Vol 55 No 1 January 2015 ₹ 100

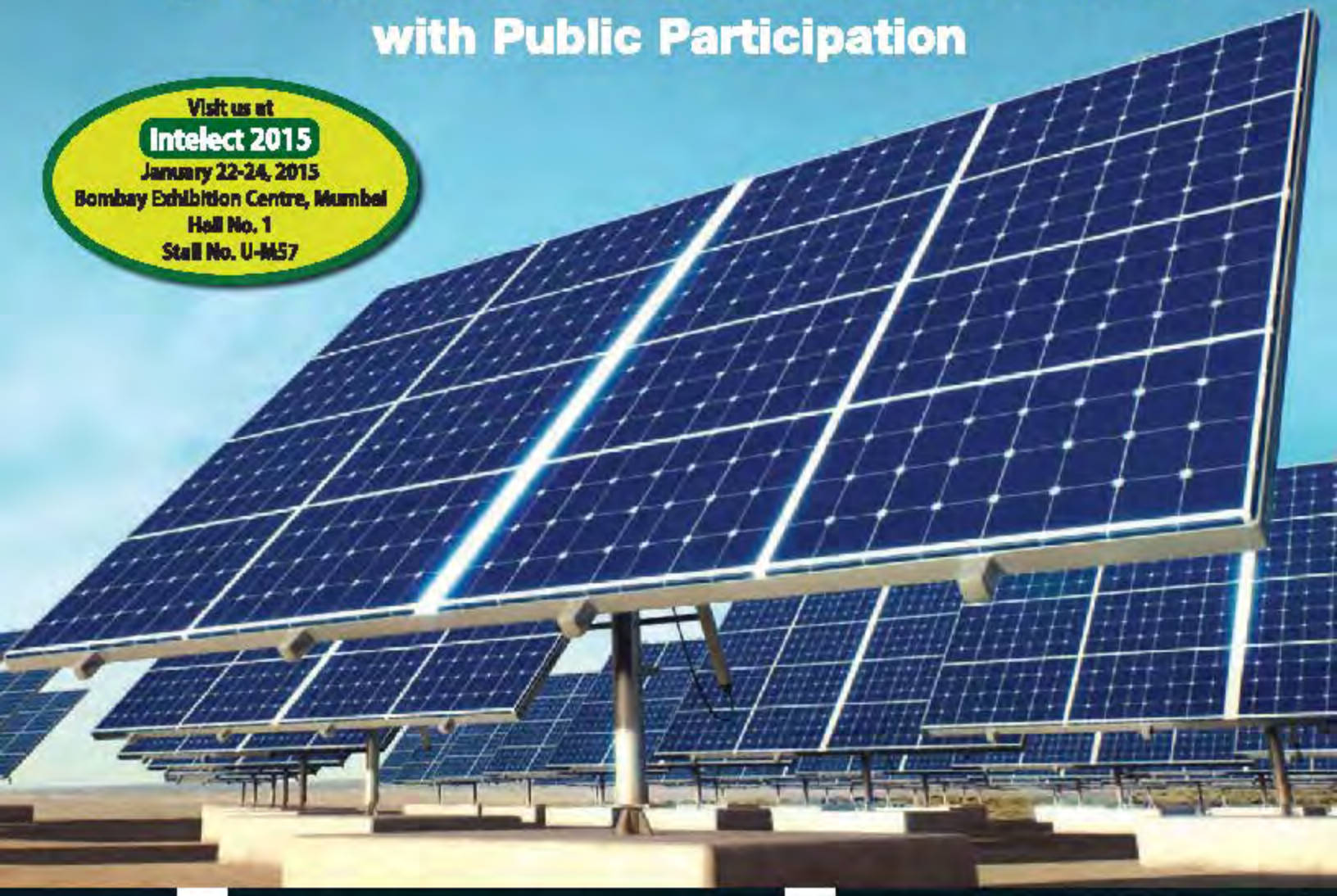
Since1961

Electrical India

India's oldest magazine on power and electrical products industry

Fifty-fifth Year of Service to the Power Industry

Innovative Project Financing Mechanism for Solar Power Plants with Public Participation



Scan the QR Code to know more about EI Website

Articles

22 Distribution Companies Financials
40 Smart Grid Technology
58 Inverter- Heart of Solar System
88 Case for Implementation of Renewable energy

Newsline

12 BHEL bags contract for Thermal Power Project in Turkey
16 Azure Power signs MoU with Government of Rajasthan for 1000 MW Solar Project
20 IHI & Toshiba to launch Demonstration Research of Ocean Current Power Generation

A Chary Publication

Follow us on

LARSEN & TOUBRO

READY-TO-USE POWER DISTRIBUTION SOLUTION

ENERSYS-S

SUB-MAIN DISTRIBUTION BOARD

Enersys-S from L&T is design verified assembly that complies with IEC 61439-2 and certified by DEKRA. It is a design verified sub main distribution board for power distribution that is designed for easy handling and simple installation. It also offers safe, reliable and higher performance.

SMS LNT<space>12 to 58161 for any query

Customer Interaction Centre (CIC)
BSNL / MTNL (Toll free): 1800 233 5858 Reliance (Toll free): 1800 200 5858
Tel: +91 22 6774 5858 Fax: +91 22 6774 5859
E-mail: cic@Lntebg.com www.Lntebg.com

L&T SWITCHGEAR
SAFE & SURE

Regd. Office: L&T House, N. M. Marg, Ballard Estate, Mumbai - 400 001, INDIA. Tel: +91 22 6752 5792 / 841. CIN: L99999MH1946PLC004768

LIGHTNING & SURGE PROTECTION FOR ELECTRICAL & ELECTRONIC EQUIPMENTS

hakel®

www.hakel.com

**** DEALERS ENQUIRY SOLICITED ****

hakel®

HAKEL Ltd.
Bratri Stefanu 980
500 03 Hradec Kralove
Czech Republic
Tel: + 420 494 942 300
Fax: + 420 494 942 303
Email: info@hakel.cz
Web: www.hakel.com

APS

ALLIED POWER SOLUTIONS
C-301, Delhi Radhani Apts
80, I.P. Extn. Patparganj
Delhi - 110 092 (INDIA)
Mobile: +91 99993 01007, +91 96500 44992
Tel: + 91 11 2223 6074
Email: info@alliedpowersolutions.com
Web: www.alliedpowersolutions.com

Mahadevan Iyer
Editor, Publisher & Managing Director
miyer@charypublications.in

Our country has enormous renewable energy potential from varied sources. The installed capacity of renewable energy as on November 2014 touched 31,692 MW, however solar being abundant. Solar technologies include solar heating, PV, thermal electricity and solar architecture, which can make considerable contributions to solving problems of energy, the world currently faces. An article 'Solar Energy' advocates, solar energy may become the formidable source of energy requirement in future.

Renewable energy also is one of the most viable solutions, as we are facing issues related to global warming all around the globe. According to BBC, during November month of 2014, while winter was yet to come in India, New York temperature dipped to -22°c, much below than freezing point. An article 'Inverter- Heart of solar system' deals with how the micro inverter system produced an average of over 20% additional power than the central inverters.

> "Installed capacity of renewable energy as on November 2014 touched 31,692 MW"

Even with 20000 MW installations in 2022 the power generated will contribute to less than 3% of the total power requirement of that time. Hence the target bar needs to be raised at least 3 to 6 times the current target. An article on 'Innovative financing mechanism for Solar Power Plants with Public Participation' proposes to raise finance for thousands of MW of solar power plants in very short span.

Do visit us at Intelect 2015 and this issue has post-event reports of Intersolar India and Nuclear energy 2014.

Wishing all our patrons a Happy and Prosperous 2015.

Do send in your comments at miyer@charypublications.in

Mahadevan

Vol. 55 • No. 1 • January 2015

Office Address:

Editorial, Subscription & Advertisement Office :
201, Premalaya,
Next to Cafe Coffee Day,
Opp. Telecom Factory,
Deonar, Mumbai - 400 088.
Tel.: (022) 2507 3300 / 01
www.electricalindia.in

Director/Publisher
Pravita Iyer
Mahadevan Iyer

Editor
Mahadevan Iyer
miyer@charypublications.in

Associate Editor
Gopal Krishna Anand
edit@charypublications.in

Sub-Editor
Kshitija Kolhapure

Editorial Co-ordinator
Nafisa Kaisar
nafisa@charypublications.in

Advertisement Department
Yasmeen Kazi
yasmeen@electricalindia.in
Kaushalya Kadam
advt@electricalindia.in

Design
Rakesh Sutar, Sandeep Amte

Subscription Department
Hemant Yelave
Nafisa Khan
sub@charypublications.in

Accounts
Dattakumar Barge
Bharati Solanki

Single Issue: Rs.100
Annual Subscription: Rs. 1000

Printed, Published and owned by Mahadevan Iyer from 311, Ratkar Chambers, Govandi (E), Mumbai 400 088 and Printed at Print Tech., C-18, Royal Ind. Estate, Naigaum Cross Road, Wadala, Mumbai 400031.

Editor : Mahadevan Iyer

A Chary Publication

mecc alte

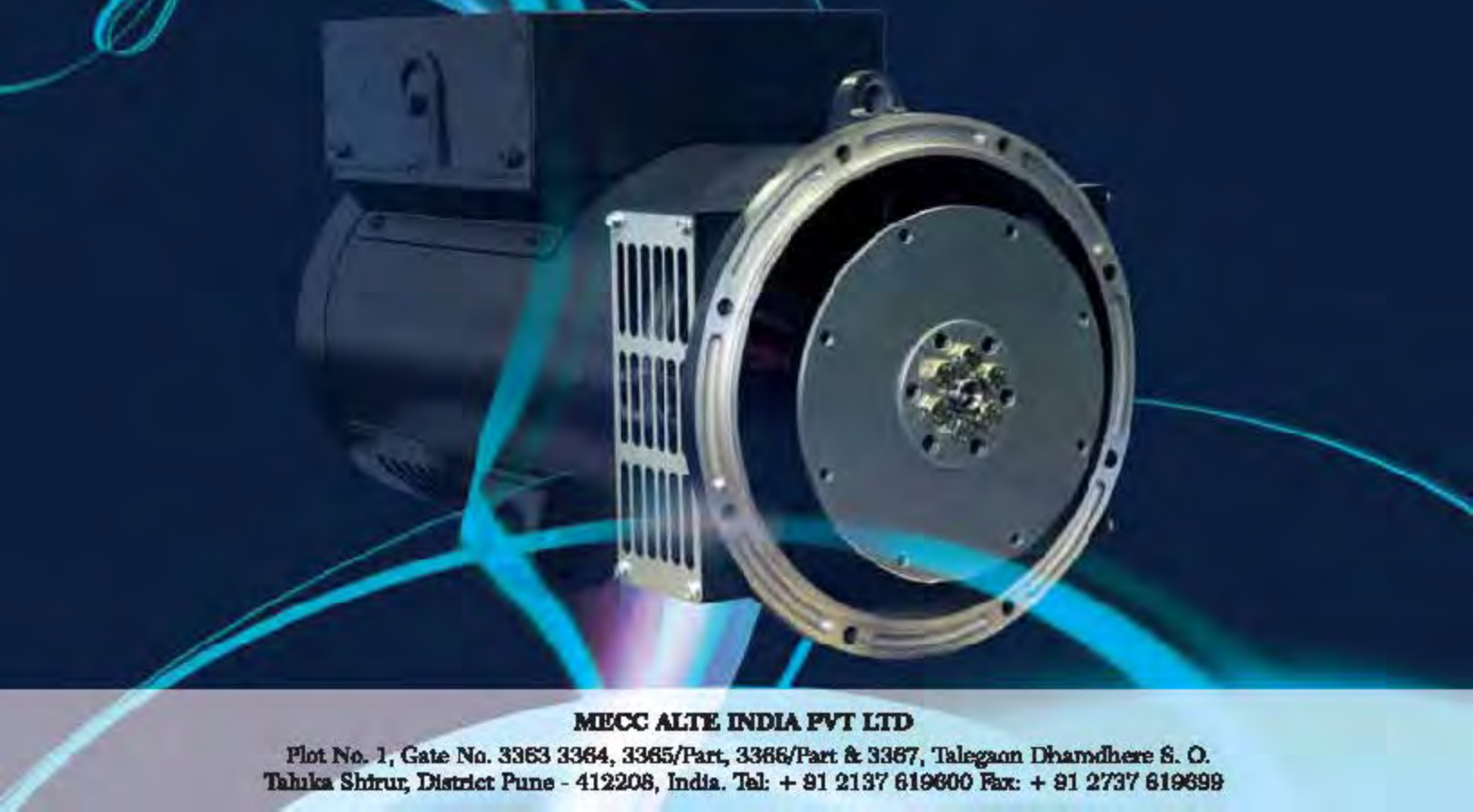
Bigger. Better. On Demand.

At Mecc Alte we're totally focused on bringing you the world-class alternators you need. Being totally independent means we can also respond to new demands quickly and effectively. That's how we've been able to increase our manufacturing capacity, especially on our large alternator range.

The world is moving fast. At Mecc Alte, we're totally ready to keep pace.

Totally Focused.
Totally Independent.

www.meccalte.com



MECC ALTE INDIA PVT LTD
Plot No. 1, Gate No. 3363 3364, 3365/Part, 3366/Part & 3367, Talegaon Dhamdhere S. O.
Tahuka Shirur, District Pune - 412208, India. Tel: + 91 2137 619600 Fax: + 91 2737 619699

CONTENTS

Vol 55 | No 1 | January 2015

22 Distribution Companies Financials: Living on the edge
- Shahji Jacob

32 Cost Effective approaches for SPV Projects & Energy Efficient Equipment
- S V R Rao

40 Smart Grid Technology: Particular Reference to Indian Power System
- Robbin Pramanick

52 Standby Diesel Generator Sets: Issues related to Selection/ Sizing, Installation, Operation & Maintenance
- S N Chavan

58 Inverter - Heart of Solar System
- Aqeel Ahmad

64 Towards Zero Emission of Greenhouse Gases
- J Devaprakash

72 Solar Energy
- P S Shah

76 Development of Solar Power - Mega or Mini!
- B N Prabhakar

78 Coating India's Rooftops with Solar Photovoltaics
- Jaideep N Malaviya

82 Innovative Project Financing Mechanism for Solar Power Plants with Public Participation
- Prof Dr Ajay Girdharilal Chandak

88 Case for implementation of Renewable energy: Friendly Laws & Policies
- Sunil Kumar Sood

Departments

Publisher's Note.....04
Editorial.....08
National News.....10
Company News.....14
International News.....18
Feature.....90, 96
Event.....92
Company Profile.....98
Product Avenue.....100
Book Review.....104
Index to Advertisers.....105

Interview

68

Subodh Garg
Director General
National Power Training Institute

A NEW LINK BETWEEN PV & GENSET POWER PLANTS

DEIF has a strong track record in developing emergency, standby and backup power solutions for mission-critical facilities and businesses.

Designed to serve as a link between photovoltaic (PV) power plants and genset power plants, DEIF's Automatic Solar Controller (ASC Plant Management) is an automated, safe and reliable control solution for PV/genset hybrid plants.

The ASC Plant Management solution is suitable for stand-alone applications with or without DEIF controllers and for power management applications equipped with DEIF's AGC Plant Management Controllers. It supports numerous communication protocols for inverter interfacing, including the widely used SunSpec protocol.

UNIQUE CONTROL SOLUTION FOR PV/GENSET HYBRID PLANTS

- Maximised PV penetration
- Minimum genset load requirement
- Spinning reserve
- Monitoring and supervision
- Record-time commissioning with DEIF Emulation

SPECIALIST POWER CONTROL SOLUTIONS.

DEIF

- power in control

The DEIF Group: Sales, Training & Competence Centres in 16 Key Markets.

DEIF India Pvt. Ltd., 602, Town Centre II, Andheri, Kurla Road, Sakinaka Andheri (East), Mumbai 400 059 MH, India
Tel.: (+91) 22 4245 2000, Fax: (+91) 22 4245 2020, India@deif.com, www.deif.com

Renewable Energy
Development Perspective and Potential

> *Achieving overall renewable energy installed capacity of 41,400 MW by 2017*

Gopal Krishna Anand

Globally, PV has become mainstream for energy, nowadays. In the overall ambit of Indian power scenario, solar power - largely solar PV than CSP is successful. Since long, we are hearing an almost stagnant figure, that 35% of Indian population has no electricity access but broadly, statistics is not always real. In the solar power, Germany is a leading country with approximately 40 GW installed capacity (almost 50% of its power requirement), Italy 19 GW, China 10 GW, Japan 5.5 GW. In terms of all renewable energy, also, it ranks fifth amongst the wind-energy producing countries of the world after USA, China, Germany and Spain. The country has target to install 18,500 MW during 12th Plan period, but new government intends to accelerate wind energy generation, adding 10,000 MW per year. Ministry of New & Renewable Energy has set a target of achieving overall renewable energy installed capacity of 41,400 MW by 2017.

In a recent report by Advisory Group for Integrated Development of Power, Coal, and Renewable Energy, suggestions have been made for enhancement of coal production in short, medium and long terms, after interactions with Ministries of Power, Coal, New and Renewable Energy etc. India is not major importer of coal currently. And, 74% of coal import is projected by 2031. Renewable Energy, particularly solar and wind, require large scale capacity addition which will balance the power sector profile, as well as also lead to price parity with conventional power. Green Transmission Corridors, incentive to Renewable Capacity Addition, purchase of Renewable Power by Distribution Utilities, are some of the recommendations in respect of Renewable Energy.

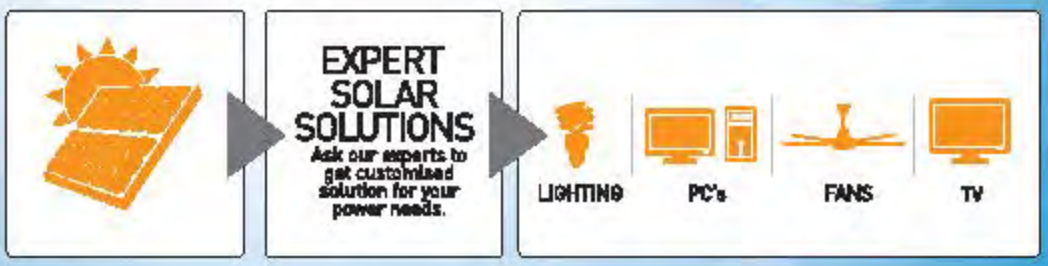
India has huge potential in solar power particularly roof solar, with around 300 days sunshine in a year. With improvement of Infrastructure prices will come down, and the cost of equipment too; simultaneously there will be low maintenance cost. Furthermore, nuclear energy may balance overall pricing of electricity, however, to sustain it, we need reprocessing. Change is evidential. CSP, Grid connected solar power and technology needs improving. Globally, we have to utilize naturally available renewable resources. Solar power is abundant and offers a solution to fossil fuel emissions and global climate change. Obviously, everybody's role is required to share the power of solar energy.

Ravin

The only thing that'll stop electricity bills from shooting through the roof *is the roof.*

Use your roof to reduce your energy bills. Call us and we will install a solar power system that will generate enough power to run several electrical appliances through the day.

Get on top of rising electricity costs. **GET RAVIN SOLAR SOLUTIONS.**



Ravin Infraproject Pvt. Ltd. | **Qubic SunTrack Energy Systems Pvt. Ltd.**

- **Solar Systems - Fixed, Single and Dual Axis Tracker**
- Energy Cables upto 220 kV • EHV Installations & Accessories • Power Equipments • Projects & Services • Renewable Energy • Retail Energy Products

Head Office: B – 403, Akruti Trade Centre, Road No. 7, MIDC, Andheri (E), Mumbai – 400093. | T +91 22 30816444, 29215000 | F +91 22 30816441, 29215011
E: **sales@ravingroup.com** | W: **ravingroup.com**

Implementation of scheme for development of Solar Parks and Ultra Mega Solar Power Projects

The scheme for setting up 25 solar parks has been approved each with a capacity of 500 MW and above and Ultra Mega Solar Power Projects in various parts of the country where large chunks of land can be spared for this purpose. These parks will be able to accommodate over 20,000 MW of solar power projects. The Solar Parks/ Ultra Mega Solar Power Projects will be set up during five years that is from 2014-15 to 2018-19 & will require Central Government financial support of Rs 4050 crore. Smaller parks in Himalayan and other hilly States where contiguous land may be difficult to acquire in view of the difficult terrain, will also be considered. The solar parks will be developed in collaboration with State Governments and their agencies. The choice of implementing agency for developing and maintaining the park is left to the State Government. The States, applying under the scheme, will have to designate an agency for the development of the solar park. State Government will first nominate the implementing agency for solar park and also identify land for the proposed solar park. It will then send a proposal to the MNRE for approval along with name of the implementing agency, which may be sanctioned a grant of upto Rs 25 Lakh for preparing a Detailed Project Report of the Solar Park, conducting surveys, etc. The DPR must be prepared in 60 days. Thereafter, application may be made by the implementing agency to SECI for the grant of up to Rs 20 lakhs/MW or 30% of project cost including Grid-connectivity cost, The approved grant will be released by Solar Energy Corporation of India as per milestones prescribed in the scheme. All the States and Union Territories are eligible for benefitting under the scheme. Solar parks will enable development of solar power in remote areas where land is inexpensive. As the transmission system will be developed for the entire park, developers will not have to set up their own transmission lines. This will not only save money but will also avoid damaging the landscape of the area as only limited transmission lines would be laid. Developers would be able to set up projects very fast as they will not have to get statutory and other clearances. India will emerge as a major solar power producing country as nowhere in the world are solar parks being developed on such a large scale.

Uttam Value Steels bags National Energy Conservation Award 2014

Uttam Value Steels Limited, announced that it has received the most coveted award recognising Energy Conservation on a national platform - The "National Energy Conservation Award 2014" Uttam Value Steels Limited is a part of the Rs. 15000 crore Uttam Group, one of the country's largest manufacturer-exporter of valueadded steel products. National Energy Conservation Award is a program set up by the Bureau of Energy Efficiency, a statutory body under the ministry of power, Government of India instituted in the year March 2002 under the provisions of Energy conservation Act, 2001. Uttam Value has received the recognition for its concerted initiatives to efficiently utilize and conserve energy. The Award was presented by Shri Piyush Goyal, Union Minister of state for Power, Coal and New & Renewable Energy (Independent Charge) to Sunil Katial, Director - Group Manufacturing, Uttam Group, at a functionheld recently at Vigyan Bhavan, New Delhi. Instituted by the Government of India, the National Energy Conservation Award is an annual honour given each year to an organisation in recognition of itssystematic and serious efforts towards efficient utilization and conservation of energy. The award is given to organisations across various sectors including Iron & Steel, Textiles, Aluminium, Paper & Pulp, Hospitality, Health Care, Tourism, among others. The evaluation criterion is very stringent and guided by an award committee comprising of industry experts from various industrial sectors.

Government announces big subsidies to India participants at Hannover Messe 2015, April 13-17

Electrical India publication would be present at 'Hannover Messe – get new technology first' during April in Germany. India has been named the official Partner Country at next year's edition of the world's leading industrial trade fair. Together with German Chancellor Angela Merkel, Prime Minister Narendra Modi will officially open HANNOVER MESSE 2015 on the evening of 12 April, and then take part in the traditional opening day tour on 13 April. India's role as the Partner Country at Hannover Messe underscores Indian Prime Minister's ambitious economic course. Under the slogan of "Make in India", Modi is promoting the modernization of India's factories and infrastructure and greater foreign investment in local production. Modi is convinced that production industries form the backbone of the Indian economy. Highlights of previous show April 7-11, 2014 include trade visitors as 180,000 from 100 different nations and highly qualified visitors from all across the Globe are 69% Europe; 19% Asia; 8% South and North America; 3% Africa and 1% Australia Oceania. There happened to be 64% decision makers and 4.2 million business contacts in 5 days. Promote the Make in India Brand at Hannover Messe 2015 – Get new technology first. Hannover Messe 2015 will comprise ten flagship fairs: Industrial Automation, Motion, Drive & Automation (MDA), Energy, Wind, MobiliTec, Digital Factory, ComVac, Industrial Supply, Surface Technology and Research and Technology.

riello ups

Reliable Power for a Sustainable World.

Riello UPS win *Product Leadership Award* 2013 FROST & SULLIVAN

Global Leaders in Uninterruptible Power Supply Systems

Riello: 1st European manufacturer to rate its product for Eco-Energy Level efficiency

- Riello is one of largest manufacturer of UPS System
- Complete range from 1kVA - 6400 kVA
- RPI has delivered over 5000 successful installations in India & Indian Subcontinent
- Technical Support Team at your service 365 days 24 x 7
- PAN India presence with offices in all major cities

When it comes to expertise in Uninterrupted Power Supplies Riello PCI India has it all

- IGBT Rectifier / IGBT Inverter with built in galvanic isolation transformer
- Advanced Battery Management
- Very Low Total Harmonic Distortion (THDI < 3%)
- High Input Power Factor > 0.99
- High Output: 0.9 (High Watt)
- Overall efficiency upto 95%

★★ Dealers and Distributors are Invited ★★

Riello PCI India Pvt. Ltd.
(A joint venture between RPS S.p.A., Italy and PCI Ltd., India)

Prime Tower, Plot No: 237-238, Udyog Vihar, Phase - II, Gurgaon-122015, Haryana (India)
Tel: +91-124-6556000 Mob: 07838552211 Fax: +91-124-4671698 Email: ups@riello-pci.com Website: www.riello-ups.in

Fortum connects first solar project of JNNSM Phase-II scheme to the grid

Fortum Finnsurya Energy Pvt Ltd, subsidiary of a Finland-based utility, has announced that its 10 MW solar PV plant in Madhya Pradesh has just been connected to the grid. It is the first project connected to the grid under the Jawaharlal Nehru National Solar Mission (JNNSM) Phase II initiative and the first greenfield solar project undertaken by Fortum. This is Fortum's second investment in solar energy production in India. The 10MW solar power plant spreads over about 70 acres in Kapeli, Dist. Ujjain. It is expected to be formally inaugurated in early 2015. Fortum has adopted a thin-film CdTe technology with more than 1,25,000 modules mounted on fixed tilt structures and 15 central invertors, which allows for better control of carbon footprint, water use and energy payback time. "We entered the Indian market to take part in developing clean and green power solutions, which India needs to pursue its economic growth. Our solar plant in Kapeli is another step in that direction. I am particularly proud that we are the first amongst all developers to connect the project to the grid, under JNNSM Phase II." said Sanjay Aggarwal, Managing Director, Fortum India. He also commended MNRE & SECI and authorities of Madhya Pradesh, involved in the administrative procedures for quick turnaround on regulatory approvals and grid connection process as well as for their guidance and support. With the 10 MW solar PV plant in Madhya Pradesh, Fortum has increased its solar portfolio to15 MW and aims to further expand its operations in this area to become a significant solar energy producer through organic and inorganic growth.

BHEL bags contract for Thermal Power Project in Turkey

Bharat Heavy Electricals Limited has achieved a breakthough in its international business by making its maiden entry in the Turkish Power Market. Against stiff International Competitive Bidding (ICB), the company has bagged a contract for rehabilitation of 3 units of Electrostatic Precipitators (ESPs) for the 430 MW Tuncbilek Thermal Power Project in Turkey on EPC (Engineering, Procurement & Construction) basis. Valued at Euro 16.96 million, the order envisages dismantling, supply, civil works and erection & commissioning of the Electrostatic Precipitators. The order has been placed on BHEL by Electricity Generation Company (Turkish: Elektrik Üretim A. Genel Müdürlü ü; EÜA) which is the largest electric power company in Turkey. EUAS is owned by the Turkish government and it generates and supplies electricity throughout the country. Turkey has embarked on a renovation and modernization (R&M) programme of its old thermal power projects and the present contract is aimed at reducing the emission levels drastically. For this prestigious contract, the Electrostatic Precipitators will be manufactured and supplied by BHEL's Ranipet unit, Motors and other auxiliaries by its Bhopal facility and Controls by the company's Bangalore unit. BHEL's globalization strategies are yielding rich dividends and BHEL today has references in over seventy six countries in six continents.

Tata Power commitment to renewable energy generation: commissions 32 MW Wind project in Maharashtra

Tata Power, India's largest integrated power company announced commissioning of final 8 MW of the 32 MW wind farm at Girijashankarwadi in Maharashtra. The wind farm uses the 2 MW wind turbine from Kenersys India. With this commissioning, Tata Power's total wind generation capacity stands at 470.6 MW, with wind farms located across five states - Maharashtra, Rajasthan, Gujarat, Tamil Nadu and Karnataka. Tata Power has developed this project through its 100 per cent subsidiary, Tata Power Renewable Energy Limited, which also has a further 300 MW of wind capacity under development and construction in the states of Maharashtra, Gujarat and Rajasthan. The wind farm is expected to generate 62 MUs per year which will be procured by Tata Power-Distribution towards fulfilment of its Renewable Purchase Obligations (RPO). With this commissioning, Tata Power's total generation capacity stands at 8623 MW. Anil Sardana, MD, Tata Power stated, "We are delighted to announce the commissioning of our wind project at Girijashankarwadi. Wind energy is an important part of our renewable energy portfolio and we aim to add 150-200 MW annually. We are committed to reducing our carbon footprint through the generation of 20- 25 % of our total capacity through clean and renewable energy sources. We would like to thank the Government of Maharashtra, the local community and authorities and all our stakeholders for the support extended in setting up this wind power project at Girijashankarwadi" Tata Power's 470 MW wind portfolio and its 56 MW solar portfolio make it the largest Renewable Utility player in India, thus reiterating Tata Power's commitment to renewable energy generation in India. The Company's strategy emphasises development of clean energy generation with 1210 MW from renewable sources to balance the carbon emissions from fossil fuel based generation capacity while contributing towards energy security of the country. Tata Power currently has four of its renewable projects registered under Clean Development Mechanism program by United Nations Framework Convention on Climate Change.

PRIME MEIDEN

(A joint venture company of Prime Group of India & Meidensha Corporation of Japan)

POWER TRANSFORMER TO POWER YOUR WORLD

Prime Tower
Prime Group headquarter at Gurgaon

EHV Power Transformers upto 765 kV class	Shunt Reactors upto 125 MVAR, 420 kV	EPC Substation projects upto 400 kV	Mobile Substation upto 132 kV	Power Components

A World Class Power Transformer Manufacturing Facility upto 765 kV at Nellore in Andhra Pradesh

- An Indo-Japnese joint venture with more then 100 years of experience in its fold in the field of transformers & EPC Projects through Meidensha Corporation of Japan.
- Technical collaboration with world famous "VIT", Ukraine a part of Electrozavod, one of the largest manufacturer of Power Transformers in the world.
- State-of-the-art manufacturing facility, fully integrated, dust controlled and air conditioned.
- Globally advanced swing shear technology based CRGO cutting & slitting lines with de-buring attachment from GEORG, Germany.
- World-class testing lab equipped with most advanced static test system from HIGH VOLT of Germany providing extremely accurate control over the testing process with capability to test both at 50 Hz as well as at 60 Hz.
- Advanced technology faraday cage designed for near zero partial discharge testing.
- State-of-the-art in house PICC manufacturing & Tank fabrication facilities.
- Highly skilled human resource trained by VIT specialities.





PRIME MEIDEN LIMITED

Corporate Office : Prime Tower, 257-258, Udyog Vihar, Phase-II, Gurgaon-122 016 (India) Tel: +91 124 4111999 (30 Lines), 6565999 (30 Lines), Fax : +91 124 4571699 99 Email : sales@primemeiden.com
WEB : www.primemeiden.com

Factory :
SEZ, Manubolu, Naidupeta, SPSR Nellore - District, Andhra Pradesh - 524 126 (India)

GE improves Grid Reliability with new UL - certified Smart Meters

GE's Digital Energy business, in collaboration with Underwriters Laboratories (UL), has announced that its commercial and industrial smart meters have achieved a UL voluntary safety certification, making them the first meters of this type in the industry to receive this significant mark. In April 2014, GE announced that its residential smart meters were the first in the industry to achieve the UL safety certification, and today, this certification has been expanded to include GE's commercial and industrial smart meters. "At GE, we are committed to helping our utility customers deliver safe and reliable power to their customers by designing and manufacturing meters that meet the industry's highest standards," said Edward Myszka, general manager, meters, GE's Digital Energy business. "This UL certification demonstrates our ongoing commitment to safety and highlights the progress we're making to ensure our customers are equipped to build modern and efficient grids, while adhering to the highest safety standards." Earlier this year, UL published the Standard for Safety for Electric Utility Meters. This safety standard contains requirements for electric shock, fire, mechanical and radio-frequency emissions aspects of all electric utility meters, including smart meters, and is the foundation for both the UL product safety certification service and the product safety testing service. GE's smart meters meet this rigorous standard. By meeting the new UL certification for commercial and industrial meters, GE can now provide its customers with an added level of confidence surrounding the quality and functionality of their smart meter installations. Smart meter technology can greatly improve customer service and reliability through features like automatic outage reporting, which speeds restoration of service. These technologies also can empower commercial and industrial consumers by allowing them the opportunity to better manage their energy use. "GE is the first meter manufacturer to deliver a smart meter that met our UL certification requirements for all categories of smart meters - residential, commercial & industrial," said Lisa Salley, vice president and GM, energy and power technologies, UL.

Contracts worth over €50 million Alstom to build and upgrade eleven electrical substations in Germany

Alstom Grid has been awarded eleven turnkey projects worth over €50 million by Netze BW, the German distribution network operator of EnBW Energie Baden-Württemberg AG, to modernise their electrical network in Germany. The projects include the construction and upgrade of four gas-insulated substations (GIS) in Stuttgart city centre and seven turnkey air-insulated substations (AIS) in rural areas, scheduled for completion by 2017. Alstom will supply the necessary electrical equipment to build and extend the gas-insulated and air-insulated substations. The turnkey projects include the related civil works. The construction and modernisation of these substations will strengthen power distribution, ensuring a reliable energy supply. "Due to the ongoing development of renewable energies, we are currently modernising and expanding our distribution networks. The use of modern technologies is enhancing the performance and capacity of our networks, increasing security of supply for our customers," says Dr. Martin Konermann, Managing Director of Netze BW. Axel Kossmann, Country Sales Director Alstom Grid Germany, added, "The orders from Netze BW confirm our leading expertise in turnkey projects, a key facet of Alstom's contribution to Germany's energy transition. Meanwhile, the current projects represent a yet another milestone in the modernisation of Germany's electrical distribution networks."

Vikram Solar: winner of EPC World Award 2014

Vikram Solar, which specializes in manufacturing of solar photovoltaic (PV) modules and EPC contracts for solar power plants, won the EPC World Award in the category Outstanding Contribution in Renewable Energy EPC. Vikram Solar's EPC division provides end-to-end EPC and O&M solutions with a guaranteed efficiency and the team has a proven track record of 420 MW installed solar capacity implemented worldwide including 70 MW in India. Currently the EPC team is working on a 48 MW PV power plant in Madhya Pradesh as well as on India's first floating solar power plant which will be located in Kolkata. The EPC World Awards recognise and honour companies and individuals broadly covering the entire infrastructure, energy, EPC and construction industry on the basis of their qualitative and quantitative performance during the year. Now in its 5th year, it is the foremost event acknowledging the accomplishments of those active in the mentioned market segments and has evolved as one of the most cherished industry recognition awards in India. Held on Dec. 18 the event was supported by knowledge partner Ernst & Young (EY) and the VDMA – the German Engineering Federation as well as the European Business and Technology Centre.

EXPERIENCE LIFE
IN ITS TRUE COLOURS WITH

Finoglow

Finolex

Eight Times Longer Life | 40% Extra Life*

Energy Saver | Eco Friendly | True Colour Lighting

Newly launched a wide range of LED Lights - FinoLED

/finolexindia /finolexindia YouTube /finolexgroup /finolex-cables-ltd

Regd. Office : 26-27 Mumbai-Pune Road, Pimpri, Pune 411 018, India
Tel : 020-27475963 Fax : 020-27470344 Visit us at : www.finolex.com Email : sales@finolex.com

Azure Power signs MoU with Government of Rajasthan for 1000 MW Solar Power Project

Azure Power, in the Indian Solar Industry signed a Memorandum of Understanding with the Government of Rajasthan to develop a 1000 MW solar power project. The announcement comes along with. Vasundhara Raje, Chief Minister of Rajasthan, laying foundation stone for Azure Power's 100 MW Solar power plant to be commissioned by April 2015. Present at the occasion was HS Wadhwa, Chairman, Azure Power. This is the largest capacity project won under the prestigious National Solar Mission -Phase II taking the total capacity of Azure Power under NSM to 142 MW, making it the largest winner under this policy. It also makes Azure the largest private solar investor in Rajasthan with a total investment capital over INR 1300 Crore in the State. Spread across 725 acres of land at Hardhani and NandlaKalan in Jodhpur, the plant will electrify 1,00,000 households and create an estimated 1500 jobs in the locality. The project is expected to be completed before 30th April, 2015. HS Wadhwa, Chairman, Azure Power said, "It is an extremely proud moment for us as we sign the MOU with the Government of Rajasthan and lay the foundation stone of our 100 MW solar power plant. Azure Power has continuously demonstrated its commitment to inclusive growth through clean energy generation and this is a vital next step in further strengthening it. The Rajasthan Government under the dynamic leadership of Chief Minister and high solar radiation in the state, has encouraged us to invest in such a scale. We look forward to providing our customers the highest degree of quality standards coupled with cheaper tariff.

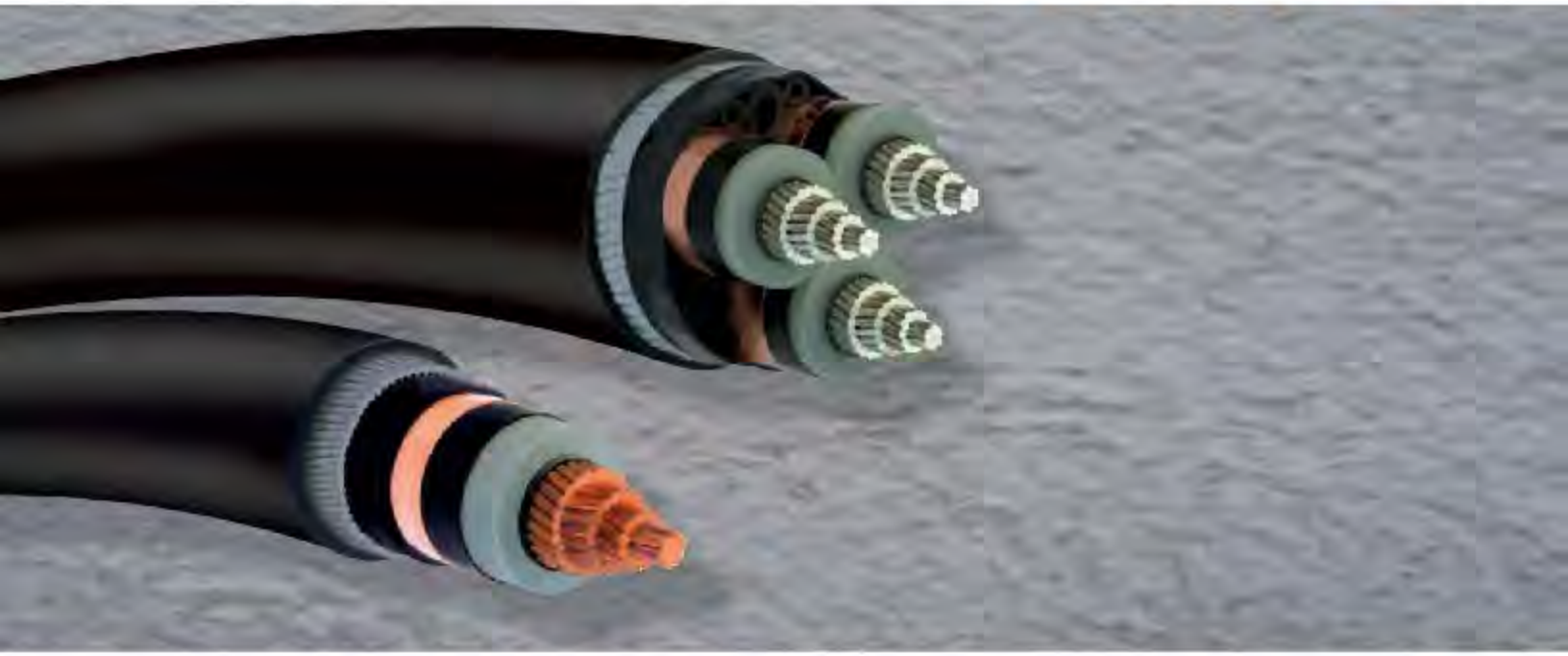
Siemens' transmission technology to Power Grid Corporation's subsidiary

Siemens Ltd, will be supplying power transmission technology to Power Grid Kala Amb Transmission Limited, a wholly-owned subsidiary of Power Grid Corporation of India Ltd. The equipment to be supplied is for the upcoming 400/220kV GIS substation at Kala Amb, Himachal Pradesh and is the first GIS substation with FSC awarded in India under the Build, Own, Operate and Maintain (BOOM) segment. Kala Amb, an industrial area in Himachal Pradesh, is an existing load centre with a present power demand of about 350 MVA. In order to meet the present and future load requirements, a 400/220 kV GIS substation will be established on a BOOM basis by 'Line In Line Out' of the Karcham Wangtoo Hydroelectric Plant. While successful completion of projects in the past played a key role in the customer's choice, Siemens' local footprint combined with engineering competencies and strong project management skills enabled the company to win this order. By offering the complete transmission portfolio backed by robust after sales services, the customer can rely on a cost effective solution from Siemens Ltd.

Concurrent show upto 11 kV during Intelect Expo & Conference

Three IEEE societies and IEEMA will co-host IEEE-IEEMA INTELECT Conference & Exposition during January 22-24, 2015 at the Bombay Exhibition Centre in Mumbai. The exposition will focus on the connected intelligence in the Electricity of Things. The concurrent Show UPTO 11 kV will demonstrate readiness of the Indian electrical industry to help the Government accelerate Distribution Sector Reforms & focus on rural electrification. It will be an opportunity for the Equipment manufacturers to effectively showcase their latest equipment, technology and services and interact with utility officials from all across the country IEEE Computer Society, IEEE Communications Society, and IEEE Power & Energy Society will produce the event's conference portion, which will feature globally renowned keynote speakers and high-caliber panelists, as well as user-experience pavilions showcasing cutting-edge innovations and future technologies on H3O, Digital Smart Cities, and Smart Rural Electrification. "As a global organization, IEEE has a strong interest in serving technology professionals in India, and IEEE Computer Society will be helping co-found a brand new event that centers on such a promising and essential future technology as smart electricity," said Angela Burgess, executive director of IEEE Computer Society. INTELECT is designed to draw builders, architects, city planners, energy and government officials, transportation industry representatives, venture capitalists,utilities, contractors, consultants, academia, and others interested in learning about new technological advancements and knowledge to smart electricity. "India is fast becoming more urbanized and digitized to adapt to the growing aspirations of the large young population. Its impact on electricity demand and consumption will be significant. IEEMA is privileged to partner with IEEE, which can provide invaluable global knowledge and expertise," said Sunil Misra, Director General, IEEMA. For the first time, with the support of three ministries of the GoI - Ministry of Power, Ministry of Urban Development and Ministry of Communications & IT - an all India Utility Round table will be organized.

SCOPE



Cable Fault Locator

Ultimate solution for locating faults in all types of underground power & telecom cables has arrived...

- Surge Generator up-to 32kV, 2000J
- Pre-location up-to 64km
  - TDR, ICM, SIM Modes
- Pin Pointing
  - Simultaneous display of acoustic & magnetic waveforms
  - Use as Route Tracer along with the Audio Generator
- SIM Filter
- Cable Identification System
- Damp Discharge Rods
- Trolley mounted set up

Corporate Office
402, Aurus Chamber, Annex - A,
S. S. Amrutwar Marg, Worli,
Mumbai 400 013, INDIA

Phone : +91 22 4344 4244,
FAX : +91 22 4344 4242
e-mail: marketing@scopeinm.com,
Web site: www.scopeinm.com.

Infineon to launch High-power Module Platform, offers Royalty-free license of Package design for Industry use

Infineon Technologies AG announced the launch of two new power module platforms designed to improve the performance of high-voltage IGBTs in voltage classes from 1200V up to 6.5kV. To make the benefits of the new module broadly available, Infineon is offering a royalty-free license of the design to all providers of IGBT power modules. First products using the platform concept will include the high voltage classes 3.3kV (450A), 4.5kV (400A), and 6.5kV (275 A) with a newly designed package measuring 100mm x 140mm x 40mm. The new modules will be introduced during PCIM which will take place in Nuremberg during May 19–21, 2015. Additionally, a package design for the lower voltage classes is being developed. Reliable, high performance IGBT modules are a workhorse technology for electrical switching of industrial and traction drives, wind and solar energy systems and long-distance electrical

transmission. Through a more than twenty-year history of use,chip technology developments have allowed IGBTs to meet demands for higher energy efficiency and higher operating temperature, as well as miniaturization, reliability and cost reduction with little modification to the standard packaging technology. As applications face more and more demanding and harsh environments this approach is reaching its limit, making a change in package technology of high-power modules a key to continued performance improvement. The new module platform developed by Infineon addresses the emerging system requirements for high-power density, energy efficiency, long lifecycle and robustness. Its flexible concept allows the connection of similar parts in parallel, thus enabling a simplified structure to be used for the DC link terminal and capacitor. The AC terminals can be connected in parallel with only one busbar. The flexibility and scalability of the new modules will simplify system design considerably, thus supporting the time-to market requirements of developers. Utilizing the latest package technology the new high-power module also will help to reduce overall system cost and ensure future-proofing of designs. The new module package will be of great benefit for all demanding high-power applications.

Alstom and Light Energia to stabilize electricity flow to Rio de Janeiro

Alstom Grid has been awarded a contract of approximately €6 million by Light Energia, who controls and distributes part of the power in Rio de Janeiro State in Brazil, to improve and modernize Santo Antônio's Gas-Insulated Substation in Rio de Janeiro. The project will boost power reliability to better serve Light Energia's clients in Rio de Janeiro. Modernizing the equipment will increase the lifespan of the substation by 20 years. This technical upgrade is part of an overhauling maintenance work. Under this contract, Alstom will implement new technologies to extend the lifecycle of the substation, whilst preserving the environment. The new components will promote, ease detection and identification of SF6 gas leakage. It is composed of new material for sealing gaskets, a BWatch3 digital monitoring system to check conditions online, new safety devices and new fast coupling filling valves to reduce gas emission. "This new project stems from a long-term commitment to support the modernization of Light Energia's gas-insulated substations, highlighting their trust in our global expertise and our local team's dedication. We are committed to offering the best services to our clients, and to their final customers," says Sérgio Gomes, Senior VP of Alstom Grid in Latin America. This new contract falls within a large modernization strategy implemented by Light Energia.

Smart Thermostats for WTU Retail Energy customers

WTU Retail Energy announces registration for low-income residential WTU customers to receive a free programmable Honeywell VisionPro smart thermostat with professional installation. WTU will send certified home services technicians to install and test the smart thermostat at no cost to qualifying customer homes. Installations will begin on January 1, 2015 and continue through the earlier of March 31, 2015, or until the program is fully subscribed. The Honeywell VisionPro smart thermostat includes a five-year manufacturer's warranty on equipment. "Installing a smart thermostat in your home can help save on energy usage, and WTU is happy to bring our energy expertise to make a difference in people's lives," said David Draper, Commercial Director, WTU Retail Energy Residential. "As a part of this community, we want to help those who need help the most." Smart thermostats are available in limited quantities to current eligible residential WTU Retail Energy customers only, and there is no requirement to enter into a new contract or rate plan. Customers must be enrolled in the Public Utility Commission of Texas' Low Income Telephone and Electric Discount Program (also known as the LITE-Up Texas Program) at the time the customer is authorized to receive an in-home device.


ANCHOR
by Panasonic
"Matches seamlessly with my authentic African Blackwood teapoy."
- Mr. Rawat
"Matches with my Australian satin curtains perfectly."
- Mrs. Rawat
When it comes to choosing the perfect colour for their switch, Mr. & Mrs. Rawat have no worries.
Introducing Roma colour, a range of modular switches
that lets you create your own colour combination to match your individual lifestyle.
168 COLOUR COMBINATIONS
Customise your own switches
Plate
Frame
Accessories
ROMA®
For more information please visit www.anchor-world.com or contact:
EAST - Sharad Lakhani - 9324659046 I WEST - Anand Joshi - 9309037175 / Riyazali Nalband - 7498614917, 9371657600
NORTH - Udham Singh - 9419139745 / Sharad Dave - 7428259882 I SOUTH - Vishal Patel - 9322656234 / Mahesh C R - 9916043748

IHI & Toshiba to launch Demonstration Research of Ocean Current power generation system

IHI Corporation & Toshiba Corporation have been selected by Japan's New Energy and Industrial Technology Development Organization (NEDO) as co-researchers in the R&D of Ocean Energy Technology - Demonstration Research of Ocean Energy Power Generation". After concluding the formal contract with NEDO, we will conduct demonstration research of a turbine system driven by the ocean current. IHI and Toshiba, together with the University of Tokyo and Mitsui Global Strategic Studies Institute, have conducted R&D financed by NEDO's "R&D of Ocean Energy Technology - R&D of Next-Generation Ocean Energy Power Generation since 2011. The demonstration research is based on their achievements to date. Power generation driven by ocean energy from currents, temperature differences, tidal movements, waves, etc. is undergoing extensive study in Europe and U.S. as a measure to counter global warming, and there are expectations of market growth. NEDO has promoted R&D projects in ocean energy power generation technologies, with the goal of developing world-leading technology and contributing to lower CO_2 emissions in Japan. Within this framework, the unique "underwater floating type ocean current turbine system" developed by IHI and Toshiba will demonstrate power generation in a real ocean environment, in a project expected to continue until FY2017. The research work is expected to prove viability of ocean energy power generation and to create the framework for an industry, and also to contribute to improved energy security for Japan.

Next-generation system for operating wind farms from a distance

Gamesa and Iberdrola Group, through its engineering and construction subsidiary, have launched a wind sector-pioneering system which enables the remote management, using a single interface, of any make of wind turbine, anywhere in the world. This new system, called WindCORE® + WindOne®, enables operators to control and monitor this class of renewable facilities from a distance, analyse their operating data and generate reports with a view to optimizing their electricity output. The tool developed jointly by Gamesa and Iberdrola is indispensable for supervising, in real time and from a single control centre, the multiple variables which can affect a wind farm's operations, from wind speed at each turbine to their temperature, intensity and production. Analysis of these variables feeds the development of predictive models which in turn facilitate operations and maintenance work. WindCORE+WindOne system is capable of operating, using a single interface, turbines made by any manufacturer, doing away with the need for a different software programme for each technology brand. 'Gamesa operates over 400 wind farms worldwide from its control centre in Sarriguren (Navarra). With over 10,000 MW in operation, and reinforced by Iberdrola's know-how, we want to offer this value-added tool to our customers so that they can get the most out of their wind farms by operating them to the highest performance specifications', explains F. Valldeperes, Director, Services Sales & Marketing at Gamesa.

Morgan Stanley installs Bloom Energy Fuel Cells

At a ribbon-cutting ceremony, Morgan Stanley unveiled a new fuel cell system manufactured by Bloom Energy. The system, which was installed at the firm's headquarters facility at 2000 Westchester Avenue in Purchase, NY, is now operational and supplying energy to the building. The fuel cell system, along with a solar panel field completed earlier this year, are the latest in a series of initiatives to improve the facility's energy efficiency and resiliency. The Bloom Energy fuel cell system produces electricity without burning fossil fuels, thus reducing emission of greenhouse gases. It will supply approximately 250 kilowatts (kW) of constant base load power to the facility, as well as grid-independent electricity to power portions of the building's critical load during grid outages. "Environmental sustainability begins at home, and Morgan Stanley is committed to improving the energy efficiency and resiliency of all of our facilities," said Jim Rosenthal, Chief Operating Officer of Morgan Stanley. "Annual grid consumption at Westchester has dropped from 29.1 million kWh in 2008 to 23.7 million kWh projected for 2014. We are proud of the progress we've achieved so far and are excited to incorporate this new technology into our facility in Westchester." "We are excited to bring another Bloom Energy project online in New York," said Bill Kurtz, chief financial and commercial officer at Bloom Energy. "By installing Bloom Energy's business continuity solution, Morgan Stanley can protect its critical business operations from grid events and mitigate the risk of escalating energy prices." The new solid oxide fuel cell system (SOFC) technology converts fuel into electricity through a highly efficient electrochemical process, resulting in on-site, clean and reliable power. Combined with the solar field, new installations are expected to produce approximately 3 million kWh of energy a year. During peak energy consumption times, they can supply one megawatt, or up to 30% of the building's demand. Support for this project was provided by New York State Energy Research and Development Authority. Founded in 1975, NYSERDA is a public benefit corporation that provides information, services, programs and funding to help New Yorkers increase energy efficiency, save money, use renewable energy and reduce reliance on fossil fuels.

QUALITY THROUGH ACCURACY

Switchgear

HRC Fuse
The Efficient System Protector




We, at havells, have set up one of the most advanced production facilities in the world to produce switchgear and controlgear. By bringing world's best machines, superior grade raw materials and the best production practices together under one roof, we produce, an industrial range that is at par with the best in the world.

Features:
- ISI Marked
- Low watt loss
- Easy availability
- Excellent AC and DC performance

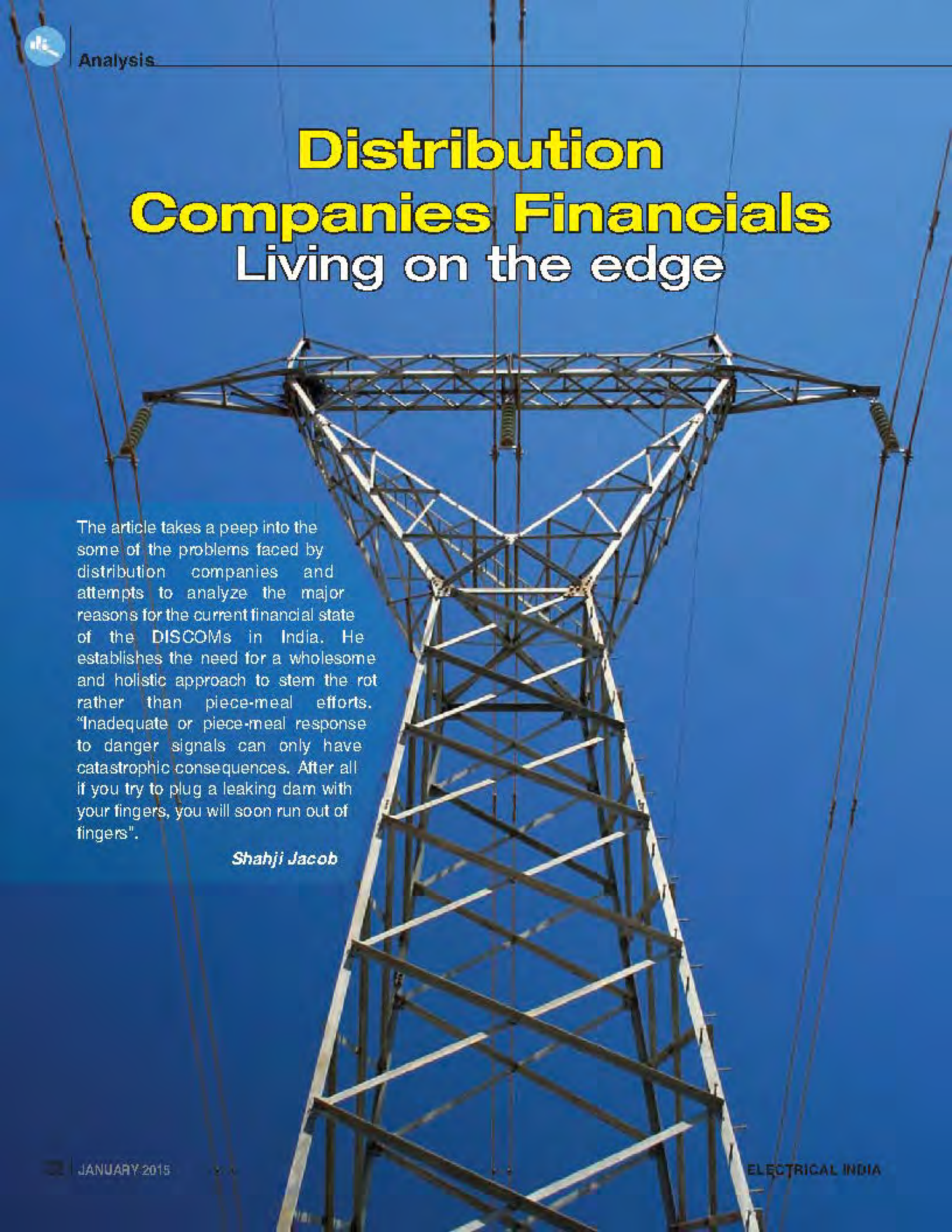
Range:
- 2A-800A in Bolted design (BS Type)
- 6A-630A in Blade Contact design (DIN type)
- 4A-63A in Round Head design (RH type)

HAVELLS

Customer Care no. for Product enquiry: 1800 11 0303 / 1800 103 1313 / 011-4165 0303
Corporate Office: Havells India Ltd., QRG Towers, 2D, Sector-126, Expressway, Noida-201304 (UP) India, Tel.: +91-120-3331000, E-mail: marketing@havells.com, enquiry.IP@havells.com, www.havells.com | Join us on Facebook at www.facebook.com/havells and share your ways to save the planet!

Distribution Companies Financials

Living on the edge



The article takes a peep into the some of the problems faced by distribution companies and attempts to analyze the major reasons for the current financial state of the DISCOMs in India. He establishes the need for a wholesome and holistic approach to stem the rot rather than piece-meal efforts. "Inadequate or piece-meal response to danger signals can only have catastrophic consequences. After all if you try to plug a leaking dam with your fingers, you will soon run out of fingers".

Shahji Jacob

India's power sector is a leaking bucket, the holes deliberately crafted and the leaks carefully collected as economic rents by various stake holders that control the system. So goes one of the most telling analogies in the report by the Deepak Parekh Committee on the power sector. The report went on to say "The logical thing to do would be to fix the bucket rather than to persistently emphasize shortages of power and forever make exaggerated estimates of future demands for power. Most initiatives in the power sector (IPPs and mega power projects) are nothing but ways to pour more water into the bucket so that the consistency and quantity of leaks are assured".

Efficient and service oriented distribution companies are needed to enable economic growth and to support the rapidly improving lifestyle of the people

Much water has leaked since then. Many studies and suggestions on the ills of the power sector have done the rounds. But the sad fact is that the bucket continues to leak. It's time to realize that a leaking bucket can never be an Akshaya Patra. After all, continuously milking an underfed cow can only lead to catastrophic consequences. Unfortunately, prudence and diligence is often sacrificed on the altar of political and populist expediency.

Reform as a panacea

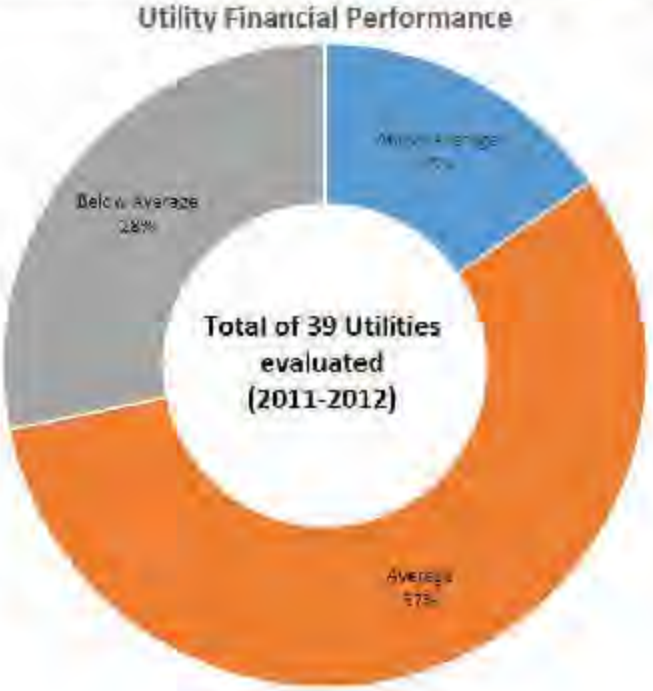
To be fair, it's not that nothing has been attempted to stem the rot. Power sector reforms has long been seen as a dire need. Reforms kicked off in the mid 1990's when some State Governments, led by Odisha, enacted legislations to restructure the erstwhile Electricity Boards. The Electricity Regulatory Commission Act 1998, provided for the formation of State Electricity Regulatory Commissions, thus, at least on paper, creating a Chinese wall and distancing the Government from the role of tariff determination. The Electricity Act 2003, was another major act that kindled hope of bringing about the much needed change in the sector. However, the actual progress on the ground has been slow and lackluster. The proof of the pudding, as they say, is after all in the eating.

The power of Power

Consequent to the reforms and the subsequent unbundling of the power sector, the power distribution companies turned into the vital last leg in the power chain, after the generation and transmission companies. Perhaps, more importantly, the DISCOMs became the direct interface with the individual consumers, direct bulk consumers excepted. That power distribution is important for a growing economy like India would be stating the very obvious. Suffice it to say that strong, efficient and service oriented distribution companies are needed to enable economic growth and to support the rapidly improving lifestyle of the people. The consumption pattern is changing with the share of domestic and agricultural sector consumption going up from 8.36% and 11.36% respectively in 1973-74 to 21.79% and 17.95% in 2011-12, while the industrial consumption has dropped from 68.02% to about 44.87% during the same period. The rapidly improving lifestyle is often illustrated by the fact that the per capita consumption of power, which was a low 172 units in 1979-80 grew at an annual rate of 6.7 % to 329 units in 1989-1990 and further increased to 883 units in 2012. This still pales in comparison with the world average of 2890 units. The fact that even other emerging economies like Russia and Brazil have an average consumption of 6460 and 2384 units respectively indicates the potential for far higher consumption patterns in India in the future. Will our utilities be able to measure up to this task given its current financial position is the moot point?

Genesis of the problem

Distribution companies are today faced with a double edged sword being crushed on both fronts: revenue and expenditure. On the revenue side, years of dilly dallying have led to a situation where the tariff has not been revised for several years – as much as 3 to 5 years in many states. It's only in the last two to three years, with most DISCOMs on a precipice,



that the inevitability of periodical tariff revisions got due attention and thankfully it has now started to happen. But, the damage has already been done. Let's however draw comfort that the stable doors are being now bolted before all the horses have bolted.

On the expenditure side, the galloping cost of power has played havoc with the DISCOMs financials in the absence of a provision for automatic mechanism to pass on the rise in cost of supply to the consumers. The average cost of supply per unit of electricity sold has been progressively growing over the years at about 3.5% per year, from 263 paise per kWh sold in 1998-99, to 355 paise per kWh sold in 2009-10. With the expenditure on power purchase constituting 70% of the total cost of supply, the effect of not passing on such increases for years together can only be imagined.

Non availability of fuel and its rising costs has not only bled many power generation companies, but also put many upcoming projects in a state of limbo as it became financially unviable. The recent instance of APTEL's (Appellate Tribunal for Electricity) order allowing two generating companies to secure higher price for the power sold from one of their plants on account of the higher fuel cost, could have been the boost required to get most of these projects back on the rails. However, it cannot be denied that the unintended effect would be that the beleaguered DISCOMs would end up paying a still higher rate for its power purchases. An interesting recent related development was the Gujarat Urja Vikas Nigam Ltd's (GUVNL) demand to seek lowering of the tariffs contracted for some solar plants in the state. Their probable rationale could have been if generating companies can go the regulator to raise the tariff on grounds of rise in input costs, the state utilities can do the same and seek tariff reduction as the cost of building these plants are now much lower than when the tariff was fixed. That's two sides of the same coin!

However, in both these instances it is all back to square one. The APTEL order on tariff hike has been recently stayed by the Supreme Court with a direction to APTEL to re-hear and expedite the case and APTEL has also upheld the decision of the Gujarat Electricity Regulatory Commission (GERC) to turn down GUVNL's demand. There is however a positive side to the whole drama. At a time when private investment is most needed in the sector, a contrary decision, particularly in the Gujarat case, would have been the classic case of winning the battle but losing the war as it would have cast doubts on the consistency in policies and the integrity of agreements which is now a major concern among investors. However, the new government at the Centre seems to have realized the need for drastic action and the recent ordinance on coal mine allotments, the proposal for pooling of domestic and imported fuel prices etc may give many stuck power projects a new lease of life. The new minister of power at the Centre seems to have sent the right signals to the market that he means business and wants to get the projects back on the rails, but then there could be many a slip between the cup and the lip. For example, with the Chairman of APTEL due to retire in Nov 14 and a new one yet to be named, it's safe to assume that the tariff hike issue will continue to hang fire for some more time.

The recent episode of a state regulatory commission approving a tariff hike by re-introducing the power price adjustment cost (PPAC) surcharge on the 13th of Nov 14 only to withdraw it in less than 24 hours is indicative of the malady. That the state in question is poll bound may have been a coincidence but it does raise uncomfortable questions. It may be noted that the PPAC was originally introduced in 2012 to help distribution companies recover some of increase in fuel cost, but was withdrawn later.

Other contributing factors

Though rising fuel costs and inability to raise revenues was the major reason for the damage to the DISCOM's financials, there were other contributing factors too. According to the annual report 2011-12 on working of State power utilities, the number of employees in India, per million units of energy sold was about 5 in 1990-91, while it was 0.2 in Chile, Norway and the US. The manpower cost of DISCOMs which kept on rising over the years put further pressure on the financials. Rising inflation, improvement in standards of living and the pay panel recommendations made this a fait accompli. Indeed, given the growth in the other sectors of the economy and rising pay packets elsewhere, DISCOMs had a problem in attracting personnel with key skills who could bring the much needed fresh energies and drive into the lethargic system. So much so, many DISCOMs had to resort to the policy of hiring personnel on contract basis. The fact that the average number of employees in India per thousand consumers had however declined from 0.51 in 2007-08 to an estimated 0.45 in 2009-10 perhaps is a consequence of this shortage rather than a planned reduction in personnel due to higher productivity. Nevertheless, the fact that manpower cost had increased at around 24% between 08-09 and 2011-12 while power cost rose 20.5% during the same period ensured that the manpower costs was also a major contributor in the beating down of the financials.

Coupled with this was the handout of free electricity and subsidized power to certain sections. The annual report on state power estimates that the gross subsidy on domestic and agriculture sectors had increased from a level of Rs 48,024 crore in 2007-08 to around Rs 71,016 crore in 2011-12 . The effort to recover the losses on account of the subsidized power supply to domestic and agriculture consumers led to a scenario of cross subsidization, with industrial and commercial consumers paying a tariff higher than the cost of supply which in turn rendered them less competitive. The industrial and commercial consumers therefore found it more prudent to set up their own captive plants to de-risk and free themselves from the clutches of the utilities. With open access now being available to select high value consumers and the proposed amendment to the Electricity Act that plans to separate wire (distribution infrastructure) from content (power) set to offer retail consumers, the option of choosing their power supplier, the writing on the wall is clear. Over time, it was evident that the revenue earned through such cross subsidization was not keeping up with the level of subsidy giveaways. The scope of robbing Peter to pay Paul is getting negated. In many cases the reimbursement of the subsidy portion due from the Government, never came in, and even when they did, it was far too late causing severe cash flow mismatches and consequently undermining the operational capability of the utilities.

PRESENTING REACTIVE POWER SOLUTIONS THAT YOU'LL LOVE, BUT YOUR ELECTRICITY PROVIDER WON'T.

Havells Capacitors are built to make sure your factory consumes lesser energy and saves more. The design and materials used to build them not only ensure safety from high voltage, current stress and the ability to withstand extreme temperatures, but also provide low electrical losses and help reduce energy consumption around 30%*. This means more saving for you and lower revenue for your electricity providers. So if you were in their place, would you love these capacitors?

HAVELLS

*Condition apply.

Customer Care no. for Product enquiry: 1800 11 0303 / 1800 103 1313 / 011-4166 0303
Corporate Office: Havells India Ltd., QRG Towers, 2D, Sector-126, Expressway, Noida-201304 (UP) India, Tel.: +91-120-3331000, E-mail: marketing@havells.com, www.havells.com | Join us on Facebook at www.facebook.com/havells and share your ways to save the planet

It was but natural that in such a situation the gap between revenue (excluding subsidy) and average cost of supply increased from 76 p in 98-99 to Rs 145 p in 2009-10 according to the annual report 2011-12 on working of State power utilities. The average cost coverage ratio (CCR) of DISCOMs, which measures the % of cost of supply that is recovered through revenues (excluding subsidy) fell from 81.5% in 2008 to 75.7% in just 2 years. A recent statement by the new Power Minister indicates that the accumulated losses of the DISCOMs is nearly Rs 3,00,000 crore with an addition of Rs 60,000 to 70,000 crore every year! Power finance corporation (PFC) report had estimated that 8 states together accounted for 80% of the accumulated loss in the sector and that some of these states had a cost coverage ratio of just around 56%. It is clear that the continuous under recovery type of lifestyle of the DISCOMs had assumed cancerous proportions and would be soon beyond cure unless the rogue cells are immediately targeted and controlled. It is pertinent to note that even the CCR of Gujarat which had the highest CCR in the country was just under 1 - still below the minimum threshold.

Consistent poor collection record has also resulted in the utilities carrying on its shoulders the heavy burden of accumulated baggage of revenue arrears. These arrears have increased from Rs 20,382 crore in 1998-99 to Rs 55,430 crore in 2009-10. Prudent accounting norms would have meant that many of these arrears are written off, but the hole that it would burn in the account books can only be imagined.

The Rajiv Gandhi Grameen Vidyutikaran Yojana which was launched in March 2005 with the objective of electrifying over one lakh un-electrified villages and to provide free electricity connections to 2.34 crore rural households. This program despite its best intentions is in part creating problems for electricity utilities. Contractors entrusted with work under the scheme, regularly charge the new lines without even consulting the DISCOMs and therefore no load management was possible, besides leading to more unbilled consumers. To add to the problem most of these connections are unmetered leading many of the beneficiaries to assume that free electricity is given to them by the Government as a right. Once used to free electricity, it's quite natural that the beneficiaries will find ingenious ways of ensuring that it continues to be free for them. A laudable scheme indeed, but faulty implementation is indirectly propagating undesirable practices unfortunately.

Compounding the problem further was the fact that DISCOMs had to resort to borrowing from Banks to bridge the yawning gap in its finances. DISCOMs are estimated to have a total debt of Rs 3,04,000 crore. Driven to the wall, some DISCOMs had the ignominy of resorting to the ultimate financial horror strategy of raising fresh borrowings to service interest on the earlier ones. Banks' exposure to DISCOM's was estimated to be around Rs 1,90,000 crore in March 2012. The precarious condition of DISCOMs finances meant that the Banks had its own share of concern on further lending to the DISCOMs. With the road to further borrowing narrowing, most DISCOMs were truly on the verge of being cooked in its own broth - a victim of its own doing.

In the absence of a proper rating methodology to assess the performance of State distribution utilities, in July 2012, the Ministry of Power formulated an integrated rating methodology on a range of key metrics. This was also expected to incentivize/ dis-incentivize the utilities according to their performance and also help the Banks and other Financial Institutions to better assess the performance of the utilities and give quicker funding. The first rating results were published in March 2013. As expected the utilities did not come out with flying colours. Out of 39 utilities rated, only 6 companies got A grade or better and 22 got below average rating, leaving the balance 11 with moderate ratings. The study further pointed out that only 21 utilities could submit their audited accounts for FY 2011-12 which is a pointer to the state of affairs in the DISCOMs.

Consequential or Ancillary loss

The pressure on the financials had its impact on the almost every aspect of distribution operation. High levels of maintenance expenditure are required to keep the ageing and heavily loaded distribution infrastructure system up and running. It's but natural that in such a cash strapped environment, there was not enough resources to go around. Maintenance and loss control activities naturally suffered as the limited resources went more into breakdown restoration activities etc. It was therefore more a case of fire fighting.

The financial crunch of DISCOMs had several other effects. Indian Power Industry is characterized by heavy Aggregated Technical and Commercial losses (AT&C) losses. In some DISCOMs it was as high as 62% to 73%. Even on a combined average basis the AT&C loss is around 27% to 30%, compared to the level of 6% to 8% in developed countries. Though there has been some decline in the average losses in recent times, these losses is almost criminal considering that the country is still power starved.

Apart from electricity theft and pilferage, one of the more important reasons for this high loss was the improper metering of energy consumption due to the defective meters and even absence of meters in many cases. Strapped as they are for finances, most DISCOMs were not in a position to replace the defective meters in adequate numbers, or install meters in case of unmetered consumers. As regulations allowed consumers to be charged on the basis of average of past three months consumption, most of these consumers were happy that they could consume electricity without any impunity, safe in the knowledge that they be charged a fixed bill! Indeed this led to a peculiar situation where consumers vied with each other to have their meters declared "defective" thus enabling them to enjoy almost free power to their heart's content! Trust some Indian ingenuity to start working in this scenario! Some of these consumers saw a business opportunity and became a mini, albeit, illegal distributor themselves by supplying power to their neighbours. Add some vested interests and we soon had "advisors" offering their services, for an unofficial fee of course, to ensure that meters are declared defective. The rot goes deep indeed.

It is an acknowledged fact that if the DISCOMs could replace the old electro mechanical meters that still adorn most houses with the more accurate digital meters

EPLAN

efficient engineering.

EPLAN Software & Service

We advise companies on the optimization of their engineering processes, develop software-based engineering solutions for mechatronics and implement customized CAD, ERP PDM and PLM interfaces to accelerate your interdisciplinary product creation process.

Smart solution for multiple industries


Food and Beverage


System Integrator


Water Treatment


Panel Builders

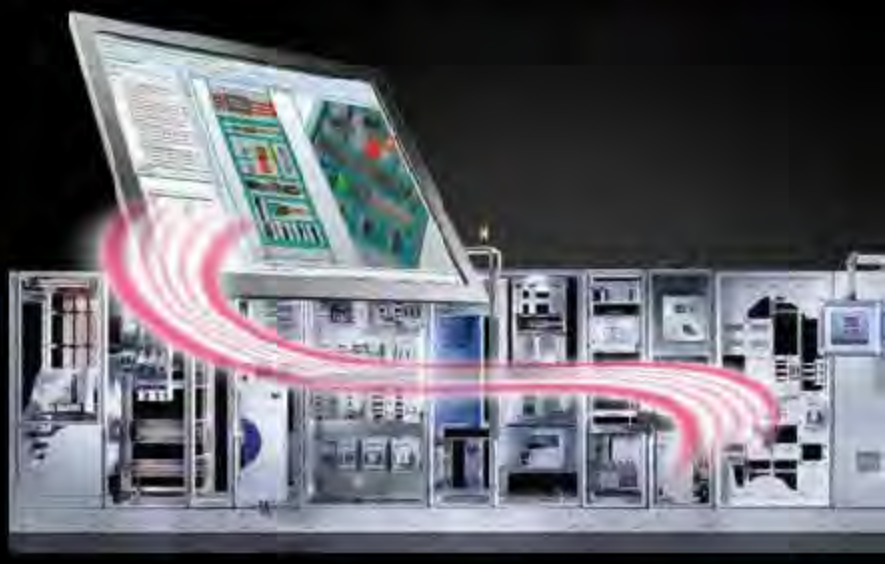

Machine Building


Automation

EPLAN electric P8

Electrical Engineering

- Power drives
- Electrical control systems
- Safety engineering
- Machine monitoring
- Machine wiring
- PLC (digital/analogue)



EPLAN pro panel

Control Cabinet Engineering

- 3D monitoring layout
- Control cabinets
- Switchgear
- Flexible power distributions
- Order information
- Production drawings

EPLAN fluid

EPLAN pipe

EPLAN psim

EPLAN harness proD

Visit us at

AUTOMATION 2014

15-18 October 2014
Hall-1, Stand No. H6 & H7

- More than **40,000** Customers
- More than **100,000** Software users
- Presence over **50** Countries worldwide

Head Office: Bangalore. Branch Office: Mumbai, Chennai, Noida, Pune, Kolkata.
080-41515497 | Info@eplan.in | www.eplan.in

PROCESS CONSULTING | ENGINEERING SOFTWARE | IMPLEMENTATION | GLOBAL SUPPORT

EPLAN

FRIEDHELM LOH GROUP

FRP – Decoding the lack of success

Some of the reasons for the limited success of the FRP could be attributed to the following:

- Poor financial health of the state Government prevented them from taking up liabilities of the DISCOMs as proposed.
- The Fiscal Responsibility Act, by which the state was bound also, precluded them from accepting the proposal as it would impact its financial position.
- Banks were not interested to convert their loans into bonds which fetched them lower interests.
- The proposed Bonds did not qualify as SLR securities and was therefore less attractive to Banks.
- Investment guidelines required that these Bonds were classified in the "Available for Sale" category. Hence Banks would have to re-value their investments in these bonds every quarter. This could create a situation where Banks would have to write off, in their books, the anticipated loss in case of a general rise in the interest rate scenario. This further reduced the bonds attractiveness to Banks. Had it been categorized as "Held till Maturity" then such quarterly re-valuation would not have been necessary.
- Further Banks were required to create in its accounts a provision of 5% of all restructured loans and if the restructured loan turned bad it would require still higher provisioning. Considering most DISCOM's financials, banks were clearly not comfortable in restructuring the outstanding loans to DISCOMs.

Thus the two main players, the State Governments and the Banks were not very interested in the scheme. The schemes limited success in this scenario was only to be expected.

the loss at the metering side could be cut significantly. Though replacement of such meters is being done, the slow progress, mainly on account insufficient meters, which in turn is on account of financial crunch, is resulting in mounting losses day after day. With smart metering technology now available, India could directly skip into the new generation meters.

Having said so much about the difficulty in meeting operational expenses, need we say more about the capability of DISCOMs in making adequate Capex demands to meet the burgeoning demand for power? The already old and weak infrastructure is groaning at the seams. Most transformers are already heavily loaded and long past its efficient life and incapable of taking the further load needed to meet the increased demand. Clearly to expect heavy investment from the DISCOMs in the current scenario would be akin to asking for the moon.

Given the high borrowings and high liabilities of the DISCOMs, it was apparent that a drastic surgery or restructuring was required. The Government's Financial Restructuring Package (FRP) made an attempt to clean the Balance sheet of the utilities but the plan seems to have fizzled out. Under the FRP for state-owned DISCOMs, States were to take over 50 per cent of the outstanding short-term liabilities as on March 31, 2012 and convert them into bonds which would then be issued to banks backed by state government guarantees. The Centre was to provide, as incentive, 25 per cent capital reimbursement of principal repayment by the state on the liabilities taken over by it. Banks were also required to restructure the remaining 50% of the debt. Though only eight states accepted the scheme, most of them were also not able to meet the requirements under the FRP. The underlying reason for its failure is not far to seek. There was no real business restructuring in the package except for a repacking of the old debt with a new one. The fundamental issues that lead to the financial mess in the first place wasn't really addressed.

Faced with the non-disbursal/delayed disbursal of subsidy amounts by the government, for power supplied to the agricultural sector, some DISCOMs have been forced to curtail power supply to the sector. Agricultural subsidy has grown to 64% of total subsidy in 2011-12 from 37% in 2007-08 and subsidies of around Rs 48,500 cr remain unrecovered. Thus the move of granting subsidized power which was supposed to aid the sector ended up hurting it more. It is a no brainer that unequal cash flows cannot continue forever and that economics will eventually come to play. With agriculture sector in India consuming more than 22 % of the power sold and contributing only 8% to the revenue, and subsidy not flowing in time, it was a disaster waiting to happen.

The International Energy Agency estimates India will add between 600 GW to 1200 GW of additional new power generation capacity before 2050. This added new capacity is equivalent to the 740 GW of total power generation capacity of European Union in 2005. Investment required for electrification in India is estimated to be around $ 6.4 billion. It remains to be seen how a cash strapped sector, with poor access to bank funding can meet this minimum requirements given the current state of power generation projects in the country.

It's should be clear from the foregoing that the Deepak Parekh's 'leaking bucket' analogy may in fact be a mild understatement. It's not just a bucket that's leaking, it's actually a leaking dam. A tiny leak in a dam, if unplugged promptly, soon grows into a gigantic one. And if fresh such leaks continue to erupt, the end cannot be too far off. Inadequate or piece meal responses can only have catastrophic consequences. As the popular fictional story goes, the little Dutch boy may have saved Holland by plugging the leak in the dike with his finger. But try to plug a huge leaking dam with your fingers, you will soon run out of fingers!

The light at the end of the tunnel

However there is a silver lining in the darkness. Much is expected out of the Integrated Power Development Scheme (IPDS) scheme announced in the recent Union Budget which aims to strengthen the transmission and last mile connectivity and metering of power entailing an investment of Rs 32,600 crore. Besides the IPDS, some regional programmes for strengthening of the intra-state transmission and distribution system, have been approved or are in the process which could boost the much needed investment in much needed areas. One such programme, which was approved recently was in Arunachal Pradesh and Sikkim at a cost of Rs 4,754 crore.

A ICRA study of October 14 estimates that the aggregate capital expenditure for strengthening the distribution infrastructure approved

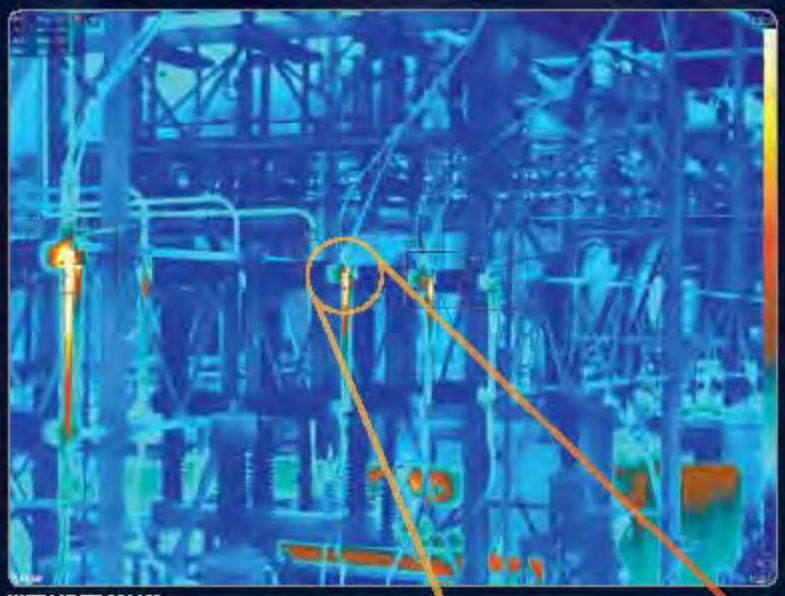
FLIR | The World's Sixth Sense™

THERE'S NOT ENOUGH SPACE HERE FOR THE FULL ULTRAMAX™ STORY.

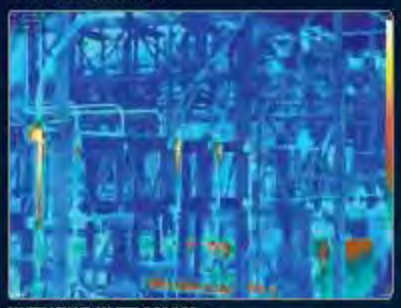
ONLY ROOM FOR A FEW GOOD EXAMPLES.

There's much more you'll want to know about how well FLIR's stunning new UltraMax resolution works and the difference it could mean to your inspections.

GET THE COMPLETE LOWDOWN AT WWW.FLIR.COM/ULTRAMAXELECTRICAL



WITH ULTRAMAX



WITHOUT ULTRAMAX

ULTRAMAX AT 8X ZOOM

NEW T480

NEW T640

EXCLUSIVELY ON ALL THE LATEST T-SERIES CAMERAS

For further information, please contact us at:

FLIR Systems India Pvt. Ltd.
111, D Mall, Netaji Subhash Place, Pitampura, New Delhi – 110034
Tel: +91-11-4560 3555 Fax: +91-11-4721 2006 E mail: flirindia@flir.com.hk
Website: www.flir.com

FLIR

The World's Sixth Sense™

by the SERC's is estimated to be around Rs 44,000 crore in FY 2015 which represents an increase of around 8% over the previous year.

Encouraged by Gujarat's success in supplying electricity through separate feeders for agricultural and rural domestic consumption feeder separation, the new Government plans to spend Rs 75,600 crore for a similar programme on a much wider scale nationally aimed at providing eight hours of quality power supply to agricultural consumers and 24 hour electricity to households. While this outlay includes expenditure towards the IPDS initiative, Rs 43,000 crore has been earmarked for the Deendayal Upadhyaya Gram Jyoti Yojana for feeder separation, The scheme when completed is expected to bill more users and reduce the technical and commercial losses due to theft. These investments and the benefits from the ongoing R-APDARP projects in various utilities will no doubt help in reducing AT&C losses significantly in the future.

While the average AT&C loss is estimated to be around 27%, it is still significantly high in many states. While populism has so far helped in preventing an increase in power tariffs, the ICRA study shows that there is another way to achieve the same objective minus the hit to the DISCOMs bottom line. For a utility with a loss level of say 25%, the ICRA study estimates that a 1% loss reduction leads to a cost saving of 11-13 paise per unit which results in a relief of 2.2% on the retail tariff assuming that the cost of power remains the same. ICRS estimates also indicates that a 1% reduction in all India AT&C loss could cut cash losses by as much as Rs 3900 crore. Thus reduction in AT&C loss levels needs to be looked at as the real alternative that can soothe both DISCOMs and consumers alike.

A recent report states that the Government is considering capping prices power generated from auctioned coal blocks so as to prevent DISCOMs from having to increase tariffs. But the generating companies are seeing the move of capping prices, while simultaneously requiring them to pay for coal blocks, and for royalty and also to absorb the developing and productions costs as absurd and unviable. Those for capping price say such ceiling would promote efficient utilization of coal while discouraging companies from bidding arbitrarily for blocks auctioned. Clearly managing the conflicting requirements will be a challenge but it's gratifying to note that attempts are being made to remedy the situation

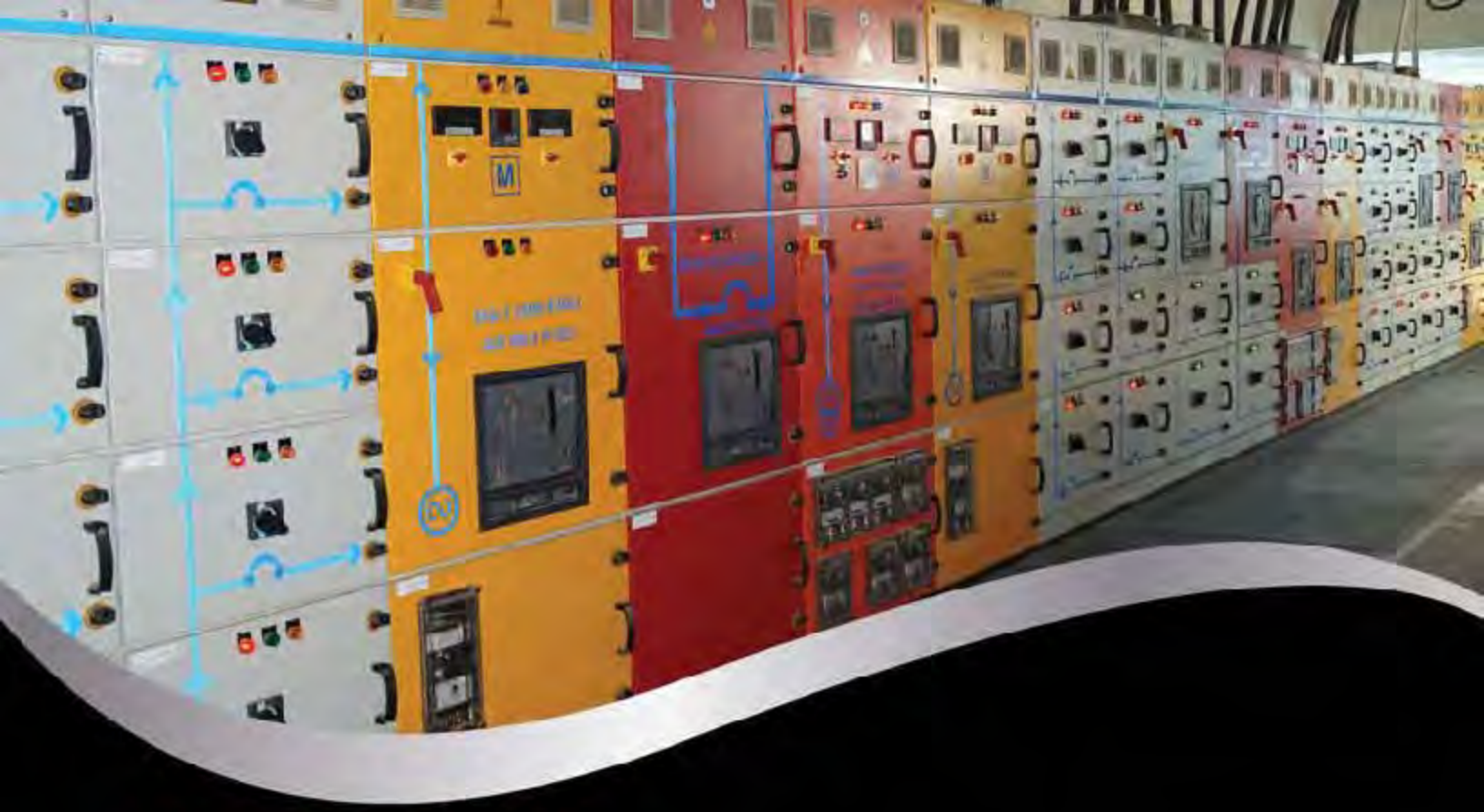
The proposed changes in the Electricity act, if approved, could play a big part in making a sea change in the current scenario. It envisages breaking up the current distribution licensees further into a system business (distribution) and supply business (supply license). The distribution licensee will then be responsible to operate and maintain the distribution system to enable supply, and the supply licensee will supply the electricity through the network provided. The proposed segregation is said to be prelude in allowing multiple licensees to operate in a single area finally leading to a system of open access where retail consumers have the freedom to choose their supply licensee. This is expected to bring about competition in the sector which will eventually force the utilities to improve their services. You only have to look at how competition drove the banking, insurance, and the telecom sectors to improve their service levels to understand what competitive stimulus could do. But the path will certainly not be easy and it will take some tough riding and may have unpleasant side effects, before things pan out right. But most of all it will call for sea change in the outlook and attitude backed with a strong willingness to bite the bullet.

It is hoped the earnestness that the new Government is displaying and the growing realization that there can no more be any free lunches in the distribution sector will spur the changes in the sector. The experience of the past have clearly proved that half-baked measures without a comprehensive plan can get us nowhere and will only draw the sector deeper into the mire. That India needs a very strong power sector needs no elucidation; nor is the fact that it needs fertile ground and space to grow, backed by strong enabling measures that nurture wholesome growth. After all, you cannot grow an oak tree in a thimble.

Shahji Jacob

is currently Senior General Manager at Enzen Global Solutions. He piloted setting up of the finance function of electricity distribution service operations of company and has been overseeing finance operations. He has experience in negotiating franchisee electricity distribution operation and major partner agreements. Prior to Enzen, he was serving in executive cadre of a leading private sector bank in the country. He holds Master Degree in Management as well as in Commerce and is also Certified Associate of the Indian Institute of Bankers.

Profile



Authorised System Integrator for

Schneider Electric
(Frisme iPM Smart Panel - IEC 61439 Certified)

LARSEN & TOUBRO
(HT Panels upto 33KV)

- ✔ CPRI Tested for 100 KA Short Circuit.
- ✔ CPRI Tested for 6000 Amps Temperature Rise .
- ✔ An ISO 9001 : 2008 Certified Company.

"We cherish the strong relationships we have built with our BELIEVER's over the years, and we truly appreciate their loyalty"

Amit JINDAL
Chairman & Managing Director

Shivalic Power Control (P) Ltd. is one of the leading manufacturers of custom-built Electrical Panels and also executes Turnkey Projects. "*Shivalic*" works with an aim to provide human safety, product quality with technical competency and timely solutions to its customers, thus we enjoys an enviable market share in India and overseas.




Shivalic
Make Things Possible

Shivalic Power Control (P) Ltd.

Corporate Office: 3E/35, B.P., 1st Floor, N.I.T., Faridabad-121001
Factory: Plot No.18, Sector-24, Faridabad - 121004
Phone: +91-129 4059168 / 69 / 71, 9718388509, 9718388310
E-mail: sales@shivalic.com | Web : www.shivalic.com
facebook.com/shivalic.spcpl

Cost Effective approaches for SPV Projects & Energy Efficient Equipment

Today's power scenario in the world and in India in particular has changed from that of 'Generation, Transmission,Distribution' to 'Generation, Storage, Distribution & Effective usage'. Solar power generation especially at the last milestone has been recognised as the need of the hour and though, India has not woken up to the effective storage and efficient use of power, the world at large is seriously looking at these dimensions.

S V R Rao

In this presentation, an attempt is made to investigate the nuances in SPV generation, Energy Efficient use, storage and localised Distribution of Power. Let us start looking at the numbers, starting from the tail end.

Lighting

Lighting contributes to a major component of the use of Power in India, the national average stands at 22%. If we segregate the urban and industrial loads, lighting and pumping contributes to about 90% of the rural loads and, not being able to meet these demands often fell the political party from power and seat them in the opposition – for very valid reasons.

No surprise, the lighting load can be reduced by 60 to 70% by changing the bulbs and tube lights to LED lamps. Realising this and for Environmental goals, in America and Europe, the Utilities themselves offer the LED bulbs at huge discounts and with 3 years replacement guarantee. Let us study the economics of LED lighting as compared to the traditional units. It is in the light of these evaluations and for reducing CO_2 emissions, the planners in the other countries have offered LEDs in open malls at subsidized rates.

What Can India and new States like Telangana Do?

Taking ground realities into considerations, it would be prudent to adopt a policy like:

> ***The ground reality is that, most of the lighting consumption in general and especially in non urban areas is from unauthorised consumers and commercial users***

I Provide 2 LED bulbs free of cost to all households with regular connection and whose monthly bill is less than say, Rs 500.

II Provide 3 LED bulbs free of cost to all households with regular connection and whose monthly bill is above 500.

III Provide LED bulbs at subsidised cost of Rs 50 for all requirements above these free supply for consumers having legal connection subject to a maximum of 5 bulbs.

IV Provide LED bulbs at subsidised cost of Rs 100 for all consumers other than III above.

V Collect Energy Conservation cess of 15% on all incandescent lamps, tube lights and CFL's with PF less than 0.9.

Item IV above needs special discussion.

In item I and II we spoke about free supply of LEDs to regular consumers while, in Item III we are supplying another 5 bulbs at concession rate for legal consumers and in IV we are providing bulbs at less subsidised rates irrespective of whether he is a legalised consumer or not. Does it not mean that we are providing subsidies to illegal consumers also!

The ground reality is that, most of the lighting consumption in general and especially in non urban areas is from unauthorised consumers and commercial users. In general, for every consumer in I above, there are 3 to 4 consumers not falling in I. The Establishment cannot afford to miss this huge saving in this uncountable spent energy.

Moral of the Story

Without huge subsidy program, such a significant saving to the nation cannot be affected as a normal consumer looks for his immediate cash out but not the life cycle costs.

Issues Relating to Storage

Power is not available for supply to the houses in rural areas in the evening hours – a time when they want most. Even if available, the supply is erratic. Both such phenomenon cause irritation & nurses anti establishment sentiment.

Storing of power in the household just enough for the evening supply solves this problem as, power can reach the storage any time of the day/ night and kept ready for use in the evening hours. In India, as of now, the most convenient and reachable solution lies in inverter and battery storage – as discussed

S.No	Item	Detail	Remarks
1	Cost of LED bulb to replace a 60 W bulb / tube light	Rs 200	Apparently very high for the Consumer. Ways to reduce this cash out for the commoner are discussed later.
2	Supplier's replacement guarantee	3 years	None in the case of other lighting units.
3	Life in yrs	30	3 years maximum in the case of other units
4	Saving of load at the LT end	40 W per bulb	The investment saved to the nation / state in Generation and Transmission works out to Rs 60 per watt saved.
5	Time taken to affect this saving in avoided Generation and Transmission	Instantaneous	Minimum 3 years, average 7 years for adding new Generation and Transmission
6	Value of saving of Rs 60 for an average life of 30 years	Instantaneous: Rs 40 * 60 = 2400 less diversity factor of 2 = Rs 1200	The question before the State would be, should we give a subsidy and induce the consumer to use LED bulbs or, perpetually burn power into thin air for 30 years and invest for new Generation and Transmission with gestation periods of 3 to 7 years?
		Value of units saved: The units saved of 60W * 3 hours per day *300 = 36 units @ Rs 2.50 Cost of Supply at LT for 30 years @ 12% rate of interest working out to Rs 725	
		This is a huge saving to the utility and to the consumer	
		Total saving Rs 1200 + 725 = Rs 1925	

Table 1: Costs and Economics of LED Bulbs

later in this paper. There are serious cost and maintenance/ replacement irritants in battery storage for some technical reasons. So, let us closely examine these issues & seek remedies for resolving them.

Requirement of Storage for a Simple Household

In a typical household seeking comfortable living, it is estimated that 2 light points and 2 fans are used for 5 and 10 hours each. These consume 2.15 units per day and with 15 to 20% inverter losses, the total consumption works out to abut 2.5 units per day.

The storage requirements and the wear and tear of the battery under the conventional & Energy Efficient systems are tabulated below:

It is known case that, many of the solar power installations and inverter household installations become dysfunctional because of the costs involved in replacement of battery every 3 years & the high rising costs of batteries. This has become a major irritant in the advancement of storage solutions. The Energy Efficient Lighting (LED) & the Energy Efficient Fan (Standing) can improve the life of the battery & to some extent, mitigate this problem.

Issues relating to Power Quality

As already mentioned earlier, the large incidence of inverters into the system can affect quality of power mainly because of harmonics. Therefore, there is a need for introducing minimum standards to be met by the inverters to avoid this disturbance in the networks. For this purpose, at the time of purchase, quality standards should be stipulated as below & type testing and strict quality control exercised.

In particular, the Harmonic distortion should be treated as essence of the inverter design.

If the inverter resolves the problem of lighting, is there a case for SPV power generation at the consumer's end?

Case of solar home lighting system vs. Inverter

SPV power generation is very costly. Let us have a look at the present day costs of an SPV system with inverter and subsidies Vs. an inverter battery combine (for which has no subsidies are provided). It is clear from the Table above that, even with subsidies, the SPV system works out costlier to the consumer as compared to an inverter with a 3 hour standby.

S.No.	Item	Traditional way	Energy Efficient way	Remarks
1	Bulb wattage	55 plus	20	
2	Fans	Used mostly with resistance type of regulators; 70 to 80 W	35 W	
3	Watt hours per day	2500	1000	1500 WH Quantify in rupees: 1.5KWH * 365 days * 25 years = 13687.5KWH @ Rs 5/- = 68,437/- for investing about Rs 11,000/-
4	Battery	2 nos. 12VDC C10 type 150AH	40% lesser capacity would do. 1 nos. 12VDC 150 AH	Saving one battery (Rs 15,000)/-
5	DOD: Depth of Discharge	High as the load is deep	As loading is less, the DoD is less and the battery stands more cycles, lasts longer	
6	Life of battery	3 to 4 years	6 to 8 years	
7	C10 and C20	Current drawl is heavy from C20	As loading is less, the discharge is at a slower rate. The cost of C10 batteries are higher but they last longer.	It means that if the battery capacity is rated 12VDC - 150AH @ C10, the battery is designed to delivers 15 amperes for 10 hours amounting to 150AH. If the battery is operated at the capacity close to operating conditions it is designed for, battery lasts for the designed life cycles The lesser the drain on the battery, the better would be its physical life. In solar power input and energy efficient use of power, the throughput is slow paced and the drawl of power is also relatively slow. In such a scenario, the battery lasts longer.
8	Cost implications	Battery needs replacement every 3 years	Battery operating life increases from 3 years to 6 years if the load is reduced by 50%. This is direct saving in maintenance cost.	In addition to this, considering life of the batteries last 5 years, in 25 years, one has to replace 5 times instead of 8 times. This saves about about 3/8 = 37.5%. In this specific case, for 150 AH capacity, replacement cost for batteries reduced from Rs 1,20,000/- for 8 time to Rs 75,000/- for 5 times. Thus the saving is about Rs 45,000/- for 3 batteries in 25 years.

Table 2: Comparision of Storage Parameters Traditional use Vs. Energy Efficient use of Power

Product Range for Nuclear\Power

MICROTEX
Standby-Power

4	OPzS	200
5	OPzS	250
6	OPzS	300
6	OPzS	420
7	OPzS	490
6	OPzS	600
8	OPzS	800
10	OPzS	1000
12	OPzS	1500
16	OPzS	2000
20	OPzS	2500
24	OPzS	3000

TBS/OPzS
TUBULAR

CALCIUM-Plus™

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

Standby-Power **OPzS** SERIES Stationary Cells in transparent SAN containers

For Nuclear Power plants, Electric Power Generation facilities, Petrochemical plants, Switchgear and control applications, Wind, hydro & solar photovoltaic, Large UPS Systems, Railway signaling, Telecommunications.

Manufactured by
Mysore Thermo Electric (P) Ltd
36 & 62, 4th Main, 3rd Phase, Peenya Industrial Area, Bangalore - 560058, India
Tel : + 91 80 2839 2380, Fax : +91 80 2839 7243
info@microtex.in www.microtex.in facebook/microtex.energy

Some of the recommended specs are:		
Sr. No.	Requirement	Specifications
1	Input Voltage	415Volts, 3 Phase 4 Wire
	Voltage Variation	+15%, -20%
	Input Frequency	50Hz
	Frequency Variation	47Hz to 55Hz
	Power Factor	0.92 to unity
	IGBT Based Rectifier	
	DG Set Sizing Requirements	No De-rating Required
2	Output Rating	150-kva 120KW
	Output Voltage	415Volts, 3 Phase 4 Wire
	Output Voltage regulation	+/- 1%
	Output Power Factor	0.8 lag to unity
	Output Crest Factor	3 : 1
	O/p Frequency & Variation	50Hz +/- 0.1%
	Output Waveform	Sine wave
	Output Harmonic Distortion	<2% THD on Linear Load <5% THD for Non linear load
	Output Overload Rating	150% for 60 Seconds
	Output Transient Response	For 100% Load change, voltage remains within +/- 5%
	Response Time	Recovery to +/-1% within 5 m-Sec
3	DC Link Bus Voltage	360V
	DC Bus Volts Ripple	< 2%
	Battery Isolation	DCCB
	Battery Charging Current	Settable between 5 to 25 Amp
4	Inverter Efficiency	Better than 95%
	Overall Efficiency	Better than 90%
5	Rectifier Protections	I/P AC Over & Under Voltage
		DC Over Voltage
		Battery Charging Over Current
		Single Phase Failure
		Reverse Phase Sequence
	Inverter Protections	O/P Over & Under Voltage
		Output Over Load
		Output Short Circuit
		DC Under Voltage
		Over Temperature

Table 3: Desirable Specifications for Inverter

In addition, the monthly cash out for the consumer for repaying the loan in the case of SPV works out to as high as Rs 300 for a 5 year period, an inconvenience he has to pay for while, his counterpart in uninterrupted urban and other areas enjoy low cost supplies.

Issues such as these and the need to change the battery every 3 years form a formidable road block for a massive take off in the case of SPV home lighting program.

'Possible Solutions for Massive offtake of Solar Home Lighting Program – Feasible Within Regulatory Framework'. In the present scenario, the solar power from the SPV is neither measured nor, it is pumped into the system.

In the absence of stock taking, the number of SPV systems installed are only for "Statistification" (Statistical Satisfaction) that describes unaudited or un-monitored benefits as, on any evaluation, probably, only 10 to 15 % of the installations would be in operation (battery changing being one of the main irritants, electronics – the other).

On the other hand, if the units generated are measured and pumped into the system and the units are paid for, they ensure:

- Income to the consumer.
- Accountability as, the flow of revenue to the consumer leads to incentives.

The utility installed meter is a legal instrument and therefore acceptable to all role players.

The units accrue revenue to the utility at a rate of Rs 9.3 around. Taking the accrual to the SPV unit as Rs 7 (after retaining the rest for handling charges by the utility), the final payment to the SPV unit can be Rs 7 and APPC (Andhra Pradesh) of Rs 3.50 making a total of Rs 10.50 per unit. All these prices are already agreed to by the Regulators.

The inverter part acts as a standby for power shortages. Once, a sunlight sensor is installed, the inverter can be programmed to switch on the power to the house only after 6 pm so that, the peak evening load can be reduced and the consumer will be happy to get uninterrupted supply in the evening hours. During the evening hours of 6 to 9 pm, the consumer has 2 LED's and one standby fan working for him apart from the other points in the house so that, even if power is not available in the evening hours, he still gets the comfort of lighting and a fan.

In short, the approach suggested:

- Providing a SPV home lighting system of 100 wp with a C10 battery and inverter
- The inverter having a sun light sensor that starts the supply at 6 pm
- Providing 2 LED bulbs and one Energy Efficient solar stand fan free of cost to the consumer
  - Will instantaneously save 80 Watts or, Rs 4800 in investment on new Generation and Transmission,
  - Will reduce evening peak on the system,
  - Will provide evening lights and fans to the consumer in the villages.

MIDEL®

Synthetic Ester Natural Ester

We can help you make the right choice for your project

MIDEL 7131 synthetic ester and MIDEL eN natural ester are the world's leading ester-based transformer dielectric fluids.

MIDEL 7131 synthetic ester offers increased fire safety, environmental protection and could extend asset life by at least 5 times longer than mineral oil. It is suitable for breathing and sealed systems and very cold climates.

MIDEL eN natural ester is made from 100% renewable vegetable oil and offers similar protection to MIDEL 7131 but it is only suitable for sealed systems and temperate locations.

t: +91 (0)11 6517 7114 -16 **f:** +91 (0)11 4104 7850
e: midelsales@mimaterials.com **www.midel.com**

M&I MATERIALS APIEZON METROSIL MIDEL WOLFMET

S. No.	Item	With SPV (A)	Without SPV (B)	Remarks
1	Effective cost per system to the consumer	Rs. 16200 (source: http://www.thriveenergy.co.in/subsidy-schemes/mnre-nabard-solar-home-lighting)	Rs 12,690 (source: http://www.inverterprice.in/luminous-ion-300va)	SPV system is for 5 hr. loads a day. The inverter system referred to meets only 3 hrs standby only.
2	Battery life	5 to 6 years as C10 batteries suffice with energy efficient loads	3 years with C20 batteries	The battery in (A) lasts 3 yrs. on the average while in the case of (B), it lasts 6 to 8 yrs.

Table 4: Comparision of Inverter Battery Combine with and Without SPV Middle Income Group, Comfortable Living TI 100: 100 W, 120AH Battery, 300 VA Solar Inverter Load 60Watts

In addition, the recurring saving in units work out to a huge sum of over Rs 12000 per unit installed over the life of the LEDs and SPVs.

This approach – which does not need any policy modifications and the only requirement would be for metering the SPV output and pumping the units into the network, triggers a massive uptake of the Solar Home Lighting systems to the advantage of the new states like Telangana and, to the Nation.

Suggested Implementation Plan

Inveter – Battery Combine for Evening Power

The Governments like Telangana, should come forward to encourage private investors to install Inverter and Battery combines by giving a subsidy of Rs 1000 per unit so that, they can formulate bankable projects for installation of such units in rural households. The consumer would have to make an upfront payment of say Rs 800 per month and monthly payments of about Rs 250 for a three year period for the purposes of financial viability to the investor.

SPV – Inverter – Battery Combine with Energy Efficient Lights and Fans

Likewise, the Government should announce a system of purchasing power from the SPV household units at a rate of Rs 7 towards REC and Rs 3.5 as APPC so that, the SPV household system program becomes a bankable proposition.

S V R Rao

who retired as GM, REC; President, Society of Power & Telcom Professionals, Hyderabad; Director Power, CBIP; was a consultant to the World Bank, USAID, DFID; and Srinivasa Molupalli who is, MTech (chemical), Certified Energy Auditor, BEE India; Director Ecospace Green Solution Pvt Ltd. He is member of Society of Power & Telcom Professionals and Life member IAEMP.

Profile

When You Test, Use the Best

5th Generation Digital Power Meters

WT310 / WT330

Powerful Tool for Designing Energy Saving Products

No Need to Choose. WT Tests it all!

Product Efficiency
Engineering
Research & Development
Inverters
Variable Frequency Drives
CFL & Electronic Ballasts
UPS Systems
Transformer
Low Power Consumption Devices

LCA by YOKOGAWA

Precision Makers

The World's most trusted measurement partner

YOKOGAWA ◆
Test&Measurement

For further information, please contact:

Yokogawa India Limited
Plot S6, Electronic City
Hosur Road, Bangalore - 560 100
Tel: 080-41586000 Fax: 080-28528656
Email: tmi.india@in.yokogawa.com
Web: www.tmi.yokogawa.com

tmi.yokogawa.com

Smart Grid Technology

Particular Reference to Indian Power System

Smart Grid is adding necessary measuring, monitoring, communication, analysis and control capabilities to bring efficiency and optimization in electricity sector by integrating IT Technology onto the power network.

A full Smart Grid will encompasses all aspects of the power sector value chain, from What is Smart Grid? Generation, transmission, distribution to consumption.

Outlines of Presentation

- Indian Power System – An overview
- Smart Grid
- Drivers for Smart Grid
- Present Initiatives
- Smart Grid Pilots
- Smart Meter
- Immediate Way Ahead.

Indian Power Sector – An Overview

- Peak demand – 130,000 MW app.
- Installed capacity – 210,937 MW
- Economy to grow @ 7-8% p.a.
- Power sector to Grow @ 10%

Indian Power Sector

India can certainly use solar energy, as capital goods prices fall. Solar photo-voltaic provides DC power for about six hours a day

Projected Power Scenario

- Per capita consumption for 2011-12– approx 820 kWh/annum.

Components of Smart Grid

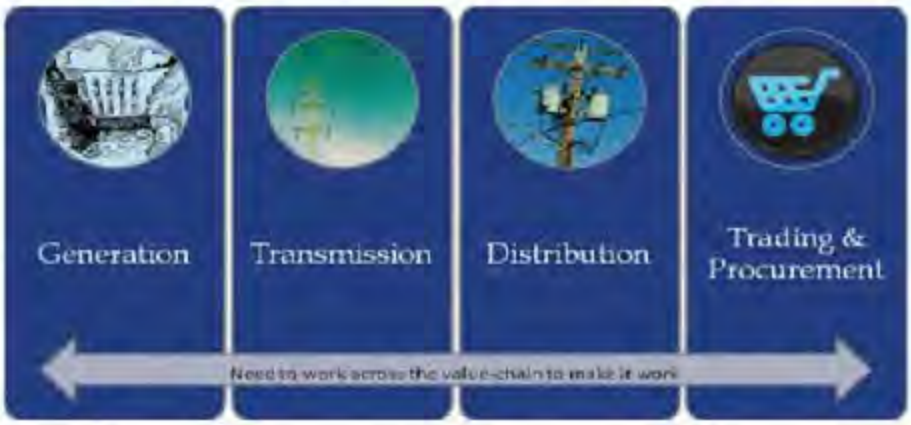
- Transmission and Distribution Automation
- Renewable Integration
- Demand Participation
- Small appliances / EV/ Storage
- Distributed Generation & Storage
- Energy Efficiency
- System operation.

Renewable Energy sources (RES)

- High Potential
- Perennial energy source
- Lower reliance on imported fossil fuels
- Lower CO_2 emissions
- Wind power to contribute 74%.

Sun shines brightly over India

- India can certainly use solar energy, as capital goods prices fall. Solar photo-voltaic provides DC power for about six hours a day.
- Rs 100 per Wh capital cost: with 10% interest and payback in 20 years, amounts to Rs 12 per year(not computing costs of land).



Amongst five largest in world		
Source	Potential (MW)	Achieved (MW)
Bio-mass	62,000	866
Wind-power	45,000	11,807
Small Hydro-power	15,000	2,735
Co-generation - Bagasse	5000	1334
Waste to energy	5000	65
Rural Distributed Power	30,000	405
Captive Distributed: industrial / commercial	20,000	
Total	182,000	17,222
Solar Power	4-7 kWh/sq m/day	10

- Costs a little over Rs 7.25 / kWh assuming 10% losses
- As opposed to Rs 3 to 5 per kWh for grid power.

If not used immediately, would require feeding to grid.

- DC to AC conversion loss + grid T&D losses
- Expensive energy being wasted Or Energy Storage Systems Just like several other renewable energy solutions like wind-power, power from ocean-waves
- Off-grid (local usage) in day-time would make a lot of sense.

Decentralized Solar PV

- Would be ideal in day time
  - To complement grid
  - Direct usage in offices / shopping malls can reduce the day time peak load requirement to a considerable extent
  - Some coupling to ice-battery (charged during off-peak hours)
  - Makes economic sense today, provided there is space for solar PV installation
  - Some solar PV / solar thermal feeding to grid would be helpful
  - What about evening peak loads?
  - Solar can not help here
  - Reducing load by enhancing efficiency
  - Reducing consumptions by introduction of time of day metering
  - Using some storage (electrical / ice-battery – charged during 5 PM to 7 PM).

Integration of Electric Vehicles

Electric vehicles will become an integrated part of smart grid: they will act both as mobile consumers & electrical storage possibilities.

The charging infrastructure for electric vehicles will have to comply with certain technical requirements. Indeed, an intelligent connection between the grid and the car is necessary to smoothly integrate the additional loads into the distribution networks, while coping with an increasing share of intermittent and decentralized renewable energy sources.

Latest Technology to be used for Smart Grid

- Use of Superconductors for transmission lines, Transformers, Generators, HT Cables – Nano materials going to play a major role.
- The sophisticated revenue models they will employ to shape customers' behavior.
- Easy-to-install, low-cost sensors to measure energy use with high resolution
- Networked power electronics for everything from solid state; New Technology development opportunities, lighting to solar micro-inverters.
- Grid-scale electricity storage to buffer transients in supply and demand.
- Electrified-vehicle infrastructure including batteries and charging stations (Few MW).
- Universal Remote Control to a Set-top Box which includes Home Control.
- Fuel Cell.

Challenges to be tackled While Designing Smart Grid

- Financial Resources
- Government Support
- Development of compatible Equipment
- Speed of Technology Development
- Policy and Regulation to be framed
- Cooperation between different entities.

Drivers for Smart Grids in India

- T&D loss reduction and efficiency improvements: Transmission & Distribution network losses (including commercial) is around 27% /year revenue losses to utilities through smart metering, modernization of lines and substations, automated systems)
- Access to energy for the masses: About 20% rural households do not have access to power. Govt intend to electrify 100% households in next 5 years through micro-grids, rooftop solar)
- Renewable integration to grid: Central theme of government is low carbon development. Several initiatives being taken to increase the share of renewable in energy mix.
- Peak load management: Demand response for high volume consumers and micro grids for groups of consumers with captive generation facilities that can island during peak hours; enhancement in energy efficiency and other demand side management programs
- System improvements: Reduction in outages/power cuts, improvements in reliability and quality of supply
- Customer service: Improved customer service
- Infrastructure for electro-mobility: 6 million EVs expected by 2020.

Salient Features of Smart Grid

- Self healing: The grid has the ability to rapidly detect,analyze, respond and restore from disturbances;

Since 1961

The Subscription In-charge
Electrical India
Chary Publications Pvt. Ltd.
201, Premalaya, Next to Cafe Coffee Day,
Opp. Telecom Factory, Deonar, Mumbai - 400 088.
Email: sub@charypublications.in

If You are already a Subscriber
Enter the Subscription No. EI/SUB/ ☐☐☐☐☐

Yes, I would like to subscribe **Electrical India** for.....years
at Rs..... (US $.....overseas subscribers)

Payment details :
Cheque / DD No.....Dated.....
Drawn on Bank.....Branch.....
In favour of **CHARY PUBLICATIONS PVT. LTD.**

Or charge my ☐ MasterCard ☐ VISA For Rs.....

CARD No. ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐

CARD EXPIRY DATE: ☐☐ ☐☐☐☐ (M M Y Y Y Y)

Date of Birth ☐☐ ☐☐ ☐☐☐☐ (D D M M Y Y Y Y)

Name.....

Signature.....

Designation.....

Company.....

Address.....

.....

City.....PIN ☐☐☐☐☐☐

Tel.....

Email.....

No. of Years	Amount	US $	Tick ✓
☐ 1 (12 issues)	1000	200	
☐ 2 (24 issues)	1750	350	
☐ 3 (36 issues)	2500	625	
☐ 5 (60 issues)	4000	900	

(Kindly add Rs. 50/- for Non-Mumbai Cheques)

Now SUBSCRIBE/RENEW Online Just Log on to www.electricalindia.in

EI \ January 2015

Lighting India
Bi Monthly

The Subscription In-charge
Lighting India
Chary Publications Pvt. Ltd.
201, Premalaya, Next to Cafe Coffee Day,
Opp. Telecom Factory, Deonar, Mumbai - 400 088.
Email: sub@charypublications.in

If You are already a Subscriber
Enter the Subscription No. LI/SUB/ ☐☐☐☐☐

Yes, I would like to subscribe **Lighting India** for.....years
at Rs..... (US $.....overseas subscribers)

Payment details :
Cheque / DD No.....Dated.....
Drawn on Bank.....Branch.....
In favour of **CHARY PUBLICATIONS PVT. LTD.**

Or charge my ☐ MasterCard ☐ VISA For Rs.....

CARD No. ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐

CARD EXPIRY DATE: ☐☐ ☐☐☐☐ (M M Y Y Y Y)

Date of Birth ☐☐ ☐☐ ☐☐☐☐ (D D M M Y Y Y Y)

Name.....

Signature.....

Designation.....

Company.....

Address.....

.....

City.....PIN ☐☐☐☐☐☐

Tel.....

Email.....

No. of Years	Amount	US $	Tick ✓
☐ 1 (6 issues)	750	150	
☐ 2 (12 issues)	1350	275	
☐ 3 (18 issues)	2000	500	
☐ 5 (30 issues)	3000	700	

(Kindly add Rs. 50/- for Non-Mumbai Cheques)

Now SUBSCRIBE/RENEW Online Just Log on to www.lightingindia.in

EI \ January 2015

NEPTUNE
MARK THAT CARRIES POWER

Personifying Energy Saving & Power Quality Management

NEPTUNE (INDIA) LTD.

Corporate & Mktg. Office:

Neptune House, A11, IInd Flr., Sector 59, Noida-201301 (INDIA)
Tel.: 0120-4205900 / 4297900 & 9871234349
E-mail: enquiry@neptuneindia.com

www.neptuneindia.com

- Tolerant to attack: The grid should be resilient to physical & cyber security attacks;
- Provide quality power required by users;
- Accommodate various generation options, including green power;
- Allow competitive electricity markets;
- Use IT for monitoring and minimize O & M costs;
- Empower the consumer and incorporate consumer equipment and behavior in operation and design of the grid.

Overview of Smart Grid Technology

- Detect and address emerging problems before they impact service;
- Respond to local and system-wide inputs & know much more without broader system problems;
- Incorporate extensive measurements, rapid communications and feedback controls that quickly return the system to a stable state after interruptions or disturbances;
- Automatically adapt protective systems to accommodate changing system conditions;
- Reroute power flows, change load patterns, improve voltage profiles and take other corrective steps within seconds of detecting a problem;
- Enable loads and distributed resources to participate in operations;
- Be a grid that is self-healing and adaptive, interactive with consumers & markets,more secure from attacks, accommodate all generation & storage options, accommodate bidirectional energy flow for net metering and predictive rather than just reacting to emergencies.

Smart grid requirements

- Network planning
- Power electronics (HVDC/FACTS)
- Bulk renewable integration
- Energy Management System (EMS)
- Smart substation automation and protection
- Integrated Substation Condition Monitoring (ISCM)
- Communication Solutions
- Distribution Management System (DMS)
- Distribution automation and protection
- Distributed Energy Resources (DER)
- Decentralized Energy Management System (DEMS)
- Smart metering solutions.

Network planning

A comprehensive strategy for building Smart Grids is necessary – including the part of the network that addresses power supply systems. The foundation for designing an efficient Smart Grid is a detailed analysis of the system's required performance.

The solution will integrate the most innovative technologies for power generation, transmission, distribution and consumption, while taking into account each system's individual history and current condition.

Power electronics (HVDC/FACTS)

Power electronic solutions for High Voltage Direct Current transmission (HVDC) & Flexible Alternating Current Transmission Systems (FACTS) address the greatest challenges in power transmission.

Reinhausen solutions for optimized High-voltage Direct Current Transmission (HVDC)

FACTS devices can significantly increase the power transmission capacity of existing alternating current (AC) systems and extend maximum AC transmission distances by balancing the variable reactive power demand of the system.

Reactive power compensation is used to control AC voltage, increase system stability, and reduce power transmission losses.

Bulk renewable integration

In order to begin fulfilling the climate protection requirements of 2020, we need to use energy efficiently and reduce CO_2 emissions. Power generation needs to change accordingly.

Solutions for Renewable Energy Integration (S&C)

Energy Management System (EMS)

At power plants, the focus is on ensuring reliable supply, using generation resources efficiently, and reducing transmission losses.

As Energy Management System (EMS) handles these by balancing the demands of the transmission system, generating units, and consumption. Intelligent Alarm Processors (IAPs) reduce the critical time needed to analyze faults in the grid and take corrective action, as well as the risk of incorrect analysis.

Transient and lightning protection systems

Your effective protection against surge voltages and lightning strikes

- Surge protection energy technology
- Surge protection, photovoltaics
- Surge protection device for data and information technology
- Protection and spark gaps
- Equipotential bonding systems
- Earthing systems
- Interception and arrestor systems
- Insulated lightning protection and OBO IsCon® system

External lightning protection

Air termination > Down conductor > Earthing

Surge Protection

Power line > Telecommunication > Data line

OBO BETTERMANN India Pvt. Ltd.
A51, SIPCOT Industrial Growth Centre,
Oragadam, Sriperumbudur Taluk,
Kancheepuram - 602 105,
Tamilnadu, India
Tel: + 91 44 710 33 800/01/02
Fax: + 91 44 710 33 999
Email: sales@oboindia.com

OBO BETTERMANN

THINK CONNECTED.

Smart substation automation and protection

The automation & protection of substations must be enhanced to securely meet the extended requirements of future Smart Grids. The substation is in the process of becoming a node on the utility IT network for all information from the distribution substation to the customer.

For example, data from the feeder automation units, power quality, meters, decentralized energy resources and home automation systems will be collected and analyzed to improve the system.

Integrated Substation Condition Monitoring (ISCM)

Integrated Substation Condition Monitoring

A modular system for monitoring all relevant substation components, from the transformer and switchgear to the overhead line and cable. Based on known, proven telecontrol units and substation automation devices, ISCM provides a comprehensive solution perfectly suited to substation environments.

Distribution Management System

It integrates seamlessly into the existing communication infrastructure so that monitoring information from the station and the control center is displayed.

Communication Solutions

Telecommunication systems for power grid transmission have a long history in the utility industry. In today's transmission grids, almost all substations are integrated into a communication network that allows online monitoring and controlling by an Energy Management System (EMS).

An important element in creating and operating Smart Grid is comprehensive, consistent communication using sufficient bandwidth & devices with IP/Ethernet capability.

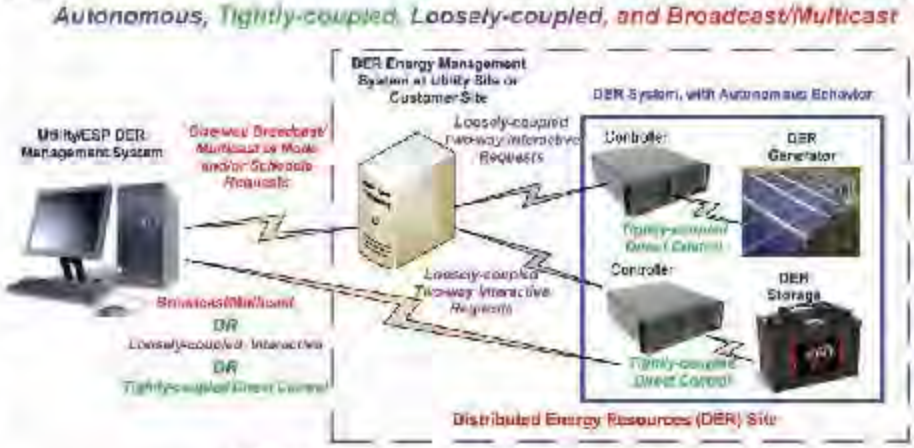
Networks of this kind must eventually extend all the way to individual consumers, who will be integrated into them using smart metering. Consistent end-to-end communication helps meet the requirement for online monitoring of all grid components and, among other things, creates opportunities to develop new business models for smart metering and integrating distributed power generation.

Distribution Management System (DMS)

Power Distribution Management System (DMS) will create a smart, self -healing grid by providing the following enhancements:

- Reduction of the occurrence and duration of outages through the application of advanced fault location and network reconfiguration algorithms.
- Minimization of losses through improved monitoring.
- Optimized utilization of assets through management of demand and distributed generation.
- Reduction of maintenance costs through online condition monitoring.

The smart management of power distribution grids is one of the key success factors for achieving ambitious Smart Grid goals.



DER Management: Interactions between Components

Differnt configauration for managing DER

Distribution automation protection

The following levels of distribution automation can serve as a roadmap for grid upgrades moving toward the implementation of a Smart Grid.

Local Automation (without communication)

- Sectionalize (automated fault restoration by using switching sequences)
- Voltage regulator (automated voltage regulation for long feeders)
- Reclose controller (auto-reclose circuit breaker for overhead lines).

Control, monitoring, and automation (two-way communication to distribution substation or control center)

Distribution Automation RTU (DA – RTU) with powerful communication and automation features applicable to Smart Grid functions, for instance:

- Automated self -healing routines
- Node station for power quality applications
- Data concentrator for smart metering systems
- Node station for decentralized power generation
- Node station for demand – response applications.

Distributed Energy Resource (DER)

Integration of distributed energy resources (DER) calls for a completely new concept: the virtual power plant. A virtual power plant connects many small plants that participate in the energy market in a completely new way.

Linked together in the network, the power plants can be operated even more efficiently and therefore more economically than before, benefiting the operators of decentralized generating facilities.

Decentralized Energy Management System (DEMS)

DEMS, the core of the virtual power plant, is equally appropriate for utilities, industrial operations,

DEMS uses three tools to optimize power:

- Predictions,
- Operational planning
- Real-time optimization.

Smart metering solutions

Automated Metering & Information System

BETAflam® Solar

Clean cables for clean energy

NEW TÜV 1500 V

BETAflam® cables are halogen-free, flame retardant and electron-beam cross-linked. With TÜV/cTÜVus approval and UL listing as "PV wire".

NEW BETAflam® Solar 125 flex UL 1000V / TÜV 1500 V DC approved.

LISTED

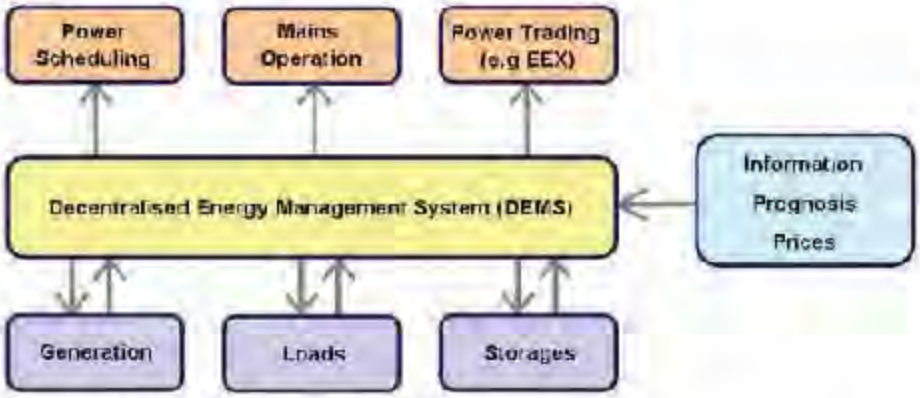
TÜV Rheinland Product Safety

The Quality Connection

LEONI
www.leoni.com

Brinder Gandhi
Sales & Business Development Manager

LEONI Cable Solutions (India) Private Limited
Indospace Rohan Industrial Park, Gut No. 428, Village Mahalunge,
Off Chakan Talegaon Road, Taluka: Khed, District: Pune, Pin - 410 501, India
Mobile: +91 84 11 966 236, Phone: +91 2135-391625
e-mail: brinder.gandhi@leoni.com <mailto:brinder.gandhi@leoni.com>



Decentralized Energy Management Systems (DEMS)

(AMIS) records the power consumption of each individual consumer over time, and in turn, consumers are given detailed information about their power consumption.

India Smart Grid Task Force (SGTF) is formed, which is an Inter-Ministerial Group and will serve as a focal point for activities related to the smart grid technology. Sam Pitroda, Advisor to PM on Public Information Infrastructure and Innovation is the Chairman for Task Force.

A.B.C. Hydro smart meter, which uses short bursts of radio waves to communcation with the electricity grid

Experts estimate that the use of smart meters can save up to ten terawatt-hours of electricity, or almost two percent of total energy consumption

Smart Grid Roadmap for India

Vision: Transform the Indian power sector into a secure, adaptive sustainable and digitally enabled ecosystem that provides reliable and quality energy for all with active participation of stakeholders. In order to achieve this vision a forum and task force is formed in India

India Smart Grid Forum (ISGF), which is a non-profit voluntary consortium of public and private stakeholders, was launched on 26th May 2010.

In order to achieve this vision, stakeholders are advised to formulate state/utility specific policies and programs.

Distribution

- Appropriate policies and programs to provide access to electricity for all with uninterrupted life line supply (8 hours/day minimum, including the evening peak) and electrification of 100% households by 2017.
- Availability of an indigenous low cost smart meter by 2014.
- Development of Micro grids, storage options, virtual power plants (VPP), solar photovoltaic to grid (PV2G), and building to grid (B2G) technologies in order to manage peak demand.
- Policies for mandatory roof top solar power generation for large establishments, i.e., with connected load more than 20kW.
- EV charging facilities may be created in all parking lots, institutional buildings, apartment blocks. Micro grids in 1000 villages/industrial parks/commercial hubs by 2017 & 10,000 villages/industrial parks/ commercial hubs by 2022, which can island from the main grid during peak hours or grid disturbances.
- Optimally balancing different sources of generation through efficient scheduling and dispatch of distributed energy resources (including captive plants in the near term) with goal of long term energy sustainability.

Transmission

- Development of a reliable, secure and resilient grid supported by a strong communication infrastructure by 2027.
- Implementation of Wide Area Monitoring Systems (WAMS, using Phasor Measurement Units, or PMUs) for the entire transmission system.
- Setting up of Renewable Energy Monitoring Centre's (REMCs) and Energy Storage Systems to facilitate grid integration of renewable generation.
- Enabling programs and projects in transmission utilities to reduce transmission losses to below 4% by 2017 and below 3.5% by 2022.
- Implement power system enhancements to facilitate evacuation and integration of 30 GW renewable capacity by 2017, 80 GW by 2022, and 130 GW by 2027.
- 50,000 Kms of optical fiber cables to be installed over transmission lines by the year 2017 to support implementation of smart grid technologies.

Policies, Standards and Regulations

- Formulation of effective customer outreach and communication programs for active involvement of consumers in the smart grid implementation.
- Development of state/utility specific strategic roadmap(s) for implementation of smart grid technologies across the state/ utility by 2014.

- Policies for grid-interconnection of captive/consumer generation facilities (including renewable) where ever technically feasible; policies for roof-top solar, net-metering/feed-in tariff; and policies for peaking power stations by 2014.
- Policies for energy efficiency in public infrastructure including EV charging facilities by 2015 and for demand response ready appliances by 2017. Relevant policies in this regard to be finalized by 2014.

Other Initiatives

- Tariff mechanisms, new energy products, energy options and programs to encourage participation of customers in the energy markets that make them "prosumers" – producers and consumers – by 2017.
- Create an effective information exchange platform that can be shared by all market participants, including prosumers, in real time which will lead to the development of energy markets.
- Investment in research and development, training and capacity building programs for creation of adequate resource pools for developing and implementing smart grid technologies in India as well as export of smart grid know-how, products & services.

Conclusions

In the coming years, many distribution systems will not resemble the distribution systems of today. These systems will have advanced metering, robust communications capability, extensive automation and distributed generation. Through the integrated use of these technologies, smart grids will be able to operate, provide high degree of reliability & power quality.

There will also be muti-directional power flow possible, increased equipment utilization & more importantly, the customers will be offered a variety of services possibly at lower costs.

Intelligent or Smart grids, the vision unfolded, would soon becomes a reality in a couple of years. Increasing energy demands, depletion of natural resources, effect of carbon emissions, need for a sustainable environment together with changing life styles requiring increased automation, make smart grids an inevitable option of the future.

The only viable way to realize an extensive smart grid is to develop a vision for the ultimate design of a smart grid and then make short term decisions that incrementally transform existing distribution systems into this future vision.

Profile

Robbin Pramanick

BE Electrical from Jadavpur University, Kolkata., MBA from Karnataka Open University, has about 35 years of experience in different industries like Coal India Limited, Ferro alloys Corporation, Tata Sponge Iron Limited as Sr.Divisional Manager etc. Presently he is working in WESCO ,orissa as Chief Project Officer and has published articles in Technical Journals

Standby Diesel Generator Sets

Issues related to Selection/ Sizing, Installation, Operation & Maintenance

India is world's fourth largest growing economy. Our currently available power capacity is approximately 40% short of total demand. As a result the State Electricity Boards have to control the power distribution by imposing 'Load Shedding' to Industrial, Commercial and Residual consumers in a phased manner. For sustainable development, the growth in power demand will be never ending.

S N Chavan

Under the prevailing scenario, the Industries especially, continuous process industries; Commercial organizations like Data Centres and Call Centres/BPO's etc, have to rely on a dependable Back-up power sources. For short time, back up U.P.S. with batteries are useful. For long time and heavy block loads UPS are not useful. Though, Natural-Gas, Fuel cells & the renewable power sources such as Solar, Wind etc, are available for giving power back-up but due to their non-availability on 24x7 basis all-round the year, most of the Industries & Commercial organizations mostly rely on Diesel Generator sets due to easier availability of diesel at most of the places, their comparatively quick starting, there acceptability of large block loads, their effective speed/frequency /voltage regulation with load changes etc. However, where instantaneous load transfer is needed they can not replace the UPS systems as the DG sets need minimum 30 seconds to start and deliver power at the desired voltage & frequency.

Selection/Sizing of DG Sets

Environment/Site conditions impact the diesel Engine and consequently DG set performance. Various factors which impact the Selection/Sizing of the DG sets are: Altitude, Heat, Humidity, Dust and Corrosive Surrounding etc.

Altitude

As the altitude increases the air density lowers. DG set needs clean & dense air for efficient combustion of fuel. Generators to be installed at an altitude above 1000 mtr. needs to be de-rated by 1% for every 100 mtr or 328 ft. above 1000 mtr above mean sea level.

Heat

Generators are normally designed for ambient temperature of 40^{O}C OR 104^{O}F. When ambient temperature is more the DG set needs to be de-rated as per manufacturers specification manual.

Humidity

In a highly humid environment, there is a possibility of condensation which adversely affect the DG performance. In such a site use of space heaters for prevention of condensation is desirable.

Dust

Metallic dust like cast iron dust, sand, graphite powder, coke & lime dust, quarry and wood fibre etc, types of dust which may be drawn in to DG set by the ventilation fans may cause flash-over inside DG set Alternator.

> *In DG set the capacity of diesel Engine should be always 10 to 20% more than max. load to which it is designed. Diversity factor of load will determine the optimum size of DG set.*

Corrosive Surrounding

Salt and other corrosive elements may damage Alternator winding insulation. For such atmosphere additional coating of insulation during manufacture & epoxy compound as a final overcoat is essential.

For Right Sizing of the DG set there is need to know-

- The total wattage of the equipment,
- Block load requirement,
- Starting/Surge current,
- Type of load i.e Inductive/Capacitive/ Resistive etc.

Apart from these factors we have to take in to consideration the projected expansion of the organization. Depending upon the projected growth, availability of space etc, a judicious decision whether to install a higher capacity of a DG set OR to install 2 smaller sizes of DG sets needs to be taken. In this connection it may be noted that at lighter load the DG set consumption is more as compared to when it is loaded up to around 80%. Secondly, if the DG set is always operated at load lower than 30% it adversely affects its overall performance especially the normal useful life. When two generators are planned & installed they can be operated independently i.e. one for critical load & other for non critical load OR one for critical load and other as a hot Standby for redundancy. Or the two DG sets can be operated in parallel load sharing mode etc. In DG set the capacity of diesel Engine should be always 10 to 20% more than max. load to which it is designed. Diversity factor of load will determine the optimum size of DG set. In case of DG set for industries the quantity & ratings of motors with their starting methods and largest size motor, influence the Right sizing of the DG set. As per C.P.C.B. norms the DG sets up to 1000 KVA rating had to supplied with enclosures complying with noise control norms.

When Right Sizing of DG Set Is Done We Get Following Advantages:

- No unexpected system failure
- No shutdown due to capacity overload
- Increased longevity of the generator
- Guaranteed performance
- Smoother and hassle-free maintenance
- Increased system life span
- Assured personal safety.

Basic Components of a Standby DG Set

A Standby Diesel Generator consist of following main parts

- Engine
- Alternator
- Diesel Tank & Fuel System
- Automatic Voltage Regulator
- Cooling& Exhaust System
- Noise Level
- Battery & Battery Charger System
- Speed Governor
- Engine Control Panel
- AMF Panel
- Synchronization panel for parallel operation of 2 or more DG sets etc.

Engine & Alternator

There are several reputed manufacturers of Diesel Engines and Alternators. A right combination of Diesel Engine and matching Alternator based on the basic points given earlier will create a best Diesel Generator set satisfying our emergency/standby power need. As per ISO-8528 (Part-1) clause 13.3.2 the DG set engine/prime mover shall be rated at 0.85 load factor. A horizontal foot mounted, self excited, screen protected, self regulated brushless alternator having single/double bearing construction (Depending upon capacity) and having a rating of 1ph /3 ph. 230/415 V (depending on 1/3 ph), 50Hz, 0.8 p.f. with self ventilated SPDP enclosure, F/H class insulation designed for max. ambient temp. of 40^{O}C & having an overload capacity of 10% for one hr within 12 hr of continuous use are recommended.

Diesel Tank & Fuel system

Based on the capacity of DG set there is pre-determined fuel consumption /hour which is

given in the manufacturers instruction manual. However, based on the period of power failures and business need the capacity of tank may be decided. Another deciding factor is availability of space. For deciding fuel tank capacity following points need consideration:

- **Emergency Stock:** How much fuel you need to store for utilization considering delay in supply of diesel.
- **Lead Time for Supply:** Lead time needed to procure the diesel from the outlet and the time taken for transportation of the same to the site.
- **Lead Time Stock:** Requirement of diesel for operation of generator during lead time.

Minimum Storage Tank Capacity = Emergency Stock+ Lead Time Stock.

Normally all DG set manufacturers provide a diesel tank of capacity up to 990 litres (day tank) depending of DG set capacity. For storage of higher quantity we have to obtain necessary approvals from Statutory Authorities. There are three types of storage tanks:

- **Sub-Base Storage Tank:** As the name indicates it is a tank above ground but below the DG set. It has a double walled tank constructed by using heavy gauge welded steel to prevent spillage in case of leakage. Accessories such as air vent, pressure relief wall high low fuel alarm etc. need to be provided.
- **Underground Diesel Tank:** Depending upon the criticality of load & Business Continuity & based on the total load requirement and number of DG set installation and the minimum storage to be kept etc, the capacity of underground tank needs to be decided. Permissions/ Approvals from various statutory authorities such as local Municipality, Fire brigade, Police, Department of Explosives etc is needed. These tanks are either made of heavy gauge welded steel Or of special grade Fibre glass.
- **Above Ground Diesel Tank:** These are used where large number of big DG sets are used and their type and construction & Approvals/permissions needed are similar to Underground Disel tank with some additional safety precautions.

Automatic Voltage Regulator (AVR)

Main function of AVR is as under-

- To automatically control the DG output voltage accurately in response to slow changes in power Or reactive VAR demand Normal Voltage regulation has to be plus-minus 1%.
- To limit the magnitude of voltage excursion in response to sudden changes in load
- To maintain steady state stability
- To ensure transient stability in response to system faults.

Cooling & Exhaust System

DG Sets which are of smaller capacity are normally air-cooled. DG sets are usually designed for ambient temperature of 40^{O}C. Medium and higher ratings are usually water-cooled. Care has to be taken to ensure that atmosphere surrounding the radiator is not dusty to prevent clogging of radiator. It is mandatory to have proper cross ventilation for DG set. Enclosure temperature should not be more than 5^{O} above ambient Exhaust piping is normally made of M.S pipes. It is usually cladded with 50 mm thick loosely bound Resin mattress/Mineral wool/Rockwool of density not less than 120 kg/sq.mt. and Aluminum cladding of 6 mm thick. Exhaust system should create minimum back pressure. Exhaust outlet should be in the direction of wind A silencer provided in exhaust piping and its location from engine have a direct effect on the noise level. A silencer located as close to the engine minimizes noise level. Different types of silencer such as industrial, residential, hospital grade are used depending upon the noise suppression level to be achieved. As per C.P.C.B. norms the exhaust stack height of DG set up to 1000KVA should be as follows:

H = h + .2 X Sq. root of KVA

where H = Total Exhaust Pipe stack height.

h = Building height.

For DG set of capacity more than 1000 KVA the exhaust pipe height shall be 30 mtrs or 3 mtrs above building height whichever is higher. A rain cap has to be provided at the end of pipe. Distance between rain cap and exhaust pipe should be more than diameter of exhaust pipe.

Noise Level

DG set should be provided with integral acoustic enclosure at manufacturing stage itself and maximum permissible sound level for the DG set up to 1000 KVA rating as per C.P.C.B. guidelines should not exceed 75 dB at a distance of 1 metre from the enclosure surface. In case of DG sets which are not covered by above norms the noise level has to be controlled by providing an acoustic enclosure or by treating room acoustically. They should be designed for a minimum 25 dB insertion loss. Measurement of insertion loss may have to done at different points at a 5 metre from acoustic enclosure / room and then averaged. DG set should be provided with proper exhaust muffler with insertion loss of minimum 25 dB.

Battery & Battery Charger

Since Diesel engines need high initial starting current for cranking, the Industrial Lead Acid 12 volt batteries of high AH value are normally needed. Depending upon the capacity of the DG sets the quantity & AH values of industrial type Lead Acid batteries normally recommended by manufacturers is as under:

DG set of capacity up to 25 KVA	1 No of 12 Volt 88AH capacity
DG set of capacity 25 to 62.5 KVA	1 No of 12 Volt 120 AH
DG set of rating 62.5 to 82.5 KVA	1 No of 12 Volt 150 AH
DG set of rating 82.5 to 500 KVA	1 No of 12 Volt 180 AH
DG set of rating 500 KVA & above	2 No of 12 volt 180 AH capacity

For battery charging a static battery charger is recommended. Depending upon the capacity of DG set suitable current rating of charger is selected. Normally 3 attempt starting setting is preferred for engine starting with a sequence of 6 seconds ON and 5 seconds Off cycle. If engine does not start even after 3 attempts it is normally locked out by Master timer and a time re-adjustment between 1 To 10 seconds is to be made before making another attempt. If engine does not start even after 4th attempt there is a need to investigate the problem otherwise the battery will drain off completely and we may have to wait till it is fully charged Or replaced depending upon the investigation.

TDK

Superior Solutions for
Reactive Power Compensation.

Power factor correction system with filter circuit reactors for reduction of harmonics.

EPCOS

EPCOS PFC capacitors

- SquareCap: ND, HDLL, SHD
- PhiCap: ND, HD
- PhaseCap: Gas-filled
- APP: LV, MV

EPCOS key components

- PF controllers
- Capacitor contactors
- Thyristor switching modules
- De-tuned filter reactors

EPCOS India Pvt. Ltd. • A Member of TDK-EPC Corporation • www.global.tdk.com

Mumbai: 022-2575 0800 • Noida: 0120-450 5801 • Kolkata: 033-2419 8815 • Bengaluru: 080-4039 0640 • sales.in@epcos.com

Speed Governor

For DG sets of capacity up to 200 KVA mechanical governors of A2 class are used. As per ISO 3046/BS 5514 Electronic governors of A1 class with actuator shall be provided. Governor shall be self contained unit capable of monitoring the speed.

Engine Control Panel

DG set control panels are of Analogue OR digital type. However, now a days Digital control panels are preferred. Digital control panels are highly integrated and report real time status of all aspects i.e. fuel, engine oil, coolant levels, engine temperatures, battery status, transfer switch status, accurately and simultaneously. This helps the operator in monitoring the engine to get overview of entire system 7 to locate/ identify any problem through B.M.S. in control room. Some digital control panels have a built in redundancy allowing continual system function in case of failure of a component or a part of control circuit. They have a capability to increase engine efficiency & reduce exhaust emission by providing correct rate of fuel to engine etc.

AMF & Synchronization Panel

AMF panel is normally fabricated out of 1.6mm thick sheet steel. It has to be totally enclosed, dust-damp and vermin proof, free standing, floor mounted and front operated type. It should be compartmentalized/ sectionalized. All indication lamps and meters are flush mounted in front cover panel. As per ISO 2147 the panel shall have IP-42 type protection. The A.M.F. panel normally consists of relays, contactors, timers for Automatic operation on Mains failure as well as for manual operation. In addition the panel has-

- Equipment's to test healthiness of DG set with Test mode & with load on mains.
- Energy Analyzer Or Load Manager with selector switch/button to view readings of voltage, current, KW, KWH, p.f. frequency etc.
- Audio-Visual Alarm indication /annunciation facility.
- Engine/DG shutdown device (due to fault/ abnormality).
- Battery charger, excitation control, voltage regulating equipment.
- Circuit Breaker.
- Auto/manual mode selector switch and (g) Master Engine control s/w etc.

Installation of DG Set

Depending upon the KVA capacity of the DG set and load bearing capacity of the soil DG set with acoustic enclosure if it is to be installed in a separate DG set room it should have a PCC foundation (1:2:4 M-20 grade) of appro depth 150 mm above finished Gen-set room floor. It should have 250mm to 1 meter free space all around DG set enclosure. If installed in open space it may be mounted on a PCC (1:2:4 & M-20) foundation of height 2.5 times the operating weight of DG set. The DG set has to be installed on Anti-vibration pads.

Operation & Monitoring of DG set

When DG set is started and is in operation the following parameters of the DG set needed due monitoring :

- Exhaust smoke is not excessive & not too black in colour.
- Voltage and frequency is stable.
- Engine Vibration and Sound/noise is not abnormal.
- Engine temperature and pressures are normal.
- There is no leakage of lubricating oil, fuel (Diesel), coolant etc.
- There are no Fault indication/alarms.
- Operation of A.M.F. panel by manually switching off the mains power to check immediate and smooth transfer on DG set and vice-versa. All these observations are to be made on full load which should not be less than 30 to 40% of DG set capacity.

Preventive Maintenance Checks

DG sets of all the capacities need systematic preventive maintenance when following items need serious checks. Based on their conditions the remedial actions/ replacements etc. need to made.

- Air locks in Cooling system for radiators, lube oil circulation etc.
- Air leakage in air intake as well as in ventilation system, wear& tear if any of hose pipes, belts etc.
- Condition of air and fuel oil filters, turbo-charges, mufflers, traps etc.
- Fuel systems for fuel levels, sediments, proper functioning of pump.
- Exhaust system for leakes, chokes & condensation.
- Functioning of various meters, batteries etc.
- Operation of bearings, brushes, speed governor, Circuit breakers etc.
- Proper functioning of all controls, relays, indication lamps.
- Auto Transfer switch functioning with proper time delays.
- Performance parameters like A.C. voltage O/P, frequency etc.

Depending upon the load criticality and redundancy requirement the Standby DG sets can be sized in a such manner that instead of installing a bigger size DG set, we may install two or more no of smaller sized DG sets depending upon availability of suitable space and which can be operated independently by suitable distribution of Critical and Non-critical loads. Alternatively, these DG sets can be operated in parallel by use of a synchronization panel for which the matching of DG set parameters are of paramount importance. This topic is being dealt with separately.

SN Chavan
Electrical & A.C. Consultant, ShreeLakshmi Electro-Tech.

Profile

Search Citizen Metalloys Ltd

Web Images Maps More Search tools

About 5,050 results (0.24 seconds)

Citizen Metalloys Ltd
www.citizenmetalloys.com/

We are one of the leading manufacturer of world class quality, **Oxygen free & ETP Grade High Conductivity Copper Components with Machining, Forging, Forming, Punching, Bending, Drilling, Tapping, Plating** in India.

We are the first manufacturer of Copper extruded products & components in India having ISO 9001:2008 :: 14001:2004 & BS OHSAS 18001:2007 and Government Recognized Export House.

Personifying Copper

CITIZEN METALLOYS LTD.

Registered Office :
808,Sukh Sagar Complex,
Nr. Hotel Fortune Landmark,
Usmanpura, Ashram Road,
Ahmedabad - 380 013.
Gujarat, INDIA.

Phone : +91- 79 - 275 60 272
+91- 79 - 329 11 675
Fax : +91- 79 - 275 60 240
Email : info@citizenmetalloys.com
sales@citizenmetalloys.com
Visit us : www.citizenmetalloys.com

Benefits / Features of CITIZEN's Product
www.citizenmetalloys.com/products.html/

> Higher Conductivity for current carrying capacity
> Excellent dimensional surface finishing for superior contacts
> Crack - free Bends
> High efficiency with less labour effort.
> Excellent straightness

Government Recognized Export House

ISO Certificate

EEPC INDIA Export Excellence Award 2012-13
STAR PERFORMER

Images for Citizen Products

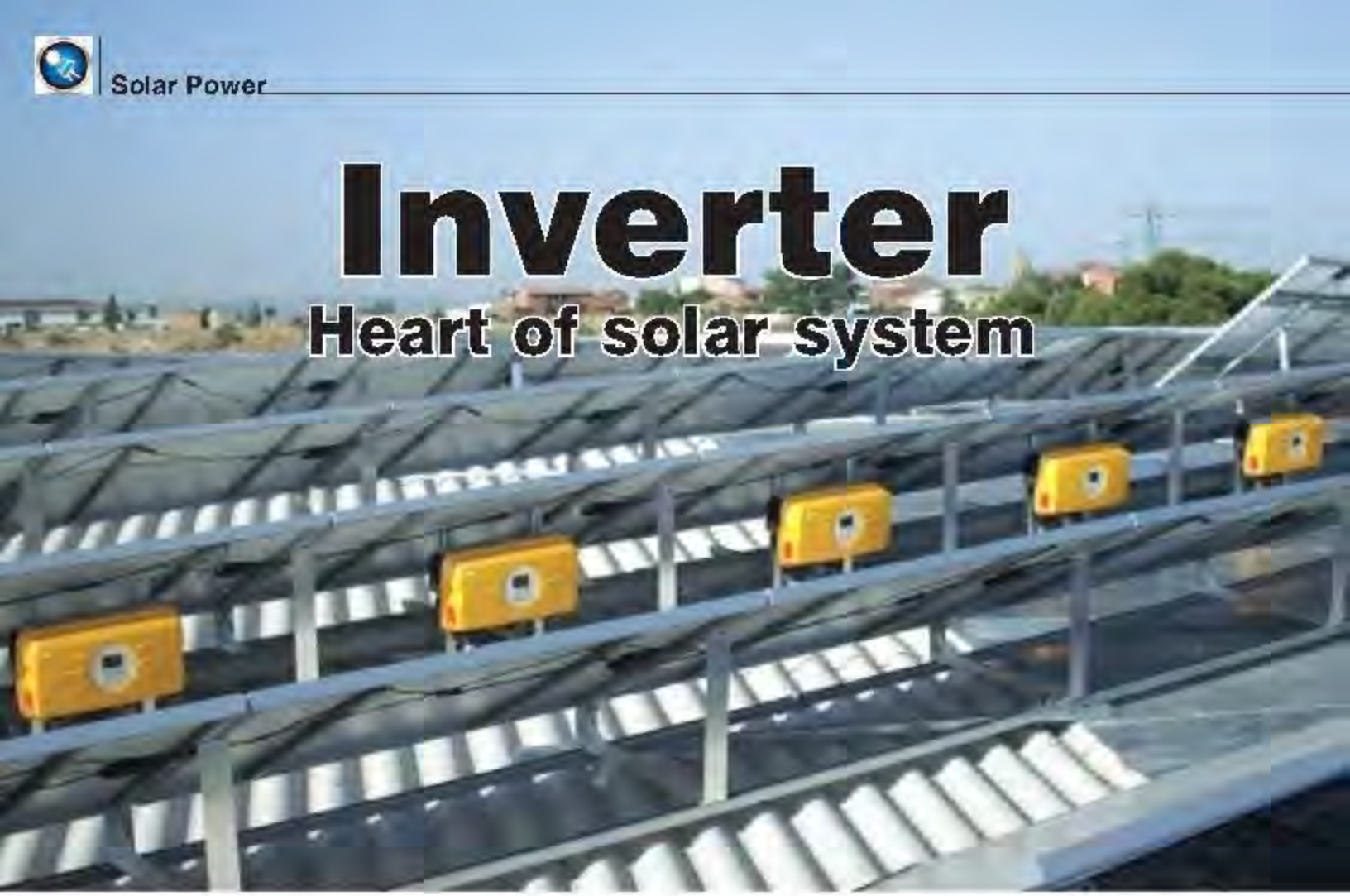



Seaaaaaaaaarch

1 2 3 4 5 6 7 8 9 10 Next

Inverter

Heart of solar system



India is one of the fastest growing economies in the world like China, South Africa, Russia and Brazil. It is the second largest country in the world as far as population is concerned and fifth largest country in the world after USA, China, Russia and Japan as far as electricity generation is concerned, in spite of that its per capita power consumption is merely 920 units. There is a huge gap in power generation and peak power demand. Renewable energy is one of the most viable solutions as we are facing serious consequences of global warming all around the globe.

Aqeel Ahmad

According to BBC, TV channel, in the present month of November 2014, while winter is yet to come in India, North America is already under the thick blanket of snow; New York temperature dipped to -22 degree centigrade, much blow than freezing point.

In the solar power, Germany is the leading country in the world with approximately 40 GW installed capacity (almost half of its total power requirement), Italy 19 GW, China 10 GW, Japan 5.5 GW. The world largest fossil fuel producer, Saudi Arab is also having ambitious plans with 41 GW of solar power by 2032 and UK 22 GW by 2020.

Under the Jawaharlal Nehru National Solar Mission JNNSM 2010, India's is having following ambitious targets like in

- First phase (10 -13) : 1.1 GW
- Second phase (13-17) : 4 – 10 GW
- Third phase (17-22) : 20 GW

PV solar system comprises of

- Solar Panels (Changes Solar energy into electricity DC)- sturdy with almost 20-25 years performance guarantee
- DC Cable (Transfer DC to Combiner boxes) – Specially designed with solar plant to bear high temperature, humidity, wind and rough weather conditions, sturdy with almost 20-25 years performance guarantee
- Combiner boxes
- Inverter (To convert DC to AC)- Most vital but weakest link in solar system, 5-10 years guarantee

Basic Grid-Tied Solar Electric System

- AC Cable (Transfer AC from inverter to Transformer/grid)
- AC & DC control gear and protection circuit
- Transformer (To raise inverter output to grid voltage).

Here we will focus our discussion on inverter only.

Role of Inverter: Inverters are used primarily to change direct current to alternating current. An inverter converts a DC current to an AC current through a delicate electrical switching process. An inverter converts DC power drawn from PV arrays or battery banks into AC power for use on AC loads or export to the utility grid. The term "inverter" was initially derived from the action of inverting the constant polarity of DC into negative and positive voltages, causing the current to flow in alternating directions. Different inverters produce various waveforms of AC power, including the low quality square-wave, modified square wave, stepped sine wave, and pure sine wave. Waveforms other than pure sine wave result in poor operation of some AC loads and increased total harmonic distortion (THD), a measure of AC quality. The cheapest and lowest quality inverters often produce waveforms other than pure sine wave. These inverters are usually characterized by short warrantees, few safety precautions, low efficiency, lack of listings with Underwriters Laboratory (UL) standard, and lack of National Electric Code (NEC) compliance. It is important to recognize that various qualities of inverter AC output waveforms exist.

Functions of Inverters

Inversion: The process of converting DC power received from PV array into AC power is called Inversion. It is done by using MOSFETs or IGBT by using pulsed width modulation (PWM) technology by flipping DC power back and forth.

Maximum Power Point Tracking (MPPT): PV modules have a characteristics' I-V curves, they look for "knee" point where voltage multiplied by the current yields the highest value. It is a microprocessor based device embedded in inverter and it uses dc-dc closed loop.

Grid Disconnection: As per the requirement of IEEE 1547, all grid tied inverter must disconnected if the AC line voltage or frequency goes above or below certain well set limits. These protections eliminate the chances that a PV will inject voltage or current into disconnected utility or switch gear or could be hazardous to utility personnel. UL 1741 and IEE 1547 also require that inverter not create a power island- that means if utility goes off, inverter cannot remains 'on'.

Integration & Packaging: It means AC/DC manual & automatic disconnection, EMI and RFI filtering and connecting the inverter with remote sensing utilizing RS -232 and RS - 485 protocols and other software.

Selection of Inverter: It must be based on factors such as

- Very High Efficiency (+95%)
- Latest technology like IGBT for better efficiency, fast switching device
- Design life time more than 35000 hours with 40 degree ambient temperature. This is approximately 4-8 hrs. at full load/day for 20 years.
- With or without transformer as per the local guidelines or standards.
- Inverter must be grid compliant i.e. matching frequency, voltage, phase sequence etc.
- Maximum DC voltage of PV string with no load VOC must under no circumstance ever exceed an inverter max DC voltage
- Minimum DC voltage for tracking system, the minimum DC voltage at which the inverter remains 'on'. During cloud cover, a solar PV strings voltage can drop to a very low level. At some point, the inverter should decide to 'stop'.
- MPPT – This is the voltage range where inverter optimizes power output out of many perimeters like voltage, current, panel temperature, I-V curves etc.

Classifications of Inverters

Central Inverters

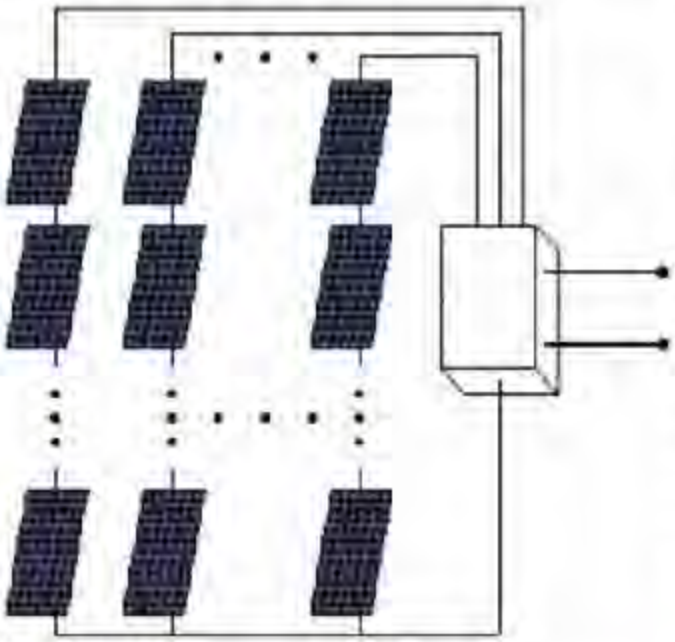
These are connected to no. of parallel strings or modules.

Central Inverters

Drawback is if inverter is down, whole plant is down. Not suitable for partial shadow regions, performance drops drastically but easy to maintain. In utility scale plants still we are using central inverters. Solar power system with Central Inverter is thus bulky, noisy, and most importantly, inefficient but reasonable on cost of installation.

String Inverters

String inverters dominated the solar market for quite some time. In a traditional solar power system with string inverters, interdependent strings of panels are placed together. If one panel gets obstructed by a bit of shade or dust the entire string of panels suffers, even if the other panels have no dust or shade problem. A slight change in orientation can cause mismatch in output. It is better than central inverter in performance but cost of installation is more.



String Inverters

Transformer /Transformer less inverters

Recent shift of inverter technology is towards transformer less inverters because they are light in weight (no transformer), easy to install, no humming, better in efficiency, no grounding required(except floating ground, no negative positive grounding) with the same output. Transformers less inverters are popular in Europe but not in USA. But it needs as per NEC 690.35, a double insulated single conductor cable with better UV weather resistance because it is ungrounded. UL1741 and NEC allows transformer less inverters. But in some cases Galvanic Isolation and grounding is mandatory, in that case, transformer is compulsory with inverter.

Micro Inverters

A rapidly growing architecture, the micro inverter, converts power from one PV module to the AC grid and is usually designed for a max output power in the range of 180-300W. Micro inverter's have advantages in terms of ease of installation, localized maximum power point tracking (MPPT) and redundancy that provides robustness to failure. It is a relatively new technology. One Micro inverter is connected to each solar panel. It converts DC current from a single solar panel to AC current. The electric power from several micro-inverters is combined and fed into an electrical grid. It offers several advantages over conventional systems with central and string inverters, the main advantage being, even small amounts of shading, dust, snow or debris on any one solar panel, or a panel failure, does not disproportionately reduce the output of an entire array. Each micro-inverter obtains optimum power by performing maximum power point tracking for its connected panel, thus improving efficiency. Primary disadvantages of micro inverters are that they have a higher initial cost per peak watt than a central inverter, and secondly, as they are located near the panel, they may be harder to reach and maintain. But these problems are surpassed by their higher durability, efficiency & ease of installation.

Working of Micro Inverter

At the heart of the inverter is an MPPT algorithm which can be implemented through a microcontroller or an MPPT controller. The controller executes the very precise algorithms required to keep the panel at the maximum power extraction point while adjusting the DC-DC and DC-AC conversion to produce the output AC voltage for the grid. In addition, the controller is responsible for being locked in frequency to the grid. The controller is also programmed to perform the control loops necessary for all the power management functions. The PV maximum output power is dependent on the operating conditions and varies from moment to moment due to temperature, shading, cloud cover, and time of day so tracking and adjusting for this maximum power point is a continuous process. The controller contains advanced peripherals like high precision PWM outputs and ADCs for implementing control loops. The ADC measures variables, such as the PV output voltage and current, and then adjusts the DC/DC converter and DC/AC inverter by changing the PWM duty cycle depending on the load. Complex schemes exist to track the true maximum even in partially-shaded PV modules.

Micro inverter

Advantages of Micro inverter

Increased Efficiency and Performance through MPPT

If a single panel is operating at a different point, a string inverter can only see the overall change, and will move the MPPT point to match. Shading of as little as 9% of the entire surface array of a PV system can, in some circumstances, lead to a system-wide power loss of as much as 50%. Micro-inverter based systems yield 5-25 % increased power compared to systems using central inverters.

GIANTLOK®

CABLE TIE AND FASTENING SYSTEM


CABLE TIES


TEFZEL® CABLE TIES


ROUND HEAD TIES


RELEASEABLE TIES


HEAT RESISTANT CABLE TIES


MARKER TIES


PUSH MOUNT TIES


DOUBLE LOOP TIES


MOUNTABLE HEAD TIES


BUTTON HEAD TIES


SELF ADHESIVE CABLE TIE MOUNTS


SELF ADHESIVE WIRE SADDLES


SELF ADHESIVE TWIST LOCKS


CABLE CLIPS

CABLE PROTECTION


SLOTTED/SOLID WALL WIRING DUCTS


TELEPHONE WIRING DUCTS


WRAPPING BANDS


BUTTON TUBES


HOOK & LOOP TUBES

CONDUITS AND FITTINGS


PF FLEXIBLE CONDUITS


FIVE-PIECE CONDUIT ADAPTORS


SINGLE TYPE CONDUIT ADAPTORS


QUICK-FIXED CONDUIT ADAPTORS


CONDUIT MOUNTING BRACKETS

WIRE TERMINATION


WIRE CONNECTORS


CORD-END TERMINALS


TERMINALS


END CONNECTOR

TOOLS


CABLE TIE TOOLS

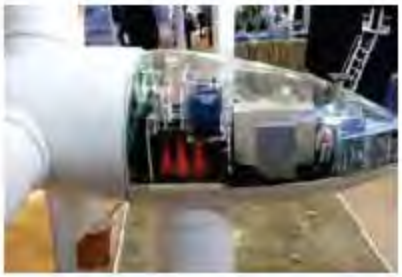

BENDING TOOLS


MULTI-CUTTER


WIRING DUCT CUTTER


TERMINAL TOOLS

Leading Wiring Accessories, Cable Ties, & Wiring Management Solution Provider



For more information, please visit us at: www.giantlok.com

Corporate Office India
GIANTLOK INDIA PVT LTD.
#43, 2nd Floor, Community Center,
Naraina Industrial Area,
Phase-1, New Delhi-110028, India
Tel.: +91-11-47001540
Fax.: +91-11-47001525

TAIWAN HEAD OFFICE
GIANTLOK CO. LTD.
1, 26th Rd., Taichung Industrial Park,
Taichung, Taiwan
http://www.giantlok.com
E-mail: service@giantlok.com

Real time performance reports for each panel and inverter

Web-based monitoring on a panel-by-panel basis is available for both the users and the installers. Analyzing this information can be used to further improve performance and helps making sure that maintenance and repair is done when it should be. With some systems, you can even check the performance of your PV system on your mobile phone.

Ease of Installation

Installing Solar Panels with Micro inverters is easier and faster and leads to lower installation costs compared to traditional Inverters. Installers are no longer limited by string design, marginal designs, co-planarity, and matched modules. Micro inverters reduce wiring time, and remove the need for DC switching points.

Longer life

Micro inverters usually come with a warranty of 10-25 years. The Mean Life of micro inverters is more than the life of the traditional String Inverters, which have to be replaced every 5-10 years.

Flexibility

One of the major benefit of micro inverter is its flexibility and scalability. One can start with a minimal set of solar modules and add modules as needs and budgets grow without requiring the replacement of a large centralized inverter. For example, if you want to build a 10 kWh solar panel installation for your home, you can start with a simple 120 or 240 watt solar panel, set it up with its own micro inverter. Then go on adding new solar panels, each one with its own micro inverter. You never have to worry about producing too little, or too much, for a large conventional inverter when you use micro inverters.

Cost Effective

Cost savings using micro inverters is manifold.

- Micro inverters individually are less expensive than a conventional inverter. When a conventional inverter fails, it is expensive to replace. Micro inverters, should they fail, are far less expensive to replace.
- Micro inverters are far less likely to fail because of the smaller amount of electricity they must process when compared to a conventional inverter and
- Because of the limited range of power rated inverters available, solar panels have to generally use power inverters of greater size for e.g. 800 W of Solar Panels will have to use 1 KW solar inverters wasting the 200 W.

Decreased shock hazard

In a traditional String / central inverter, DC bus voltage is as high as 600V DC to 1000V DC. This creates high personal injury risk. With a micro inverter, it becomes an AC module system, and the installer's crew or the maintenance personnel are not exposed to high voltage DC.

Maintenance without Major Service Interruption

While installing the system or performing maintenance on an existing system, one must de-energize the AC distribution in traditional DC system with string inverters. This results in service interruption. While using micro inverters, you don't need to shut down your energy generation for the rest of the panels. So there are no major service interruptions.

Fire prevention and arc faults

Arc faults are a major cause of PV fires, which are both dangerous and expensive. Unlike DC-based systems, AC systems are less likely to sustain arcs for two reasons. First, the current passes through zero twice per cycle.

Second, the internal DC voltage is only that of a single PV module instead of multiple modules. An AC module system may also help prevent fires in the first place because the micro inverter can detect an abnormality in the grid voltage and shut off the PV power automatically.

Worker safety

In case of fire, firefighters first shut off the power to protect workers and prevent the fire from spreading. However, in the case of a DC system, shutting off power with the circuit breakers only shuts off the central inverter, not the DC voltage generated from the panel. As a result, firefighters may hesitate to spray water, as it can actually make a PV fire worse.

Drawbacks of Micro inverters

- High Initial Cost
- Placement of Micro-inverters
- Still not ideal for large Utility systems, hopefully in near future we will use them in utility scale too.

A third party study was conducted in USA, an independent experiment on two photovoltaic systems, one with a central inverter and the other with micro inverters, to determine their comparative performance characteristics in real, outdoor conditions. An un-shaded existing array was retrofit for the two systems to operate side by side, and the power output of each array measured and recorded. This data was combined with daily irradiation measurements from a calibrated pyrheliometer and analyzed.

After 30 days of initial testing, controlled shading was introduced on each system, and the experiment was then repeated. The micro inverter system produced an average of over 20% additional power than the central inverters, and in partially shaded conditions the micro inverters exceeded the central system by an average of 26% more power.

Aqeel Ahmad

BSc Engg (Elect), DME, ACPDM, DELF, Substation and Solar Energy Expert, has over two decades of experience in Steel Authority of India Ltd, Gulf Ferro Alloys company in Saudi Arab and a decade long experience of working on UNDP, govt. of Germany sponsored project in Ethiopia, Africa in the areas of design, commissioning, O&M up to 230 KV substations and solar power. He writes articles and books on electrical engineering and solar for national and international magazines.

VENTURE LIGHTING
An Advanced Lighting Technologies Company, USA

Bright Ideas Bold Innovations

LED

INDUSTRIAL LED LUMINAIRES

Award Winner
Best Export Performance
2006, 2007 & 2011

Venture Lighting India Limited, Plot No. A30, D5, Phase II, Zone B, MEPZ, Tambaram, Chennai 600045.
Tel : 91-44-2262 3094 Fax : 91-44-2262 5569 E-mail : marketing@vlindia.com

International Approvals

Towards Zero Emission of Greenhouse Gases

For decades climate scientists have warned to limit the human influence on ecosystem and climate that led to global warming and climate change. Now they say we have very little time to act. The Intergovernmental Panel for Climate Change (IPCC), a global institution that studies climate change, has recently released another alarming report that bespeaks the increasing harm we humans are doing to the environment in the form of greenhouse gases emissions. This disrupts the climate more and raises global warming. There should be zero emission of greenhouse gases by 2100, the report suggests, if there has to be no further rise in the temperature. That means, all nations have to phase out the usage of fossil fuel by end of this century.

J Devaprakash

A week after the IPCC released its final part of the fifth assessment report, Denmark, a small country in the European Union, has announced its plans to stop using fossil fuels in the near future. By 2050, it aims to become a fossil-fuel-free country by putting an end to the usage of fossil-fuel not just in power generation but also in transportation.

Recently, China, the world's largest user of coal, has revealed its energy plans that include limiting consumption of coal. Although coal is the main energy source in China, it says, coal will not be used more than 62% in its energy generation from 2020.

Like China, other countries in the world can cap the usage of fossil fuels to begin with. And like Denmark, it can be planned to phase out the usage entirely. It is a strenuous task, indeed, but not impossible. "With appropriate policies and institutions, it is technically feasible to transition to a low-carbon economy", said. Youba Sokona, the Co-Chair of IPCC Working Group III in a recent press release of IPCC.

Indian power scenario

With changes in energy plans and policies that are taking place across the world to tackle climate change, let us look at the Indian power scenario and the options India has.

According to the BP Statistical Review, the country has consumed about 334 million tonnes of coal in 2013; and was the third-largest coal consumer & CO_2 emitter among the countries of the world after China and United States

With more than 1.25 billion people, India has emerged as the fourth largest energy consumer (primary energy) in the world and as second in Asia.

Currently, fossil fuels are the mainstay of India's power programme; about 67% of country's total electricity is generated through thermal resources, predominantly coal. According to the BP Statistical Review, the country has consumed about 334 million tonnes of coal in 2013; and was the third-largest coal consumer and CO_2 emitter among the countries of the world after China and United States.

In light of the IPCC's recent report, this dependency on coal and other fossil fuels has to be brought down from high to low step by step. At the same time, the other power generation modes that emit no greenhouse gases like renewable and nuclear have to be increased multifold.

As the phase-out of fossil fuel accelerates, the burden shouldered by coal and oil will increasingly and obviously fall on these other sources. Increasing the capacity of hydel, which is presently in the second position in India after thermal, and renewables like wind and solar is necessary, but it can do only a little help to the staggeringly growing power demand.

But nuclear power that has a vast yet-to-be-tapped potential can cope with this swelling demand of energy. The country has the high level of technical expertise in nuclear power technology and its capabilities in nuclear power generation is world known. Although presently nuclear power in India contributes about 3% to the country's total power generation, upon the exploiting of its enormous potential, it can increase energy security. In fact, about 60 years ago when plans were made to initiate nuclear

Dr Homi J Bhabha, the architect of Indian nuclear power programme

power in India, a path to produce green power for centuries was also laid.

Three-stage nuclear power programme

Dr. Homi Jahangir Bhabha, an acclaimed nuclear scientist of India, had a profound insight that nuclear power was a viable and green source of energy that could provide for the electricity needs of the nation on a sustainable basis. He learnt that the uranium, an element used as fuel in a nuclear reactor, in the country was limited. At the same time, he was also aware that the thorium available in the country was huge and almost 30% of world's thorium reserves were in India. So, Bhabha came up with a proposal that the utilization of plentiful thorium in power generation would be the best option for India to meet the huge electricity demands in the coming years. But, the biggest challenge in front of him was that thorium could not be used directly as fuel and there was no such technology that existed. Then, he meticulously devised a plan, called the three-stage nuclear power programme, to exploit the abundant thorium available in the country. A clever plan, indeed!

The Indian three-stage nuclear power programme

His plan has three stages of nuclear power generation, spanning out over a few decades. In stage 1, the naturally available uranium will be used to generate electricity by deploying Pressurized Heavy Water Reactors (PHWRs). This stage has a potential of producing 320 GW-year. At present, the country operates about 18 such PHWRs of varied sizes, with an installed capacity of 4460 MW. The spent fuel of these reactors, as per Bhabha's plan, is the cornerstone of the second stage nuclear power programme. The Fast Breeder Reactor (FBR) of the second stage can use plutonium as fuel (derived from the spent fuel of stage 1), with thorium as blanket. Besides electricity generation, the PFBR will produce 233U. Through this second stage, India can produce up to 42000 GW-year. A prototype FBR is now under the advanced stages of construction near Chennai at Tamil Nadu.

The third stage of the Indian nuclear power programme is where the key answer for the country's long-term energy needs lies. The technology to be used in this stage will unleash the usage of vast thorium that is now lying idle. The AHWR or Advanced Heavy Water Reactor, as it is called, will use the fuel produced in the second stage, 233U, along with thorium as blanket, to generate electricity. "The design for AHWR has recently been finalized and a 300-MW reactor will soon come up", said Sekhar Basu, Director of Bhabha Atomic Power Station, Mumbai, in a recent media interview. As per the design, the AHWRs will have a life of 100 years unlike the existing reactors that have an average life of about 40 years, and will have futuristic safety features. Upon launching of commercial thorium-based reactors, the total potential for nuclear electricity generation can go up to a prodigious level of 1,55,000 GW-year.

Nuclear power generation is safe. India has been operating nuclear power reactors immaculately for several decades. In its over 400 reactor-years of experience, there has been no nuclear accident in the country. Through nuclear technology so far, since the beginning of commercial nuclear operation in the country in 1969 till October this year, about 457051 million units of electricity has been produced in India. But what is remarkable is that more than 400 million tons of CO_2, a major greenhouse gas, has been avoided during this power production, which otherwise would have been added to the environment had fossil fuels been used.

With promising potential, nuclear can play a greater role to meet the ever-increasing energy needs of the country with no greenhouse gas emissions and can be the best alternate to fossil fuels.

J Devaprakash

The author is Manager (Corporate Communication) at Nuclear Power Corporation of India Limited. He writes about energy and nature.

Profile

LIGHTNING AND SURGE PROTECTION FOR SOLAR APPLICATIONS

hakel®

www.hakel.com

**** DEALERS ENQUIRY SOLICITED ****

hakel®

HAKEL Ltd.
Bratri Stefanu 980
500 03 Hradec Kralove
Czech Republic
Tel: + 420 494 942 300
Fax: + 420 494 942 303
Email: info@hakel.cz
Web: www.hakel.com

APS

Marketed in India:
ALLIED POWER SOLUTIONS
C-301, Delhi Rajdhani Apts
80, I.P. Extn. Patparganj
Delhi - 110 092 (INDIA)
Tel: + 91 11 2223 6074
Email: nfo@alliedpowersolutions.com
Web: www.alliedpowersclutions.com

Interview

"Progressing towards a one-stop solution for providing information to the power sector"

Subodh Garg, Director General
National Power Training Institute

National Power Training Institute, an ISO 9001 & ISO 14001 organization, is a National Apex body for training and human resources development in power sector with its Corporate Office at Faridabad. A number of demand driven courses are being conducted by the Corporate Center and the Regional training Institutes in different power zones of the country. NPTI has trained 2,37,372 power professionals over four decades. In an exclusive interview to **Electrical India, Subodh Garg** says, we have also for the first time in the country, conducted Training & Certification of Power System Operators for executives.

➢ **You have had more than three decades of experience in power sector. Could you describe your journey till assuming responsibilities as Director General of NPTI?**

Before taking over as the Director General of NPTI, I had worked in premier power sector organizations such as NTPC, POWERGRID and Rural Electrification Corporation in various areas such as Contracts Management, Procurement, Project Management and implementation of Power Projects on PPP mode etc. In the POWERGRID, I was responsible for implementation of the first Transmission Project on JV mode. I have also successfully finalized various JV/Transmission Service Agreements with various companies. At REC, I was responsible for appraisal, sanction and financing of Renewable Energy and large Generation Projects. I was also the Chief Executive Officer of RECTPCL, a fully owned subsidiary of REC Ltd. I was responsible for the selection of developers of Transmission projects on tariff based bidding. The first two transmission projects on tariff based bidding based on guidelines issued by Ministry of Power were awarded by me. Additionally, I was also holding the charge of HR and responsible for various functions of personnel management and industrial relations. I always believe in the motto that 'Work is Worship'. I don't get deterred by failures and I believe that 'Dreams are not those, you see while asleep; Dreams are those, that don't let you sleep'.

➢ **The power sector is facing crucial times as demand is increasing and according to you what are the challenges faced by the Indian Power Sector?**

Power Sector has been constrained by multiple challenges in Generation, Transmission & Distribution and associated areas. Some of them need to be addressed right away such as:

- High Aggregate Technical & Commercial Losses pose a major challenge as a significant portion of the power generated is lost or goes unaccounted. This has largely been on account of old and outdated sub-transmission,

poor distribution infrastructure and heavy commercial leakages.

- Metered Supply to consumers leads to correct estimates of losses, subsidies, incentives, and effective planning and implementation. There is an urgent need to identify an action plan for 100% metering of consumers and implementation.
- Delays in the development of captive coal blocks have led to shortages in the supply of Coal.
- The absence of adequate and location of Coal washeries in the country makes it necessary to import low-ash coal. Low ash coal is largely imported as high ash content in Indian coal makes washing necessary before it is supplied to power plants.
- I am of the opinion that installed capacity in the country is sufficient to meet the power demand of the country provided national level Aggregate Technical & Commercial losses are brought down to 15% which is an achievable target as some states have been able to achieve this target.

➢ Could you detail about NPTI's programs with the objective to create competent professionals who would take care of power sector needs of the country?

NPTI conducts the following industry interfaced academic programs with the objective to create a pool of committed and competent professionals equipped with appropriate technical skills to steer the Indian Power Sector:

- Two-Year MBA program in Power Management approved by AICTE
- Four-Year BE/ BTech Degree in Power Engineering approved by AICTE
- One Year Post Graduate Diploma Course in Thermal Power Plant Engineering
- One Year Post Diploma Course in Thermal Power Plant Engineering
- One Year Post Graduate Diploma Curse in Sub-Transmission & Distribution Systems
- Nine Months Post Graduate Diploma Course in Hydro Power Plant Engineering
- Six Months Post Diploma Course in Hydro Power Plant Engineering
- 12 weeks Post Graduate Certification Course in Thermal Power Plant Engineering.

The students graduating from these industry-interfaced programs are ready off-the-shelf skilled manpower for immediate placement in the power sector specializing in the operation, maintenance, commissioning, project management, commercial and regulatory areas in Thermal, Gas, Hydro, Renewables etc. Therefore, the students passing out of these programs are placed in various power sector companies in the areas of Generation, Transmission & Distribution and other techno-managerial areas of infrastructure sectors.

In addition to the above, several long-term, medium-term, short-term training programs in the areas of Thermal, Hydro, Transmission & Distribution and System Operation, Management, Regulatory Affairs are being conducted in the various institutes of NPTI. Also, customized training programs for various power utilities are also organized round the year.

➢ How many institutes are run by NPTI all over India? And what kind of specialized training is provided at those institutes to address the challenges in the power sector?

NPTI operates on an all India basis through its nine Institutes in different zones of the country viz.

- **Northern Region:** Corporate Office, Faridabad, Regional Institute at Badarpur, New Delhi and a Hydro Power Training Centre at Nangal;
- **Southern Region:** Power System Training Institute & Hot Line Training Centres at Bengaluru, Regional Institute at Neyveli;
- **Eastern & North Eastern Region:** Eastern Region Institute at Durgapur and North Eastern Region Institute at Guwahati;
- **Western Region:** Western Region Institute at Nagpur city. All NPTI institutes are well equipped with Hi-Tech infrastructural facilities for conducting different courses on technical as well as management subjects covering the needs of Thermal, Hydro, Transmission & Distribution Systems, and Energy related fields of the Indian Power and allied Energy Sectors.

NPTI has equipped itself with state-of-the-art high-quality, high-fidelity, real-time, full-scope & DDC based training Simulators. A 500 MW & 2 Nos. of 210 MW Thermal Power Plant Simulators, a 430 MW Combined Cycle Gas Turbine Simulator, a 250 MW Hydro Simulator and a Load Despatch Simulator have ever since been used for training purposes.

Beginning September, 2014, we have also started a six (6) months Certification Course on "Regulatory Framework & Commercial Aspects of Indian Power Sector" through Distance Learning Mode for Senior Executives of JSW Energy. The course appraises participants to Policy & Regulatory Framework of the Power Sector through Modules & Assignments at their doorstep/workplace and has been very well appreciated by the Corporate. Contact Sessions have also been arranged for enriched learning & doubt clearing of the Participants. We would also like to take forward this exercise in a big way to develop a thorough understanding of the all-important Regulatory Framework to the power professionals in the country.

We have also for the first time in the country conducted Training & Certification of Power System Operators for executives of various Load Dispatch Centres of the country in the Basic as well as Specialist level Learning & Development courses.

➢ Please detail us about your MBA program in Power Management; the opportunities available for such competent professionals and your

further initiatives in management education.

NPTI's Centre for Advanced Management and Power Studies (CAMPS), launched its first ever MBA Program in Power Management in the year 2002 which was a first in the sub-continent, to meet the huge requirement of Power Managers in Ministry of Power's massive efforts of attaining self-sufficiency in Power Sector and run the Indian Power Sector on techno-commercial lines. This MBA program duly approved by AICTE is affiliated to Maharshi Dayanand University, Rohtak. The intake for the program is 120 seats out of which 15 seats are reserved for candidates sponsored from Power Sector organisations. In addition to the inputs provided in regular MBA programs, this 'Program with a Difference' lends special emphasis on specific Power Sector issues and ethos to give extra strength to Indian Power Sector Engineers to steer Power Sector of the country in the challenging times ahead. The MBA in Power Management Program in the last twelve (12) years has catered to the industry needs in providing Power Managers who have taken on issues in the industry from both technical and managerial insight. A large number of power managers have found excellent placement in the companies like PWC, KPMG, Care, Deloitte, Infraline, Tata Power, Torrent Power, Enercon, Capital Fortunes Ltd., Suzlon, Noida Power, PTC, UJVNL, GMR, Crisil, TERI, Lahmeyer, Enzen Global, NDPL, Erudite, KSK Energy Ventures, Datagen, LNJ Bhilwara, Moser Baer, Eco Securities, Feedback Infra, ABPS Advisory, Adani, IL&FS, Vedanta, Lanco, BSES etc.

Further we have ambitious plans to spread Power Management Education all over the country. We are planning to start One and Half Year Executive MBA Program in Power Management, 3-Year Part-Time MBA Program & also a MBA Program in Power Management through correspondence. We are also embarking on a very ambitious innovative project for an on-line MBA Program in Power Management through Internet which shall provide video recording as well as text of all the subjects on-line, thus making Power Management Education available to all, right at the door step of students, at any time and at any place.

➢ **Could you further enlighten us with specific areas where your Power Management graduates exactly drive the power sector economy?**

The MBA program in Power Management is a unique techno-managerial program for engineering graduates to address the needs of the power sector. The program meets the power sector needs of elite personnel having technical, managerial and commercial competence possessing comprehensive decision making requirements. These highly skilled graduates can competently perform their duties in constructional Project Management of large Power Plants, Consultancy Divisions, Business Development, Strategic and Commercial areas, Distribution Companies, ARR Filing, Regulatory, Knowledge Management, Power Trading, Fuel Management, Technology Licensing & JVs, Mergers and Acquisitions, Captive Power Plant Business to name a few.

➢ **Please detail us about your training methodologies and use of real-time power plant scenarios and training strategies and newer areas.**

NPTI's institutes are essentially located near large power plants. Along with classroom sessions, Plant Visits and On-Job Training in the areas of Operation & Maintenance of Power Plants is intrinsically woven into the various programs conducted by NPTI. In addition to our core faculty we invite practicing Power Sector experts from the field for further substantiating conceptual understanding and providing newer information and insights and sectoral expertise and developments.

NPTI's 500 MW & 210 MW Thermal Power Plant Simulators, the 430 MW Combined Cycle Gas Turbine Simulator, the Load Dispatch Simulator and the 250 MW Hydro Simulator, all of these provide the Operational skill-set expertise required to man the power plants. The emergency situations created on these Simulators provide special insights into operational practices, preparing the plant personnel with the requisite readiness to man plants effectively with lesser break-downs improving Plant Load Factor.

We have also for the first time in the country conducted Training & Certification of Power System Operators for executives of various Load Dispatch Centres of the country in the Basic as well as Specialist level Learning & Development courses.

We have also recently started a six months Certification Course on "Regulatory Framework & Commercial Aspects of Indian Power Sector" through Distance Learning Mode for Senior Executives of JSW Energy. The course appraises participants to Policy & Regulatory Framework of the Power Sector through Modules & Assignments at their doorstep/workplace and has been very well appreciated by the Corporate. Contact Sessions have also been arranged for enriched learning & doubt clearing of the Participants. We would also like to take forward this exercise in a big way to develop a thorough understanding of the all-important Regulatory Framework to the power professionals in the country.

In our attempts to cater to the additional exigent i.e. demanding and long-term training requirements, 2 more multi-functional training institutes at Alappuzha, Kerala and Shivpuri, Madhya Pradesh, shall cater to the needs of all aspects of the power sector and also house multi-functional Simulators to address operational area specific needs.

➢ **Tell us something about Knowledge Bank on NPTI Website.**

NPTI's website with a new look has been vastly improvised and has been made more user friendly. A link has been provided viz., "Knowledge Bank" wherein lot of study material related to Thermal, Hydel, Transmission, Distribution,

Regulatory Affairs and miscellaneous topics is regularly being uploaded. This Knowledge Bank of Reports/Information uploaded are very useful to students, trainees, faculty of NPTI and all the employees working in various Central, State and Private Sector Utilities and this will also improve the quality of education and training. We are gradually progressing towards a one-stop solution for providing information to the power sector.

Also, a Daily upload of "Power News" appearing in media on NPTI website provides ready and quick reference to power sector personnel.

➢ **What are your future plans to strengthen the training activities of NPTI and meet challenges down the road in the next few years?**

NPTI faces huge challenges in the years to come and we have the following road map ahead for us-

- Renovation & Modernization of existing Institutes with state-of-the-art facilities.
- Establishment of more Power Training Institutes.
- Improvement and upgradation of skill and knowledge of existing faculty to keep pace with fast changing technological advancements.
- Our several Post Graduate & Post Diploma courses will also provide the much required specialist personnel to man the various power sector areas.
- The 800 MW Supercritical Thermal Power Plant Training Simulator and the other multi-functional Simulators being procured would address the mandatory needs of Simulator training.
- Starting new MBA Programs in Power Managementthroughcorrespondence, Part-time and also Executive programs for experienced power professionals to address the huge techno-managerial vacuum.
- Starting an on-line MBA program in Power Management to meet the student requirements anytime, anywhere reaching their doorsteps. This mode of education will revolutionize our power management education in the country and will vastly improve the power sector as a whole.

The above initiatives, I am sure would further address and improve the quality of power education and training being provided by NPTI. We at NPTI are aware and conscious of the enormous training needs of the country taking strident steps to assist in increasing Plant Load Factor of Generating stations and reduction of AT&C losses, as proper training alone can address these issues as the men behind the machines are the ones crucial and all-important to achieve it.

Solar Energy

Radiant visible light and invisible heat from the sun, collectively referred to as solar energy, has been the main source of energy for all living things e.g. humans, animals and plants since ages. Humans need light mainly for visibility. But after sunset, the natural light is not available so the search for artificial lights was done. This led to the discovery of fire and then other fossil fuel for the creation of heat and lights as needed.

P S Shah

The evolution of energy generation continued with the evolution of mankind. The solar energy is harnessed by humans since ancient times using a range of ever-evolving technologies as well as practices. Solar energy technologies include solar heating, solar photovoltaic (generation of electrical energy), solar thermal electricity and solar architecture, which can make considerable contributions to solving some of the most daunting problems the world now faces, such as energy security, pollution control and global warming. Beside this source of energy is renewable.

Among many alternative non-conventional and renewable energy sources, the three and technically feasible options are Tidal, Wind and Solar energies. Nuclear energy is yet another option for very large scale electrical power generation. While Tidal and Wind energy generation is possible only at limited locations due to dependence on availability of Tidal waves and good velocity Winds, the Nuclear and Solar energy generation do not have such locational constraints. Tidal wave energy is yet to reach its commercially viable position.

The advantage of Wind and Solar energy generation is non-requirement of water either for process or for cooling, as a result these can be installed at any arid place. Beside these are not dangerous like Nuclear power plant where radiation leakage problem may occur due to some acts of God like earth quake, floods or Tsunami. The only constrain is the requirement of large space for large scale electrical energy production. India is blessed with many such places like Rann of Kachchh in Gujarat for example, where although water is not available, the vast non agricultural land with good wind velocities as well as good solar radiation is available. Here already many wind farms as well as solar farms are in operation for large scale electrical energy generation. Due to very high capital cost, the wind turbines or wind mills are installed in the range of more than 250 KW capacities. A large number of such wind mills are located at one place and known as wind farms, where electrical energy in MW range is generated and wheeled through the existing net work of Discoms or Transcoms. Although the concept of micro wind mills is also being debated, but so far wind farms of MW range are commercially viable and are in operation worldwide.

The greatest advantage of solar power generation is its range. It can be from few watts to mega watt, depending upon the requirement. Due to this the solar energy can be generated and used for the individual requirement and can be specifically designed. Also in such case there is no need for transmission and distribution. A few KW solar power plants can be roof top mounted and the electrical energy so generated can be used for the particular application. Some of such examples are solar traffic signal lights, solar street lights, and solar water pumps. Solar lights that charge during the day and light up at dusk are common sights along walkways, traffic signals, signage boards, village road lighting to name a few applications. Solar-charged lanterns have become popular in developing countries where they provide a safer and cheaper alternative to kerosene lamps. In case of use of solar energy to generate heat are solar cookers to cook food, solar water heaters. This is yet another advantage that the same solar energy can be used to

generate electricity as well as heat. Unlike other non-conventional energy sources such as wind, tidal and nuclear plants, it does not need skilled men power for its upkeep and maintenance and are easier to install. Also the gestation period for such solar power plants is much less. It is pollution free, safe and clean source of energy. Solar generators can be the best method of distributed generation. The only constraint is the requirement of large space per KW of electrical power. But other advantages like non-dependence on water, safety, ease of operation and maintenance and flexibility of the rating depending upon the power requirement, fund availability and the space available outweigh this constraint. Although the manufacturing of solar panels is highly techno sophisticated, the users do not have to face many problems. So the solar energy has vast potential for development as well as usage.

Solar technologies are broadly characterized as either passive solar or active solar depending on the way they capture, convert and distribute solar energy. Active solar techniques include the use of photovoltaic panels for generation of electrical energy and solar thermal collectors to generate heat to harness the energy. Passive solar techniques include orienting a building to the Sun, selecting materials with favorable thermal mass or light dispersing properties, and designing spaces that naturally circulate air. Active solar technologies increase the supply of energy and are considered supply side technologies, while passive solar technologies reduce the need for alternate resources and are generally considered demand side technologies.

In 2011, the International Energy Agency said that "the development of affordable, inexhaustible and clean solar energy technologies will have huge longer-term benefits. It will increase countries' energy security through reliance on an indigenous, inexhaustible and mostly import-independent resource, enhance sustainability, reduce pollution, lower the costs of mitigating climate change, and keep fossil fuel prices lower than otherwise. These advantages are global. Hence the additional costs of the incentives for early deployment should be considered as learning investments; they must be wisely spent and need to be widely shared".

The Earth receives a lot of incoming solar radiation approximately 30% of which is reflected back to space while the rest is absorbed by clouds, oceans and land masses. It is estimated that the amount of solar energy reaching the surface of the planet is so vast that in one year it is about twice as much as will ever be obtained from all of the Earth's non-renewable resources of coal, oil, natural gas, and mined uranium combined. On a surface on the Earth's orbit, normal to the sun, solar radiation that hits the earth is estimated at the rate of 1,366 Watt Per Meter Square. This is known as solar constant. Solar energy can be harnessed in different levels around the world. Depending on a geographical location, the place closer to the equator, the more solar energy is available. Solar energy refers primarily to the use of solar radiation for practical ends.

The photocell or photovoltaic cell (PV), is a device that converts light energy into electric current using the light sensitive substances such as Selenium and Silicon which convert incidental light energy into electric energy. India is lucky to have a huge potential for tapping the abundant, free, non-polluting and renewable energy of sun. The Indian Renewable Energy Development Agency is busy creating a programme to facilitate the use of solar energy in over one million homes in India in the next few years. Solar Energy is the energy received from the sun that sustains life on earth. For many decades solar energy has been considered as a huge source of energy and also an economical source of energy because it's free availability. However, it is only now after years of research that the technology has made it possible to harness solar energy. The most basic process of harnessing the solar energy is pictorially illustrated as under. (Reference: Wikipedia). A photo panel receives solar light energy and converts the same into electrical energy. A device called charge controller regulates the flow of electrical current to a storage battery, which stores the electrical energy so generated in chemical forms. The battery storage will be required to supply power during night time and during cloudy or stormy conditions. Now this electrical energy can be used to operate electrical devices. Two most popular applications of solar energy for illumination is the Solar powered street lights and Solar powered Lanterns are depicted below.

Typical Solar Street Light

Typical Solar Lantern

Solar Energy Facts: Solar Energy is already being successfully used in residential and industrial settings for cooking, heating, cooling, lighting, space technology, and for communications among other uses. In fact, fossil fuels are also a form of solar energy stored in organic matter. With fossil fuels making major impact on the environment and raising issues of pollution and global warming, solar energy has gained its importance in industries and homes. While the reserves of fossil fuels are restricted, available at selected places, available at cost and liable to be exhausted, there are no limitations to the availability of solar energy. With improvement in solar energy technology and the increase in prices of fossil fuel, solar energy is gradually becoming more and more affordable source of power generation as well as heat source. In addition, there is additional cost in the form of importation and transportation, required for oil, coal and gas. In the last few years, the cost of manufacturing of photovoltaic cells has gone down considerably and the percentages of government subsidies have gone up.

The cost of the technology is decreasing almost every few months and the efficiency is improving significantly. Today, we can find different types of solar solutions.

This means that every year, it is becoming more and more affordable to use Solar Energy. It is estimated that the amount of energy released by a single Kilo Watt of solar energy unit is equivalent to burning as much as 76 Kg of coal that releases over 35 Kg of carbon dioxide. As per energy industry giant, Shell more than 50% of the global energy in 2040 is going to be in the form of renewable energy. And, the demand for Solar Energy has grown due to policies in green pricing from utilities and government rebate programs. The demand has also grown due to the interest of households to get electricity from renewable, non-polluting and clean source. Vacation homes or holiday homes that don't have access to the grid can utilize Solar Energy in a more cost-effective manner as compared to relying on the grid for running wires to the remote location. People living in remote areas having sufficient sunlight can get reliable power in the form of solar energy. The basic components required in the solar power system consists of a solar panel, battery for storing all the energy gathered during daytime, a regulator and essential switches and wiring. These types of systems are commonly known as Solar Home Systems (SHS).

Solar Energy Cost: When you want to install Solar Energy system at home, you would require it to be sufficient for meeting all electricity requirements in home for a day plus it should generate enough power to store for 3 to 5 days for contingency purpose. Such a system would keep supplying power and getting charged when the days are sunny. During rain or winters it would be able to keep backup charge for a couple of days until the sun emerges. This means that such a solar power system is going to supply you a regular flow of electricity. Solar panels are one of the most important factors in the generation of Solar Energy. On an average, 1 sq ft of Solar Panel generates 10.6 Watts of power. And, the cost of 1 sq ft of Solar Panel is approximately Rs 4,500. 10.6 Watt of power is sufficient to light a 10'*10'*10' room. So, if you want to power appliances like television, refrigerator and computer, you would need more solar panels, and it may not be economically viable.

Advantages of Solar Energy: Solar Energy has more advantages than you can point out the disadvantages. Once the initial cost of installation is met, the electricity generated by solar panels is free of cost. So it provides hedge against. The government offers lots of rebates and incentives to cover the initial cost. Another good thing about solar power is, the cost of the technology is decreasing almost every few months and the efficiency is improving significantly. Today, we can find different types of solar solutions that are more convenient to install. Solar Energy is a renewable and clean source of energy and there is no transmission cost as well as losses. This is because the energy would be produced and consumed at the same place. Depending upon the budget, we can get all or a part of our electricity requirements fulfilled by solar energy. When batteries are used in the system to store electricity we can become entirely independent of the grid. This also means that no power failures and we would be able to enjoy seamless supply of electricity.

Disadvantages of Solar Energy: Even though Solar Energy has several disadvantages, they are not major in degree and the benefits of this renewable source of energy far outweigh them. The initial cost of the installation and equipment is high. When you compare fossil fuel technology with solar power technology, the former will seem to be far more affordable for large scale power generation. Even though Solar Energy is being used at an increasing rate, the initial costs don't encourage the maximum users to switch to this renewable source of energy.

If there is shortage of space for installing solar panels, you would not be able to generate sufficient amount of Solar Energy required to meet your electricity requirements. Due to this reason, the solar energy use is restricted to the applications which are not power intensive such as lighting and direct heating. The use of solar energy to generate power on commercial scale is still not in vogue, although power plants in the range of few megawatts are set up recently. With the availability of high luminous efficient light sources such as Compact Fluorescent Lamps (CFL) and Light Emitting Diodes (LED), the use of solar energy for illumination has gained momentum. This has resulted in wide spread use of solar street lights, solar lantern etc. Considering all these factors, it appears that solar energy may become the formidable source of energy requirement in households as well as in industries, both in the future and in the next few years. It is only a matter of time before Solar Energy technology becomes easily affordable to make this untapped and unending source of energy a common phenomenon in every household.

Synopsis

Sun is the universal source of energy. Its light is used by default during day time and heat is used for some application such as hot water and cooking. But the ability of photovoltaic plates to convert light energy into electrical energy and the storage of this electrical energy into storage battery and then using the electrical power so generated has led to a situation where solar energy is used even during night hours. India is blessed with a unique geographical location where sun is everyday shining on it. We can use this free form of energy to meet our most basic needs of illumination by harnessing it for illumination and leaving other highly capital intensive high end electrical energy needs for lavish applications such as Air Conditioning, Heating for cooking and refrigeration etc.

Profile

P S Shah

More than three decades in Projects and Maintenance mainly in Electrical Engineering, he also worked as Chief Engineer for five years looking after total engineering function. He is presently working in Surat Special Economic Zone as DGM.

Over Five Golden Decades of dedicated service to Power Sector

For over five decades now, one name has facilitated Applied Research in electrical power engineering, enabling Testing and Certification of electrical Power Equipment as an Independent Third Party laboratory-CPRI. The Institute is renowned Internationally as a reputed brand and well-recognised for its Quality and Excellence. CPRI is adequately equipped with advanced infrastructure to handle Collaborative Research with Academic Institutions and Training to Utilities/Industry

CPRI

TESTING & CERTIFICATION

- State-of-the-art Test facilities for High Power Short Circuit, Ultra High Voltage, High Voltage testing of Transformers and Switchgears, Cables and Capacitors, Transmission Line Towers, Material characterisation, Seismic Qualification, Power System Studies, Energy meter testing.
- Four Short Circuit testing facilities.
- Facilities for testing equipment of 800kV/1200kV rating
- Evaluation of Vibration Characteristics
- Protocol testing for Power System Automation
- Refrigerator and Air-Conditioner test facility
- Pre-Qualification Tests on Cables & Accessories up to 400kV

RESEARCH

- Center of excellence for undertaking Collaborative and advanced Research in Power Sector
- Sponsored Research Projects of relevance to Power Sector
- Coordination of National Perspective Plan Projects

2400kV, 240kJ Impulse Voltage Generator

CONSULTANCY SERVICES

- Smart Grid initiative - Design and Development of Pilot Project for BESCOM
- Third Party Independent evaluation agency for Energy Accounting and SCADA/DMS Consultant for R-APDRP
- Third Party Inspection and Supervising work under RGGVY scheme
- Diagnostics & Condition Monitoring of Power Equipment
- Consultancy in Power System Studies, Real Time Simulation of Power System Controls, Power System Protection Audit
- RLA and R&M, Energy Efficiency & Audit Services
- Third Party Inspection Services & Vendor Assessment

TRAINING

- Customised Training Programmes
- One year PG course on Testing & Maintenance of Electrical equipment

ACCREDITATIONS

- **Accredited as per ISO/IEC 17025:2005**
- **Member - Short Circuit Testing Liaison(STL)**
- **Corporate Member in DLMS UA, UCA IUG**
- **ISO 9001:2008 Certification for Research and Consultancy activities**

केन्द्रीय विद्युत अनुसंधान संस्थान

CENTRAL POWER RESEARCH INSTITUTE

(Autonomous Society under Ministry of Power, Govt. of India)
Prof. Sir C.V. Raman Road, Sadashivanagar P.O.
PB. No.: 8066, Bangalore - 560 080, INDIA
Ph: +91-80-2360 2029 Fax: +91-80-2360 1213
E-mail: hegde@cpri.in / kamala@cpri.in / shyamr@cpri.in / manoharnagulal@cpri.in
Website: www.cpri.in

2500MVA Short Circuit Generator

HVDC Generator at UHVRL, Hyderabad

1200kV Insulator String testing

Erection of Tower for Testing

Cable Testing

Your Trusted Partner in Research and Testing in Power Sector

CPRI UNITS: BHOPAL, HYDERABAD, NOIDA, NAGPUR, KOLKATA, GUWAHATI

Development of Solar Power Mega or Mini!

The Government of India has recently announced its intention to develop 25,000 MW of solar power through 25 Nos. solar parks i.e., @1,000MW in each park, across the country and announced incentives to the states willing to develop the parks. The government aimed to utilize the large tracts of unusable land available in the country while promoting clean energy and giving big boost to the solar industry in the country. The Govt. intends to extend grant of Rs 20 Lakh/MW from National Clean Energy Fund to meet the part of expenses required for development of infrastructure required for solar park.

At the same time, the Government has also issued fresh guidelines for extending capital subsidy to promote small solar installations in the homes, institutions and pumping schemes. While doing so, the government has made eligible the mini grid connected solar power projects for agriculture and pumping purpose, for capital subsidy. We may now look at the issues involved in adopting the above programmes for the benefit of people.

Solar Parks

The primary requirement for solar power projects is requirement of huge land. It requires 2 Hectares/MW compared to 0.25 to 0.4 Hectares/MW of thermal power projects. The gestation period is also less (say 6-8 months) compared to 5 years for thermal & other projects. The technology involved is simple and easy to design the required capacity and instal the solar plants. Because of downward trend in the cost of equipment and increasing cost of thermal projects associated with non-availability of coal, etc it will be a tempting proposal to set up solar power projects

wherever the large tracts of unusable and cheap land available.

However the associated issues need to be critically examined.

> *Estimated cost on development of solar parks may be offered to the solar power developers as viability gap funding or as an incentive*

- **Cost of Development of evacuation infrastructure:** The large solar parks require huge investments, more than Rs 2 Cr/ MW, for development of transmission evacuation infrastructure. This will add cost of service to the consumers.
- **Right of Way issues:** Now-a-days, laying of electrical lines is becoming huge task and many lines are hold or half way hold, by transmission companies for the increased right of way issues. There is tremendous stress on the land use due to increase in developmental activities and economic growth. At the same time, majority farmers in country are holding less than 1 Hectare, which is their livelihood and they oppose vehemently for laying of transmission lines, as to eke their bread and butter. This is happening in spite of the fact that the transmission companies are still exercising powers delegated under Telegraph Act, 1885 and the other stakeholders are not aware of the legal position after enactment of Electricity Act, 2003 and Electricity Rules, 2006. According to new position, the transmission companies need to follow the procedure laid down viz., obtaining the consent of the land owners, pay the compensation, etc before proceeding with the laying of lines. They also need to follow the procedures stipulated in new Land Acquisition Act, 2014 for acquisition of usage rights and compensation. It may thus become more difficult for the transmission companies to complete the new lines in future.
- **Land acquisition:** Though the huge government lands are available at most of the places in the country, they are not on contiguous. Some parts were given away to the people by the previous governments for usage of land with a right to take back. However, taking back is a difficult task after many years of land use by them and may become a hurdle in ensuring contiguous land for development of solar parks in time.

While increasing the cost of power generated by the solar project, the above issues vitiate the very important comfort of the solar project i.e., short gestation period and distributed generation.

Mini Solar Projects

The issues associated with mini grid solar projects are:

- Cost/MW: There will be increase in installed cost/MW in respect of small or mini solar projects. However, the increase may be little, about 5-10%, when compared to large size plants.
- O&M cost: There may be slight increase in operation and maintenance cost of plant.

However, the following advantages will nullify the increased cost on the above account.

- Huge land bank is not necessary
- Line losses will be reduced drastically
- Improved reliability of power to the tail end consumers connected to LT network.
- The investment on transmission and distribution network an account of maga solar parks can be saved and can be used in other way to encourage roof top or mini plants.

Wayforward

Therefore, it is suggested that the development of mini/small solar projects at load points i.e., projects connected to the sub-stations is a viable option for immediate development of solar power in the country. The states may adopt various methods like,

- The estimated cost on development of solar parks may be offered to the solar power developers as viability gap funding or as an incentive for early completion of the small projects.
- The incentives offered by the central government for grid connected mini solar plants for agriculture or pumping purpose may be utilized by the states by suitably devising the schemes. The states may adopt to develop small solar projects exclusively for meeting the requirements of the farmers.
- The agriculture connections may be installed with prepaid meters with timer facility and the present system of extending power for free/ nominal charges can be continued. This will also avoid huge cost on account of feeder separation being adopted by many states.
- Distributed generation is ideal option for renewable energy, particularly solar. The rooftops of parking places, market yards, FCI godowns, industry roof tops, park boundaries, departmental stores, etc can be utilized effectively for development of solar power suitably modifying the present policy for encouraging all stake holders which ultimately beneficial to all.
- huge bank of land identified for solar park may be developed as farming ventures by taking up in a big way involving corporate to experiment all kinds of latest technology in agriculture which will boost up food production in the country and increases our GDP and food security.
- All steps may be initiated to reduce the cost of domestic solar industry to promote indigenous production and reduce the project cost.
- Considering the optimal usage of capital invested, the solar operated pumpsets may be limited to the areas, where grid connectivity is not available.
- Use of solar power shall be mandated in remote locations and stand alone areas.

BN Prabhakar

MTech, PGDFM, LLB, MIE, is President, SWAPNAM (NGO based at Hyderabad working on conservation of water, power and natural resources). He is working for APGENCO (Undertaking of Government of Andhra Pradesh) as Divisional Engineer.

Profile

Coating India's Rooftops with Solar Photovoltaics

It is a known fact that India is a rarest of the countries rich with sunlight radiation and offers the best hope to revolutionise solar energy in the world. It receives about 5,000 trillion kWh of radiation annually. For every square kilometre 50 MW of solar power can be commissioned that can yield average annually 42.5 GWh of electricity assuming present PV cell efficiency of 15%.

Jaideep N Malaviya

India's present electricity requirement is 1,102,900 GWh as per Central Electricity Authority. This means an area of 26,000 km^2 is required to meet the country's annual electricity demands using solar energy. Against India's landmass area of 3,166,414 km^2, it is a meagre 0.82% space required. Such is the gravity of sunlight that India receives. Presently the country has more than 2,500 MW of grid connected power plants besides additional nearly 200 MW off-grid systems. The National Solar Mission targets 20,000 MW of grid connected solar power and additional 2,000 MW off-grid solar by the year 2022. The challenge is in sight rather will grow much more.

The cost of solar PV modules (panel) has dropped by more than 60% in the past 5 years.

Solar power generation broadly gets classified into grid type and off-grid type. The former feeds the generated power in the grid, traded under market mechanism. In the the off-grid system the energy generated is for captive consumption. Typical examples are lanterns, street lights, home lighting systems, pumping systems. Besides there decentralised systems in form of mini power packs & roof-top systems.

The rising cost of electricity and diesel is making solar power more attractive even at individual level. Particularly every dwelling be it industrial, commercial or household wants to explore how best a solar systems can be integrated.

Solar water heater (SWH) that works on thermal principle has reached a state of pinnacle and is a viable technology affordable to masses to consider on their rooftops. The country has presently more than 80 lakh m^2 of solar collector (panel) area commissioned that is delivering daily 80 crore litres of hot water at 60OC on a normal sunny day. 80% of these installations are in the residential sector and is now considered as an amenity. Contrary to a decade ago when they were considered as disturbing the aesthetics of building these days the change in mindset has made it affable to any India as a mark of the individual's commitment on use of a green technology. The last 3 years have seen markets more than double as per the source, Ministry of New and Renewable Energy, govt. of India. India is presently fourth global leader in SWH.

If electricity is precedence and solar energy offers hopes then any open space must be welcome rather than emulating the western concepts. This puts a challenge to the architects and builders to create the best designs

SWH is pre-dominantly a product of the urban masses and the rural rich. As per census of 2011 there are close to 10 crore residential houses in urban India. 95% of urban households are electrified. As a means of energy conservation drive in the critical case if the government plans to make solar water heaters mandatory to all electrified households, this potential translates to 19 crore m^2 of collector area.

Electricity is equally an imperative commodity to a human being that provides quality of life and its minute absence makes life distressful. Hence the demand for individual solar power systems is also witnessing growth in India. The cost of solar PV modules is rapidly falling is converging to coal based electricity prices. The break-even may be achieved in the year 2015 (source A.T. Kearney). Thus the desire to use solar energy on micro level for individual needs is fast catching up.

The western countries have a popular concept of Building Integrated Photovoltaics (BIPV). A BIPV system consists of integrating PV modules into the building envelope, such as the roof or the façade. By simultaneously serving as building envelope material and power generator, BIPV systems can provide savings in materials and electricity costs and add architectural interest to the building. The cells are also made of colour that match the exterior walls. They resultant energy can be fed to the grid or also used for self consumption.

One of the essential criteria for any solar PV system to be successful in India is the south facing area should be shadow free so as to capture maximum sunlight. Many architects tend to overlook this requirement when drawing any building plan and thus deprive use of solar energy. Secondly urban buildings are densely populated hence getting shadow free south facing wall is a challenge. The only option is to make use of the open roof space. Hence Rooftop Solar systems are the way out.

If electricity is precedence and solar energy offers hopes then any open space must be welcome rather than emulating the western concepts. This puts a challenge to the architects and builders to create the best designs that favour any solar energy panel installation and can further be aesthetically appealing. What is vital is capturing the sun into energy for useful purpose. After all it is the generated power which can fulfil the needs. The modern mindset of masses has drastically changed and many take pride in displaying the panels on their rooftops to display their commitment to green technologies. A major advantage of rooftop systems is it prevents investment in land cost. Picture shows a rooftop solar PV installation in Raipur on the

new building of Chattisgarh Renewable Energy Development Agency (CREDA). It is a classic example of building architecture that smartly incorporates the PV modules (panels) on the rooftop.

A basic economics of a 10 kW rooftop system is as shown below

Capacity of system	10,000 Wp
Investment @ 100/Wp	₹ 10,00,000
Energy generation over 10 year @ 1,700 kWh/KW/year	1,70,000 kWh
Accelerated depreciation (AD) of (80%) providing about 30% Tax credit in Income Tax	₹ 3,00,000
Effective life cycle cost per kWh	₹ 4.11
Life cycle cost per kWh without AD	₹ 5.90

As can be seen above solar power is not only feasible but costs less than grid supplied electricity. The Accelerated depreciation (AD) of (80%) resulting in 30% Tax credit in Income Tax under Section 80IA of the Income Tax Act, 1961 is a driver and all commercial and industrial rooftops should be the prime target. Recently Solar Energy Corporation of India (SECI), a government of India body had recently invited bid for 50 MW worth Rooftop projects and the response was overwhelming.

A major shortcoming for any solar energy project is the high capital cost. Banks and Financial Institutions are however now according priority to lending for renewable energy projects however to overcome this phobia companies can consider opting for RESCO (Renewable Energy Service COmpany) route. It is a business that develops, engineers, and installs projects designed to reduce the energy usage and maintenance costs for facilities, equipment, and infrastructure in a variety of end-user sectors. A RESCO often provides operations services, monitors savings, and assumes certain performance warranties and risks for its projects. It will enter into a formal understanding with a Financial Institution for financing the project under long term payment agreement. The beneficiary is thus relieved of the initial capital burden and is also assured of the returns from the project.

The present government has made its intentions clear to bring aggression in solar power generation. Right from Railways to ultra mega solar power projects of several hundreds of MW to the annual budget presented in June 2014 by the new government there were a surfeit of announcements encouraging solar energy projects by allocating 1,500 crore of funds, albeit largely for ultra mega solar power projects. But if one reads through the fine print then there will be 100 smart cities developed besides 60 'Solar Cities' already in place. There is also Solar Purchase Obligation (SPO) in place which requires the electric utilities company to generate or purchase solar power. It is 0.25% of the total traded power with 2012-13 as the base year and increases to 3% by the year 2022-23. SPO mechanism will help develop rooftop solar energy markets by bundling several small developers where open roof space is available to generate solar energy. The ground is already set for solar energy projects to take-off and it is up to the buildings to take up the challenges by offering their roofs.

In the benefit of masses a National toll free Solar Energy Helpline (To reach it call 1800 2334477) is also operative since August 2011, which is perhaps the first of its kind by any country. Urban cities in India are growing and shall continue to expand vertically together with increasing electricity requirements and greenhouse gas emissions. Rooftop solar PV facilities offers potential benefits including reducing dependence on fossil fuel based generation, savings on investment in transmission and distribution infrastructure, savings on reducing the network losses, reduced cost for managing the scheduling of electricity and can eliminate purchase of expensive energy from the market. It will not be a surprise to see PV modules on rooftops just the way we witness the multiple dish antennas on all the roofs or walls facing the sky. One who sets his sight on integrating solar PV in buildings will emerge the winner keeping in mind the long term business returns it will offer.

Jaideep N Malaviya
Expert analyst in Solar energy

Profile

www.Lntecc.com

The impossible, is often the untried

At L&T Construction, we have never let lack of precedent stand in the way of accomplishment.

Our specialized Power Transmission and Distribution business have set benchmarks in capacity, complexity and speed of execution. The integrated packages we offer extend from EHV transmission lines and substations (GIS / AIS) to plant and infrastructure electrification covering E-BoP and instrumentation.

L&T's international track record in this sector covers over 19000 ckm of transmission lines of various voltage levels up to 765kV; more than 475 AIS / GIS substations including India's first 1200 kV AIS and 765 kV GIS as well as 15000 MW of E-BoP for thermal power plants.

Apart from its own advanced facility for manufacturing transmission lines, L&T has in-house tower testing facilities and an exclusive substation automation system simulation lab.

Helping us every step of the way are our people. The numbers say it all. 350+ designers, 3500+ engineers, and a workforce of over 50,000. For them, making the impossible possible is all in a day's work.

Larsen & Toubro Limited
Construction-Power Transmission & Distribution, 7th Floor, D-Wing, TC-3, Tower-B,
Mount Poonamallee Road, Manapakkam, P.B.No. 979, Chennai - 600 089
Email: info@Lntecc.com Tel: +91 44 2252 6000, 2252 8000

L&T Construction
Power Transmission & Distribution

A brand of Larsen & Toubro Limited

Regd. Office: L&T House, N. M. Marg, Ballard Estate, Mumbai - 400 001, INDIA. Tel: +91 22 6752 5792841 CIN: L99999MH1946PLC004768

Innovative Project Financing Mechanism for Solar Power Plants with Public Participation

Jawaharlal Nehru National Solar Mission (JNNSM) was launched in January 2010 and target for solar power was put at 20000 MW by 2022. This was uphill task at that time as the cost of solar PV system was Rs 220 per Wp. By 2012 the prices crashed to Rs 50 per MW & same daunting task started looking a modest one.

Prof Dr Ajay Girdharilal Chandak

The speed at which the projects are coming it will easily surpass the target of 20000 MW by 2022, however considering the national scenario this is grossly inadequate. Even with 20000 MW installation in 2022 the power generated will contribute to less than 3% of the total power requirement of that time. Hence the target bar needs to be raised at least 3 to 6 times the current target. Innovative financing mechanism proposed herewith has potential to raise finance for thousands of MW of solar power plants in very short span.

Problem Statement

Favorable factors for solar power projects are that the cost of PV technology is almost bottomed out. Projects provide day-power which is expensive. However cost of power is major constraints for the investment. With Rs 7 to 8 crores per MW investment in the project even a small sized project of 10 MW demands 70-80 crores of rupees. As corporate investment decisions are based on 'Returns on Investments'. In case of Solar projects major components of annual costs are interest on capital (@14%), physical depreciation (@ 6%), and other costs like O & M, insurance etc. (@ 5%). Hence no corporate can invest in the project unless and until it can fetch ROI of around 30% in first few years. With this return on investment solar projects are not viable when compared to cost of coal based power. Even with some incentives like RPO (Renewable Power Obligation) and also mechanisms like VGF (Viability Gap Funding) still the investments in the projects is not attracting the corporate.

Roof-top installations with battery storage

These are available for solar, small wind generator or solar-wind hybrid. Cost is high @ Rs 12-18 crores per MW and with batteries coming in picture as high running cost, financially not viable. Environmental impact is also doubtful.

Roof-top or decentralized systems; grid tied

These are available primarily for solar option. In some states regulations need to change. However high cost of capital in the range of Rs 12-15 crores per MW, lower power generation (approx.. 40% less than MW scale centralized grid tied power plant) and pumping power in the grid at low voltage are the issues which makes the projects unviable.

Grid tied MW scale solar and wind projects are the only options in current scenario but still need some kind of financial assistance to make it viable. There is no role for common man, small and medium scale industries, commercial organisations etc. in participating existing schemes of projects and project financing.

Innovative Financing Mechanism, 'Solar Power Projects with Public Participation'

Innovator proposes a business model, wherein a corporate company, government agency (SECI, DISCOMs, MIDC, PSUs, Local bodies etc.), industry associations etc. can initiate a company. For discussion purpose this company is referred as 'People's Solar Power Company'. The proposed project financing innovation raises capital from residential users, small and medium scale industries, shops and other commercial organisations etc., who are also the end users of the power. Capital of the company can be raised by way of some instrument, like bonds. The innovation is that in return every investor gets his slice of power for the life of the project. This is most innovative feature of the business model to replace cash returns with power. Major cost components of the returns from the project are replaced from currency to commodity (power in this case). In addition the cash generated from the project by selling RECs and CERs can also be distributed as bonus. Fig.1 shows how a capital, power generated and cash revenue flows in such business model for a 50 MW solar power plant. The calculations are based on following presumptions.

Capital of the company can be raised by way of some instrument, like bonds. The innovation is that in return every investor gets his slice of power for the life of the project. This is most innovative feature of the business model

- Capital cost: Rs 7.50 crores per MW.
- Rate of power the end user is paying: Rs 7 per MW.
- Power produced: 1600 MWh per year per MW installed.
- Cash revenue from CERs 0.50 Rs Per kWh and from RECs Rs 4.50 per kWh.
- Cost of power in 10th year will be Rs 24.60 per kWh and in 20th year Rs 99 per kWh.

Steps in Implementation of Project

Major stakeholders involved in the process are: The "People's Solar Power Company", the "Investors" and the "Distribution Company".

Different steps in execution of project are as below.

- "People's Solar Power Company" raises all capital from the Investors. Investors are common households consmers, shop owners, small and medium industries, municipalities, corporations, government and non-government organisations etc. Minimum bond value can be Rs 1.25 lakh or so. Bonds can get 20% tax rebate as infrastructure bonds & effective investment will be Rs 1 lakh.
- Capital so raised is deployed in setting up a 'Solar Power Project'. Governments can

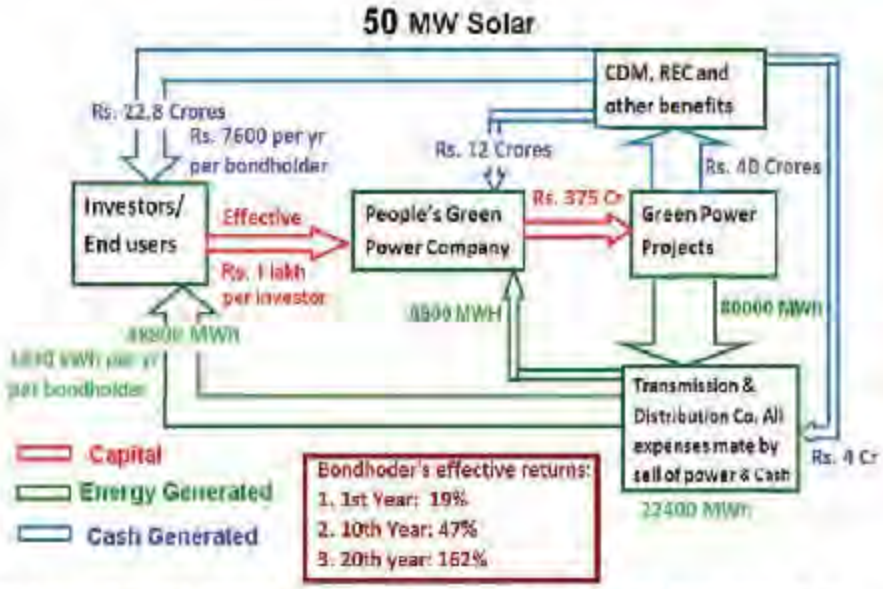


Fig.1 Flow of Capital, Power Generated and Cash Revenue for a 50 MW Solar Power Plant

take investment guarantee and the projects will be with the government as security.

- Once the project starts generating power then some part of the power is sold to pay for transmission and distribution companies for their services and some part of the power is given to compensate for T & D losses.
- "People's Solar Power Company" will sell some part of the power for 'O & M and insurance" and for its operations and profit.
- Balance of available power is distributed to the investors through the "Distribution Company" which maintains the account.
- There can be many small mechanisms introduced to take care of operational issues. These are the power per investor can be banked if not consumed in the same month. Bonds can be tradable commodity in the market. Bonds can be transferable to different location within the state, bonds can be sellable. In case of surplus power available with any bondholder same can be sold etc.
- There will be additional revenues by selling RECs and CERs. Part of these revenues will be used to pay the costs of transmission, distribution, insurance etc. and balance of the these revenues will be distributed between the "People's Solar Power Company" and "Investors" in predefined proportion.
- Governments can make the investments more attractive by awarding the status of 'Infrastructure bonds' or extending provisions of VGF.

Who Gets What?

Returns to different stakeholders will show that the project can be a big success. With sample calculations for 50 MW solar power plant with assumptions as mentioned about following scenario emerges about the returns to different stakeholders.

The Investor

Every investor who has effective investment of Rs 1 lakh will get:

- Approx. 1630 kWh per year for next minimum 20 years.
- Cash bonus of approx. Rs 6900 per year.

The business model will freeze the cost of power for 20 years and is insulated for any price rise in the cost of power. With power cost of Rs 7 per kWh today and Rs 24.60 per kWh in 10th year & Rs 99 per kWh in 20th year, the return on investment works out to be: 18% in first year progressively increasing to 38% in 10th year and further increasing to 114% in 20th year.

People's Solar Power Company

- Company will get: 8000 MWh of power per year for next 20 years.
- Company is expected to get Rs 8 crores per year by way of its share in sell of RECs and CERs.

Innovator

Gets royalty for his business innovation.

The Government

The Governments will get addition of thousands of MW of solar power plants in the grid, without investment of a single rupee. No subsidy required. This power is day power where we have deficit.

Transmission and Distribution Companies

These companies will get income for their usage of network. Additional power will be great help for power starved companies. Most of the power pumped in the grid will be day-power which is expensive and usage of power by bond holders will be throughout 24 hours which is beneficial to distribution companies.

Role of different agencies: Following roles are envisaged by different agencies in the proposed project.

State Government/ERCs

- Permissions for the project.
- Take investment guarantee for the investors

Who gets what?			
Solar PV Project	People's Power Company	Investor	IP holder
Capital invested	5 crores	Rs. 1.0 Lakh	NIL
Power per year	8000 MWh	1630 kWh/yr	800 MWh/yr
Cash revenue per yr	12.00 crores	7600 Rs*	crores
Total Revenue per year	16 crores	Avg. return 65% Per year	1.40 crores

*Depends on rate of CER & CDM benefits.

Table 1: Projected Returns for Main Stakeholders

Cooling India

Monthly

The Subscription In-charge
Cooling India
Chary Publications Pvt. Ltd.
201, Premalaya, Next to Cafe Coffee Day,
Opp. Telecom Factory, Deonar, Mumbai - 400 088.
Email: sub@charypublications.in

If You are already a Subscriber
Enter the Subscription No. CI/SUB/ ☐☐☐☐

Now SUBSCRIBE/RENEW Online Just Log on to www.coolingindia.in

Yes, I would like to subscribe Cooling India for.....years
at Rs..... (US $.....overseas subscribers)

Payment details :
Cheque / DD No.....Dated.....
Drawn on Bank.....Branch.....
In favour of **CHARY PUBLICATIONS PVT. LTD.**

Or charge my ☐ MasterCard ☐ VISA For Rs.....

CARD No. ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐

CARD EXPIRY DATE: ☐☐ ☐☐☐☐ (M M Y Y Y Y)

Date of Birth ☐☐ ☐☐ ☐☐☐☐ (D D M M Y Y Y Y)

Name.....

Signature.....

Designation.....

Company.....

Address.....

.....

City.....PIN ☐☐☐☐☐☐

Tel.....

Email.....

No. of Years	Amount	US $	Tick✓
☐ 1 (12 issues)	1000	200	
☐ 2 (24 issues)	1750	350	
☐ 3 (36 issues)	2600	525	
☐ 5 (60 issues)	4000	900	

(Kindly add Rs. 50/- for Non-Mumbai Cheques)

EI \ January 2015

Medical Equipment
-& Automation
India's Premium magazine on diagnostic, medical equipment and technology

Bi Monthly

The Subscription In-charge
Medical Equipment & Automation
Chary Publications Pvt. Ltd.
201, Premalaya, Next to Cafe Coffee Day,
Opp. Telecom Factory, Deonar, Mumbai - 400 088.
Email: sub@charypublications.in

If You are already a Subscriber
Enter the Subscription No. MEA/SUB/ ☐☐☐☐

Now SUBSCRIBE/RENEW Online Just Log on to www.medicalmagazine.in

Yes, I would like to subscribe Medical Equipment & Automation
for.....years at Rs..... (US $.....oversees subscribers)

Payment details :
Cheque / DD No.....Dated.....
Drawn on Bank.....Branch.....
In favour of **CHARY PUBLICATIONS PVT. LTD.**

Or charge my ☐ MasterCard ☐ VISA For Rs.....

CARD No. ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐

CARD EXPIRY DATE: ☐☐ ☐☐☐☐ (M M Y Y Y Y)

Date of Birth ☐☐ ☐☐ ☐☐☐☐ (D D M M Y Y Y Y)

Name.....

Signature.....

Designation.....

Company.....

Address.....

.....

City.....PIN ☐☐☐☐☐☐

Tel.....

Email.....

No. of Years	Amount	US $	Tick✓
☐ 1 (6 issues)	750	150	
☐ 3 (18 issues)	2000	500	
☐ 5 (30 issues)	3000	700	

(Kindly add Rs. 50/- for Non-Mumbai Cheques)

EI \ January 2015

and in return the projects will be leased with govt. as security.

- Implement RPO mechanism strictly.
- Frame some user friendly policies for purchase of green bonds by new industries, new luxury houses, corporations etc.

Distribution Company: Accept the third party sell and distribution mechanism on retail and operate the business model.

"People's Solar Power Company": After projects are commissioned, liasoning with distribution company and maintain accounts of investors. Work as a professional entity.

USPs of Innovative Financing Mechanism

Following are USPs of this innovative financing mechanisms.

Corporate investment projects require minimum 30% return on capital in first few years. Even gestation period of one year adds @ 20% to the capital cost. In the proposed business model there is no increase in capital cost during gestation period. Also the model survives on lower returns in initial years as all money raised is equity by end users. For investors the returns of the order of 15% in first few years is higher than what common investors get from FDRs in bank. Higher returns in later years will be highly motivating for investors.

Also there is big class of investors who are environmentally conscious and will like to have their own green power and have no other option at present. Also many small and medium scale industries, corporations and many other such beneficiaries can put in their investment for assured power for minimum 20 years. The project ensures all 'Environmentally conscious' investors that with their investment the project is established and their own solar power is wheeled from project site to their houses.

Transfer of bonds, selling bonds in market, banking of surplus power, sell of surplus power are some of the innovative features.

This business model is patented by the innovator and any agency like SECI, Govt. of India or State Govt., distribution companies, industry organisations etc. can have agreement with the innovator for adoption of the business model.

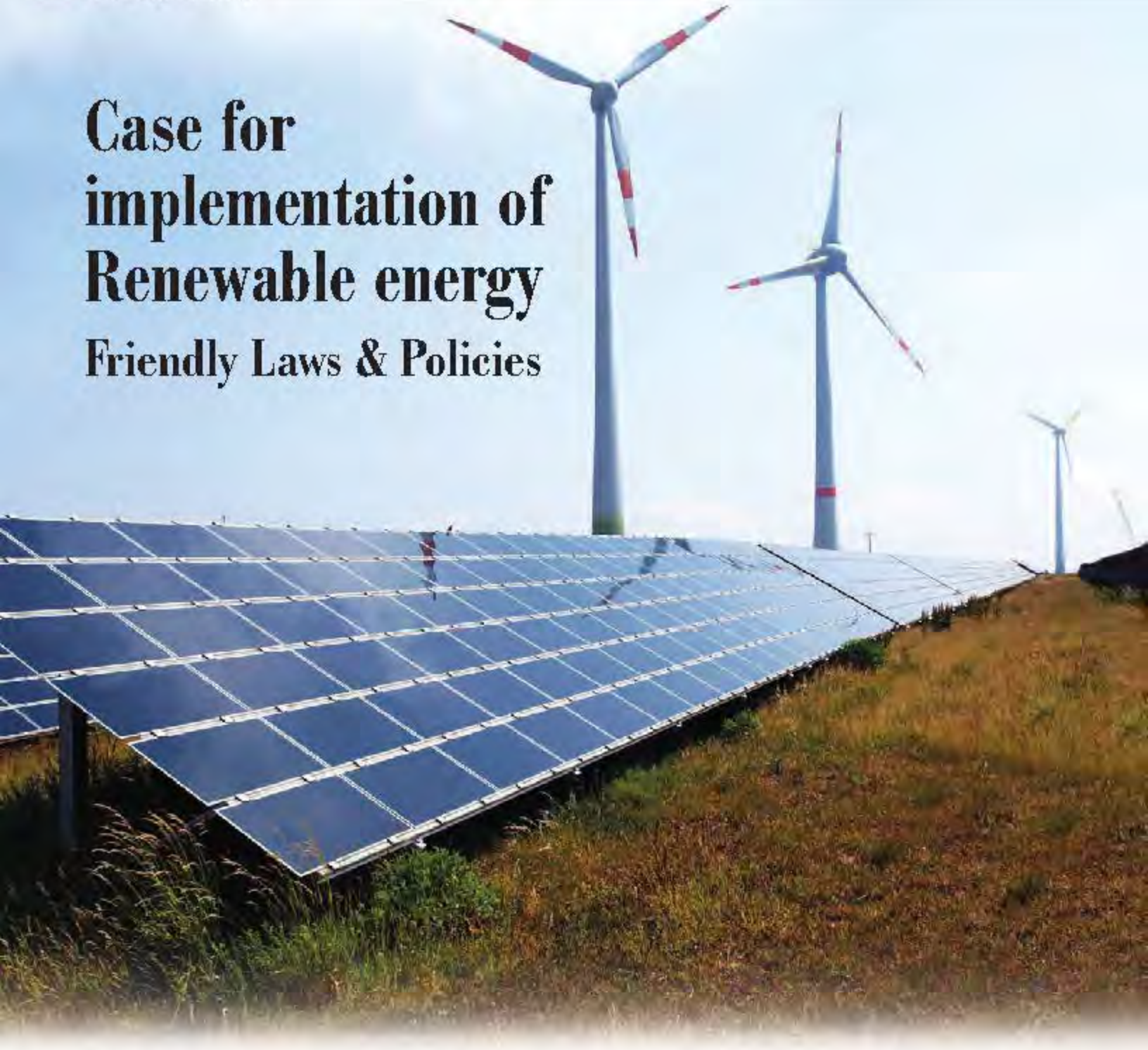
Prof Dr Ajay Girdharilal Chandak

PhD (Solar), MTech (Mech) IITB, Certified Energy Auditor & Renewable Energy Consultant, PRINCE (Promoters, Researchers & Innovators in New & Clean Energy), Suman Foundation, Agra Road, Deopur, Dhule, India. He has published many papers and has memberships of 12 professional associations including 'International Solar Energy Society', 'Solar Energy Society of India', Institute of Engineers; He is Founder: Indian Association of Energy Management Professionals, Solar Cookers World Network etc. He was elected as board of directors for "International Solar Energy Society" with HQ at Freiburg, Germany - apex advisory body of United Nations.

Profile

Case for implementation of Renewable energy

Friendly Laws & Policies



In the recent past, there has been lot of talk about likely dangers due to 'Global Warming' and how it is going to adversely affect our day to day life. Everyday newer phrases are coined to attract the attention of the people. Reducing 'Carbon foot-print' and becoming 'Carbon-neutral' are some of the favourite ones. Despite much hue and cries, there is hardly any activity visible on the ground. A few corporate house doing something as 'social responsibility' may not make any dent. People have to understand that the single largest reason for the climate change is the inefficient use of energy and resources. We need to realize that at the end of the day, we are all governed by the laws of the nature. Besides, there are other man made laws which must be followed for a sustainable life style.

'Eco-not for me' Growth

The word 'Economy' itself contains the word 'Eco', but in our pursuit for higher and higher superficial growth, we went on

neglecting the ecology and environment. Finally, the 'Economic Growth' has come to mean "Eco-not for me" Growth.

We have not only refused to obey the laws of the nature but do not even bother to understand several eco-friendly laws and policies passed by our law makers after lot of deliberations. The business and industry lobbies mistakenly resist their implementation thinking it will hamper the growth rate. The lazy and indifferent bureaucracy only helps them by going slow on the actions needed.

These laws and policies relate to conservation and efficient use of energy, prevention of water and air pollution, conservation of forests, wildlife protection, bio diversity and so on. Proper implementation of such laws and policies will only help the growth not retard it while simultaneously ensuring that the fruits of development reach the under-privileged without adversely affecting the environment. Let us take an example of one law which can make a huge difference to promote energy efficiency and renewable energy but will also help in reduction in Global warming. The law is called "The Energy Conservation Act, 2001.

Salient Features of 'The Energy Conservation Act, 2001'

It is an 'Act to provide for efficient use of energy and its conservation and for matters connected therewith or incidental thereto'. The Act includes mandatory provisions such as periodic energy audits, codes for design of energy efficient buildings, efficiency labelling of equipment and appliances, energy consumption norms for equipment and processes, appointment of energy managers, preferential treatment to energy efficient equipment and appliances. It also provides for prohibiting manufacture or sale or import of energy inefficient equipment and appliances.

There is also a provision for appointment of Inspectors with powers to inspect any premises where energy is being used inefficiently. It also provides for imposition of penalty for any non-compliance. However, these provisions are not effective since there are no Inspectors/ Adjudicating Officers and Tribunal to deal with the defaulters.

'Inconvenient Truths' about Indian energy sector

Believe it or not, but it is a fact that 25 % of world's population without access to electricity lives in India. As per the Census, 2011 Figures, 33% of households in our country did not have electricity connection. Majority of households still depend on the firewood and kerosene for cooking and lighting their dwellings. This is despite the fact that we spend about 30 % of budget allocation to meet our energy requirements. Our net Oil import bill has crossed Rs 7,50,000 crore mark.

We also import coal, nuclear fuel and even solar panels. At the same time, we continue with our policies to provide subsidy (directly or indirectly) on petroleum products and electricity to the tune of more than Rs 2,00,000 crore. Most of the subsidy is cornered by the undeserving population.

An estimated capital investment of more Rs 50,00,000 crore in the 12th five year plans is earmarked for energy sector while our social sector continues to live on lip sympathy. It might also be hard to digest but the facts remain that every 7th Child in our country sleeps hungry and that the majority of our population has no access to drinking water and sanitation. Our farmers are committing suicide everyday.

Generating wealth from nothing

The Energy Conservation Act, 2001 is a law which could help generates wealth from nothing. Wealth generation by way of conservation and efficient utilization of energy and resources is something which is entirely in our control and easily implementable.

There is no dispute that there exists a huge energy saving potential to the extent of 20 to 40% depending on the sector. This saving can be realized if the EC Act, is implemented in right manner.

An estimated amount of more than Rs 1, 50,000 crore could have been saved every year by following the law in letter and in spirit. Similarly other 'Eco-friendly' laws and policies have tremendous scope for generating wealth from 'nothing'. Of-course, the wealth is not generated from 'nothing' but by avoiding wastages, pilferage and by using the energy and resources efficiently.

How the business will grow!

The energy savings will help increase profitability for the business while simultaneously making available the saved energy to the large population living in rural areas. Presently without access to electricity if these homes are assured of power supply there will be tremendous growth for all basic electric and electronic goods. This will have cascade effect as all other sectors in the supply chain will see growth.

Steel, Cement, Copper and Aluminium sector will grow as there will be need for laying of transmission and distribution network, increased production of transformers, cables, etc. One can imagine the growth of service sector.

This is an example of only one law i.e. 'Energy Conservation Act, 2001'. Just imagine the potential of business growth from the conservation sector; if all the well meaning, eco-friendly laws and policies, are implemented sincerely. The Industry and business would do well by taking pro-active part in ensuring their implementation for the long term benefits.

Profile

Sunil Kumar Sood

Mechanical Engineering graduate from MANIT (earlier MACT, an REC) Bhopal is a certified energy auditor. He is working as Sr. Manager in Environmental Section of MECON Ltd, Ranchi and is coordinator for Sustainable development activities undertaken by MECON. He is founder member and former President of Indian Association of Energy Management Professionals. Recipient of several awards and for environment protection by Rotary Ranchi South, he is also nominated for 'Eminent Mechanical Engineer' during 30th National Convention of Mechanical Engineers, Gorakhpur.

Testo Thermography for Preventive Maintenance

In the global competition for market shares, companies depend on efficient manufacturing processes and machines that run reliably. Service engineers play a key role in this:

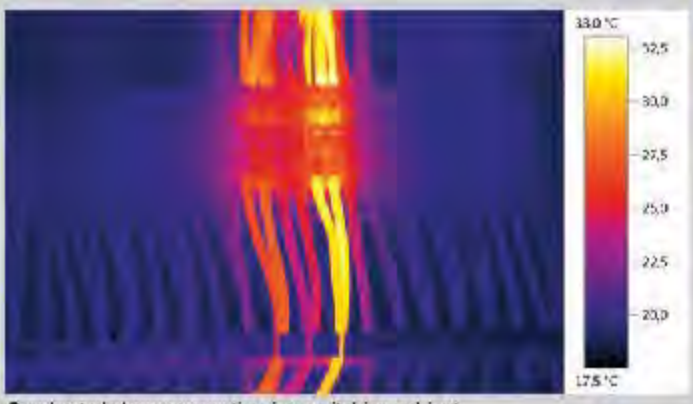
Testo Thermal Imager 885

They bear the responsibility for ensuring the permanent availability of production facilities. To them, thermography is a valuable diagnostic tool.

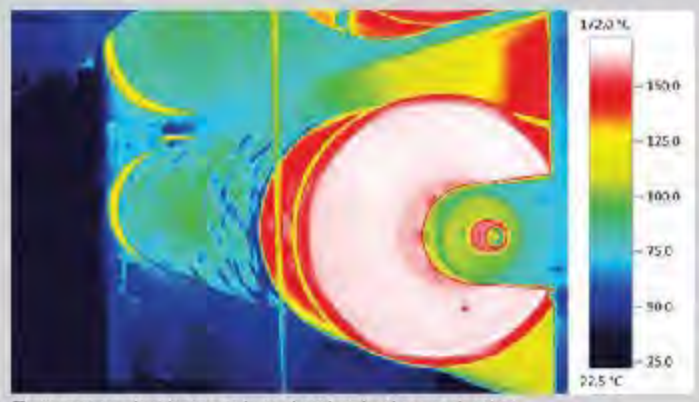
Problems with electrical and mechanical installations usually become evident at an early stage due to thermal irregularities. Thermal imagers visualise status changes and weak spots – and they do this in a non-contact, non-destructive manner. The next few pages outline how thermal imagers from Testo can help you to perform typical preventive maintenance tasks more reliably, easily and safely.

The Challenge

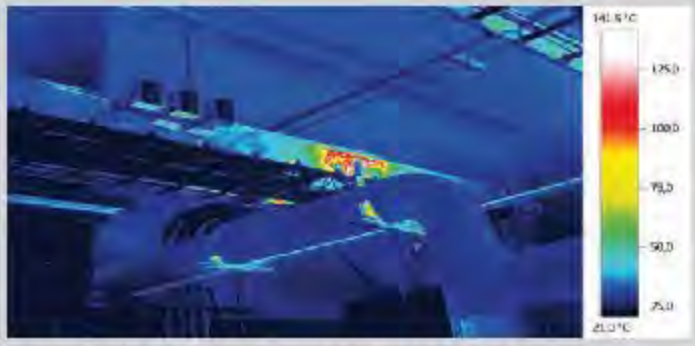
Maintenance was previously considered to be purely a tool for rectifying faults. These days, it is seen as a preventive maintenance service which ensures the permanent availability of production facilities and plays a vital role in the competitiveness of industrial companies. Every day, specialist personnel are at the forefront of the struggle to minimise downtimes, prevent damage to mechanical and electrical components, fully exploit the level of equipment utilisation, and as a result also reduce maintenance costs. Since production usually focuses on a small number of machines or automated systems, when these are shut down this often has far-reaching consequences: one leaky valve can spoil the entire batch, a machine fire could end up jeopardising your company's million euro contract, or your company's fire insurance may threaten higher premiums as an additional penalty. Large-scale damage may result in the plant shutting down. One out of three fires in industrial companies can be attributed to electrical components overheating, with minor defects such as loose terminals or damaged cables often the cause. Fault-free plant status also guarantees safety in the workplace. There is additional pressure from national and international legislation, as well as the standards of employers' liability insurance associations or trade associations. These are all in place for your own safety, since work-related accidents are more likely to occur in maintenance than in production, despite the



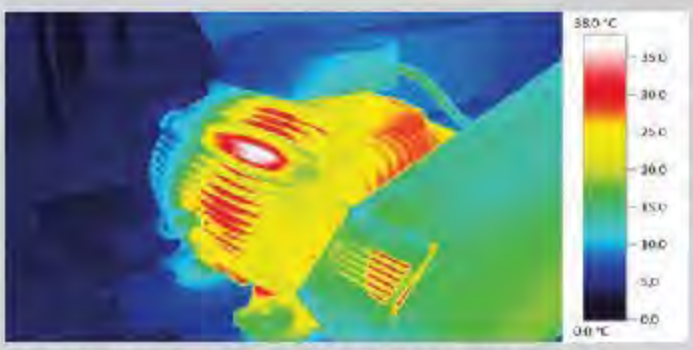
Overheated clamp connection in a switching cabinet.



Temperature development in a plant in plastics production.



The overheating bearing in a conveyor line is clearly visible.



Temperature development in a plant in plastics production.

lower number of employees. Lastly, all inspections need to be documented, and your supervisor expects a complete, technically accurate report. Thermography is a safe, efficient and simple measuring technique for these typical industrial tasks.

The Solution

Thermal imagers convert thermal radiation in the infrared range into electrical signals and make them visible. This extension of the range and function of human vision by means of the thermal image is akin to a sixth sense, which service engineers can use to detect concealed defects and anomalies before they turn into proper malfunctions and endanger system availability.

Versatile and flexible

In electrical installations, thermographic measurement methods are possible at all voltage levels. This means that entire switch cabinets, not to mention medium, high and ultra-high voltage installations, can be inspected efficiently and in compliance with the necessary safety clearance. Carrying out thermographic inspection for just a second time reduces a system's rate of failure by 80 % and provides an added safeguard against fire. Even before damage occurs, the thermal image provides information about the operating status of mechanical assemblies. Motors, gears, couplings or bearings can be examined individually or as a functional unit. Thermal imagers can be used for precise temperature measurements even on complex aggregates, containers for liquids and gases, turbines or filters. You can use thermography to inspect insulation, and also to detect internal deposits in pipelines and containers.

Safe and non-contact

A thermal imager can be used to examine live components or moving parts from a safe distance. This means that thermography can be used to monitor even difficult-to-access areas safely and accurately. This increases occupational safety and allows inspections which were previously only possible through investing considerable effort – by shutting down machines or disconnecting electrical installations. The examination also reveals the thermal behaviour under full load. Problematic areas are clearly indicated on a display. This allows the on-site service engineer to detect and eliminate sources of error at the very moment that these crop up. Using a pyrometer could cause the service engineer to miss these crucial details. In addition, thermograms facilitate clear error documentation and long-term time series comparison of system status. The software can be used to analyse the images quickly and easily, & summarise all work in a report. This reduces tedious paperwork.

Place your trust in the global market leader

Testo India is a 100% subsidiary of Testo AG, one of the world's leading manufacturers of portable, innovative measuring instruments and thermal imagers. With an infrared resolution of 320 x 240 pixels, the testo 885 professional thermal imager is the flagship instrument for universal applications. The testo 890 high-end system's 640 x 480 pixel detector will satisfy even the most demanding of requirements. Testo Super Resolution improves the quality of each recorded infrared image, making it a cut above the rest: the patented technology produces four times as many readings and a usable geometric resolution that is 1.6 times higher. testo Site Recognition facilitates repeated thermal imaging of similar measurement objects: The function's immediate measuring location detection and automatic thermal image assignment enable efficient inspection route management. The ergonomic camcorder design and extra features such as the lens protection glass ensure safe handling in tough industrial environments.

For further information contact:
info@testoindia.com

Reactive Power Management for Induction Furnace Industry

Reclamation & Welding is one of flagship company of AIA Engineering company, situated in GVMM, Odhav. This company is in manufacturing process of cast iron based grinding media. This plant were having contract demand of 2000 KVA from GEB. They have installed 2 Ton induction furnace and same was operating at 585 V. Total load of furnace were 1.6 MVA. Plant were also having auxiliary load of 1000 KVA which includes Grinders; Welding machine; Shot blasting machine & so on. They were having some 1400 KVAR of power capacitors for reactive power management in their plant.

Problem: they were not able to maintain Unity PF in their utility bills. This problem was due to their sintering process of furnace on every Saturday. During sintering process, plant were operating at 0.3 to 0.4 PF only. They were trying to bring this PF at unity by connecting power capacitors of 1400 kVAr in auxiliary load section. Inspite of these many power capacitors, plant were not able to achieve unity PF in their utility bills, but but were not able to find solution for same.

Solution: NIFA Electronics were called by client to find solution of this problem. We have studied their plant thoroughly in normal production process also in sintering process, too. Based on our Power Quality study, we have suggested them to install State of art, specially designed APFC Panel of 1800 kVAr Power Capacitors. Speciality of this APFC Panel were LT Power Capacitor bank of 1800 KVAR with VAR Based, Automatic Control depending upon load & sensing of reactive power requirement from 11 kV, HT supply. With installation of same, APFC Panel, we have assured them payback of only 18 months for this solution. We as NIFA Electronics has such kind of several solutions in field of Energy Saving; Power Conditioning & Power Management. We have served more than 3000 customers in our working of 20 years.

Nuclear Power: Global & Indian Perspective at India Nuclear Energy 2014

Electrical India had booth at the India Nuclear Energy 2014, a three day event during November 2014, hosted by UBM India at Nehru Centre, Worli in Mumbai, The show, which is India's largest civil Nuclear event, is recognised as an integral part of the power industry in India by the Associations and the industry at large.

The 6th edition of the India Nuclear Energy 2014 was inaugurated by Dr. R. Chidambaram, Principal Scientific Adviser, Government of India. Renowned industry dignitaries like S.A. Bhardwaj -DAE-Homi Bhabha Chair Professor, Dr. Srikumar Banerjee –Ex Chairman DAE & Homi Bhabha Chair Professor, Atomic Energy Commission, Dr. Prabhat Kumar - Chairman & Managing Director, Bharatiya Nabhikiya Vidyut Nigam Limited (BHAVINI), S K Malhotra - Head-Public Awareness Division Department of Atomic Energy, Dr. Natarajan, IGCAR, S P Vhora Executive Director (Technology Development) Nuclear Power Corporation of India Limited, Prof. Kannan Iyer - Mechanical Engineering, IIT Bombay honoured the show with their presence. The summit brought together senior nuclear professionals from DAE, NPCIL, INS and other private companies from the civil nuclear space. The event was marked by a summit based on the theme of 'Nuclear Power: Global and Indian Perspective', setting the stage for the Policy 'Think-Tanks' to further chart India's role as a Growing Civil Nuclear Power.

Erwan Hinault, CMD, AREVA India, said, "While the Government is exploring alternative sources of energy to cover the supply versus demand gap existing today, nuclear power becomes mandatory as the capacity load factor generated using Nuclear power is in the region of 82% viz. renewable energy which is now only 25%. India Nuclear Energy 2014 has really helped in building awareness and also the visitor profile to the event has been very relevant." Key Highlights of the show were The three day event had exhibitors from France, UK, Canada Korea and India. The total footfall achieved this year was double from that of last year.

The second day of the event focused on niche segments of the nuclear industry, including a Seminar by the UK Trade & Investment (UKTI) on doing business in Nuclear Energy. The UK remained committed to an innovative, broad based and dynamic civil nuclear partnership with India, including looking at taking Indian players from the nuclear space back to the UK to bring them to speed with the latest that the UK has to offer in terms of technology and legislation. At the UKTI seminar, key dignitaries like Kumar Iyer, British Deputy High Commissioner, Mumbai & Director General UK Trade and Investment, Chris Dain, First Secretary Trade and Investment- North India, British High Commission and Address by S K Malhotra, Head-Public Awareness Division, Department of Atomic Energy.

"There is renewed interest by the UK Government in promoting bilateral trade and there is a great opportunity for both our countries in promoting business in the nuclear sector. Lessons have been

learnt and hence mistakes will not be repeated, instead there will be new avenues which will be addressed. Ministers are serious about conducting business with India and the same voices are being echoed by the political leadership in India as well. The UK already has a rich legacy of conducting successful business in India; case in the point being the Oil & Gas sector where we have made some successful investments, bringing in expertise, up-skilling indigenous people and showing revenue by local generation." Said Chris Dain, First Secretary Trade & Investment- North India, British High Commission.

Joji George, Managing Director, UBM India, said, "The final day of the show concluded with a lot of fanfare with most of the industry stakeholders seeing value in participating in India Nuclear Energy 2014. Definite step in making this sector a reality were achieved at India Nuclear Energy 2014. We are looking forward to the next edition of the event which will see participation from a lot more industry players." Indian Nuclear Energy 2015 event will take place on October 15-16, 2015.

Exhibition & Conference - together 1st time at Intersolar India 2014

Electrical India participated with a booth at Intersolar India, India's largest exhibition and conference for the solar industry, opened its doors for the sixth time. From November 18–20, the exhibition and conference took place for the first time on the same dates at Mumbai's Bombay Exhibition Centre. Here, 160 international exhibitors from the fields of photovoltaics, PV production technologies, energy storage systems, and solar thermal technologies presented the entire solar industry value-added chain. Some 8,500 visitors from all over the world attended as expected. In parallel to the exhibition, 100 distinguished speakers discussed the latest market developments, new technologies, & application solutions at the Intersolar India Conference.

With some 300 days of sunshine per year and daily insolation levels of four to six kilowatt hours (kWh) per square meter, India has a huge potential for the production of solar energy. The new Indian government has recognized this fact, and is now focusing heavily on solar energy in its plans to tackle the country's energy deficit. Only in October, the Ministry of New and Renewable Energy (MNRE) increased the existing targets, with schedules now providing for some 15 GW of additional capacity by 2019. Alongside large-scale solar power plants and industrial or commercial roof installations, India has enormous potential for off-grid solar systems, or 'microgrids', since many regions currently have no working power grid. The technologies, products, and services needed to fulfill all these demands were showcased.

Intersolar India Conference opens in parallel to exhibition for the first time

For the first time in its history, the Intersolar India Conference opened at the Bombay Exhibition Centre (BEC) on the same day as the Intersolar India exhibition. For three days, the topics and trends affecting the solar industry were explained and discussed by 100

recognized experts from research, industry and associations – among them prominent representatives of the Indian solar industry. To get the conference underway at the opening session in hall 6, auditorium 1, speakers including Dr. Rajendra K. Pachauri, Chairman of the Intergovernmental Panel on Climate Change (IPCC) and Director General of TERI (The Energy and Resources Institute), as well as Sudhi Ranjan Mohanty, Principal Secretary, Government of Madhya Pradesh, talked about the successful development of programs for the solar industry in the state of Madhya Pradesh. The PV Executive Panel was highlighted on the first day of the conference discussing developments in the country as well as prospects for the future. Additional topics on the following conference days include: solar energy market developments in India and around the world; financing, safety and operation of large-scale PV power plants as well as training specialist staff; industrial and commercial roof installations; solar-diesel hybrid systems, and solar energy storage.

Intersolar India: technologies and trends in India's solar energy supply

At Bombay Exhibition Centre (BEC), around 160 exhibitors showcased their products and solutions in the fields of photovoltaics (PV), PV production technologies, energy storage, and solar thermal technologies. New for this year is the joint pavilion shared by the Indian state of Madhya Pradesh together with the booths of Welsun, Sun Edison and Urjaas Energy Limited. The state has been the focus of attention since it was assigned a surprising third of all projects in the latest round of tenders for the national solar mission (Jawaharlal Nehru National Solar Mission – JNNSM) in May of this year. Companies are again also presenting technologies and products 'made in Germany' at the joint German pavilion.

Intersolar Award Ceremony for Solar Projects in India

Intersolar AWARD for the category Solar Projects in India was presented for the third time at Intersolar India 2014. The coveted innovation prize in the Industrial and Commercial Use category went to Bosch Ltd. for its Maruti Suzuki Lagoon PV power plant project, which has an output of one megawatt and serves both to generate electricity and enable the collection and use of rainwater. Trojan Battery won in the Off-grid Solutions category for their Trojan Smart Carbon™ Batteries, a plug-and-play solution consisting of a PV installation and a battery supplying energy to more than 150,000 telecom towers in India. The Intersolar AWARD in the Utility-Scale Projects category was presented to Tata Power Solar Systems Ltd for a 50 MW PV power plant in Madhya Pradesh, which supplies some 90,000 households with electricity through a public-private partnership (PPP). The next Intersolar event will take place from November 18-20, 2015.

EP China 2014 concludes, achieves over 26,000 Trade Visitors

The 15th International Exhibition on Electric Power Equipment and Technology (EP China 2014) and The 8th International Exhibition on Electrical Equipment (Electrical China 2014), Asia's leading electric power and electrical exhibition, come to a close at the China International Exhibition Center in Beijing, on 24 October, 2014. The 3-day show has gathered over 900 exhibitors occupied over 35,000 sqm of exhibition area and attracted 26,336 trade buyers from 40 countries and regions, a big progress comparing to previous EP China held in Beijing. Over 90% of exhibitors are satisfied with the positive outcomes.

High-Quality Exhibitors and Professional Buyers: As the largest and most professional electric power and electrical exhibition in China, EP China 2014 respond to the industry needs and divided 8 exhibiting halls highlighting with Smart Grid Hall, and the newly created Brand Hall and Energy Conservation & Environmental Protection Hall. Industry leading enterprises have joined the show including ABB, Toshiba, Hyundai, Legrand, Rittal, Huaming, Linbo, Jilin Yongda, NARI, XJ Group, Pinggao, Sheng Long, Jiangsu Senyuan, China Southern Power Grid, Staubli, AEG, Mennekes, Tengen, People, Taiyong, CNC, IES Lab, Minghan, Gopower, Longking, Datang Technology, Beijing Nation Power, SPC, CPI Yuanda, China BOQI etc.

Being the most internationalized show in the industry, EP China featured U.S, Germany and Taiwan pavilions. As the industry technology development of China is becoming more advanced, the organizer also invited overseas buyers and introduce the Chinese latest technology, to open an export route for Chinese technologies to the world. The show has attracted overseas buyers from 40 countries and regions. 18 industry association and corporation delegations were organized to visit the show, further enhancing the visitor profile of EP China.

IEEE & IEEMA to Co-sponsor INTELECT Conference & Expo

Three IEEE societies and the Indian Electrical & Electronics Manufacturers' Association (IEEMA) will co-sponsor the IEEE-IEEMA INTELECT Conference & Exposition from 22-24 January 2015 at the Bombay Exhibition Centre in Mumbai. The conference theme is Smart Electricity for Emerging Markets, and the exposition will focus on the connected intelligence in the Electricity of Things.

IEEE Computer Society, IEEE Communications Society, and IEEE Power & Energy Society will produce conference portion, which will feature globally renowned speakers and panelists, & pavilions showcasing cutting-edge innovations and future technologies on H3O, Digital Smart Cities, and Smart Rural Electrification. "As a global organization, IEEE has a strong interest in serving technology professionals in India, and IEEE Computer Society is very pleased to be helping co-found a brand new event that centers on such a promising and essential future technology as smart electricity," said Angela Burgess, executive director of IEEE Computer Society.

INTELECT is designed to draw builders, architects, city planners, energy and government officials, transportation industry representatives, venture capitalists, utilities, contractors, consultants, academia, and others interested in learning about new technological advancements and knowledge to smart electricity. "India is fast becoming more urbanized and digitized to adapt to the growing aspirations of the large young population. Its impact on electricity demand and consumption will be significant. IEEMA, as the voice of the Indian electrical sector, is privileged to partner with IEEE, which can provide invaluable global knowledge and expertise," said Sunil Misra, Director General, IEEMA.

The event is expected to feature about 20,000 sq mtr of exhibit space with over 200 exhibitors. "The electric utilities of the world are having to share space with a growing renewables industry, which includes solar, wind, and hydro," said Patrick Ryan, Executive Director of IEEE Power and Energy Society. "However, energy storage and microgrids are quickly gathering momentum, and it's this kind of forum where industry professionals can network and share trending information." "IEEE Communications Society is proud to announce its sponsorship of INTELECT 2015," said Sergio Benedetto, President of IEEE Communications Society. "Effectively addressing many of the world's Public Imperatives depends on intelligent creation, use, and distribution of energy."

Solar Power – Need of the hour

Among the renewable sources, Solar power is gaining momentum in India with the push given by government and the abundant solar potential in India. The increasing demand is driving down the cost of solar energy which is attracting more and more investment in this sector. While the investment and increasing of Solar share in the energy sources is fully justified, it is also equally important to have efficient controls that will enable solar penetration to maximum possible extent including the possibility of exporting the excess power back to the grid.

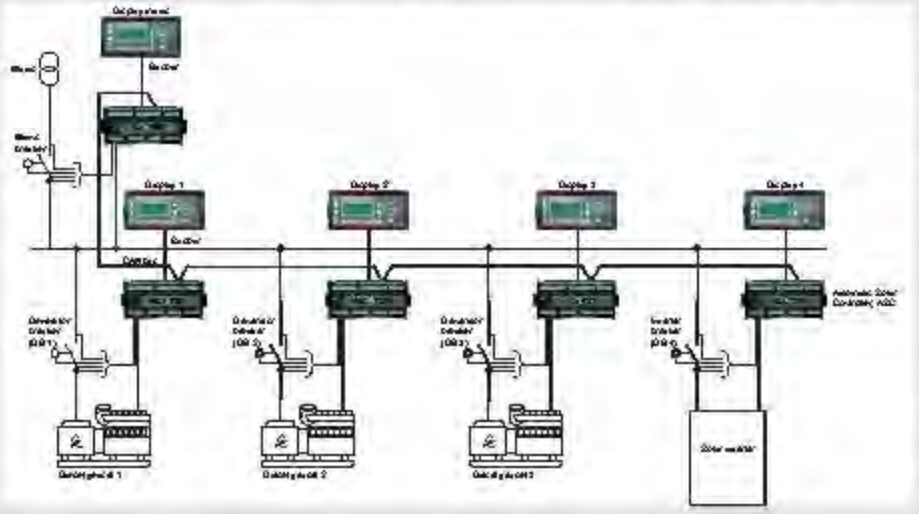
Challenge with solar

In a contemporary system, solar power can only be utilised as long as the utility supply is available. In the absence of utility, solar power can no longer deliver the power and the diesel generators come in to deliver the backup power. The Solar systems are not geared up to supply power along with the diesel or gas genset as the load sharing between the two groups is a challenge. This leads to burning the fuel (diesel/gas) for the genset to take the entire load for the duration for which the utility is absent, in spite of solar power source being available.

DEIF's answer to the challenge

DEIF with its experience and expertise in the field of power generation control solutions; has come up with an innovative solution to this challenge. DEIF introduces the Automatic Solar Controller (ASC), a solution that provides integrated solution for systems with utility, diesel and solar power source.

The system provides an interface between the diesel/gas genset and solar, with or without presence of utility power - a solution that enables you to share the load between solar PV cell and diesel/gas genset with maximum solar penetration, thus resulting in maximised savings even during utility failure. DEIF solutions being cost-effective balance your economy and conserve the environment as they are highly efficient. A solar system consists of series of PV cells connected to their respective inverters. DEIF's solar controller is connected to the master inverter or central control point of the group of inverters and interconnected among Utility and Genset Controllers through CAN bus communication. DEIF's solar controller serves as an interface between Solar source and the diesel genset controllers/Utility Power, namely Advanced Genset Controllers (AGC), over the CAN bus to adjust power output to meet the load requirement with solar system taking the maximum load share. When the utility fails, Genset start up to provide the reference and provide minimum load that will let it run efficiently and let the solar meet the rest of the demand. If the solar power output decreases due to bad sunlight, the deficit will be met by diesel/gas genset through the intelligent interface, thus ensuring reliable supply of power in all conditions.



How much can you save!

To get a glimpse of what you would be your minimal saving after installing DEIF's solution, let us consider a simple real life example. On an average, considering power loss of up to 20 hours per week implies that in a year you can have almost 1000 hours of lack of utility power. Considering that the diesel consumption normally is of 125 litres per hour (500 KW at full load) and assuming 1.5 $/litre as cost of diesel, for 1000 hours of no utility power, 187.5 $/hour is the cost for running a diesel genset for one hour. For 1000 hours you would spend 1, 87,500 $ and for running 2 genset, the total spending will be 3, 75,000 $ on fuel cost alone. In addition to this, the cost for handling the fuel, managing resources, maintenance of genset, gas emissions, and environmental setbacks add to the overheads.

On the other hand, DEIF's solar solution enables you to use solar power even in the absence of utility with high solar penetration. Say with a 60 % solar penetration you can run just one genset and save on fuel cost of the other in the period of utility failure which implies a saving of 1, 87,500 $. Using solar for the additional period of the year can make that period also further green and help maximize the project's overall return on investment. DEIF's solar solution will thus prove to be a boon to India's evolving solar sector.

For further information contact:
india@deif.com

Comprehensive range of surge protection solutions




NEW LINE

Surge-Trap®

Lightning current arresters and surge protective devices
Type 1, Type 1+2, Type 2 and Type 2+3 SPD's to EN/IEC 61643

Mersen India Pvt Ltd
(EP Activity)
Plot no 19, 4th Cross,
Bommasandra Industrial Area,
Bangalore- 560099
Email: sales.ep.India@mersen.com
Tel: +91 80 27834005/4006
Website: www.ep.mersen.com

Download the new Surge-Trap® brochure on:
ep.mersen.com

MERSEN
Expertise, our source of energy

Pete Hammond Power Solutions Pvt Ltd

Pete Hammond Power Solutions Pvt Ltd is unique entity that makes tranformers mostly for the specific needs of customers. Manufacture of special purpose transformers is a regular feature at PH and the manufacturer of standard transformers in volumes is rather rare.

During the last 25 years several developments like Neutral Grounding Transformer, Earthing Transformers, Scott connected Transformers, Furnace Transformers, Auxiliary Transformers, Cast Resin Transformers, VPI Transformers, Power Transformers up to 50 MVA 132 KV CLASS, Multi-Pulse Transformers, Transformers for Solar Application, for Wind Power Generation etc., were developed and manufactuerered and delivered to the entire satisfaction of their esteemed customers.

Some new challenges were thrown at us by their customer and with their active participation, they could develop some new products. Steel Industry has helped us develop complex furnace Transformers. Pharma Sector has helped us develop Transformers to operate under severe conditions affording break free service for decades. Multi Tap Testing Transformers for drives was developed with active participation of Customers. Solar industry has given an opportunity to develop integrated solution in the form of "Unitised – Substation" with Inverter enclose Transformer, HV and LV panels integrated in to one enclosure.

The wind energy segment has given us the opportunity for developing a dependable transformer for the critical application with longer life. The European market has helped us in developing LOW LOSS, SUPER LOW LOSS and low cost Transformers with aluminium conductor or Foil to suit new EU losses. They have developed Multi-Pulse Transformers for Drives Application with Design and skill transfer provided by their partner M/s. Hammond Power Solutions Inc, Canada.

Their customers have been our guides, their brand ambassadors and their quality ensures.

For further details contact:
exim@petetransformers.com

Elcon Cable Trays Pvt Ltd

ELCON CABLE TRAYS PVT. LTD
AN ISO 9001 : 2008 COMPANY
DINESH RATHI GROUP OF COMPANIES

Elcon was established in the year 1987; the company is into manufacturing of Cable Trays and Earthing Material. They also supply Erection Hardware required for Electrification and Instrumentation. They cater to many industries, like Oil & Gas, Cement, Petrochemicals, Power Generation, Sugar, Water Treatment and others.

This range essentially includes Cable Terminals and Lugs, Copper Tubes and Fittings, Condensing Pot, Junction Box, Lighting Arrestor, Pipe Fitting, Push Button, Station, S.S Tube/ Fitting and Valves & Manifolds. Elcon is engaged in making high performance products that are finding growing acceptance in the Electrical, Instrumentation and Construction industries.

All ELCON products bear the best of quality. The products are certified by the leading consultants including Bechtel, Dasturco, Desein Pvt.Ltd., Development Consultants Pvt.Ltd., UDHE India Limited, among others.

For further details contact:
www.elconhouse.com

Schniewindt

SCHNIEWINDT
THE POWER OF ELECTRIFYING IDEAS

Schniewindt was founded in 1829 in Westphalia. Since the invention of the so-called 'Schniewindt grid' in 1902, Schniewindt has manufactured electric high-voltage resistors and is consequently one of the leading suppliers of electric components for energy distribution. The company develops its products with market requirements and state–of–the–art technology, and with its worldwide partnerships, ranks among the leading manufacturers of high-performance ohmic resistors and electric heating devices and systems for industrial and commercial purposes. Schniewindt is a company with 120 employees, among them 20 engineers, who meet the demanding technical challenges of customer-based projects.

For further details contact:
www.schniewindt.cn

Xiamen Minghan Electric Co Ltd

The company is manufacturer of MV and LV switchgears, key components as well as a variety of power automation devices, systems and solutions for power distribution and substation systems. Their products and services are widely used in oil & gas, mining, petrochemical industries and utilities such as roadways, railways, airports, sanitation and sport arenas etc. The company specializes in power engineering technologies and power automation solutions. They also provide OEM products, and act as an agent sourcing in China for switchgear primary & secondary components. The company's some of major customers are China State Grid, Petro China, Sinopec, Dell China, ABB China, etc. The company has well-equipped industrial facilities and a first-class engineer team. Over 100 engineers and researchers are dedicated in the product and service innovation. MINGHAN is certified for ISO 9001:2008 (QMS), ISO 14001:2004 (EMS), OHASAS (Occupational Health and Safety Management System) and 3C (China Compulsory Certificate System). MINGHAN currently manages their patents, technologies and computer software copyrights too.

For further details contact:
http://en.minghan.com.cn

Sojo Electric

SOJO is mainly engaged in the research, production, sales and international trading of power distribution equipments and automation equipment in the field of 35kv (or lower) power T&D. SOJO Electric Co., Ltd. is a joint-stock high-tech enterprise founded in 2002. The headquartered at Zhongguancun Shangdi Information Industry Zone, Beijing. The land area of factory is 24012 sqm. SOJO is the first batch of domestic companies which independently research and products ring ring main unit, has nearly hundred products including switching station, ring main unit, sectionalizing cabinet, overhead switchgear, medium and low voltage switchboard, intelligent switchgear, etc. The products such as switching station, ring main unit, cable distribution cabinet, secondary substation, pole mounted switch and etc. are intensively and stably used in the state grid, China Southern Power Grid and their sub companies of province level or municipal level, power plant, wind power industry, railway and aviation industry, petroleum and chemical industry, mining and other industries. The company is in second phase of manufacturing base.

For further details contact:
http://www.sojoline.com

Citizen brings Top – Bottom Fixed Electrical Earthing Contacts

Citizen Metalloys Ltd, is one of the leading copper components manufacturers in India. Their Copper components are majorly used in Electrical Panel Board industry, Switchgear industry, Transformer Manufacturing, Bushing Manufacturing, Thermal Power, Wind Power industry, Hydro Power Industries etc. Fixed contacts which may be clamped together permanently for years and never opened. They have developed wide range of fixed contacts for Bharat Heavy Electricals Ltd. (BHEL), Bhopal. The bus bar contact, if not welded, brazed or soldered, is usually made by bolting or clamping, a clamped joint avoids the reduction in cross section caused by drilling to insert bolts, and give a more uniform distribution of the contact force, making the contact more efficient and hence running cooler. Bolting is used because it is cheap and convenient. Commercially pure copper has an electrical conductivity exceeded only by silver, and its ready availability in a wide variety of forms. CML have facility of Cutting, Punching, Machining, Bending, Sleeving, Coating, and Platting to develop various copper components as per customer requirements. They are also producing ETP Copper, Oxygen Free Copper & Phosphorised Copper Products like Copper Flats, Rods, Nuggets, Sections, and Earthing Tape & Pure Copper Earth Rods.

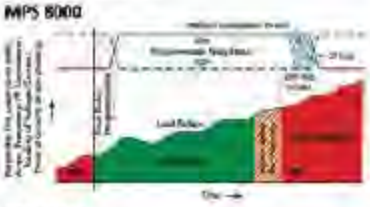
For further details contact:
info@citizenmetalloys.com

ElMeasure's Motor Protection System

Elmeasure, the technology leader in Energy Management Products and Solutions has launched a sophisticated product 'Motor Protection System / Unit'.

Working Principle

MPS 8000



MPU 5110

The product built with advanced features and functions helps the user to protect critical motors and equipment from unforeseen failure due to voltage, frequency abnormalities, overload, under PF, single phasing, unbalance on both voltage and current, neutral current and phase reversal. It can also detect winding shorts and displays reason for tripping for future correction. With many more unique features this product helps to avoid raw material and manpower wastages leading to improved productivity and better profits.

For further details contact:
marketing@elmeasure.com

Harting brings Ha-VIS RFID Sensor Transponder and Han HPR RFID

HARTING brings Ha-VIS RFID Sensor Transponder, an RFID tag intended for sensors and Han® HPR RFID, heavy duty connector equipped with RFID transponder. In Smart Factory and its essential part 'Internet of Things (IoT)', components and sensors are networked and provide information of the object itself, its condition and circumstances. RFID technology that enables to record, save and read data plays an important role here.

Ha-VIS RFID Sensor Transponder, connected to a sensor, enables to save the identification of the object as well as information of its condition in RFID tag, read and provide the data via wireless transmission using RFID reader. As the other HARTING's RFID transponders, the new product is passive tag based on UHF technology. Consequently it provides a reading range of up to 2.5 meters

Ha-VIS RFID Sensor Transponder

and feeds power into RFID tag as well as to sensor through the tag, which operate without power source. While conventional solutions are based on cable connections to transfer information gained by sensor, RFID technology can make the data transmission wireless. With its high robustness of IP 67 and durability, it is ideal for acquisition such data as acceleration, pressure, distance and temperature from mobile objects in production plant and railway. Han® HPR RFID is equipped with RFID

Han® HPR RFID

transponder, both designed to meet IP68 / IP 69 K protection class. It enables simple identification of specific data from the connector solution all the way to the ordering of spare parts in an easy, fast and reliable way. Providing protection against UV, Ozon, dust and water as well as wide temperature range of -40°C~+125°C, the product can be used outdoors and in harsh environment such as railway application.

For further details contact:
info@harting.com

Megger offers SVERKER 900

The new launch SVERKER 900 Relay and Substation Test System is the engineer's ultimate toolbox that addresses the increasing need for three-phase testing capability in electrical distribution substations, renewable power generation stations and industrial applications. The intuitive user interface is presented on the LCD touch screen. It has a powerful combination of current and voltage sources and a versatility of measurement possibilities.

The SVERKER 900 is specifically designed for basic, manual threephase secondary testing of protection devices. In addition, various primary testing can be performed, since the current and voltage sources can be series- and/or parallel connected to allow for up to 105 A AC or 900 V AC output. All three current and four voltage sources can be individually adjusted with respect to amplitude, phase angle and frequency. The fourth voltage source allows for testing of numerical relays that needs a reference voltage simulating the bushbar. SVERKER 900 is performing a wide area for manual secondary testing of protective relay equipment. Virtually all types of single-phase and three-phase protection can be tested, from modern multifunction relays to electromechanical relays. It can inject current up to 105 A when high range is needed and it has a frequency range from 10 Hz up to 600 Hz and also DC could be utilized. In the "expert mode" the user have the possibility to add layers of superimposed frequency. The rugged hardware design is built for field use over a wide temperature range, with intelligent software to perform rapid testing.

Applications

Commissioning and maintenance of distributed and generator power Substation;
Protection relays;
Electromechanical relays;
Static relays;
Numerical relays;
Plotting current transformer excitation curves;
Current and voltage transformer ratio tests;
Burden measurement for CT circuits;
Polarity (direction) tests;
Impedance measurement;
Primary injection in switchgear;
Three phase;
Single phase;
Checking SCADA annunciation and measurement values;
Wiring check.

For further details contact:
india.sales@megger.com

MV & LV Switchboard by Sojo Electric

MV & LV Switchboard
Type: KYN28A-12
Name: KYN28A-12(GZS1) Air Insulated Removable Metal Enclosed Switchboard

Product Overview

KYN28A Air insulated metal enclosed switchboard, which is for 3 to 12 KV, AC, 50 HZ current redistribution, can be fitted with ABB VD4 circuit breaker or domestic made VS1 circuit breaker. It also has the functions of control, protection and monitoring of circuit.

Technical Specification

Rated Voltage: 12kV; Rated Current: 630~3150A; Rated short time withstand current: 16~50kA, 4s; Rated peak withstand current: 40~125kA;
1 min power frequency withstand voltage: 42kV; Lightning impulse withstand voltage: 75kV; Rated shirt circuit current breaking times: 50;
Mechanical life: 2000; Degree of protection: IP4X;

Technical Features

Enclosure is made of aluminum coated steel sheet which is light weighted, high mechanical strength. Electrical gap larger than 125 mm, composite insulation gap larger than 30 mm. It has Central-positioned circuit breaker, Integrated Interlocking Mechanism and More than 80 circuit schemes.

For further details contact:
www.sojoline.com

Industrial Gas Leak Monitors : Plus Series by Subtronics

Subtronics (India) Pvt. Ltd. an ISO 9001 certified company, introduces its latest upgrade of Industrial Gas Monitors in it's most advanced form ever - The 'Plus Series' a re-defined and re-engineered unit with latest elegant design, new features & robust state of the art gas detection technology available today. This, Indian Patent Office registered design has faster signal processing, higher accuracy and wider coverage area and can detect a range of more than 300 gases. With its dual operating voltage (230/110VAC), it imbibes latest surface mounting technology that enables reduction in current consumption

thus saving power and energy. Controller reads atmospheric variations using its "Three Status" – registered technology, sounding alerts only at high levels of potentially toxic or hazardous gas, fumes, vapor in L.E.L or T.L.V ranges and implements special dedicated false alarm proof system ensuring highest reliability. Prominent features include Three Status technology, 100% compatible to your existing system, PLC, DCS, SCADA or any annunciator panel, flexible mounting options shipped in 'Kit–Form' with simple ready to use templates and illustrated manual for an easy and quick operation. Subtronics has been manufacturing safety devices for over 40 years and is a recipient of 33 awards for its excellence & contribution to the field of safety.

For further details contact:
service@subtronicsindia.com

Unipunch Toolings Pvt Ltd brings Sheet Punching System

Production of products like Electrical Control Panel, Lighting Fixtures, Steel Furniture, Bus Body Building, Pre-fabricated structures, etc. Involves punching of holes and profiles, apart from notching of large sized sheet. A cost effective method, wherein a modular types of Punching Tools (can also be called unitized or individual tools) is one way to handle this production. This system allows changing of center distances as well as size of the holes that are to be punched.

The system is capable of being used in a Power Press, Press Brake or Hydraulic Press. Multiple holes and notches are punched together. Investment in a tooling system of the above nature is 5% of the investment that is required in a Turret Punch Press. At the same time, there is no loss of accuracies or a loss in quality in using the

system, as compared to the parts produced in a turret.

Unipunch Toolings, located at Chennai have a wide range of standardized tooling, that fits into a scheme of tooling to produce the above type of parts. The system comes supported with equipment for stopping the sheet, indexing the sheet for multiple holes, supporting the sheet for loading and unloading. The company has been in this field for over 3 decades. The required supply of Punches and Dies, as well as replacement needs of punches and dies are made by the company. Modifications and specials to handle Pre-bent components, punching in extrustions, notching, flanging, knockouts, etc, are all possible.

The system allows re-grinding of punches and dies for good cutting edge, methods for quickly changing set-ups (one tools takes less than 3 minutes for setting). The system is recommended for continuous runs, large batch quantities and particularly for small and medium companies which can not afford large capital investments. Production rates are determined more by the rate at which the components are loaded rather than the time taken for punching.

For further details contact:
unipunch@gmail.com

Natural White Pulse Start Metal Halide Lighting System by Venture Lighting India Ltd

True Spectrum of Natural White© Pulse Start Metal Halide Lighting System :
Natural White© Light;
Color of Natural Sunlight 5000K;
20-50% more energy savings than other technologies; It has longer Life Span;
High CRI, 90+; 90% maintained lumens;
14% more light;
Fits into existing lighting system;
Available in both vertical and horizontal operating positions;
Low hazardous materials, less environmental impactates.

For further details contact:
marketing@vlindia.com

Complete End-to-End Solutions: T&D

COMPACT LINE & LINE UPRATING

SUPREME
www.supreme.in

Pole-Type Structure for Transmission Line

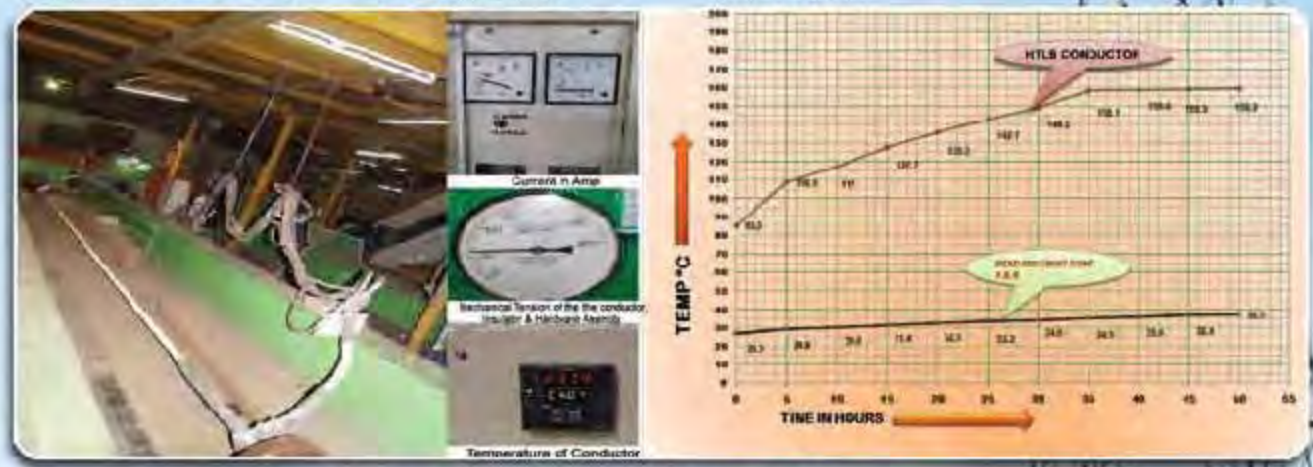
Interphase Spacer to Reduce Phase to Phase Clearance

Insulated Cross-Arm for Compaction of Lines

Expanded Asymmetric Bundle for Higher Surge Impedance Loading

Temporary Bypass for Line Uprating with minimum shutdown

Anchoring Solutions for Emergency Restoration Tower System



Testing of HTLS Conductor with Dead-End Assembly

SUPREME & CO. PVT. LTD.
Contact: 91-9803999511 | 91-9803999566 | 91-9803999516
E-mail: info@supreme.in, sales@supreme.in

A Book on Internal Corrosion of Pipelines

A book entitled 'Internal Corrosion of Pipelines' written by Dr Anil Bhardwaj and Baldev Raj, was released on November 14 during International Conference and Expo CORCON 2014, held November 12-14 at Hotel Grand Hyat. The book was released by Sekhar Basu, Director, Bhabha Atomic Research Institute. The book 'Internal Corrosion of Pipelines', dwells upon various factors responsible for internal corrosion of pipelines, which include corroding gases like O_2, CO_2, H_2S; different types of bacteria; environmental factors such as temperature and pressure; aqueous chemistry including salinity, buffer ion concentration, ionic composition and pH; flow regimes in case of multiphase flow etc. Mechanisms, causes and effects have been explained in user-friendly language with apt case studies and examples. Internal corrosion of pipes in seawater environment is a very specific issue relevant to coastal, offshore and shipping industry. The options of corrosion resistant materials and corrosion control have been elaborated which can vary depending upon requirement of industry, temperature and flow conditions. Two types of pipeline systems are common to most chemical process industries, viz. cooling water and firewater. They are essential for efficient and safe operation of a chemical process plant. The environmental and flow conditions are different for these lines and unique corrosion control measures, including specific materials of construction, for these two categories of lines have been dealt in this book in separate chapters. A discussion on composite materials has also been included, which are fast emerging as corrosion resistant materials for several environments of pipelines. Corrosion control and monitoring go hand-in-hand and therefore, the aspect of corrosion monitoring and inspection has also been duly covered in this book. Finally, there is a chapter on holistic approach to handle corrosion

Seen from L to R: Sekhar Basu, Director BARC and Dr Anil Bhardwaj, during book launch at CORCON 2014

through corrosion management tools. The chapters have been written by experts in the respective fields. Certainly, this book will be a treasure for all those involved with pipelines in variety of environments of various industries. Its readership target is Professional, Researcher, Undergraduate and Postgraduate Students. The Editors of the book are: Anil Bhardwaj General Manager (Chemistry), Oil and Natural Gas Corporation Ltd. (ONGC) and Baldev Raj, Director, National Institute of Advanced Studies, Indian Institute of Science Campus, Bangalore. Sized 185mm x 240mm, it comes in paperback edition with 372 pages and carries ISBN No. as 978-81-8487-413-6.

Power Statistics

All India Installed Capacity (MW) as on 30-11-2014 Region -wise

Region	Thermal				Nuclear	Hydro	RES	Grand Total
	Coal	Gas	Diesel	Total				
Northern	39431.00	5331.26	12.99	44775.25	1620.00	16598.11	5935.77	68929.13
Western	60169.51	10915.41	17.48	71102.40	1840.00	7447.50	11271.07	91660.97
Southern	27382.50	4962.78	939.32	33284.60	1320.00	11398.03	13784.67	59787.30
Eastern	26527.88	190.00	17.20	26735.08	0.00	4113.12	432.86	31281.06
North-East	60.00	1571.80	142.74	1774.54	0.00	1242.00	256.67	3273.21
Islands	0.00	0.00	70.02	70.02	0.00	0.00	11.10	81.12
All India	153570.89	22971.25	1199.75	177741.89	4780.00	40798.76	31692.14	255012.79

Index to Advertisers

Company Name	Page No.
Allied Power Solutions	67
Anchor Electricals Pvt Ltd	19
Central Power Research Institute	75
Chuan Shun Electric Company (India) Pvt Ltd	38
CITIZEN METALLOYS Ltd	57
DEIF India Pvt Ltd	07
Elmeasure India Pvt Ltd	99
EPCOS India Pvt Ltd	55
Finolex Cables Ltd	15
FLIR Systems India Pvt Ltd	29
Giantlok India Pvt Ltd	61
Havells India Ltd	21, 25
Indian Energy Exchange Ltd	IBC
Jindal Electric & Machinery Corp	105
Kusam Electricals Pvt Ltd	51
Larsen & Toubro Ltd	81, IFC
LEONI Cable Solutions (India) Pvt Ltd	49
M&I Materials India Pvt Ltd	37
Madhura International	87
Meccalte India Pvt Ltd	05
Megger Ltd	106
Mersen India Pvt Ltd	97
Mysore Thermo Electric Pvt Ltd	35
Neptune India Ltd	45
OBO BETTERMANN India Pvt Ltd	47
Power Control Equipment Company	71
Prime Meiden Ltd	13
Ravin Cables Ltd	09
Riello PCI India Pvt Ltd	11
Rittal India Pvt Ltd	27
SCOPE T&M Pvt Ltd	17
Shivalik Power Control Pvt Ltd	31
Supreme & Co Pvt Ltd	103
System Protection	105
The Motwane Mfg Co Pvt Ltd	BC
Unipunch Toolings Pvt Ltd	101
Venture Lighting India Ltd	63
Yokogawa India Ltd	39

Five taps in one trip.

MRCT
Relay and Current Transformer Tester

Reduce your ladder time. Make one connection and test all taps simultaneously with the new MRCT from Megger. Now you can measure saturation, ratio, polarity, winding resistance, burden and voltage simultaneously on all taps with no lead changes. With integrated insulation and single-phase relay testing, demagnetization functionality and automated test sequences, the MRCT is a small solution that creates big time savings.

Save time!
With Multiple taps in one test

Measure resistance
on short-circuited winding CT.

About Megger:

For over 100 years Megger is the premier provider of electrical test and measuring equipments in Power applications.

Creating benchmarks and leading innovations, today Megger is sole provider of wide & diverse product offerings for Power, Industrial Electrical testing and measuring instruments range worldwide.

Visit our website to know more www.megger.com
E: Marcomms.India@megger.com

Megger

Megger
211 Crystal Paradise Mall
Off Veera Desai Road
Andheri (w) Mumbai 400053
T +91 22 26740400
F +91 22 26740403
E inquiry@megger.com

■ Cable Fault Location ■ Battery Testing ■ Earth Testing ■ Transformer testing ■ Insulation Testing ■ Switchgear Testing

RNI Registration No: 6226/1961 • Postal Registration No: MNE/95/2015-17
Licence to Post Without Prepayment WPP Licence No. MR/TECH/WPP-228/NE/2015
Posted at Patrika Channel STG. Office, Mumbai - 400001 on 5th of Every Month, Date of Publication 5th of Every Month