- Compact - shorter overall length
- Increased temperature performance to 250°F (121°C)
- Additional integral electrical connector choices
- Improved Ingress Protection (IP) to IPX7, IPX9K, and IP6KX
- Expanded pressure ranges between 10-4350 PSI (0.7-300 Bar.)
- Clear RoHs compliant Zinc plated fittings.

In addition, the updated PS61 pressure switch product family is replacing the legacy PS61, PS61P, PS52, and PS32 product families.

For further details contact: Website: www.gemssensors.com

Testo precision drive at your doorstep

Testo India is proud to announce the launch of 'Testo Precision Drive' – a showroom on wheels. The roadshow will allow the customers to interact with our specialists and learn more about Testo products and their applications in their respective industries with hands on experience of the products.

In a country like India, everyone wants to physically see and experience the features and benefits of a product before making a purchase decision; the same rule is also applicable when it comes to industrial products. To bridge this gap between the customer and the manufacturer in the industrial products' sector, Testo India has launched an initiative the 'Testo Precision Drive'- a mobile exhibition to bring our entire product range to our customer at their doorstep. This mobile exhibition will provide a platform for the existing and potential customers to interact with our specialists to gain more knowledge about our products and their applications, that too at their doorsteps. This exhibition on wheels travelled across all the states in the Southern India over a period of 6 months to explore deeper pockets of the industrial hubs present in all these states starting 22nd December 2015 in Karnataka at the Bommasandra Industrial Area.

Kalidas Bhangare, MD, Testo India inaugurated the mobile exhibition 'Testo Precision Drive.' It also registered the presence of Testo India customers who became a part of the flag-off ceremony and appreciated the initiative. During this journey, in places where there are cluster of industries around, the showroom was centrally parked, so that customers from all the surrounding industries could have accessed and visited the Testo lounge. In addition, for all those corporations who permited the lounge to be taken inside their premises, Testo showroom was moved in to their peripherals for all their various functions to have a look at the Testo product basket.

For further details contact: Website: www.testo.in

LED Bollards

Efficient and cost-effective LED bollards with rotationally symmetrical illumination for ground surfaces. The photometric design of these luminaires is based on LED integrated with K-Lite's precision reflector module. Consistent implementation of a new technological developments combined with the highest technical and structural quality have resulted in these state of art luminaires. These luminaires are characterised by their high luminous efficiency, extremely long service life and the uniformity of the degree of illuminance. These luminaires are available in Ø100 and Ø166, three different heights to suit the installation site. Their sturdy construction makes them especially suitable for areas in which considerable robustness is required to ensure vandal proof service. Application: For the illumination of footpaths, entrance areas, driveway, private and public areas.

K-Lite advantages: Powerful Design Powerful Light

- Extruded aluminium alloy housing through homogenization for durability and thermal management.
- Stainless steel hardware used for long life and for easy of maintenance.
- Silicon EPDM gasket used for IP ratings and conforming to the safety and reliability requirements of the products.
- UV stabilized, non yellowing polycarbonate diffusers for better light transmission, vandal resistant and UV stabilisation.
- Finished with 60 micron thick polyester based powder coating for uniform deposition and excellent finish.
- CREE / OSRAM / NICHIA make LEDs, internationally recognised brands with higher lumen output are used for better illumination and longevity.

For further details contact: Website: www.klite.in

Panasonic offers device that helps in curtailing waste of power

Panasonic Industrial Devices SUNX Co., Ltd. has launched the Eco-POWER METER KW2M Series (Series name: KW2M-A), a power meter for measuring the power consumption and power quality of multiple circuits. By making power consumption visible, the KW2M-A is able to identify and locate devices that are wasting power. It helps to monitor and reduce power consumption.

To save energy, it is crucial to measure, compare and monitor multiple points of power consumption. There are many situations that have multiple points to measure power consumption in a distribution panel. More points for measuring electric power means more wiring, which results in higher labour and material costs to build a power monitoring system. Additional labour and material costs are also required for routing new communication cables.

More often than not, power quality and power consumption must be measured because the power quality may not be stable (e.g., power failures, unstable voltage, etc.).

The KW2M-A is a power meter that can be expanded to monitor multiple circuits. It can support up to three expansion units to handle the required number of circuits, thereby achieving 'visualisation' of power and power quality while saving both wiring and space. As for communication, it expands the range of choices for building systems because Ethernet communication is available in addition to RS485 communication. The KW2M-A helps in identifying hidden waste, thereby reducing power consumption, and contribute to preventative maintenance of equipment by easily achieving 'Visualisation' with minimal man-hours.

Features of the Eco POWER METER KW2M Series (Series name: KW2M-A):–

1. **Saving energy and monitoring electric power quality:** The KW2M-A measures power quality factors, such as harmonics, voltage, current unbalance, etc., supporting not only energy savings but also monitoring electric power quality. The collected data can be used to detect abnormal electrical incidents for equipment which can then be used for preventative maintenance.
2. **Saving wiring and space:** One unit can measure two circuits. Up to three expansion units (for up to eight circuits, three-phase four-wire) can be connected to handle the required number of circuits. When measuring eight circuits, the number of wires is reduced by about 50% compared to conventional Panasonic products (KW9M Series; Series name: KW9M Advanced Type) and KW2M-A, measuring eight circuits, width of unit, and space is reduced about 60%, when compared with conventional Panasonic products.
3. **Ethernet communication, web server functionality:** The KW2M-A also offers web server functionality, eliminating the need for dedicated software tools. Operational settings for devices and firmware upgrades for the main unit can also be performed via the Ethernet port. EI

For further details contact: Website: www.panasonic.com

Megaman presents surface-mounted LED lamps Renzo

Megaman has launched LED bulkhead series - RENZO for indoor applications. Designed to replace CFL luminaires, RENZO has exceptional lumen output, colour rendition and even distribution of light to offer maximum visual comfort. This features a simplistic and contemporary design that will fit well in many settings.

As per the company, RENZO, an energy-efficient integrated surface mounted LED luminaire, is an ideal alternative to traditional ceiling and wall mounted Compact Fluorescent Luminaires (CFL). It has a wide range of lumen packages to perfectly replace 1x18W up to 2x26W CFL. The built-in opal PMMA diffuser enables every RENZO lamp to deliver evenly distributed lighting and visual comfort.

A wide range of distinctive models are also available for different applications. For example, there is a built-in microwave motion sensor option, allowing automatic light on/off when entering and leaving the room. As this motion sensing option detects body movements, it is ideal for applications in common areas such as staircases and corridors. Another version with IP44 protection for places with high humidity, such as kitchen and balcony etc is also available. From hotels, bathrooms, kitchens, corridors to residential applications, RENZO's unobtrusive and understated design style blends well with all kinds of interior design. EI

For further details contact: Website: www.megaman.cc

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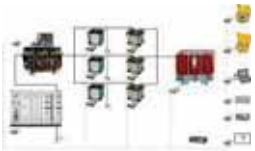

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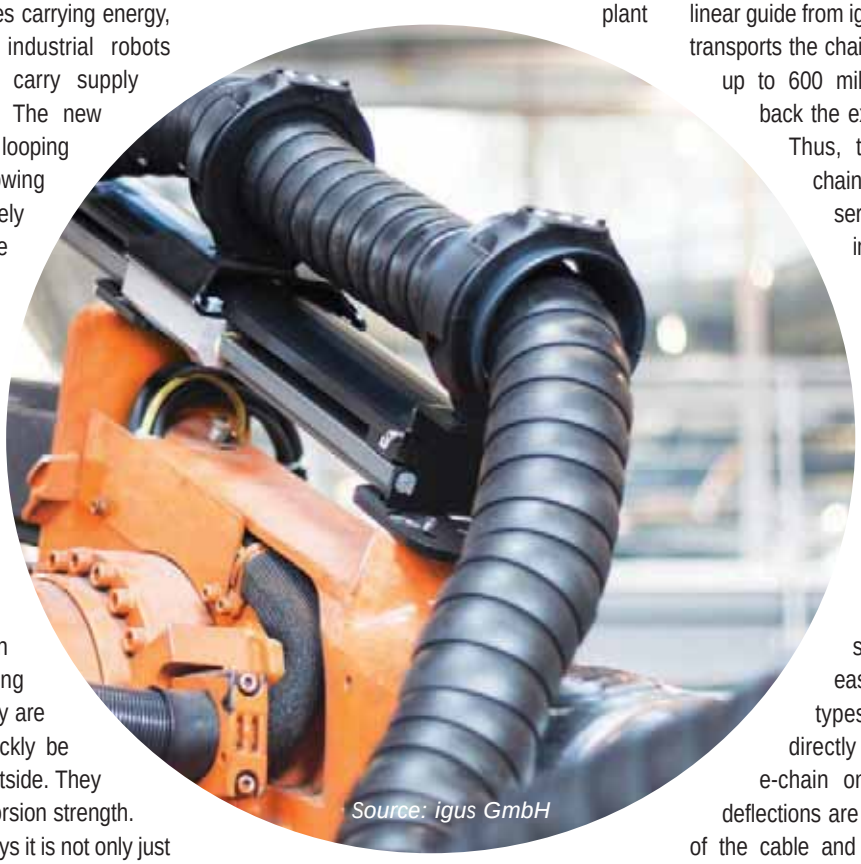
Safe Retraction Without Loops

Retraction system for e-chains on industrial robots enables guiding of supply hoses for rivets and screws...

The motion plastics specialist 'igus' has developed a lightweight and cost-effective concept for the automatic retraction of energy chains allowing further advances in robotics. Besides carrying energy, data and media cables, industrial robots nowadays also frequently carry supply hosesfor rivets or screws. The new triflex RSE system prevents looping of the energy chain, allowing these materials to be safely supplied to the end of the robot arm.

The triflex R series has been designed by igus specifically for highly dynamic industrial robotic applications and as a multi-axis energy chain that can move in all directions in space. The universal triflex chains made from high-performance plastics work in even the most demanding industrial environments. They are easy to install and can quickly be filled with cables from the outside. They also have high tensile and torsion strength.

"However, since nowadays it is not only just electrical and pneumatic cables that are conducted on the robot, but also often supply hoses for bolts, rivets or screws, tight bends or hanging loops can sometimes cause problems. Any reduction in the minimum allowable bend radius of the supply hoses can lead to a fault, reducing the efficiency of the process. In the worst case a rivet or a screw gets stuck in the supply hose, which then leads to a plant standstill," says Jörg Ottersbach, Industry Manager for Robotics at igus. With its linear retraction of the e-chain, the triflex RSE retraction system offers an efficient and cost-effective solution that requires no curve, spring rods or deflecting rollers.



Source: igus GmbH

The extremely light system is based on the proven lubrication and maintenance free drylin linear guide from igus, where a moving carriage transports the chain on a retraction distance of up to 600 millimetres. Elastic cords pull back the extended chain automatically. Thus, the looping of the energy chain is prevented. In this way the service life can be significantly increased.

The self-guiding retraction system is designed for the enclosed or snap open triflex chain versions TRC, TRE and TRCF in sizes from 60 to 125 millimetres in diameter. They are retained by means of a mounting bracket and a glide-through bracket on the system, which in turn can be easily fitted to a variety of robot types. Since the triflex RSE directly guides and controls the e-chain on the robot and no other deflections are needed, the required length of the cable and chain is reduced. For this reason triflex RSE is not only space-saving and light, but is also a cost-effective solution.

For further detaild contact: Harish Booshan, Product Manager, Tel.: +91-80-49127880, E-mail: Harish@igus.in.

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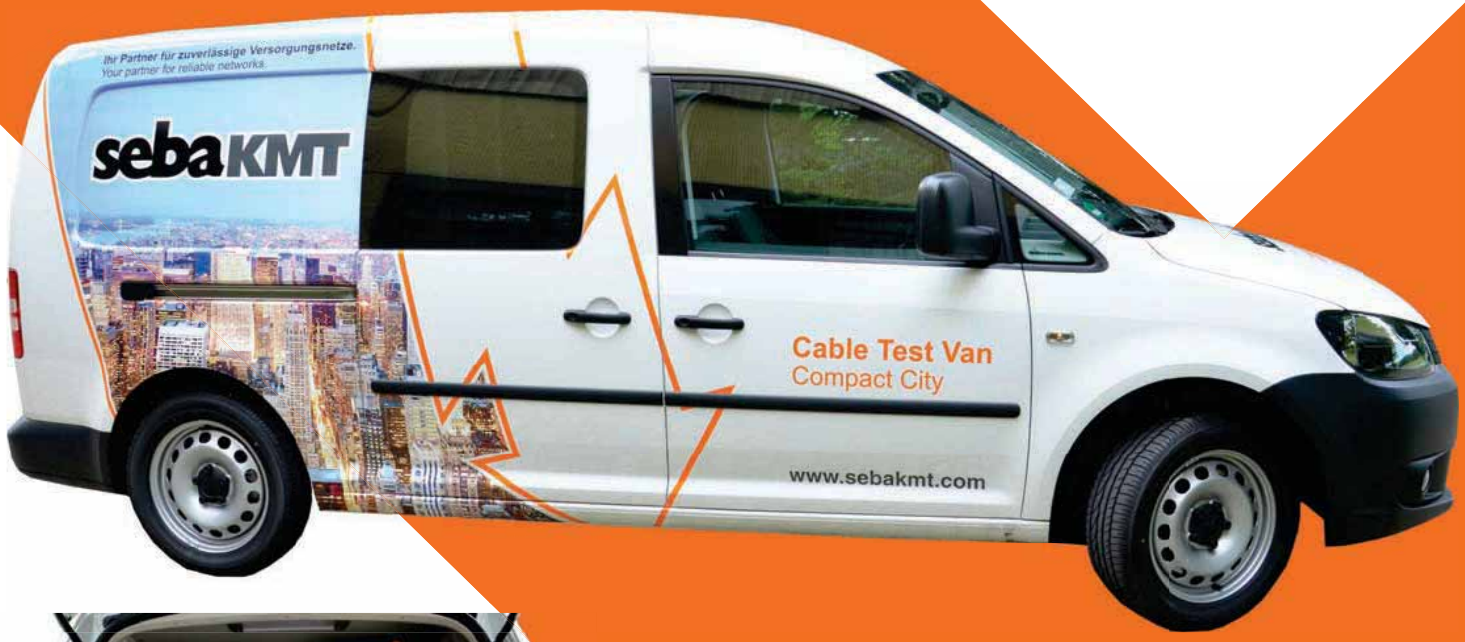

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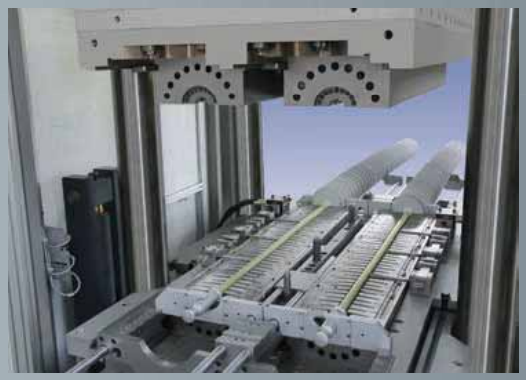

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