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Electrical India



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India's oldest magazine on power and electrical products industry

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E-mobility & Solar: The Perfect Pair



Solar beyond safeguard duty

Transmission Losses in India



- ▶ Wind of Change
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Toll free no.: 1800 103 5440
Email: hagerwow@hager.co.in
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Hello and welcome once again to *Electrical India*.

Driven by the government's strong focus on power generation from alternative energy resources, the renewable energy sector in India is witnessing unprecedented growth. Today, the country has emerged as one of the most dynamic and vibrant markets in the world for renewable energy.

Going forward, the sector is expected to see strong growth due to favourable policy support. It is estimated that nearly 40 per cent of India's total power capacity will come from renewable sources by 2030. Also, India's leadership role in the

International Solar Alliance will fuel enthusiasm for further growth.

Of late, with an aim to help the domestic manufacturers crippling due to cheap imports, the Finance Ministry of India has notified the Directorate General of Trade Remedies' (DGTR) decision to impose 25 per cent safeguard duty on solar panels imported from China and Malaysia. Though the decision is 'temporarily withdrawn' followed by strong opposition especially from the solar power developers, the industry has already started feeling the heat. According to Mercom India Research's report, solar installations in India plunged 52 per cent to 1,599 MW during the March-to-June period, mainly due to uncertainties around safeguard duty and module price fluctuations.

On this note, this time we bring you an analysis on how the implementation of safeguard duty will impact the country's solar power sector. PV makers expressed that domestic solar cell manufacturing will not be benefitted without having a long-term policy clarity on the safeguard duty, whereas solar power developers urged for complete withdrawal of the duty.

Further, India is also taking significant stride in the field of electric vehicles. Our report on why e-mobility is a future driver of the PV market is worth reading. The article also highlights the readiness of Indian players in the field of 'e-mobility'.

Though solar power has emerged as the fastest growing segment within the renewable energy sector in India, wind energy is still leading the pack, contributing around 50 per cent of total installed renewable energy capacity with cumulative installed capacity of over 34 GW. Here we find out the answers on: What it will take to regain wind power growth momentum?

Hope you will enjoy reading the issue as always. Do send me your comments at miyer@charypublications.in

Mahadevan

Publisher & Editor-In-Chief

Directors

Pravita Iyer
Mahadevan Iyer

Publisher & Editor-In-Chief

Mahadevan Iyer
miyer@charypublications.in

Group Editor

Subhajit Roy
subhajit@charypublications.in

Editorial Department

Associate Editor

Supriya Oundhakar
editorial@charypublications.in

Editorial Co-ordinator

Nafisa Kaisar
nafisa@charypublications.in

Advertising Department

Director Advertisement

Pravita Iyer
pravita@charypublications.in

Advertising Manager

Yasmeen Kazi
yasmeen@electricalindia.in

Advertising Executive

Nafisa Khan
advnt@electricalindia.in

Design

Nilesh Nimkar
charydesign@charypublications.in

Subscription Department

Priyanka Alugade
sub@charypublications.in

Accounts Department

Dattakumar Barge
Bhakti Thakkar
accounts@charypublications.in

Digital Department

Ronak Parekh
dgmarketing@charypublications.in

Chary Publications Pvt. Ltd.

906, The Corporate Park, Plot 14 & 15,
Sector 18, Vashi, Navi Mumbai 400703
Phone: 022 2777 7170 / 71

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For more information, contact:
NürnbergMesse India Pvt. Ltd.
T: +91-11-47168829/31
E: mansi.chawla@nm-india.com
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BEE Entrusts FICCI with Capacity Building Program for DISCOMS

The Bureau of Energy Efficiency (BEE), Ministry of Power has entrusted FICCI with the responsibility of supporting its training program for capacity building of DISCOMs in Jammu & Kashmir, based on the dialogue with the Forum of Regulators (FOR). The objective of the programme is capacity building of DISCOMs for carrying out load management, development of Demand Side Management (DSM) action plan and its implementation in respective areas.

FICCI organised its third program for Power Development Department, J&K from 21-23 June 2018 at Srinagar. The first program was organised from 5-7 April 2018 and second from 9-11 April 2018.

The aim is to implement DSM programmes in the state for reducing the peak electricity demand so that

utilities can delay building further capacity. In fact, by reducing the overall load on an electricity network, DSM has various beneficial effects, including mitigating electrical system emergencies, reducing the number of blackouts and increasing system reliability. Other benefits include reducing dependency on expensive fuel imports, reducing energy prices, and reducing harmful emissions. DSM has a major role to play in deferring high investments in generation, transmission and distribution networks. Thus, DSM applied to the electricity systems provides significant economic, reliability and environmental benefits. The objective of the program is to impart training to the Circle Level officials of DISCOMs on DSM and Energy Efficiency to understand the processes and technologies related to DSM.

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New Chairperson of Appellate Tribunal for Electricity

Justice Manjula Chellur has been selected as Chairperson of Appellate Tribunal for Electricity, Ministry of Power. Prior to this, Justice Manjula Chellur was Chief Justice of Bombay High Court. Technical Members I J Kapoor, B N Talukdar, Judicial Member Justice N K Patil and Technical Member S D Dubey were present on the occasion. Tribunal Bar Association President M G Ramachandran assured the Bench for full cooperation of the Bar Members in day-to-day business.

Justice Manjula Chellur was born on 5th December, 1955 in Karnataka. She received her Bachelor of Arts degree from Allum Sunmangalamma Women's

College, Bellary, and went on to earn her law degree from Renukacharya Law College, Bangalore. In 1977, the Supreme Court of India sponsored her on a Gender & Law fellowship to England's University of Warwick. In 2013, Justice Manjula Chellur received an honorary doctorate from Karnataka State Women's University.

She was the first woman Chief Justice of Calcutta High Court. Justice Manjula Chellur also served as the Chief Justice of Kerala High Court and the first female judge of the Karnataka High Court. She demitted her office as Chief Justice of Bombay High Court upon attaining the age of superannuation on 4th December, 2017.

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Proposed Amendments in Tariff Policy

The Central Government in the proposed draft amendments to the National tariff policy, 2016 has included the provision for imposition of penalties on the distribution companies for power cuts other than force majeure conditions or technical faults by Appropriate Commission. In the draft amendments to the tariff policy, it has been proposed to stipulate that the State Electricity Regulatory Commissions and Joint Electricity Regulatory Commissions shall not consider AT&C losses exceeding 15 per cent for determination of tariff after 31.03.2019.

The proposed Amendments in Tariff Policy include amendments in provisions related to Generation,

Transmission and Distribution of electricity.

The focus is to make 24x7 uninterrupted power supply to all consumers, improve efficiency in the operation of distribution business, addressing certain constraints faced in implementing change-in-law provisions, issues in open access, compliance and related aspects, Tariff design related issues including simplification of tariff categories and rationalisation of retail tariff. Consumer should not be asked to pay the price of inefficiencies of the Discom, therefore, AT&C losses in excess of 15 per cent shall not be passed on to the consumers but shall be borne by Discom.

13



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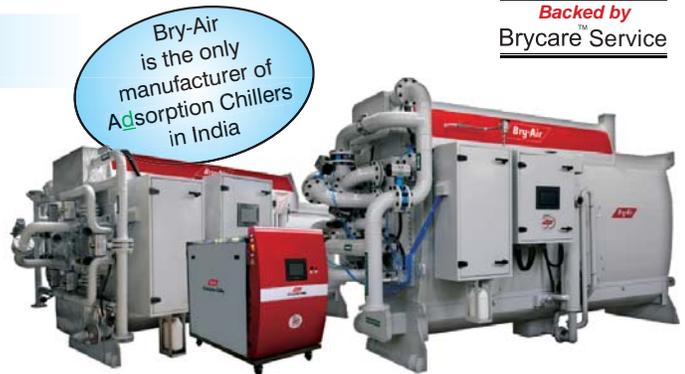
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Chief Minister of Haryana Manohar Lal Khattar flags off electric vehicles and Exicom Tele-Systems AC and DC fast chargers and hands them to Gurugram Metropolitan Development Authority (GMDA) Officials.

Exicom installed AC & DC electric vehicle charging station at car parking facility of Tau Devi Lal Sports Stadium. It is part of the plan to develop EV charging points across the country. Exicom is committed to realise the vision of making India a 100 per cent Electric Vehicles nation and aims to support Government's mission of shifting 30 per cent of country's fleet to electric mode by 2030. 



L&T's Power Business Wins Orders Worth ₹1,080 Crore

The power business of Larsen & Toubro has won orders worth ₹1,080 crore. The business has received two orders from NTPC for setting up Flue Gas Desulphurisation (FGD) systems at its supercritical thermal power plants at Khargone, Madhya Pradesh and Lara, Chhattisgarh.

Installation of FGD systems in existing and upcoming thermal power plants has been made mandatory by Ministry of Environment, Forest and Climate Change, (MoEFCC), Government of India to curtail SO₂ emissions.

Commenting on the FGD orders, Shailendra Roy, CEO & Managing Director, L&T Power and Whole-Time Director, L&T, said, "With stringent pollution

control measures in place, coal-fired power plants will play a major role in the country's energy mix for years to come, and L&T is fully geared to cater to this new market of air pollution control systems."

L&T has a long-term technical licence agreement with Chiyoda Corporation of Japan for its 'Chiyoda Thoroughbred 121TM (CT-121TM) FGD technology. The agreement grants L&T exclusive rights to undertake engineering, procurement and construction (EPC) of CT-121TM FGD systems. The CT-121TM FGD process is a unique technology developed by Chiyoda in which sulphur dioxide is absorbed from flue gas generated by coal-fired, oil-fired and other types of boilers and removed as gypsum. 

OEMs should Focus on Grid Modernisation: Frost & Sullivan

The replacement market in Europe is expected to drive a 600 billion euros investment by 2020, finds Frost & Sullivan. The massive deployment of distributed energy resources (DER) and two-way power flow is intensifying the need for strong distribution transformer infrastructure. One of the biggest upshots of distributed generation is the demand for smart or solid-state transformers for voltage management in smart grids. The accelerated sales of smart or solid-state transformers in North America, Germany, China, and India and the rising interest from the UAE, Saudi Arabia, and Brazil are expected to propel the global transformers market toward USD 35.45 billion by 2022.

"Grid modernisation, smart grids, and new rapid transit rail networks with high-speed trains and EV charging stations are expected to fuel demand for smart or solid-state transformers," said Farah Saeed, Digital Grids Research Director at Frost & Sullivan. "To make the most of this burgeoning demand, original equipment manufacturers (OEMs) should invest heavily in setting up manufacturing plants in the frontier nations. Partnering with local resellers and OEMs will give them a huge advantage when trying to penetrate the Asia-Pacific market." Frost & Sullivan's recent analysis, Global Transformers Market, Forecast to 2022, focuses on the important trends in the distribution, power, isolation, and smart transformers markets. 



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Orient Electric to Get BEE 5-Star Rating for its LED Bulbs

Orient Electric has become the first Indian lighting brand to have been awarded 5-Star rating for its 9W LED bulb by BEE (Bureau of Energy Efficiency). Puneet Dhawan, Senior Vice President and Business Head, Lighting, Orient Electric, said, "We are proud to be amongst the first to have certified BEE 5-star rated LED bulbs. We have always been a firm supporter of BEE's star labelling for LED bulbs as it helps to assure the consumer in terms of light output and energy savings. Also, we were the pioneers to introduce and market BEE 3 Star rated bulbs way back in 2016 and this norm has now been made mandatory for all. In our consistent endeavour to provide value to consumers, we have now voluntarily adopted BEE 5-star rating for high demand 9W LED bulbs."

He further added, "Our LED lighting business has

grown 8 times in just 2 years. We are today one of the largest LED bulb manufacturers in the country in the non-OEM category and a preferred supplier to many government institutions. Over the last 3 years, we have focused most of our investments on new product development, quality enhancement and automation, indigenising components and expanding production capacities. Our products are at par with global standards in terms of quality as well as cost"

BEE, under its labelling program for LED bulbs, considers luminous efficacy (Lumens per watt) and other safety requirements like photo-biological safety as main parameters to rate the bulbs on a five-star scale for energy efficiency. Orient's 9W 5-star rated LED bulb meets BIS safety standards, has long life of 25000 hours, and delivers 120 lumens per watt. 

Baker Hughes Gets Cairn Oil & Gas, Vedanta Field Development Contract

Baker Hughes has been awarded a development contract by Cairn Oil & Gas, Vedanta Limited to construct approx. 300 new wells and deploy a chemical EOR program aimed at increasing production from the Rajasthan area. The project marks the largest integrated project for BHGE in India, expanding its presence in the country and supporting the government's mission of reducing dependency on imports. BHGE will provide an integrated scope of oilfield services and equipment, delivered in phases over the next 24 months to help Cairn Oil & Gas, Vedanta Limited unlock the significant untapped

reserves in the Mangala, Bhagyam and Aishwariya (MBA) fields. This includes all associated technology and operations to develop new wells quickly and cost-efficiently, as well as solutions to enhance production from existing wells. The project is intended to be delivered in phases. To enhance recovery from existing wells, BHGE is designing an alkaline-surfactant-polymer (ASP) flooding solution- the first of its kind in operation in India and one of the newest forms of chemical EOR in the industry today. BHGE's scope includes developing the chemistry as well as constructing chemical recovery plants. 

MYSUN Commissions 397kW and 104kW Rooftop Solar Projects in Rajasthan

MYSUN has expanded its operations in Rajasthan with notable commissioning of two solar projects: a 104 kW project for a marbles and granite flooring provider; and a 397 kW project for a large polybag maker and with a pipeline of under development projects to more than 10MW.

MYSUN is vastly expanding its presence in Rajasthan with cities like, Chittorgarh, Bhilwara, Udaipur, Jodhpur and Jaipur becoming local hubs. Through a dedicated team of sales, marketing, operations, installation and services personnel, the company has set up core operational units across multiple cities in Rajasthan, with an aim to build a strong network of commercial and industrial clients.

Commenting on the feat, Gagan Vermani, Founder and CEO, MYSUN said, "We are glad to have expanded our operations in Rajasthan. The state has a high grid tariff and a large industrial base which runs a hefty electricity bill month after month. Our customised solar energy solutions and pioneering maintenance and financial services are designed to suit the local industry here."

Chittor Polyfab, a manufacturing industry is amongst the first customers of MYSUN in the state. Elaborating on the journey towards solarisation, Anil Palod, Director at Chittor Polyfab added, "Being a start to finish product manufacturing set-up, our power consumption is naturally a big expense." 

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Hind Rectifiers Net Profit at Rs 1.32 crore

Hind Rectifiers, a company engaged in designing and manufacturing industrial power electronics and power conversion equipment, announced its Q1FY19 results. Net profit for the quarter stood at Rs 1.32 crore as against net loss of Rs 1.78 crore in Q1FY18. Earnings per share (not annualised) for the quarter stood at Rs 0.82. The Net Sales for Q1FY19 stood at Rs 43.28 crore as against Rs 18.20 crore reported in Q1FY18, a jump of 137.80 per cent.

Operating profit (EBITDA) for Q1FY19 was Rs 4.22 crore, as against negative EBITDA of Rs 0.29 crore in the same period a year ago. Commenting on the company's performance, Suramya Nevatia, Chief Executive Officer, Hind Rectifiers said, "Continuing the momentum gathered from last fiscal year, our Q1FY'19 results are in line with expectations. We will work towards achieving an even stronger order book in the upcoming quarters and continue our growth trajectory." 

GE to Deploy its Solution across Aggreko's Power Solutions Fleet

GE's Distributed Power business signed a multi-year supply agreement with Aggreko to connect upto 10,000 assets to GE's Distributed Power myPlant Asset Performance Management (APM) solution over the next five years.

myPlantAPM is an original equipment manufacturer (OEM)-agnostic, industrial Internet of Things solution for reciprocating engines and generators, which will provide Aggreko with a digital toolset to manage its equipment fleet. With more than 100 other data points being derived or added to each of the assets, Aggreko will be able to monitor a large variety of items. Analytics will help, for instance, predict oil lifetime and ensure the performance and uptime of

the mobile power plant. The project represents the largest to date for GE's Distributed Power myPlant solution for reciprocating engines and generators.

Aggreko's emergency response capability also allows it to respond to emergencies of all sizes, such as restoring power to entire communities after a natural disaster. The myPlant APM solution provides a cloud-based monitoring and diagnostics infrastructure to remotely manage the performance of Aggreko's reciprocating engine fleet of power plants. Aggreko will be able to gain real-time intelligence needed for better decision-making to achieve the desired outcomes and increase the assets' uptime at customer sites in various industrial sectors and events. 

Tata Power's Generation increases to 13,113 MUs in Q1FY19

Tata Power announced that the company's generation capacity increased by 5.5 per cent to 13,113 MUs in Q1 FY19 as compared to 12,429 MUs in Q1 FY18. The company, together with all its subsidiaries and jointly controlled entities, has an installed generation capacity of 10,857 MW (as of August 2018). In line with its commitment to generate 30 per cent to 40 per cent power from non-fossil fuel sources by 2025, the company is progressively increasing its renewable energy installations in India. With the commissioning of 100 MW renewable project in Anantapur, Andhra Pradesh, Tata Power has significantly increased its presence in the renewable energy space with a gross installed capacity of 2,449 MW and non-fossil fuel capacity of 3,517 MW.

Overall in Q1FY19, the company continued its robust operations with the consolidated generation standing at 13,113 MUs and standalone generation at

3,135 MUs. Coastal Gujarat Power Limited generating 5,908 MUs in the quarter. Maithon Power station generated 1,944 MUs, Trombay Thermal Power generated 1,738 MUs. Jojobera Thermal Power Station generated 629 MUs and Haldia reported generation of 166 MUs. Industrial Energy reported generation of 764 MUs and TPREL generated 362 MUs in Q1 that includes clean and green energy sources - wind and solar. WREL reported generation of 491 MUs.

Commenting on this development, Praveer Sinha, Managing Director and CEO, Tata Power, said, "The growth in our generation capacity is a testament to our operational efficiency, thereby, establishing a strong foothold towards creating stakeholder value. The company is in an excellent position to capitalise on an exciting future by offering products and services that will meet the next generation of power consumers and create a sustained growth trajectory in the renewable energy sector." 

Use the right cable wires, avoid disaster fires

Electrical cables play a vital role in the safe delivery of power in an electrical network. Keeping in mind the health & fire safety aspects of cabling, one should pay more attention to the type of cables being installed for different uses. The performance of a fire system depends heavily on the cabling.



Understanding the types of cables and their applications

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thyssenkrupp Enhances Electrolysis Technology for Chlorine Production

Around 70 per cent of all chemical products use chlorine in their manufacturing process. At the same time, the production of this important base chemical is one of the most energy-intensive processes in the chemical industry. In order to change that, thyssenkrupp is offering the NaCl-ODC electrolysis technology (ODC = oxygen depolarised cathode) which lowers power consumption and indirect CO₂ emissions by up to 25 per cent compared to standard production processes. Engineers from thyssenkrupp have now been able to develop the technology even further by raising the current density of the electrolyser from 4 to 6 kilo amperes, output was increased by 50 per cent.

Electrolysers with the same output capacity can now be built about one third smaller, resulting in significantly lower total cost of ownership. Plant operators profit from a smaller plant footprint, lower maintenance and from the generally high efficiency that comes with the NaCl-ODC electrolysis process. thyssenkrupp's cooperation partner Covestro will be the first to utilise the advanced ODC electrolysis for a new chlor-alkali plant in Tarragona, Spain. "Three factors played a vital role in choosing the technology for our process: sustainability, energy efficiency, and increasing our site's competitiveness," states Dr Klaus Schäfer, CTO at Covestro. 

ABB wins World's Largest Offshore Wind Farm Order

ABB has won orders worth over \$150 million from Danish energy company, Ørsted (previously Dong Energy) to supply a range of technologies that will help integrate and transmit renewable wind energy from Hornsea Project Two, slated to be the world's largest offshore wind farm. The orders were booked in the second quarter of 2018 and are the first tranche of a global five-year frame agreement for the supply of electrical and automation equipment



for offshore and onshore wind power connection and integration to the grid. Hornsea Two is a 1,400 MW project to develop wind resources in the North Sea about 100 kilometers off the Yorkshire coast. Upon completion, it will be able to deliver enough clean electrical power to meet the needs of more than 1.3 million homes annually. The additional power supply will support economic growth in UK's Humber region, and help the UK meet its target. 

ENGIE Confirms its Position as Solar No 1 in France

As part of the fourth session of the fourth call for solar tenders organised by the Energy regulatory commission, 'CRE 4-4', ENGIE, through its ENGIE Green, LANGA and Compagnie Nationale du Rhône subsidiaries, has won 25 photovoltaic projects in France, nearly 230 MW out of the 720 MW awarded.

This is a new record of wins for the same operator. The Group was placed top in the four first sessions of the CRE4 call for tenders with nearly 550 MW won in all. ENGIE, thereby, confirms its position as solar leader in France with already 1,000 MW of installed capacity. With an average price for this session of €52.1/MWh (on large ground-based power plants), ENGIE is demonstrating its ability to win highly competitive projects over the whole country (including

Brittany, Vienne, Morbihan, Alsace) and in all families (with winning projects from 1 MW to 27 MW, for ground-based and canopy power plants). The selected projects have all been developed in consultation with local stakeholders and will, as a priority, use local suppliers. They will be set up only on non-agricultural land, for the most part degraded, thus allowing it to be rehabilitated and creating new activities. In 2017, a third of the megawatts connected in France came from an ENGIE installation. To more firmly establish its leadership position, ENGIE is counting on strong organic growth as well as on targeted acquisitions. ENGIE has, thus, acquired the Breton company LANGA recognised for its know-how on roofs and ground-based plants. The Group's target is to achieve 2.2 GW of installed solar capacity in France by 2021. 



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NETWORK HES43-18

National Parks Conservation Association Teams Up with SunPower

For nearly 100 years, National Parks Conservation Association (NPCA) has worked to protect and preserve America's most iconic and inspirational places for present and future generations. Through a new program with SunPower, NPCA will provide opportunities for its members and supporters to go solar, thereby, helping to reduce carbon emissions and improve air quality.

To launch the program, SunPower will make an initial minimum donation of USD 10,000 to NPCA. Now through July 11, 2019, each NPCA member or supporter that has a SunPower home solar system installed through this program will be eligible to receive a USD 500 mail-in rebate and SunPower will

provide a donation of USD 500 to NPCA.

"The health of our national parks is directly linked to the health of the air, waterways and communities that surround them," said Theresa Pierno, president and CEO for NPCA. "Through this program, our members and supporters have the opportunity to invest in the long-term health of our planet, supporting sustainable energy and our ongoing work to ensure our national parks have clean air and adequate funding." SunPower's direct current E-Series solar panels, as well as its X-Series solar panels, are Cradle to Cradle Certified Silver – making it easy for homeowners to save energy, while minimising waste and helping to improve air quality. 

Array Technologies Takes Top Spot in Australia's Solar Market

Array Technologies, the global pioneer of solar tracking technology, is continuing to grow business at a steadfast pace Down Under. The company entered the Australian market just 18 months ago and has since been awarded 15 projects exceeding one gigawatt (GW) of installed capacity, making it the fastest tracker supplier to reach the milestone in the Australian marketplace. Last week, GTM Research released its annual tracker report noting the company has taken an impressive 55 per cent market share in Australia.

"Australia is an exciting market for us here at Array. The pace at which the country is embracing

solar demonstrates how cost-competitive utility scale solar in Australia is today," said Jeff Krantz, Vice President at Array Technologies, "We have embraced our leadership role in the market, leveraging our 29-years of experience to help to set the standard for bankable solar PV in Australia."

The Australian Photovoltaic Institute estimates that a pipeline of around 35 GW of utility scale solar PV projects are in various stages of development. On the back of this, the growth in the demand for solar trackers is unparalleled: 83 per cent of utility scale projects currently being installed in the country are deploying solar tracking technology. 

Sembcorp Energy Wins Tender 250 MW Power Supply to Bangladesh

Sembcorp Energy India Limited (SEIL) has won a competitive tender conducted by the Bangladesh Power Development Board (BPDB) to supply 250 MW power to Bangladesh over a total period of 15 years.

SGPL has received letters of intent from BPDB confirming its success in both the short term and long-term bids, and supply of power is expected to commence soon upon completion of procedural requirements and relevant government approvals.

Vipul Tuli, Managing Director of SEIL said, "We are pleased to have emerged the successful bidder, and look forward to commence supply of power at a tariff that is attractive for Bangladesh and sustainable for SEIL, in

keeping with growing Indo – Bangladesh economic ties. This bid fits into SEIL's strategy of providing cost-competitive and reliable power, while prudently contracting our balance open capacity at viable tariffs." SEIL owns and operates a balanced portfolio of both thermal and renewable energy assets totaling approx. 4.37 gigawatts' capacity in operation and under construction. SGPL is part of SEIL's thermal power portfolio, which comprises two supercritical power plants in Nellore, Andhra Pradesh with a combined 2,640 MW in capacity. Both thermal plants have maintained an average plant load factors (PLF) of over 80 per cent for the period between April and December 2017 well above the industry average PLF of 60 per cent. 



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IEEMA appoints Harish Agarwal as President

Indian Electrical & Electronics Manufacturers' Association (IEEMA) - the apex association of the Indian electrical equipment manufacturing industry, has announced appointment of Harish Agarwal as President IEEMA for 2018-19. He will take the leadership role during the IEEMA Annual Convention and AGM to be held on 15th September. The theme of Annual Convention this year is 'Go Global'.



Harish Agarwal

Agarwal is the CEO of Supreme & Co. Pvt Ltd. He is also a member of important industry bodies like CIGRE, IEEE, ASM International Materials Engineering Institute, CBIP – executive committee, Project Steering Committee of 1,200 KV National Test Station, Bina, Project steering committee of smart city pilot project, Pondicherry and IEEMA Eastern Region Committee.

"The association believes that Agarwal's

outstanding professional credentials and extensive international experience make him exceptionally well placed to provide leadership to IEEMA at this important juncture.

He is well-known in the industry for his work with utilities and across electrical equipment spectrum and people management," said Sunil Misra, Director General, IEEMA.

IEEMA also announced the appointment of Vice Presidents for the year 2018-19. R.K. Chugh has a diverse set of business experiences in the fields of Power Transmission and Distribution (T&D) and Automation and Drives (A&D). Chugh is currently the Business Head for Digital Grid for South Asia in Energy Management division of Siemens and also Location Head for Gurgaon. Vipul Ray is the Managing Director of Elemex Control Pvt Ltd. **ET**

Gujarat State Petronet announces appointment of nominee director

Gujarat State Petronet announced that Gujarat State Petroleum Corporation has nominated Raj Gopal, IAS as a Director on the Board of the Company w.e.f. 8 August.

Accordingly, the appointment of Raj Gopal has been approved by the Board of Directors of the Company w.e.f. 8 August by passing the Resolution by Circulation.



Raj Gopal

"We hereby confirm that he is not debarred from holding the office of Director by virtue of any SEBI Order and the Nomination and Remuneration Committee and the Board has considered the same while approving his appointment as an Additional Director," a statement issued by Gujarat State Petronet said. **ET**

RK Chauhan Assumes Charge as Director of Projects in POWERGRID

Rajeev Kumar Chauhan, assumed the charge of Director (Projects) of Power Grid Corporation of India Limited (POWERGRID).

Chauhan is an Electrical Engineer from IIT Roorkee in Electrical Engineering and is an exceptional professional in the field of EHV power transmission system in the Country. He has diverse experience of more than 33 years in EHV AC & DC transmission system. Prior to taking over the charge as Director (Projects), he was holding the Charge Of Executive



Rajeev Kumar Chauhan

Director (Engineering) in POWERGRID.

He has been associated with POWERGRID since 1994 and has contributed to all segments of Power System Management in POWERGRID i.e. Project Management, CTU Planning, Design & Engineering (EHV AC & HVDC), Procurement, Site Execution, Operation & Maintenance, Consultancy, DMS and Commercial Functions in POWERGRID under various capacities. He has also served for 10 years in NTPC prior to joining POWERGRID in 1994. **ET**



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QolorFLEX LED dimmers used in award-winning project

City Theatrical announces that QolorFLEX 4x2.5A Dimmers are providing the dimming control for the award-winning starry sky ceiling feature at the George S. and Dolores Doré Eccles Theater, a Broadway-style urban performing arts center in Salt Lake City, Utah.



The theatre's ceiling feature was recently awarded a citation at the 2018 IESNYC Lumen Awards for its unique, three-dimensional effects that capture the look of the Utah night sky.

"City Theatrical's QolorFLEX 4x2.5A Dimmers were our choice for Eccles Theater's starry sky feature lighting for some important reasons," said Francesca Bettridge, Principal of Cline Bettridge Bernstein Lighting Design (CBLD) and lighting

design lead for the project. "The dimmers have the best dimming range for a low voltage DC product, there are lots of options for setting curve and dimming cycle rates, and we had great support from City Theatrical throughout the project – so necessary for a successful

project."

The QolorFLEX 4x2.5A Dimmers are installed at 120 feet above the ground across 78 metal frames in the theatre's ceiling. They are set up in nine different dimmable zones to allow for random control and cross-fading of the hundreds of tiny, star-like, low voltage LED lights, which are installed as two-layered LED strings over the same metal frames in the ceiling. **ET**

Tata Power-DDL adjudged 'Industry Leader'

Tata Power Delhi Distribution (Tata Power-DDL) has been adjudged as the 'Industry Leader' for crossing landmark score of 650-plus in its Tata Business Excellence Model (TBEM) assessment 2017. The



award was presented by Ratan Tata, Chairman Emeritus, Tata Sons and N. Chandrasekaran, Chairman, Tata Sons to Praveer Sinha, Chairman, Tata Power-DDL and CEO & MD, Tata Power and Sanjay Banga, CEO, Tata Power-DDL at the JRD QV Award function held recently at the National Centre for Performing Arts (NCPA) in Mumbai.

The Tata Business Excellence Model (TBEM) matrix has been conceived to deliver strategic direction and drive business improvements at the Tata Group. Aimed at enabling Tata Group companies capture the best global

business processes and practices, the model invests Tata Group companies with the inherent dynamism to evolve and keep pace with ever-changing business performance parameters. With this recognition, Tata Power-DDL has now joined the elite club of Tata Group Companies with 650-plus score, the others being Tata Steel and TCS. **ET**

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Photovoltaics Market worth \$345.59 Billion by 2020

The photovoltaic market is growing rapidly in many segments and applications due to various reasons such as their environmental friendly attributes, minimum maintenance, and cost saving.



USD 89.52 billion in 2013 to USD 345.59 billion by 2020 at a CAGR of 18.30 per cent between 2014 and 2020. The photovoltaic market is growing rapidly in many segments and applications due to various reasons such as their environmental friendly attributes, minimum maintenance, and cost saving. The major market players are investing heavily in PV technology. Furthermore, many governments are also providing various incentives and funding to this market.

This report details the market trends, drivers, and challenges with respect to the global photovoltaics market and forecasts the market till 2020, based on components, types, applications, and geography. This global report provides a bird's eye-view of the market across geographies –that is North America, Europe, Asia-Pacific, and RoW (Rest of the World). APAC holds the largest share in the photovoltaic market and has been identified as the fastest growing region with China and Japan occupying the major market share. Europe and North America are also considered to be promising markets, with Germany and the UK in Europe, and the US and Canada in North America providing an impetus to the growth of the same.

The competitive landscape of the market presents valuable insights about the players in the photovoltaics market. The global photovoltaics market report profiles 12 promising players in the market and further explains their business overview, product portfolio, recent developments, and the key strategies adopted by the same. The market is witnessing numerous collaborations and partnership agreements across the value chain between tier-one companies. 

According to MarketsandMarkets Research Report, the photovoltaics market is expected to be worth USD 345.59 billion by 2020 at a CAGR of 18.30 per cent.

Photovoltaic (PV) systems are used to convert sunlight into electricity. They are safe, reliable, incur less operating costs, and are easy to install. The speed at which PV market is growing has introduced new challenges in the management of the electricity system. The enormous potential of solar PV and its various beneficial attributes is majorly driving the market for the same. Thus, PV is playing a vital role in the power or energy system. The PV market is likely to continue to register growth in the APAC region primarily in China and Japan. PV systems are helping in delivering clean, safe, affordable, and decentralised electricity to people.

The photovoltaics market is expected to grow from



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Solar beyond safeguard duty

Picture Courtesy: www.pxhere.com

Although the court has granted a provisional stay on the DGTR order imposing 25 per cent safeguard duty on solar panel imports, cloud of uncertainty still looms large over the stiff targets the government has set.

By **Subhajit Roy**, Group Editor

Of late, the Finance Ministry of India has notified the Directorate General of Trade Remedies' (DGTR) decision to impose 25 per cent safeguard duty on solar panels imported from China and Malaysia. Under the proposed plan, the tariff would be applicable for two years and

would reduce to 20 per cent for the first half of the second year and 15 per cent for the second half. The announcement has led to rise of lots of ambiguities within the solar power industry.

While this may help the domestic manufacturers currently crippling due cheap imports in

short-term, project developers believe that the duty would increase solar power tariffs significantly as today around 90 per cent of solar equipment used in India is imported.

Commenting on how the imposition of safeguard duty will impact the country's solar power sector, Shekhar Dutt, Director General, Solar Power Developers Association (SPDA), said, "Majority of the domestic demand is met via imported modules since the domestic supply is not enough to cater the entire national demand. Therefore, the imposition of safeguard duty would lead to additional cost burden on the developers. Further, the tariffs are likely to increase by approximately 50 paise per unit. This would shoot up the tariff rates beyond Rs 3 and as a result DISCOMS would refrain from buying the power. Ultimately this will have a negative impact on the sector as a whole."

Simarpreet Singh, Founder-Director, Hartek Solar Pvt Ltd opines that the imposition of 25 per cent safeguard duty will escalate capital costs for solar power projects by at least 15 per cent. He said, "The viability of power purchase agreements which have already been negotiated with developers is a major cause for concern because discoms will be reluctant to take safeguard duty into account to rework the tariffs. The safeguard duty will impose a legal burden on developers as they will have to undergo tedious procedures to get the power purchase agreements with discoms revised."

So as to maintain their rate of return, in Singh's opinion, developers will have to hike tariffs by 30-35 paise per unit. He adds, "They may also use the 'change in law' clause in their contracts to pass on the additional cost to discoms, which may lead to an increase in working capital requirements in the short term or delay commissioning."

Manoj Gupta, Vice President – Solar Business, Fortum India Pvt Ltd, also said, "The government's move on imposing 25 per cent safeguard duty on solar



Manoj Gupta, VP – Solar Business, Fortum India Pvt Ltd

The safeguard duty will only be justified, and the country can achieve this target if the domestic industry is able to match cheap imports within the two years.

cells imports has led the Indian solar industry been pushed back by a couple of years. We believe that there is some impact on solar power developers and also on consumers. The consumers of electricity will also be affected because tariffs are expected to rise."

Girishkumar Kadam, Vice President and Sector Head, Corporate Ratings, ICRA Ltd observes that the imposition of safeguard duty on imported PV cells would result in an increase in the capital cost for a solar power project by 15 per cent, which in turn would result in an increase in tariff by about 30-35 paise per unit to maintain a similar level of returns for project developers. The solar bid tariffs largely remained below Rs. 3 per unit in CY2018 YTD varying between Rs. 2.44 per unit and Rs. 2.75 per unit, with expectation of favourable price movement in PV modules following the policy changes in China.

Kadam says, "The imposition of safeguard duty is likely to increase the bid tariffs to Rs. 2.9 - 3.1 per unit for the upcoming bids." However, he feels, the solar power tariffs would continue to remain competitive against the conventional power tariffs as well as the other renewable sources.

According to Ivan Saha, BU Head Solar Manufacturing & CTO, Vikram Solar Ltd, 25 per cent safeguard duty on solar cells imports would have helped if domestic solar manufacturing units within the special economic zones (SEZ) were exempted from this duty imposition. However, he mentions, in



Girishkumar Kadam, VP & Sector Head, Corporate Ratings, ICRA Ltd

The imposition of safeguard duty is likely to increase the bid tariffs to Rs. 2.9 - 3.1 per unit for the upcoming bids.





>>> The only way achieve 100 GW by 2022 in sustainable manner would be through the achieving parts of these targets thorough indigenous manufacturing.

Ivan Saha, BU Head Solar Manufacturing & CTO, Vikram Solar Ltd

current form there is no exemption to SEZ based manufacturing units, which by the way is the hub of solar manufacturing in India.

"40 per cent of solar module manufacturing units and 60 per cent of solar cells manufacturing units are located in SEZs. Therefore, currently, safeguard duty does not present any opportunity. The Government of India needs to prioritise domestic manufacturing and exempt SEZ-based solar manufacturing units to see any real improvement in the sector," Saha said.

Detrimental to 100-GW target?

The Government of India has ambitious plans of generation of 100 GW of solar energy capacity by 2022, but, according to industry experts, momentum has been severely eroded in the last few months. Issues such as uncertainty around import duties and future tax rates on existing power purchase agreements have somehow dampened investor sentiment.

With the imposition of safeguard duty on solar cells, Gupta of Fortum India believes, it has become all the more difficult. He said, "The recent development of a safeguard duty was unexpected and while it may prove to be a boon for manufacturers, developers are being adversely affected. The cost of solar projects will straightaway go up by 14 to 15 per cent, which would affect both the on-going and upcoming projects."

Experts also believe, considering the recent renewable energy policy in China, which has reduced

the demand for solar in the country and about to bring an issue of oversupply to the global market, it may be possible for India to generate 100 GW solar energy by 2022 on a global competitive scale through imports.

However, Saha of solar power developer Vikram Solar observes, focusing on importing solar modules from China, will only lead to further damaging the Indian solar manufacturing industry and put India's vision for solar reliance and creating jobs in question. Chinese suppliers already hold more than 80 per cent market share within Indian solar market and in 2017 India spent \$3.8 bn importing solar modules from China.

Indian manufacturing industry has huge exposure currency risk, as currently we are dependent on imports in a big manner. Therefore, Saha suggests, the only way achieve 100 GW by 2022 in sustainable manner would be through the achieving parts of these targets thorough indigenous manufacturing.

The other concern is that by the time any new manufacturer comes on stream, he will not be able to get any benefit under safeguard duties and there is a doubt that any existing manufacturers will have the cash flow or the wherewithal to make any substantial benefit out of this.

"The safeguard duty will only be justified, and the country can achieve this target if the domestic industry is able to match cheap imports within the two years," Gupta said. He expects that soon the domestic industry will scale up and bring down the cost differential.

Though a lot of questions being raised on the competitiveness of solar power upon imposition of proposed safeguard duty, Kadam of ratings agency ICRA believes, the competitiveness of solar power remains intact even with the imposition of safeguard duty on imported PV modules and should not have





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33000 V

kVA	250	315	400	500	630	800	1000	1250	1600	2000	2500
LEVEL-1				✓	✓	✓	✓	✓	✓	✓	✓
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Cover Story

any adverse material impact on future project awards. At the same time, he points out, "The implementation of the ongoing projects could face challenges in terms of getting approval from the regulators to pass-on the capital cost increase through increase in tariffs and securing funding for the additional capital cost, in a timely manner." Based on the tendering and solar project awards, ICRA estimates solar capacity addition of about 4 - 5 GW in the utility-scale segment having PPAs with the DISCOMS. With the increased tendering activity in CY2018 YTD, the capacity addition is expected to rise in FY2019 and FY2020.

How safeguard duty benefits domestic manufacturers

Research agency CRISIL describes the safeguard duty on solar modules as 'both a boon and a bane for the solar value chain'. It said, "Currently, 85-90 per cent of the solar modules used in India are imported from China and Malaysia. The boon is the opportunity it provides the domestic module industry to flourish. The bane is that the duty could raise capital costs for solar projects based on imported modules by around 15-20 per cent (at current prices)."

However, Shekhar Dutt of SPDA points out: "The duty imposition would not help the manufacturing units much as the domestically manufactured cells or modules are technologically uncompetitive as they are less efficient and are not backed-up by insurance. The first and the foremost step is to develop latest technology with high efficiency modules."

Simarpreet Singh of Hartek Solar suggests that indigenous solar panel and cell manufacturers should take it as an opportunity to step up their R&D to come



Simarpreet Singh, Founder-Director, Hartek Solar Pvt Ltd

With the safeguard duty in place for two years, domestic players should use this period to build on their solar cell manufacturing capacities.

up with more cost-effective and efficient technologies that give them an edge over their Chinese counterparts. He adds, "With the safeguard duty in place for two years, domestic players should use this period to build on their solar cell manufacturing capacities. They should heavily invest in technology so that they can truly 'Make in India' and not just 'assemble in India', as is happening now."

The imposition of safeguard duty on imported solar cells and modules would improve the competitiveness of domestic module manufacturers but, in Gupta's opinion, the extent of benefit is likely to be constrained by the recent fall in the imported PV module prices owing to the policy changes in China.

Moreover, he feels, "The duty is unlikely to lead to any significant increase in the domestic solar module or cell manufacturing capacity in the near term. Safeguard duty is applicable for 2 years and this 2-year period is insufficient for any module or cell supplier to enhance their capacity to become competitive to Chinese players."

"Instead," Kadam of ICRA said, "The domestic solar cell manufacturing would benefit by having a long-term policy clarity on the safeguard duty or anti-



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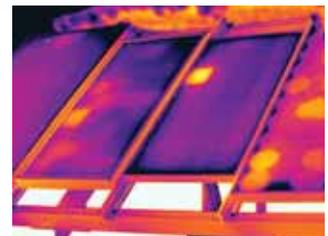
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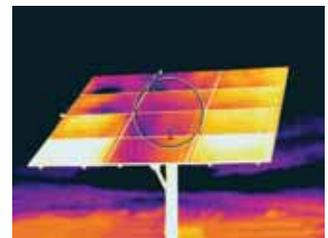
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>>> The duty imposition would not help the manufacturing units much as the domestically manufactured cells or modules are technologically uncompetitive as they are less efficient and are not backed-up by insurance.

Shekhar Dutt, Director General, Solar Power Developers Association

dumping duty on imported cells or modules.”

India has around half-a-dozen makers of solar cells and modules, with a total capacity of around 8,000 MW, out of which around 5,000 MW is in SEZ zone, which will also be impacted from this order as supply from SEZ to domestic market is also considered as import. The balance left out capacity of 3,000 MW is not enough to meet the country's increasing demand. Moreover, the decision has also not gone down well with solar cell manufacturers within SEZs as their domestic sales will also attract safeguard duty. Vikram Solar's Ivan Saha said, “Imposing 25 per cent safeguard duty on SEZ based domestic solar module and cell manufacturing units will increase solar module production price and push domestic manufacturers in India out of business. The duty will also bring in issue of job losses, as the demand for domestically manufactured modules and cells fall.”

Industry Wish

Explaining the solutions to remove the ambiguity created due to the imposition of duty, Fortum India's Gupta said, “The first immediate solution is to exempt projects from safeguard duty whose PPA or bids are closed and in many cases deliveries of modules are expected to begin shortly so that there can be a smooth execution of the projects and for new biddings.”

He feels that the best solution will be to withdraw the safeguard notification and to provide the financial support to domestic manufacturer in the form of VGF

or interest subsidy as the duty could also kill thousands of jobs created from the down-stream activities of solar power generation including the manufacturing sector. It could also risk availability of low cost energy to the consumers, Gupta adds.

Whereas Saha of Vikram Solar proposes, “The government should exempt SEZ to DTA clearance of solar cells and modules and exempt projects, which have already been auctioned out from the ambit of duties of Safeguard to remedy the situation.”

No safeguard duty for now!

The safeguard duty on solar cells and modules that seeks to empower domestic manufacturers is now ‘temporarily withdrawn’ followed by strong industry opposition especially from the solar power developers. Earlier, on a petition filed by ACME Solar, the Orissa High Court had issued a stay on the proposed order itself till 20th August. However, ignoring the Odisha High Court's stay order, on 31st July the Finance Ministry had notified the imposition of 25 per cent safeguard duty with immediate effect. This has led solar developers ACME Solar, Hero Future Energies and Vikram Solar to file petitions in the Odisha High Court against the DGTR for violating the court's order. Following this, the Finance Ministry directed all chief commissioners of customs “not to insist on payment of safeguard duty for the time being”.

Conclusion

Though the future of ‘safeguard duty’ is hanging in the balance, solar power developers urged that the ongoing projects should be exempted from the safeguard duty or allowed a pass through. Even the Ministry of New and Renewable Energy (MNRE) has urged the Finance Ministry to exempt solar power projects that have already been awarded or were at the implementation stage before July 30. However, Shekhar Dutt of SPDA believes, “The ultimate solution is the withdrawal of the duty.”

19



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“Tariffs are likely to increase by approx 50 paise per unit”

The imposition of safeguard duty would lead to additional cost burden on the developers, informs **Shekhar Dutt, Director General, Solar Power Developers Association** in an interaction with **Electrical India**

India imposed 25 per cent safeguard duty on solar cells imports. What kind of potential will it generate for domestic solar cells manufacturers?

The duty imposition would not help the manufacturing units much as the domestically manufactured cells or modules are technologically uncompetitive as they are less efficient and are not backed-up by insurance. The first and the foremost step is to develop latest technology with high efficiency modules.

What challenges will it create for the solar sector?

This would create hurdle in achieving the timely commissioning of the ongoing projects as the modules are under transit or are lying unclaimed at the ports since developers are not in position to bear the additional cost burden. This would ultimately impact the overall target of achieving 100 GW under National Solar Mission. One of the immediate solutions is to exempt the already awarded projects from the payment of the duty.

How will this move of the government impact the country's solar sector?

The solar sector is still in development phase and has to achieve 100 GW installation by 2022. Majority of the domestic demand is met via imported modules since the domestic supply is not enough to cater the entire national demand. Therefore, the imposition of safeguard duty would lead to additional cost burden on the developers. Further, the tariffs are likely to increase by approximately 50 paise per unit. This would shoot up the tariff rates beyond Rs 3 and as a result DISCOMS would refrain from buying the power. Ultimately, this will have a negative impact on the sector as a whole.

Will the country achieve the target of 100 GW of installed solar energy by 2022 with the imposition of safeguard duty on solar cells?

As per one of the recent reports by CRISIL, India will

not be able to achieve its ambitious target of generating 100 GW solar power by 2022.

What are the solutions to remove the ambiguity created due to this imposition of duty?

The ongoing projects should be exempted from the safeguard duty or allowed a pass through. The ultimate solution is the withdrawal of the duty.

Why have the Indian manufacturers failed to scale up, upgrade plants or integrate backwards?

The domestic manufacturers are not globally competitive, majority of the manufacturing capacity is not using latest technology. India presently manufactures two stages from wafer to cell and cell to module which are basically assembling units. The Government is coming up with domestic manufacturing policy to promote fully integrated value chain from silica to module. This would definitely provide a boost to the domestic manufacturing.

So, has the government created a trade barrier to support domestic manufacturer?

The Government has adopted two different approaches for promoting domestic manufacturing and creating trade barrier by imposing safeguard duty; which cannot be mixed together. In order to promote domestic manufacturing, the Government is coming up with domestic solar PV manufacturing policy and has already released RfS of 5GW manufacturing linked PPA. Whereas it is difficult to say that whether the duty imposition will protect the existing manufacturers as the notification is not clear regarding the manufacturers located in SEZ.

Lastly, how badly private rooftop solar and open access market would be hit by duties?

The rooftop segment would equally be impacted by safeguard duty with the increased cost burden. Further it would become difficult to sell power in the open market due to increase in total project cost. 

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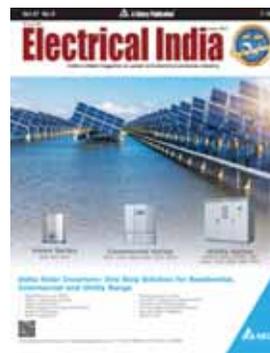
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“Today we contribute to about 70-75% of total solar rooftop installations in India”

With the rate contracts with all our major suppliers, we intend to increase our market share in the next few years, states **Bharathiraja Kaliyamoorthy, Managing Director, GEESYS Technologies (India) Pvt. Ltd.**, in an interaction with **Electrical India**.

GEESYS is an expert in general electrical and electronics system support. Could you brief us about your expertise in the solar segment?

In the ever-growing, ever-competitive market of electronics and electricals, GEESYS is a name synonymous with present day requirements of by and large solar industry. We are manufacturing products which will support power generation, distribution, conditioning, backup, security and automation.

Started in 2011, we have gradually but definitely grown. Our technical expertise and out of the way support to all our partners, integrators, the distributors and all stakeholders has led us to be a highly trustable and dependable associate.

We have today reached from the suburbs of Chennai to the nationally available product. We intend to reach to the nook and corners of the country by 2019 and serve the clients with the range of high quality low or medium budget priced products. At Chennai, we have established a 6000 sqft manufacturing facility with technically qualified engineers.

Our other product range includes, online UPS and servo stabilisers from 1KVA to 2000KVA, isolation transformers, LT panels (PCC, MCC, APFC, APSC & Metering Panels), lightning arrestors, maintenance-free earthing electrode, lightning arrester, online UPS, inverter and few other residential products.

We intend to enter the entire gambit of IoT and aim to

be available in each and every household of the country. This will most certainly lead us to export to other parts of the world including China.

What are the solar products and solutions you offer?

In solar segment, we offer the entire Solar BoS materials which includes: ACDB, DCDB, Solar Combiner Boxes, Solar Array Junction Boxes, Solar String Combiner Boxes - both in Polycarbonate & CRCA metallic boxes; Solar Module Mounting Structure (MMS); DC and AC Cables both flexible and armoured; Lightning arrestors and Earthing material; Cable Management Accessories (Cable Trays, Duct and Ties); MC4 Connectors, Terminal Lugs and other Accessories; Video Surveillance System CCTV; and Fire Alarm system (FAS).

All our products are technically defined to suit to every requirement across the country. We follow the latest technological upgradations and thus, stand apart from the competitors. Any layman can also install our products straightaway on the sites as it comes with plug and use options.

How do you see the acceptance of your solar products?

It would be imperative for us to mention here that, we are the pioneer of developing, launching and leading our competitors to just follow suit with the design, product mix and remain at the top of the list in the organised sector.

As far as the acceptance goes, today we contribute to about 70 to 75 per cent of total solar rooftop installations in the country. The difference of the loss of market share goes to the regional and unorganised players who normally influence mainly on pricing. With the rate contracts with all our major suppliers, we intend to increase our market share in the next few years.

Today, the client is in a position to demand GEESYS and more so, our major sales come from referrals. We value this as our achievement and strive to build on this strong footing to continue to develop and launch one of the best and sought-after products from time to time.

For our distributor Redington India Ltd., we are offering our range into a kit, which we call it as Solar BoS kit, wherein right from 5kW to 20kW.

What are the unique features of your Solar Combiner Boxes/LT Panels?

SunBox (Solar DC/AC Combiner Box) is a DC string combiner box installed between the PV modules and the inverter. AC Combiner Box is installed between PV inverter and main LT panel, providing real protection and performance monitoring for PV power plants. GEESYS is a pioneer in this field of Solar BoS components manufacturing and supplies. Solar DCDB/ACDB are customised products in the region, But, we have made it as catalogue product with technical expertise.

Having invested huge amount of capital in their solar PV plants, the plant operators want to get the maximum output from their photovoltaic power plants.

The solar photovoltaic plant operators want to know the reason behind any fall in the PV plants output - whether the fall is due to some known cause or a fault in the plant that needs to be rectified. In any case of fault, they want to know the exact location of the fault. A solar PV plant typically has hundreds or thousands of PV modules spread over a large area. Using conventional means for finding answers to both these questions is very difficult and time consuming.

The string monitoring and diagnostics system offered by GEESYS has a smart solution to above mentioned problems.

GEESYS Solar String Combiner Boxes are meant for combining all the incoming lines from the solar panel

strings or arrays and deriving one common array output for the multiple array inputs. In a large solar photovoltaic (PV) array, multiple solar modules are connected in series in a string to build the voltage upto proper levels for the inverter. Multiple strings of solar modules are then combined together in parallel to multiply the string output currents to higher levels for input into the inverter.

GEESYS String Combiners (Combiner Boxes) allow the system designer great flexibility in terms of number of circuits, enclosure type and output conductors. GEESYS combiners come in NEMA-3R, 4 and 4X enclosures in either Polycarbonate, powder coated steel, stainless steel, or fibreglass. All enclosures feature complete casketed seals and all output terminals are rated for 90C. GEESYS typically stocks 2 and 32 circuit units in all three enclosures, but other circuit counts can be built to order.

GEESYS Solar ACDB provides overload, short-circuit, over voltage (surge protection and lightening protection), earth fault, low or high voltage cut off, phase failure, phase reversal and reverse power protections. It also provides sophisticated monitoring system with multifunction energy and PLC. We are also providing web-based monitoring solutions to monitor the entire solar power plants from different places to single screen. This helps the customer to ensure their ROI and maintenance activity becomes easier.

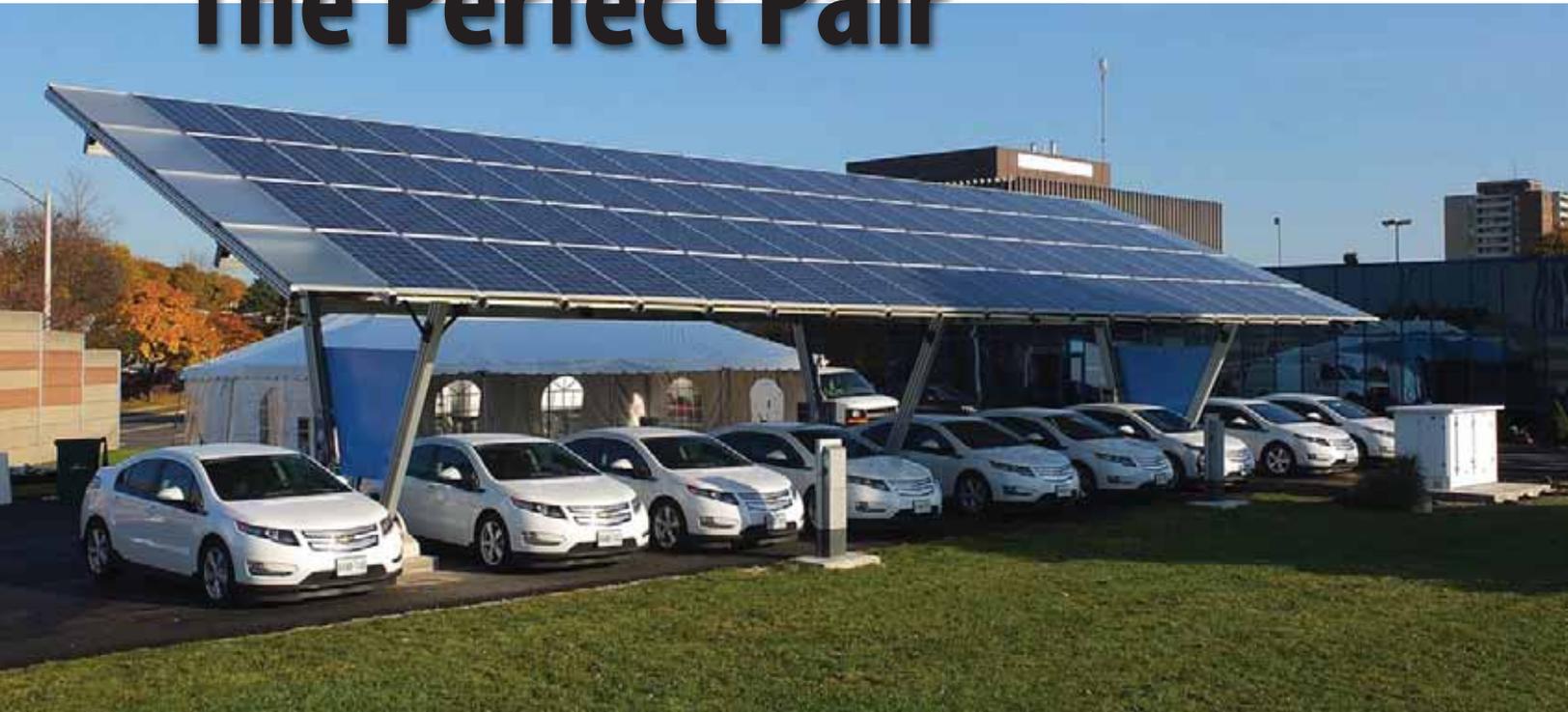
For a comparatively new player in the market, how difficult is it for you to compete with the MNCs?

As far as the Indian operations are concerned, we are the pioneer in this segment and our steady growth signifies our commitment and determination to excel. Moreover, right from the beginning, our approach to every query, every client is personalised which will be difficult for our competitors to even match anytime soon.

As far as the MNC influence is concerned, we wish them to launch their products, which may give us an opportunity to upgrade ourselves, serve the client with additional vigour and offer the very best at the most competitive price.

We would like to capitalise on our strengths to expand our client base, serve them with sincerity and integrity. By doing so, we not only retain their patronage but also remain a dependable partner. 

E-mobility & Solar: The Perfect Pair



Picture Courtesy: www.fleetcarma.com

Since solar energy has gained worldwide acceptance due to its feasibility, easy to install, and reliability, solar energy growth and EV growth have become interconnected.

By *Supriya A Oundhakar*, Associate Editor

Global transport system is witnessing a rapid transition due to burgeoning global CO₂ emission levels and commitments to decarbonisation as the transport system is one of the factors responsible for deterioration of environment. The transport system, being the biggest consumer of crude oil, is responsible for greenhouse gas

emissions and thus, it is making a switch to green energy utilisation worldwide.

Following in the footsteps of Germany and China, India is also focusing on the growth of **electric vehicles (EV)** depending on solar. India, being the world's second largest two-wheeler market, fifth largest photovoltaic (PV) market and seventh largest commercial



vehicles market, has set the target of 30 per cent adoption of current electric vehicle new sales of electric passenger cars, light commercial vans, buses and trucks by 2030.

EV Future Driver of PV

EVs have started gaining momentum due to its energy efficient and environment-friendly nature. Use of solar energy for charging EVs has emerged as the cleanest energy option having zero carbon footprint. Since solar energy has gained worldwide acceptance due to its feasibility, easy to install, and reliability, solar energy growth and EV growth have become interconnected.

While taking note of this emerging trend, Awadhesh Jha, Vice President-Charge & Drive & Sustainability, Fortum India, states, "Though various research and study has proven that despite use of fossil fuel, EV is cleaner than ICE (internal combustion engine) vehicles, it would be prudent if EVs are powered by renewables likes solar. It will spur the demand for more cleaner



Praveer Sinha,
CEO and Managing Director, Tata Power

"It would take massive investments in land to generate enough power to change the transportation sector given the current state of technology for PVs."

energy and that will be provided by PV as it has become quite affordable. In fact, PV and EV are supplementing to each other. With much lower price of solar energy, operating cost of EV will be lower which will create more demand for EV which in turn push for more solar power."

He adds, "More and more PV getting added to the system will create imbalance in the grid requiring to be stabilised by some form of storage. Battery EV provides good storage system to PV which again boosts the deployment of PV."



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Awadhesh Jha,
Vice President-Charge & Drive & Sustainability, Fortum India

“India is poised to take a big leap towards adoption of EV and for this, the charging infrastructure for electric vehicles also needs to be expanded to meet the growing number of electric vehicles.”

Technological innovations can make PVs more efficient, leading to e-mobility to be the growth driver of solar. According to Praveer Sinha, CEO and Managing Director, Tata Power, “The technologies, both in terms of EVs and PVs, are evolving as we speak. So, until there is a technological breakthrough that significantly improves the quality of power generated from PV panels that is enough to run an automobile, the demand for PV will be driven by the inevitable growth in EV offtake.”

Going ahead, in 2017-18, India's crude oil imports witnessed a jump ballooning its import bills to US\$ 87.7 billion. Further, the transport sector is the biggest consumer of crude oil with usage of 70 per cent of diesel and 99.6 per cent of petrol. To this, Ivan Saha, BU Head Solar Manufacturing & CTO, Vikram Solar states, “Understanding the threat to India's economy, pollution, and convenience, the Government of India is focusing on EV market growth depending on renewable energy (especially solar) to save billions of forex outflow, and reduce dependency on fossil fuels. With countries waking up to realise the potential of green energy transition of transport market, e-mobility will undoubtedly drive the PV market globally.”

As per a NITI Aayog report, India can save 64 per cent of energy demand for road transport and 37 per cent of carbon emissions by 2030 by pursuing a shared and connected electric mobility future. Worldwide, the industry is gearing up to lower carbon dioxide emission targets over the next decade, especially, through the use of renewable power generation techniques. The move to EV is necessitated by the urgency to curb the current account deficit by

cutting down on oil imports. This will reduce India's dependence on oil-rich countries, opines Simarpreet Singh, Director, Strategy, Hartek Group, and Founder-Director, Hartek Solar Pvt Ltd.

Bumpy Ride Ahead

Though electrification of transportation and the use of solar-powered charging stations as an electricity source will ultimately improve people's quality of life, its penetration in India is likely to remain low due to the challenges like charging infrastructure and battery technologies. According to Simarpreet Singh, as of now, storage solutions in India in the form of lead acid batteries are very expensive. The next critical technology for e-mobility and rooftop solar in India is the development of more cost-effective and efficient batteries which can store electricity when generation is at its peak and meet the requirements of users during peak demand hours.

Moreover, land availability is also one of the stumbling blocks posing in the way to e-mobility. Praveer Sinha is of the opinion that it would take massive investments in land to generate enough power to change the transportation sector (personal and commercial) given the current state of technology for PVs. This challenge will be even more acute in cities where land costs can be forbidden to warrant the creation of a solar powered charging infrastructure.

According to Ivan Saha, people are often concerned about range of EV. Enough number of charging infrastructure is required to keep this from becoming a reason behind failure of EV.

Although, the Government of India is working to promote EV development, there are challenges in establishment of charging infrastructure:

- Research shows that India has nearly 350 renewables public EV chargers, while the number of petrol stations stand at 57,000. While comparing with China, it has installed around 2,15,000 charging points at the end of 2016. In the same breath, we can point out that if Solar panels cover 0.5 per cent of Rajasthan, can generate power for 330 million EVs. Delay in installing more solar

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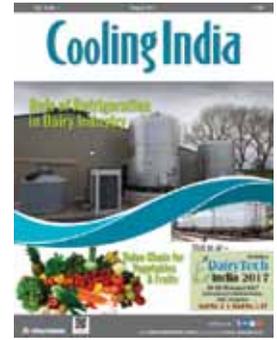
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charging stations is keeping India's first EV procurement plan in limbo.

- Electricity Act forbids companies without distribution license to sell electricity. This restricts development of charging infrastructure. Currently, the government is taking steps to implement the charging as a service model to aid in EV adoption.
- One of the reasons for lack of charging infrastructure is confusion of charging standards. India has recently decided to back off from implementing an EV policy, thus paving the way for the market to decide on charging standards and keep pace with the global technology advancement.

In India, DC fast charging would be the main charging mode for EV as Indian urban areas do not have majority of single family house which would provide charging overnight facility. A DC fast charging would need higher load at continuous level. To meet this load requirement of charger, an in-situ solar plant needs to be designed as it has characteristic to supply to its full load only during few hours of the day. This combination makes the solar powered charging station not affordable for EV as one of the hallmarks of EV is its low operating cost. This has to wait till the time efficiency of solar panel increases substantially necessitating lesser area need, suggests Awadhesh Jha.

E-mobility Wave

The e-mobility wave will gather more steam in the near future in India as EVs are the way forward for a clean world. For this, India is gearing up to ride this wave by enrolling e-charging technologies and highly efficient lithium ion batteries. It is also possible that in the initial phase of this wave the adoption rate will be higher in the public transportation space. Further, the rapid expansion of charging infrastructure will be essential to drive the e-mobility wave, even as auto makers continue to make the vehicles more efficient and offers higher range per charge, observes Sinha.

Electric vehicles and residential or commercial solar power charging stations can serve and aid growth of each other. With solar energy becoming mainstream energy source worldwide, potential for EVs using solar energy is high. It is estimated that



Ashish Modani, Assistant Vice President & Co-Head, Corporate Ratings, ICRA Ltd

“ICRA expects that EV adoption in Indian market is likely to remain low as compared to other economies because of high upfront cost and lack of charging infrastructure related issues.”

India's energy import bill will rise from \$150 billion to \$300 billion by 2030. Keeping this scenario in mind, Saha avers, “It is fair to say that the country's shift to solar power generation and EVs is the best and actually, the only move left. Considering India's focus towards EV growth through policy development and investment, Vikram Solar has elaborate plans to contribute to India's e-mobility growth.”

The success of e-mobility in India will largely depend on upgraded grid infrastructure to cater to an electricity demand of 100-120 Gwh for powering an estimated 65-75 million electric cars, buses and trucks by 2030. The automobile manufacturers are investing billions in conversion of its product ranges to ride the e-mobility wave.

Fortrum has plans to set up charging infrastructure in India and are evaluating several locations. Jha opines that all parking places must have minimum 20 per cent of parking earmarked for charging station. These locations could be used for DC fast charging. The earmarked parking spaces should be given free of cost to potential charging service provider initially for couple of years. Alternatively, the Government can adopt Transport for London (TfL) model in developing charging infrastructure where TfL secured sites and provided upgraded electricity grid infrastructure.

Moving ahead, in 2018, Government exempted e-vehicle charging station from licencing requirement for charging EV batteries. This step will help in entry of new players or third-party service providers in setting up charging infrastructure, concludes Ashish Modani, Assistant Vice President & Co-Head, Corporate Ratings, ICRA Ltd.

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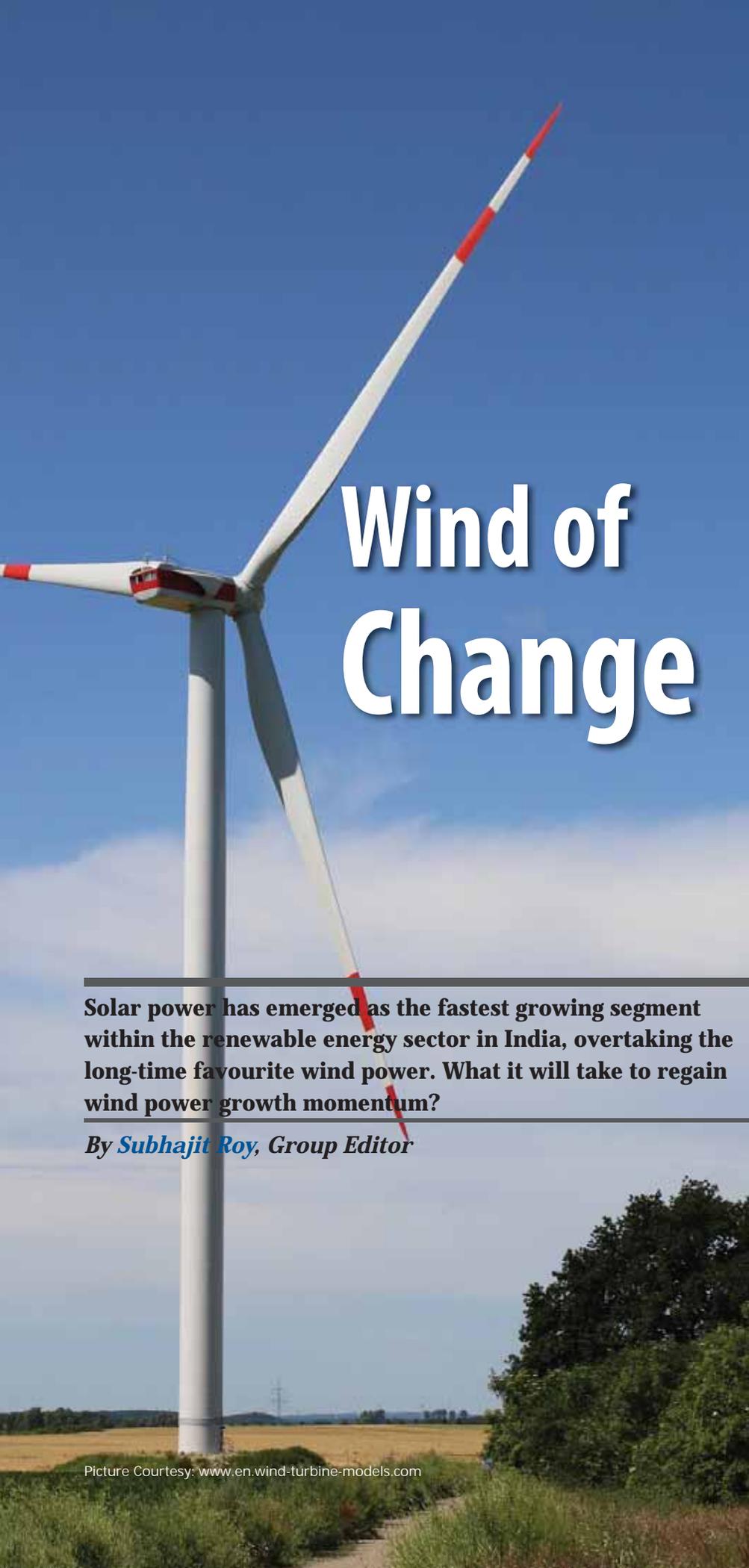
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Wind of Change

Solar power has emerged as the fastest growing segment within the renewable energy sector in India, overtaking the long-time favourite wind power. What it will take to regain wind power growth momentum?

By Subhajit Roy, Group Editor

In the last 3 years, installed renewable energy capacity in India has more than doubled from around 32 to 71 GW. Wind energy is leading the pack, contributing more than 50 per cent of this with cumulative installed capacity of over 34 GW. According to JP Chalasani, Group CEO, Suzlon, "Due to the shift to competitive bidding, wind energy has become the cheapest source of energy across all sources. Because of the tariffs coming down, the demand from market has picked up substantially and distribution companies are showing interest in buying wind energy since it's a viable model for them."

However, the last year had been challenging as the wind industry witnessed slowdown due to the transition from FIT (Feed-In Tariff) to competitive bidding, which impacted margins and created temporary uncertainty in terms of volumes. "The overall wind industry installations plummeted to 1,766 MW in FY18 (32 per cent of FY17 installations) due to stagnant volumes, uncertainty on PPAs and policy environment," opines Chalasani.

"One advantage which wind has over solar is lesser technological risks related to project life as many plants have already demonstrated complete project life cycle. Another area of opportunity for wind can come from offshore where PLFs can be 50 per cent more than onshore projects (although costs can also be higher) and more than 7,000-km long coastline obviates the need of land procurement, which is a limited resource," Ankur Agarwal, Senior Analyst, Global

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Wind Power

Infrastructure Ratings, India Ratings and Research (Ind-Ra) said while listing the advantages of wind power in India.

The industry is on a growth trajectory and there is a clear visibility of volumes. The sector last year saw bidding of 7,500 MW (6,000 MW from central and 1,500 MW from states like Gujarat, Tamil Nadu, and Maharashtra. Additional 10,000 MW of bidding is scheduled to take place by the end of FY19. Under the new bidding process the project size has significantly gone up to 250 MW - 500 MW. As a result, there is an increase in the economy of size and project cost is reduced, improvement in technology has led to viable tariffs, avers Chalasani.

India is attracting investments from large scale global utilities. Commissioning volumes will improve in FY19 compared to FY18. Volumes to exponentially grow to over 8,000 MW FY20 onwards. New bids awarded will be commissioned over FY20 and FY21.

However, Dr Sanjiv Kawishwar, Sr. Vice President, ReGen Powertech Pvt Ltd. says, "Implementation of competitive bidding for tariff determination in wind sector has devastated the growth and there is hardly any progress in project execution finalised through such mechanism."

He acknowledges that solar power has emerged as the fastest growing segment with the favourable government policies for last few years.

Technical feasibility and reliability of wind power is ensured by complying to the well-established type certification standards. "Commercial feasibility of wind power set ups needs to be enhanced by right mechanisms for tariff determination and restoring the beneficial schemes like GBI or AD that were prevailing earlier," suggests Dr Kawishwar.

Volatility in yearly PLF - a major risk

Volatility in yearly plant load factors (PLF) is a major risk in wind compared to solar, avers Agarwal. While in the Ind-Ra portfolio, it is witnessed PLFs around P90 level in FY16 and FY17 (except Tamil Nadu and Rajasthan where there were more grid availability related issues), PLF in FY18 were about 3-15 per cent lesser than the previous year in five states among the seven most windy states (except Tamil Nadu where PLFs were more than previous year owing to improvement in grid availability and Rajasthan where generation levels were almost same as previous year).



Due to the shift to competitive bidding, wind energy has become the cheapest source of energy across all sources.

J P Chalasani, Group CEO, Suzlon

Agarwal also admits that generation risk in case of wind power projects is much more compared to solar. He adds, another major risk faced by wind compared to solar is the seasonality. Bulk of the annual generation is achieved during four windy months of June to September and repayments of the loan have to be structured around it. Also, many counterparties (mostly state discoms) pay within time just before and during the windy season, but start delaying after the wind season is over, because of shifting of their priority towards other sources of power.

To regain the growth momentum, Agarwal feels, wind will have to establish its cost superiority compared to other renewable sources especially solar. This can only be achieved by investing in technology by turbine manufacturing companies. We have seen times (early 2000s) when PLF of 24 per cent were considered good with a CAPEX of around Rs 60 million per MW. Now bidders are factoring in PLFs as high as 40 per cent with just a marginal increase in capex to around Rs 65 million per MW. This has led to drastic reduction in wind tariff to as low as Rs 2.43 per unit discovered in an auction conducted in December 2017 by Gujarat state Discom. Can it go down further and how fast? And, the bigger question is: Can the tariffs for wind go down faster than solar? Right now, solar is looking to win the race but much will depend on research and development being done by this wind turbine suppliers. According to Agarwal, if they are able to achieve better generation levels with lesser increase in CAPEX requirement, the tide can change.

Suzlon gaining strength

Suzlon has commissioned 626 MW of wind power projects in the financial year 2017-18 (FY18), the highest installations by any player during the fiscal, claims Chalasani. He asssd, "With this, Suzlon has gained a market share of 35 per cent despite an extremely challenging year for the sector and several hurdles due to the transition from FiT to bidding regime."





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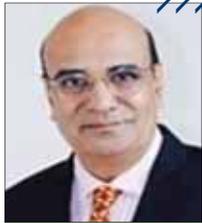
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Implementation of competitive bidding for tariff determination in wind sector has devastated the growth and there is hardly any progress in project execution finalised through such mechanism.

Dr Sanjiv Kawishwar, Sr. Vice President, ReGen Powertech Pvt Ltd

Suzlon's market share has been continuously growing: from a market share of 19 per cent in FY15, the wind major has attained a market share of 35 per cent in FY18. From 7,500 MW bidding completed, Suzlon has the largest share of order win from capacities auctioned till date, the company informs.

"Suzlon is well positioned to reap the benefits in this new business regime with our end-to-end solutions, continuous investment in India specific wind turbine technology, vertically integrated operations and best in class services. Technological innovations will continue to be the bedrock of our growth. Our current order book is of 1,134 MW," Chalasani said.

Recent initiatives at Suzlon

- In FY18 Suzlon and associates commissioned the first Operational Offshore LiDAR based Met Station in the Arabian Sea
- Launched India's tallest 2.1 MW WTG (S111 – 140m)
- Launched India's largest 2.1 MW WTG (S120 – 140m)
- Launched India's largest rotor diameter 2.6 to 2.8 MW WTG (S128 – 140m).



Prototype of Suzlon S128 WTG installed in Sangneri, TN.



To regain the growth momentum, wind will have to establish its cost superiority compared to other renewable sources especially solar.

Ankur Agarwal, Senior Analyst, Global Infrastructure Ratings, India Ratings and Research

Recent initiatives at ReGen Powertech

ReGen Powertech has launched 'Multi-brand Services' (ISP) for O&M of other company wind turbines also. The company is progressing in the areas of 'solar hybridisation' and new high efficiency wind turbine models profitable for such low tariff, informs Dr Kawishwar.

Technologies that help to improve wind turbine efficiency

Institutionalisation of energy management systems with a scope to generate optimum energy for 25 years and implementation of RE Efficiency Standards - IEC 13273 have helped to improve efficiency hence energy economics, comments Dr Sanjiv Kawishwar of ReGen Powertech while talking about the technology that helps to improve wind turbine efficiency.

Today, for wind turbine manufacturers, the focus is on developing products with higher energy yield, reducing Levelized Cost of Energy (LCoE) and maintaining cost competitiveness.

Apart from a host of other features including aerodynamic profile and material of blades, hub height and wing span are the two major factors leading to increase in PLFs. Hub height has slowly increased from 50 metres (in 1990s and early 2000s) to 130-140 metres in majority of the upcoming wind projects. Suzlon recently commissioned its S128 machine with 140 metres hub height and capacity of 2.8 MW. A mere increase in hub height totally changes the kind of resource one is looking at. While at 50 meters hub-height, total wind resource in India was estimated at 48 GW, the same increased to 102 GW at 80 meters hub height. The same potential increases to more than 300 GW at 100 metres hub height (as per analysis by National Institute of Wind Energy). "More hub height means one can install bigger blades covering more span/area resulting in better power generation (due to more energy transfer). Lighter blades with better aerodynamic profile also have a role to play in better generation estimates for these bigger turbines," explains Ankur Agarwal from Ind-Ra. Suzlon's Group CEO J P Chalasani also said, "Innovation in tower and blade technologies aimed towards making unviable wind sites viable, ensuring better yield and increasing turbine utilisation have been the key focus areas"

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Transmission Losses in India

In this article, the power sector is reviewed with specific focus on transmission and distribution system losses.



Picture Courtesy: www.eesi.org

Transmission and Distribution (T&D) losses are a percentage of energy lost in the power grid in the process of transporting electricity from generating stations to points of consumption. The concept of Aggregate Technical & Commercial (AT&C) losses was introduced in India in the 90s. It

provides a picture of energy & revenue loss situation at the distribution level. The AT&C losses comprise two elements namely:

- Technical losses, which are entirely in the transmission and distribution systems
- Commercial losses, which are in revenue realisation, and

pilferage in distribution systems.

With the aim of reducing losses and improving the power distribution sector of state utilities, the Union Government has launched the Restructured-Accelerated Power Development and Reforms Programme (R-APDRP). The Government has notified mandatory labelling of distribution transformers to ensure distribution transformer losses are minimised. IT-enabled system has been introduced for energy accounting and Supervisory Control and Data Acquisition (SCADA) for big cities. In broad terms, the power sector is expected to achieve break-even at T&D loss levels of around 20 per cent or so for the utilities to make profits.

T&D losses are at the level of 33 per cent with huge revenue losses to the distribution utilities. The transmission losses are further sub-grouped depending upon the stage of power transformation & transmission system as transmission losses (400kV/220kV/132kV/66kV), and as distribution losses in 33kV and lower levels of transmission. The commercial losses are caused by pilferage due to theft, defective meters, and errors in meter reading, and in estimating unmetered supply of energy. The technical losses are intrinsic to the power transmission system and are caused due to I²R losses, transformer losses, insufficient reactive compensation, and other ill-maintained equipment losses.

Loss Reduction Techniques

Table 1 reports the year-wise T&D losses by CEA, and AT&C

losses by Power Finance Corporation (PFC). Free electricity without metering to agriculture has been unaccounted on average which is about 40 per cent of electricity generated in the country. The major portion of losses of the utility is due to theft and pilferage. Figure 1 shows the trend of transmission losses over the net electricity generated.

Withdrawing free and unmetered power supply to agriculture sector is very difficult politically. Charging flat rates and metered supply is assured with high quality power. Separate feeder to agriculture is provided in a roster of farm power supply through separate feeder along with high quality power. Implementing High Voltage Distribution System (HVDS) as segregated feeder to farmers has been attempted as free and subsidised power to agriculture. HVDS feeder provides quality power and stops theft or illegal tapping of power.

The transmission losses in distribution system has two categories technical losses that are not paid by customers and non-technical losses, that are high in distribution system that can be reduced within limits by adopting different loss reduction techniques.

Technical losses are related to the material properties and its resistance to the flow of current that is dissipated as heat in the transmission lines and distribution transformers. The non-technical losses are caused due to:

- Poor electrical terminations among lines switches and transformer and other

equipment in the distribution network to the consumer

- Frauds in energy meters and theft of energy by illegal direct tapping from live lines
- Diversity of readings and deficiencies or losses in energy measurements.

High rate of technical and non-technical losses causes poor quality of service to customers, high cost of premature investments for development, reduction in revenue collection by utilities leading to financial stress. Major losses make the Utilities to look for subsidies from state budgets. The loss reduction techniques are:

- Perform regular inspection to randomly selected and any suspected customers.
- Install new meters at the primary substation to measure the internal consumption and invoice the company to avoid considering substation consumption as losses.
- Survey and identify the defective meters to replace them, and replace meter seals with new tamper-proof ones.
- Conduct regular campaign to increase the customers' awareness with the efficient use of electricity.

On the other hand, technical losses can be reduced by taking the following actions:

- Install capacitor banks.
- Re-conductoring overloaded lines with bigger conductors.
- Avoid any overloading of system and monitor the progress in losses reduction.
- Disconnect unloaded transformers to avoid no-load losses.

Analysis

- Balance the transformer loading to reduce the neutral current and power losses.
- Upgrade transformers to match the load and the installed capacity, and to replace old/ degraded ones.
- Ensure that all industrial customers are meeting the requirement of 0.9 PF.
- Perform regular preventive maintenance.
- Ensure the frequent live-line washing to reduce the leakage current.
- Use of advanced technology to manufacturing electric machines, generators. Motors and transmission line conductors with super conducting materials
- Energy conservation in utility systems and appliances
- Energy auditing in industry and commercial centres
- Use of energy efficient appliances and behavioural practices of energy uses
- Use of High Voltage Distribution System (HVDS) to clusters of agricultural and bulk consumers
- Allowing differential and dynamic tariff pricing to peak load shaving and reducing losses
- Developing High Voltage transmission networks between National and regional Grids
- Smart Grids and distribution automation with smart meters
- Use of ICT for electricity pricing, billing, collection and accounting system professionally
- Shunt and series compensation systems in long transmission lines at appropriate locations
- Reactive power management in T&D systems.

Advantages of HVDS

- **Line Losses:** The loss in HV system for the distribution of the same amount of power is less than 1 per cent as compared to that of LV line.
- **Voltage Drop:** The voltage drop for distribution of same quantum of power is less than 1 per cent as against that in LVDS and this ensures proper voltage profile at all points.
- **System Power Factor:** The single-phase motors can be used for all agricultural services. The single-phase motors have built in capacitors and the PF is more than 0.95 and almost unity. Thus, system power factor is maintained high.
- **Failure of Distribution Transformers:** The length of LV lines is minimum. Thus, the failure of transformers due to LV line faults is minimised. The loading of transformer beyond its capacity is effectively prevented by consumers.
- **Theft of Energy:** The LV lines are virtually eliminated and even the short LV line required is of Aerial Bundled (AB) cable, which makes direct tapping of lines a very difficult task.
- **End use equipment efficiency:** The voltage drop for distribution of same amount of power is about 1 per cent that of LVDS and thus, the voltages at the consumer premises can be maintained satisfactorily.
- **Reliability of supply:** The LV lines are short and insulated, avoiding all LV faults. The faults on HT line come to the notice of the operator immediately due to the tripping of substation breaker.
- **Voltage fluctuations:** The voltage drop on the LV line is negligible. The additional drop due to extension of HV line up to consumer premises is also negligible. Thus, the voltage profile is very stable and no need to use voltage stabiliser.
- Capital Cost.
- Higher investment on transformation equipment. Larger capacity due to low diversity
- High cost/KVA due to small capacity of Distribution Transformers. Lower investment on short LT lines. Small size conductors are adequate causing low I²R losses due to low currents

Table 1: T&D losses as per CEA & PFC reports

Year	T&D (%) (CEA)	AT&C (%) (PFC)
2004 - 05	31.25	34.33
2005 - 06	30.42	33.02
2006 - 07	28.65	30.62
2007 - 08	27.20	29.45
2008 - 09	25.47	27.37
2009 - 10	25.39	26.78
2010 - 11	23.97	26.04
2011 - 12	23.65	26.63
2012 - 13	23.04	25.48
2013 - 14	22.84	22.58
2014 - 15	22.77	24.62

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Analysis

- Less number of conductors
- Operating cost.

HVDS is technically superior and provides ready solution to the problems of distribution system. Capital investment for new HVDS is 16.5 per cent lower than that of LVDS. The Peak Power loss and energy losses of HVDS are 33 per cent and 18 per cent lower than that of LVDS respectively. The peak power loss and energy losses of restructuring HVDS are lower. Restructuring of existing distribution network as HVDS is viable.

The strategy proposed for implementation of HVDS and its integration with the existing network is found to be technically feasible and financially viable. The restructuring of existing LVDS as HVDS is practically feasible and viable. This is technically feasible and least cost solution approach for reduction of losses in low voltage network.

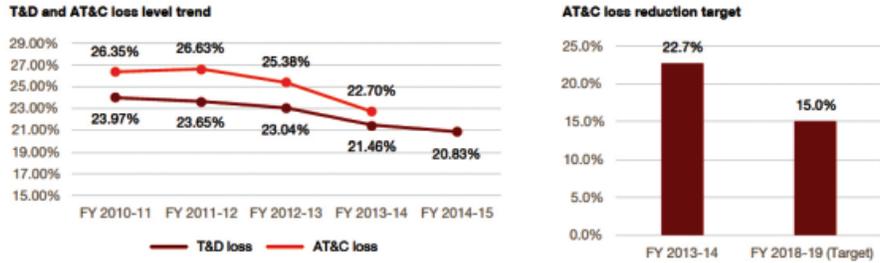
The distribution loss is 20 per cent of the total AT&C losses. About 15.7 million people are below poverty level and 9529 un-electrified villages are yet to access electricity. The Government has taken initiatives such as;

- Smart grids
- IT enablement and automation
- High Voltage Distribution
- Demand side management
- Public Private Participation
- Power Trading practices
- Energy Efficiency Initiatives

The distribution infrastructure development in India needs the following Government initiatives.

- Policies and regulatory guidelines to implement smart technologies
- Initiatives to implement outage

Figure 1: Transmission Losses over generated electricity



Source: CEA, 'Power for All' documents, Ministry of Power (MoP)

management, power quality management, demand response, renewable energy integration, energy storage systems, Use of Plug-in- Electric vehicle and associated charging infrastructure, Cyber security and developing communication infrastructure.

- On-grid and Off-grid renewable and distributed direct generation sources.

Policy Challenges

Indian power sector had been tightly regulated and controlled by State Electricity Boards (SEBs) until 1991, when economic reforms took place. The State Electricity Boards controlled the entire supply chain generation, transmission and distribution within the state with distorted tariff structure and high level of transmission and commercial losses resulting in inefficient, unreliable electric supply and near bankruptcy of the SEBs. The power sector reforms in late 1990s made the sector competitive through deregulation and private investment. Private investment in generation and distribution was allowed in 1991. By 1998, private investment in transmission was allowed. The Mega Power Policy in 1995 allowed incentive investments to accelerate power generation in above 1000

MW plants for capacity addition. The power trading company was formed in 1995 to trade power from private mega power plants and SEBs. The Electricity Regulatory Commission Act 2008 constituted the Central Regulatory Commission (CERC) and encouraged the states to establish the State Electricity Regulatory Commission (SERC) to regulate and rationalise the tariffs. However, the power sector remained commercially unviable till 2000s, demanding more policy reforms. The Electricity Act 2003 created a consolidated policy framework for generation, transmission, distribution, trading and consumption of electricity. The main features of the act are:

- Unbundling of SEBs for competition in generation, transmission and distribution utilities
- De-licensed thermal and captive generation
- Non-discriminatory open access to all generators to transmission
- Mandatory metering, stringent punishment to electricity theft and multi-year tariffs were introduced to curb financial losses of SEBs. Furthermore, advance subsidy from State Governments from budgets to offset losses for free supply to certain targeted consumers

- Purchase Obligation from Renewable Energy Sources.

The amendment of this act in 2007 provided additional features such as;

- Elimination of cross subsidy and levy of surcharges on Industrial consumers to subsidise agricultural consumers
- Mandated two key policies:
 - The National Electricity Policy 2005 to carry out the mandates of Electricity Act 2003 and address issues on rural electrification, recovery of cost of services and targeted subsidies.
 - The National Tariff Policy 2006 to strengthen financial viability of SEBs and attract private investments. The Multi-Year tariff (MYT) aims at minimising risks to Utilities and consumers and reducing system losses.

Implementation of Ultra Mega Power Projects Policy in 2005 has been initiated to accelerate power generation for coal-based plants above 4,000 MW projects using supercritical technology through competitive tariff-based bidding and under Power Purchase Agreement (PPA) with distribution companies. Rural Electrification Policy 2006 aims at extending power supply to people below poverty line.

The key players in the Indian Power Sector, after Electricity Act 2003 and unbundling of SEBs, are a multitude of market players. The Ministry of Power (MoP) is responsible for planning, formulation, implementation and monitoring of the power sector

policy. It coordinates two statutory bodies, six Public Sector Units (PSUs) on thermal and hydro generation, transmission and distribution and financing.

Initiatives for Reduction

The Electricity Act of 2003 instituted certain broad reforms: introduced elements of privatisation and created more consistent national rules governing the generation and transmission of power, but its provisions have been implemented only in some states and not at all states. The National Smart Grid Mission, 2015 will provide grants covering up to 30 per cent for upgrades to regional and local grids. A 20-year plan has been announced to upgrade the national transmission network, including an exemption from inter-state transmission charges for power from renewable sources. Discoms in many states have announced rate hikes ranging from 5 per cent to 45 per cent.

Full reform is towards complete privatisation, less interference by state governments in utility operations, and an end to free electricity for farmers.

In the cities, distribution companies intent on modernising—and getting customers to actually pay for their power rather than steal it—have been forced to broaden their scope. In any case, reducing power theft among the urban poor will solve only one of the many problems for India's grid. Expanding the grid to reach every home and business would require many trillions of rupees. For many, gaining access to electricity through solar micro-grids and other local power sources that

bypass the traditional utility model is a far more practical option.

Rooftop solar power or alternatively, microgrids powered by various combinations of small renewable installations and diesel generators are the only way their inhabitants will ever get reliable electricity. The results of the government's first solar auctions have been striking. In other words, solar builders in India are bidding unrealistically low prices for these projects, counting on the Indian Government to make up the difference. The government has initiated a scheme for public-private infrastructure projects with grants to solar developers.

Ultimately, some combination of distributed solar power, local micro-grids, and large renewable-power plants will be needed to address India's energy needs over the next 50 years.

Electricity conservation at home is possible by proper education to consumers. Power theft is widespread in developing countries and important economically as well as politically. Power theft is politically correlated. It occurs more often around election time when well-off farmers are allowed to exceed their allotted usage for private tube-wells.

Reducing power theft to more moderate levels requires policy changes:

- Power company officials need to be sheltered from political influence.
- The state government should adopt a policy of metering agricultural energy usage.
- A general policy study of the overall costs and benefits of the

Analysis

current electricity pricing scheme, which subsidises agricultural users.

For stable electricity supply, T&D system enhancement is essential. The power sector needs better products and solutions such as smart grids and metering, use of technology to map the network and energy-efficient equipment like transformers and switchgears.

Reducing T&D losses can be achieved by a system for accurate measurement of energy consumption, accounting for energy generated and its consumption by various categories of consumers and for energy required for meeting technical requirement of system elements. Efficient transmission and utilisation of power and need of efficient meter systems in the infrastructure are required. Advanced Metering Infrastructure (AMI) is the next generation meter system like smart meters that can communicate real time data consumption with the power provider. It can also link load control instructions from Micro-Energy Management System to the operation and control of local devices, thereby, reducing the consumers' energy consumption.

Smart grid is one of the key components of this transformation. A smart grid is a digital electrical grid with an information network that facilitates the gathering and distribution of information with regard to the usage of power by suppliers and consumers. This will lead to electricity services becoming reliable, efficient, cost-effective, and environmentally conscious.

The other key component is smart metering which not only reduces theft and pilferage, but also helps the distribution companies collect data which can help in better load planning and management. There needs to be implementation of energy audit schemes for all big industries and utilities. It is important to set bench-marks for yearly reduction of T&D losses. Measures for reducing technical losses are identification of the weakest areas in the distribution system and strengthening or improving them so as to draw the maximum benefits of the limited resources. The central and the state governments should draw plans to provide financial support to the utilities for installation of meters at all the distribution transformers. The financial institutions should be encouraged to provide easy loans to utilities for taking remedial measures to reduce the T&D losses. It is a very important factor for efficient utilisation of energy.

Smart meters are highly functional electricity meters to collect power data and automatically send information on power use to electric power providers. The amount of electricity consumed in a building or home is converted into data in real-time and provided to the electric power provider over a network.

With Micro Energy Management System (MEMS), the operational control of devices consuming electricity, and consumers' energy consumption can be reduced. This combined solution of smart meters and smart grids can empower the end consumer to manage energy

better by availability of information.

Conclusions

It is extremely difficult to eliminate all the causes simultaneously to reduce transmission losses. Strategically, measures should be taken to reduce or marginalise the major causes of losses. The distribution losses can be reduced by proper selection of distribution transformers, feeders, proper re-organisation of distribution network, placing the shunt capacitor in appropriate places, theft control, adoption of upgraded technology etc. HVDS should be implemented at faster rate. Training of the operating personnel would result in improved system operation. The distribution companies should be ready for initial investment, keeping in view the future savings in energy. Restructuring of electricity supply system with automation and implementing smart grid technology and regulating the operation and performance monitoring of power systems by regulatory commissions are sure ways to reach the target levels in reducing transmission losses. 



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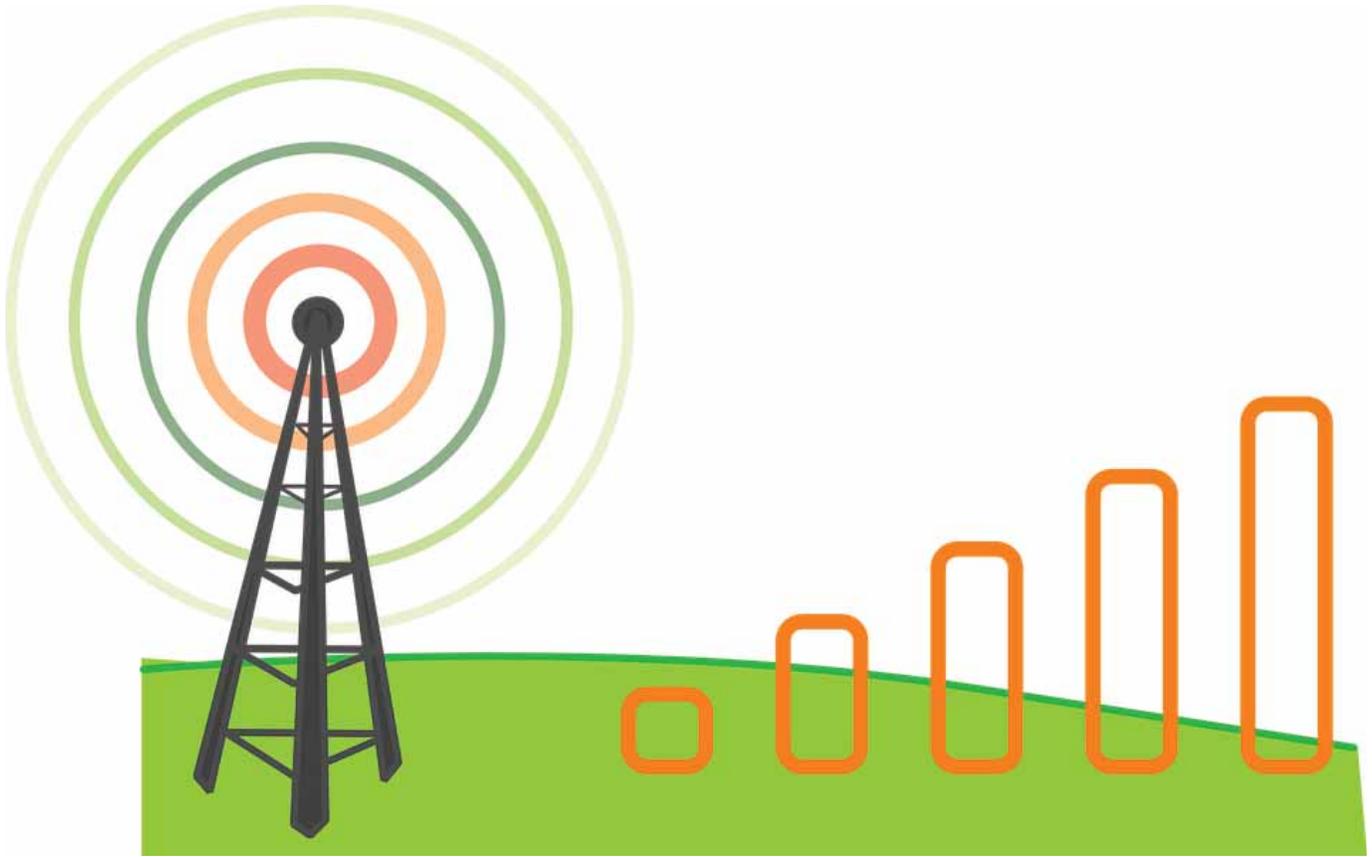
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Wireless Power Transmission

Transmission of electrical energy from source to load without having any physical wired connection, i.e. wireless power transmission will play significant role in future electronics and electrical applications. This paper discusses about wireless power transmission, principles, advantages and its scope in future.



Brainstorming on WPT

There is an unsolved problem over a century, Wireless Power Transmission (WPT). It all started in last decades of 19th century, as we know, Nicolas Tesla was the first to propose and work on Wireless

Power transmission. He demonstrated Wireless bulbs at World Columbian Exposition in early 1890s. In early 1961s William C Brown proposed possibilities of microwave power transmission. In 2007 a team from MIT

(Massachusetts Institute of Technology) has achieved to light a 60W bulb at a distance of 2 meters with ~40% efficiency. Recent years so many experiments and advancements are being happening on WPT. Different wireless mobile chargers are results of these experiments.

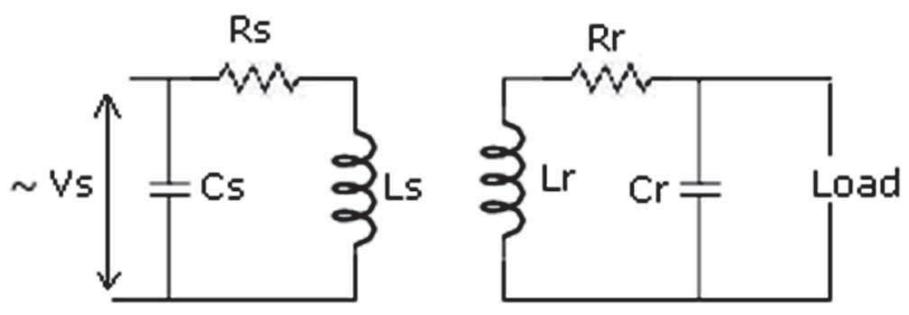


Figure 1: Simple Transmitter and Receiver circuits

Practicality of WPT

Induction Method

Induction charging usually called as wireless charging. This technology is used to manufacture wireless charges for toothbrushes, mobiles, shavers and portable devices. Wireless charging uses same principle as transformer where there is no direct connection between primary and secondary coils. Mutual induction makes the energy transfer between primary

and secondary circuits. Similarly induction coil on the charger acts as primary coil and makes alternating electromagnetic field when power is supplied to it. Secondary coil on the portable device (which needs to be charged) receives power from this electromagnetic field when it is placed on the charger and converts it to electrical current and charges the battery. This amazing principle

is applied to charge devices with very small range.

It is advantageous as there are no hazardous conductors are exposed, so no risk of electrical shock and it is convenient and safe.

Same principle with resonant inductive coupling can be used for power transmission. Resonant inductive coupling increases the transmission range. Here, primary and secondary coils resonate at



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same frequency. Electricity given to the primary coil produces oscillating current generates oscillating magnetic field and is picked up by secondary coil which is converted into electricity for the load.

Another type of coupling is capacitive coupling or is electrostatic induction. Principle is capacitive coupling between two or more electrodes or plates with high frequency, high potential AC current.

All above principles are limited to small distances. These technologies can't be implemented for larger distances.

Microwave Power Transmission

Through this method power can be transmitted over greater distances. William C Brown demonstrated wireless power transmission through microwaves using Rectenna in 1964. Rectenna is an antenna with rectifier device. Microwave power transmission gives us feasibility of directional power transmission. Typically, this system contains microwave transmitter which generates microwaves using an antenna. Receiver contains a Rectenna which converts microwaves back to electricity. One of the major obstacles with this method is it needs very large scale antennas.

Laser Beam Power Transmission

This method uses photovoltaic cells, which converts light into electricity by photovoltaic effect. First power is converted to laser beam and transmitted from the source. Photovoltaic cells are used at receiver. These cells are used to convert laser beam back to electricity by exposing them to laser beam. Laser beams cross

section is very less and it is advantageous for transmitting over larger distances, but laser beams are dangerous to humans and animals. Other disadvantage is it is highly directional receiving photovoltaic cells should be exposed to the transmitted laser beam otherwise complete loss of power could happen. Atmospheric absorption, environmental scattering effects, weather difficulties could affect the efficiency of this system.

Trends and Future of WPT

There are number of technologies for transmitting electric energy from one point to other for shorter distances. Inductive coupling is most commonly used technology for very short distances in mobile charging as discussed.

Recently one of the major mobile manufacturers has filed a patent for scheduled charging of its appliances. Reportedly it is RF based wireless power. It makes an impact on wireless charging mobile devices. It would irk its competitors to do R&D on futuristic wireless charging facilities. Energy square developed a conductive wireless charging. A strip with two conductive points is used to charge mobile. Mobile is placed on top a pad which is connected to power source to charge.

Future mobiles could be charged with mobile service provider, delivering required power from mobile base station. Mobile inbuilt software and hardware takes care of energy threshold level to charge from base station. Higher efficiency is

possible with proper handshake between mobile and service provider's base station. No need to carry a charger or a power bank. Mobiles adopt such change, and soon charging devices become history.

Trends are towards wireless charging points at signals for Electrical Vehicles. In order to minimize carbon footprints, EVs are being replaced with petroleum product vehicles. Charging EVs while driving for longer distances is obstacle to replace existing vehicles. Special roads are to be constructed across utilities and maintained with inductive coupling to provide continuous charging for EVs. Each EV is identifiable from source perspective. Alternative charging possibilities are being researched to construct roads for continuous charging for EVs.

Wireless power plays major role in life saving departments in future. Remote power is a demanding requirement for hurricane prone areas. Quick recovery is possible with wireless power and also it is possible to stop major equipment damage from such disasters. Remote power receivers dug into earth when hazard level meets threshold. Later raises and receives energy and distributes it to required load.

We are not far from wireless power transmission and distribution with high efficiency. Utilities have to take step on it as it has advantages over wired connections.

Advantages of Wireless Power

Wireless power is future and will replace existing wired communication of electricity. Some

of the advantages are listed below:

- Power can be transmitted to remote areas where wiring is not feasible.
 - Wireless power is not hazardous as wired power where conductors are exposed.
 - Transmission and distribution losses of existing system can further more decreased when high efficiency wireless power transmission is implemented.
 - Electric vehicles can be charged from anywhere.
 - Advantageous to customers is they can be free from power cords, plug in cables and plug in adaptors.
 - Expenses on transmission and distribution assets can be reduced, and maintenance costs on transmission and distribution assets can be mitigated.
 - Devices can be free from chargers as devices can be charged from anywhere.
 - Secure from power theft with handshake from source to load.
 - Market enhancement with possibility of welcoming more power vendors to larger distances and customer choice of selecting the power vendors when more power vendors enter into the market.
 - Market based prices can be applied on power when more vendors are participated in the market.
- Efficiency is one of key factors to consider in WPT. Still the problem which Tesla tried to answer is not answered yet. Transmission and distribution of electrical energy with utmost efficiency is not practically implemented. High capital cost and interference are also considerable points to make commercial implementation of wireless power over long distances. More researches required having wireless power system with safe, secure, high efficiency and optimal capital cost as it has so many advantages. As technologies are growing, it is possible to see complete wireless power in future and that day is not too far. ■



Raghukishore Marupaka

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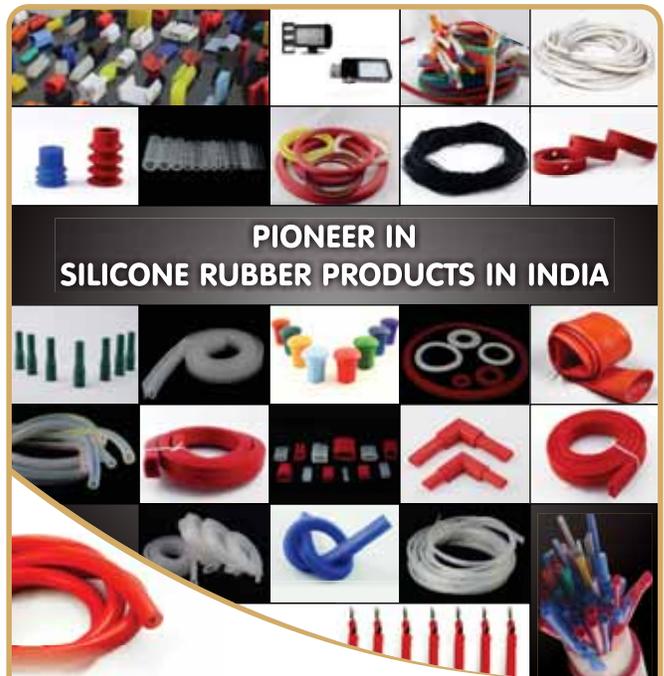


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Solar Rooftop: Attractive Option of Grid Security

The development of rooftop solar projects makes considerable sense for commercial segments as the levelised tariffs are significantly lower than grid-based tariff. These segments are, therefore, driving growth in the rooftop solar space, followed by the government & institutional segments.



Picture Courtesy: www.gvec.org

Renewable energy contributes about 20 per cent to India's installed capacity. Although conventional fuels still dominate this segment, the share of renewable sources has been steadily increasing from about 10 per cent in 2009. This growth has been fuelled by the increased availability of renewable sources at competitive costs near industrial demand centers, declining capital costs of equipment, and rising grid tariff of industrial and commercial consumers. Measures like preferential tariffs, accelerated depreciation, generation based incentives, third party power sale

option, provisions for the banking and wheeling of power, concessional loans, and prompt clearances have also played a crucial role in promoting the renewable power segments growth.

The climate change threats are driving our dependence on pollution-free sources of energy to minimize greenhouse gas emissions. Solar PV energy is one of the cleanest sources of electricity and is being considered as next to fossil fuel based conventional electricity systems. India has set its renewable energy capacity addition targets to 175 GW by 2022 in view of the significant renewable energy potential in the country. This includes 100 GW from solar, 60 GW from wind, 10 GW from biomass and 5 GW from small

hydro power. Solar photovoltaic rooftop has emerged as a potential green technology to address climate change issues by reducing reliance on conventional fossil fuel based energy.

With a strong commitment to increase the renewable sources-based energy capacity, India has a target to install 100 GW of solar energy capacity which includes 40 GW from solar rooftop. Some of the electricity demand will be met locally through these rooftop solar installations, leading to less requirement from the grid. For players that need smaller capacities, rooftop solar is an attractive option. Another upside is the additional revenue that rooftop solar can derive from the sale of surplus power to the grid. It is also used to

fulfill the renewable purchase obligation of distribution companies.

Most of India's installed solar capacity is ground mounted with rooftops accounting for only a little over 7 per cent of the total. However, the government is making concerted efforts to promote this segment with 40 GW by 2022 target being planned on rooftop. The countries' total installed rooftop solar capacity has crossed 2 GW. A number of states have come forward to support the centre's plan and are encouraging rooftop solar plants based on net metering. Such projects are quick to implement and offer stable and fast returns. Solar rooftops are gaining relevance in the energy security plans of small, medium and large scale industrial users.

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However, with a number of positive policy and technology developments taking place, the pace of installations is expected to pick up. With favourable project economics, a progressive regulatory scenario and easier availability of finance, segment growth is clearing picking up.

Development of Rooftop

World cumulative installed solar energy capacity was 3.7 GW in 2004 has reached 177 GW in 2014 i.e., increasing almost 50 times in ten years. Over the past two year, there has been a strong impetus to rooftop solar, which has resulted in a sharp increase in installed capacity. The rooftop solar segment grew by 80 per cent in last two years over FY 2015-16. As opposed to other rooftop-rich countries that have grown on the back of high capacity additions in the residential rooftop segment, the Indian market has seen greater growth in the commercial and industrial rooftop solar segments. As of March 2018, the total installed solar power capacity in India stood at 21.6 GW, of which 9.6 GW was added in FY 2017-18. As of March' 2017, the installed rooftop solar capacity in India was stood at 1.40 GW and it has touched 2 GW in 2017-18.

Maharashtra is the largest rooftop solar state in India in terms of installed capacity followed by Tamil Nadu, Rajasthan and Karnataka, while Uttar Pradesh, Andhra Pradesh and Punjab lag far behind the target. Uttar Pradesh and Andhra Pradesh are among the nine states that have a policy for gross metering in addition to a net metering policy. Almost all utility-scale developers have jumped on

to this bandwagon, assigning separate terms for establishing their solar rooftop businesses. In the past one year, number of engineering, procurement and construction companies have entered into this market, mostly concentrating on different regions in the country. As far as the policy framework is concerned, all the states have announced their net metering policies for rooftop solar, which is noteworthy.

Solar Rooftop PV Design

A solar photovoltaic power plant consists of different components i.e., photovoltaic modules, mounting system, dc-ac converter and electrical connections. The Rooftop PV systems are smaller PV systems in comparison to land mounted ones, installed on rooftops of residential, commercial or industrial building complexes. It comprises of solar inverter, meters for regulating electricity generated and various components for modification of electrical output and input rate in kWp. The electricity generated from such systems could either be entirely fed into the grid at regulated feed-in-tariffs, or used for self consumption with the net metering approach.

Rooftop solar PV installation technology in urban or rural areas requires intervention for (i) Grid connected solar installation; (ii) Solar system synchronised with diesel genset (iii) Off-grid solar installations with battery back-up. Designing of rooftop solar according to local conditions is the basic engineering skills required. Methods must be devised to capture low radiation energy and converted into actual power for optimisation. A

good design would integrate the location specific parameters with rooftop solar PV system. Full potential of non-grid Rooftop PV is yet to be utilised as due to high cost. With part financial support provided by the state to promote their use, such systems are considered the most appropriate for rural and remote areas. In the regions of power shortages, performance reliability of non-grid rooftop PV can also be improved with back-up battery and this helps in bringing down the cost.

Need for New Business Models

High capital cost of Rooftop Solar system which is estimated approximately Rs. 75,000/kW has been a key challenge for its adoption by the industry or small consumers. The payback period is 6 to 7 years and 9 to 10 years in commercial and residential sectors, respectively. The success of Rooftop Solar system, therefore, remains dependent on new business models evolved from time to time to overcome the cost barrier. At present three types of business models are envisaged.

- i. Self owned, the roof owners own the PV system and generates electricity. It is called CAPEX (capital expenditure) model and the risk is of the owner who invests in the system.
- ii. Third party ownership, in which third party or a developer bears the cost of solar rooftop and sells to customer at a rate lower than grid tariff. This is called OPEX (operational expenditure) model because developer which is also Renewable Energy Service Company (RESCO) pays



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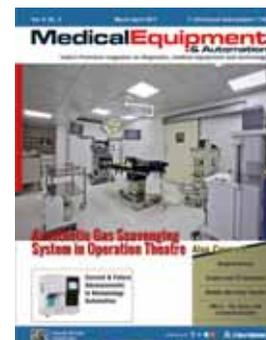


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for the system for specified number of years and also owes the risk. Third party investment model has only 10 per cent share at present. It is yet to pick up because of high contract default risks arising from rapid declining cost of solar energy.

iii. The third is Lease model in which customer leases the system and pays for it overtime. This type of arrangement may suit multi-storey flat owners but not yet come into existence.

To make solar Rooftop Solar system an attractive proposition, Indian Renewable Energy Development Agency (IREDA) is joining hands with banks and multi-lateral financial institutions to provide soft loans for development

of solar rooftop system.

Policy Initiatives

In its efforts to encourage the implementation of rooftop solar projects, the government has rolled out a number of schemes and regulations. In 2015 Government of India has considered increased provisions of funding for implementation of grid connected rooftops over next five years. The subsidy of 30 per cent announced to all states and up to 70 per cent to special category states. The commercial and industrial sectors are made eligible for accelerated depreciation, custom duty concession, excise duty exemption and tax holidays.

The Sustainable Rooftop

implementation of Solar Transfiguration of India (SRISTI) scheme the Ministry of New and Renewable Energy to target residential rooftop owners. Under this, the government has earmarked Rs 235.5 billion as financial assistance to be given for rooftop solar installations to discom on a performance basis. To address the quality issues associated with installations, the MNRE has also come up with standard for grid connected and off grid rooftop solar projects. In addition, the MNRE has brought battery energy storage systems under the purview of the solar photovoltaic systems. This will be beneficial for the rooftop and off grid segments as many consumers

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rely on batteries to meet their peak load and regulate the photovoltaic module output.

Following the trend set by the Central Government, the state agencies have also announced their own schemes for improving rooftop solar deployment to meet their renewable purchase obligation. The Uttar Pradesh Government provides a subsidy of Rs 15,000 per kW for rooftop solar projects in the state, this amount would be capped at Rs 30,000 for projects exceeding 3 kW. Added to that, a financial subsidy of 30 per cent or Rs 21,000 per kW could be provided by the center to the state. In Assam, a 70 per cent financial subsidy will be given for projects under its programme to develop 14 MW. Jharkhand has a programme to provide a 30 per cent subsidy, with additional 20 per cent subsidy for rooftop solar installations by educational institutions on their campuses. The other states have also announced subsidies on rooftop solar installation.

Net Metering

It is often said that one of the best way of popularising adoption of rooftop solar is by making net metering policies cohesive and also allowing users to sell surplus electricity to utilities. Net metering is helpful because the excess power is harnessed and used elsewhere and the source consumer gets equivalent benefit on his tariff or power consumption. A strong net metering policy not only helps in increased consumption of power generated by rooftop solar but also encourages its faster adoption among corporations and institutions once they see reduction

in their operational costs.

One of the biggest challenges around net metering has been involvement of various agencies and multiple approvals leading to inevitable delays in implementation. Other challenges include lack of uniform regulation across the country, caps on energy that can be returned to the grid at an absolute number of KWs without regards to class of consumer, reluctance of distribution companies due to anticipated revenue loss and lack of understanding on part of implementing agencies of net metering as a concept for being an enabler for residential rooftop solar. In most of the states, the officers of distribution companies are not aware of the policies and they don't have the required infrastructure to record and give benefits of units exported to grid. Addressing these issues in a time bound manner in relation to the yearly targets envisaged will help give thrust to the adoption of net metering as a key tool to achieve the overall growth of rooftop solar. There is need to build infrastructure for net-metering and also educate all concerned so that net metering can be implemented.

Challenges

As against Ministry New Renewable Energy (MNRE) target of 5 MW in 2017-18, cumulative rooftop solar capacity touches 2 GW as on March' 2018, with less than 5 per cent of the 40 GW rooftop solar target to be achieved by 2022, it is clear that there are bottlenecks on the supply and demand side that are posing significant challenges to the

segment's growth. On the supply side factors such as lack of debt financing, high customer acquisition costs, low entry barriers, resulting in inexperienced players entering the fray, and focus on capital expenditure over operational expenditure by service providers have led to the situation. On the demand side, factors such as heavy focus on commercial and industrial entities, exclusion on residential sector, lack of consumer awareness, lackadaisical movement on net metering, and moderate tendering activity due to multiple stakeholder involvement appear to be the key reasons for the slowdown.

While the government has introduced some growth-enabling policies, their implementation has run into many challenges and operational issues. Different land and infrastructure agreements have different duties levied on them, instead of a stamp duty in some states. The goods and service tax (GST) for the solar segment has been the subject of discussion in last year. There was a major debate about taking modules at 5 per cent or 18 per cent, before it was finally settled at 5 per cent. There is also ambiguity regarding the GST for balance of system equipment. While GST has been specified for a few components such as inverters, the rates for remaining parts remain ambiguous.

A developer's primary job is to set up a plant and produce power, instead of going to the judiciary to settle legal and regulatory issues. In addition, any changes in law will only lead to legal completions, thereby, delaying project development. Therefore, there should be greater certainty



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regarding the regulatory regime. The main barriers faced during large scale deployment of solar rooftop PV include lack of awareness among consumers about the system, lack of manufacturing facilities, lack of skilled workforce, high upfront cost and lack of business models and regulatory challenges.

Consumer Awareness & Acceptance

Consumer awareness about the rooftop solar PV and its market acceptance is the most significant challenge in promoting solar energy, which is having a social bias. The consumer not only has greater affordability and awareness about the consumer rights, but also is facilitated with dynamic policy instruments which are consumer friendly. In developing countries people are less aware of the government policies and the available incentives. Being cleanest source of energy its climate change imperatives are not fully understood. There is need of Consumer guidance centers to educate about placement and function of meters, process for metering and interconnection with grid as well as maintenance are needed so as to achieve the potential target of rooftop solar. Nodal agencies in respective states may play a vital role in this regard

Way Forward and Recommendations

For development of rooftop solar, the central and state governments have done good job on solar rooftop policies, incentive mechanism, recommended changes to the net metering rules and plant size specifications to

accelerate solar rooftop. Since last year, many uncertainties have disrupted growth momentum like fluctuation in PV model prices, bottleneck in implementation of net metering and uncertainty in policy on the implementation of unviable duties. Many government agencies including Solar Energy Corporation of India had tendered mega projects for subsidies and incentives for residential, social and government sector rooftop installations. Further, there is substantial reduction in capex on the rooftop solar. A lot is still required to be done to promote and educate private sector for rooftop solar installation.

Net metering and a package of incentives to utilities are no doubt necessary foundations. Means of covering investors risk and greater consumer awareness can be the basic building blocks. Skill development, maximising rooftop spaces and mandates to support the adoption of rooftop solar can lead to a sustained growth.

The rooftop solar power market needs to gain traction in order to achieve its targets. The thrust, however, must come from policies that look to simplify the approval procedures through single-window clearances. The financial subsidies should be removed for the C&I consumer segments and the market should be allowed to grow on its own in order to create a sustainable ecosystem. A framework for development of rooftop solar system plus storage technology also need to be developed to enable better offtake of power and innovative methods of finance must be introduced to

lower the cost of capital.

While strong foundations are being built in India through net metering policies and revising package of incentives; at city level greater role of municipalities in amendment of building by-laws for considering solar rooftop structure as temporary structure so that it does not need fresh approval for raising height of the building and role of DISCOMS in providing reduction in electricity bills by selling at lower rate in proportion to higher wattage achieved from solar installation so as increase home owners' contribution in energy security for 24x7 power for all are being considered. Provisions are also needed for soft loans, tax credits in property and investment. It is also proposed to make solar rooftop mandatory for properties with connected loads greater than 20 kW.

Conclusion

The development of rooftop solar projects makes considerable sense for the industrial and commercial segments as the levelised tariffs are significantly lower than grid-based tariff. These segments are, therefore, driving growth in the rooftop solar space, followed by the government and institutional segments. Urban homes and residential societies, however, have not been as enthusiastic owing to the lack of awareness as well as the high upfront cost of these projects. 



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Thermography in Photovoltaic Plants



Testo Thermal Imagers for Photovoltaic system application

Photovoltaic systems are an important contribution to the energy transition, and to a sustainable handling of resources. In recent years, they have been one of the greatest sources of power and electricity.

But with great results there are some serious threats that tend to jeopardise the power output of the system. This makes the maintenance of the plants a significant aspect to tackle such threats concerning the functioning of a solar set up.

Potential threats to PV plants

Even a small technical defect is sufficient to have a considerably negative effect on the solar yield – and therefore the economic viability of a PV plant. The causes

could be like; Carelessness during installation, degeneration of the laminates or slow damage due to years of UV radiation and weathering.

Some of the biggest problems that could be witnessed are

- **Hot spots:** Shadowed or defective module cells form an internal electrical resistance which can lead to undesired warming hotspot. Also, faulty or unsuitable bypass diodes (where shade is minimal) continue to lead to uncontrollable hotspots.
- **Delamination:** The EVA protective layer may come away due to external influences. Any moisture getting in may lead to cell corrosion and to a performance loss.
- **Modules run at open circuit:** This may be caused by incorrectly connected modules or cables that have worn through.
- **Overheating of connection sockets:** This can lead to poor operation of modules & typical faulty images for defective individual cells and substrings.
- **Micro-cracking & cell**

ruptures: It can occur during transport and installation or due to any external mechanical influences.

- **Corrosions & loose connections:** Aside from the individual cells and modules, electrical components can also have corrosions on electrical components or have loose cables.

These threats consequently lead to decrease in the electricity yield. In few cases, individual cells or the entire module starts consuming electricity instead of generating it. This unwanted electricity consumption heats up the modules & can also lead to a real fire risk.

Revolutionary Tool for easy assistance – Testo Thermal Imagers

Checking photovoltaic plants using thermography places very high requirements on the use of a thermal imager. Several criteria must be taken into account when choosing a thermal imager suitable for this purpose:

- **Infrared resolution of the detector:** The geometric resolution describes a thermal imager's capability of recognising objects (e.g. individual faulty modules) from a certain distance. An IR resolution of at least 320 X 240

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Bluetooth connectivity with other devices

pixels (76,800 measurement points) are recommended in the case of large PV systems and for measurements from a long distance.

- **Thermal resolution (NETD):** The thermal resolution describes the capability of a thermal imager to detect temperature differences on an object surface. The lower the thermal resolution, the better the IR image generated.
- **Exchangeable lenses:** In order to be able to save time measuring large areas, e.g. from an elevated platform, imagers with exchangeable telephoto lenses should be selected that have suitable opening angles.
- **Camera functions:** Includes various features and properties that enable the camera for easy handling and friendly usage such as; Rotating lenses for accurate positioning of imager, solar mode for ambient adjustment, radiometric video measurement etc.
- **Software:** The analysis software (e.g. testo IR Soft) enables the optimisation and analysis of the thermal images, and ensures that the findings in the images are clearly presented and

documented.

- **Bluetooth connectivity with other devices:** Interfacing of thermal imagers with temperature, humidity probes & clamp-meter for solar power analysis.

Needs & Benefits of thermography

- Using thermography, it is possible to check whether the quality of the module cells fulfils the requirements or not.
- Incorrectly fitted or inadequately cooled electrical components that can quickly pose a fire risk can be easily traced.
- Corroded or loose electrical cables indicating thermal irregularities can be easily detected and eliminated by thermography.
- Thermography is a very safe inspection method as it reduces the considerable risk of electric shock to personnel.
- Thermography is a non-contact, visual measurement method. Large-surface solar modules can be scanned very quickly thus saving a lot of time and money as well.

Step ahead in solar thermography with Testo Thermal Imagers

Thermal imagers from Testo are specially designed for solar thermography requirements. They allow solar engineers to offer their customers a valuable after-sales service, while plant operators obtain a reliable statement on the status of their solar plants.

Solar thermography: Overview of applications and benefits

- Early identification of faults,

avoidance of yield loss

- Increasing operational safety, prevention of fire danger
- Fast, safe inspections
- Detecting cell rupture, corroded and loose contacts & overheated connection sockets.
- Identification of hotspots, modules at open circuit, short circuits, delamination etc.
- Creation of added value for solar engineers and plant operators.

Practical application tips

- Measure in sunshine and at low outdoor temperatures
- Point the thermal imager correctly, bear reflections in mind
- If possible, measure on the rear
- Carefully analyse the causes of temperature deviations

Selecting the right thermal imager

- Observe suitable geometric and thermal resolution for the application
- Imagers with exchangeable lenses and rotating display provide more flexibility
- Useful functions such as solar mode and video sequence recording, as well as versatile analysis software, simplify measurement and analysis. 

For more details visit www.testo.com or write on info@testo.in



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FALCON – introducing a new era of PD Monitoring for MV applications

TECHIMP - ALTANOVA Group has released its new FALCON PD acquisition unit especially designed for MV applications like MV-switchgear, Ring-Main-Units (RMU), MV-cables and motors.



Currently permanent partial discharge monitoring is applied mostly to the costliest electrical devices like HV-cables, GIS, Power Transformer and Generators, as PDM systems are known to be complex and exclusive. Today for this reason only in rare cases, where process stability or other critical parameters prevail (mostly in industries), MV assets are furnished with PDM systems.

The FALCON will radically change this perception by combining high-end technology, easy installation and high reliability with affordable cost.

The technology of the FALCON benefits from decades of research of partial discharge phenomena within TECHIMP. Proven technology has been transferred from HV monitoring like GIS, HV-cable, power transformer and generators to the brain of

the FALCON. The device incorporates TECHIMP's patented and well recognised T/F-map technology for unsurpassed noise suppression as well as PD source separation and identification. The FALCON will be connected to PD sensors like HFCTs, TEVs or coupling capacitors.

HFCTs, TEVs or coupling capacitors.

Onboard computing power and data storage allow for detailed analysis of actual and historical data through a web-browser interface making a central server obsolete. The unit can be connected to the LAN-network and reached through a web-browser from any PC/Laptop anywhere inside the network. Alternatively, the unit can be connected to a laptop directly on site. The HMI informs the customer about status, alarm events, system notifications, trends of various statistical magnitudes and setup functions.

The FALCON is the new device introducing reliable PD monitoring in distribution networks on a larger scale. 

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Kyoritsu's 1019R is a versatile digital multimeter

Kyoritsu, Japan has a frontline global presence in electrical test & measurement equipment since 1940, with specialised expertise in low voltage test & measurement.



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Kyoritsu's Earth Ground Tester is measure 3-pole and 2-pole Earth Resistance and also this tester makes earth resistance measurement with fall of potential method, which is method to obtain earth resistance value R_x by applying AC constant current I between the measurement object E (earth electrode) and H(C) (current electrode) and finding

out the potential difference V between E and S (P) potential electrode.

Kyoritsu's 4105 DL are two different model available:

- 4105DL (Cable Reel Set Model)
- 4105DL-H (Hard Case Model).

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Applicable standard: IEC 61010-1, CAT IV 100 V / CAT III 150 V /CAT II 300 V Pollution degree 3

- 3-pole and 2-pole Earth Resistance measurement (0.01 Ω -2000 Ω): 0.00 - 2000 Ω
- Measurement Accuracy: $\pm 1.5\%rdg \pm 0.08 \Omega$
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igus has advanced its intelligent cable. The experience of customers in the automotive and machine tool industries provided important insights into the development of this new generation. The new CF.Q module in combination with isense uses the new potentials of digitisation and networking to make maintenance easier and more efficient, thereby saving money.

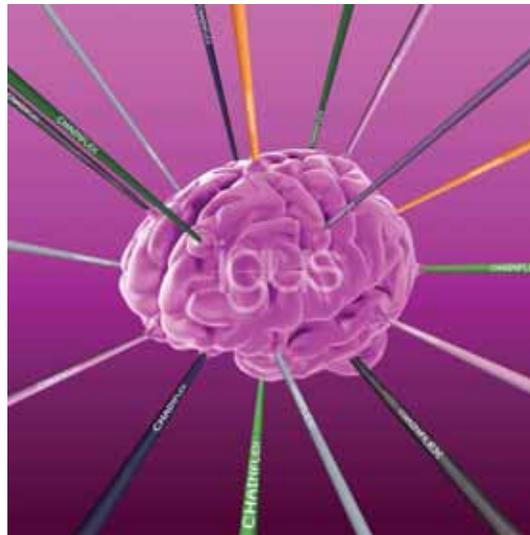
At the heart of every intelligent cable from igus is a complex sensor called CF.Q. With the module, the electrical properties can be tested in additional measuring cores and continuously compared with existing empirical values of a given chainflex cable. Damage by bending or extreme loads can be reliably detected. In addition, guide values for the cables can be defined in advance. If the CF.Q module is installed, it informs the customer by actuating a normally closed contact when these predefined values of the electrical parameters change. Only the combination of empirical values and real-time measurement allow users

precise maintenance predictions for their cables - especially in the dynamic production environment. This is made possible by an industry 4.0-capable application called isense-online. It compares the recorded real-time values of the cable and the empirical values existing in a database, and if it detects fluctuations, it prompts the plant operator to initiate maintenance. And this is indeed done before the damage occurs and the production or plant shutdowns become a risk.

Predictive maintenance reduces maintenance work

The new generation of CF.Q modules are now suitable for switch cabinet assembly thanks to top-hat rail housings and thus offering additional flexibility for electrical engineers in terms of integration as well as handling. In addition, the modules are suitable for data logging thanks to the SD card slot. An output of the measured values on a serial interface is also integrated as standard. Customers who want to get a precise insight into the recorded measured values can

do so by connecting to the isense-online system via a detailed view. In any case, the user has access to a wide variety of communication channels and reporting options. Maintenance recommendations or impending failures are displayed in the classic browser view of desktop PCs, as well as on all mobile devices such as tablets and smart phones. For maintenance teams and production managers, intelligent igus cables are bringing in a paradigm shift in maintenance and servicing through accurate



Combined with technology trends such as neuronal networks or artificial intelligence, igus is setting new standards in intelligent cables and predictive maintenance.

prediction. Thanks to Industry 4.0 and the active integration of smart technologies, the maintenance of the future becomes predictable and thus more efficient. Sensors and the isense-online application can be used across industries. With the beta device IS.CF.Q.03.01.0., which is available from stock, customers can start their own beta test project and prepare their production processes still more for digitisation and smart factories. 

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Date: 21-23 November 2018

Website: www.cwstexpo.com

Intersolar India 2018

Venue: BIEC, Bangalore

Date: 11-13 December 2018

Website: www.intersolar.in

International

Global Power & Energy Exhibition (GPEX)

Venue: Barcelona, Spain

Date: 17-20 September 2018

Website: www.gpexevent.com

Power Gen International

Venue: Orange County Convention Center, Orlando, USA

Date: 4-6 December 2018

Website: www.power-gen.com

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		Thermal				Nuclear	Hydro	RES * (MNRE)	
		Coal	Gas	Diesel	Total				
Northern Region	State	16794.00	2879.20	0.00	19673.20	0.00	8643.55	689.56	29006.31
	Private	22760.83	558.00	0.00	23318.83	0.00	2514.00	11994.32	37827.15
	Central	13290.37	2344.06	0.00	15634.43	1620.00	8496.22	329.00	26079.65
	Sub Total	52845.20	5781.26	0.00	58626.46	1620.00	19653.77	13012.88	92913.11
Western Region	State	21280.00	2849.82	0.00	24129.82	0.00	5446.50	311.19	29887.51
	Private	34285.67	4676.00	0.00	38961.67	0.00	481.00	19752.90	59195.57
	Central	15042.95	3280.67	0.00	18323.62	1840.00	1620.00	661.30	22444.92
	Sub Total	70608.62	10806.49	0.00	81415.11	1840.00	7547.50	20725.38	111527.99
Southern Region	State	19432.50	791.98	287.88	20512.36	0.00	11808.03	518.02	32838.41
	Private	12124.50	5322.10	473.70	17920.30	0.00	0.00	34525.57	52445.87
	Central	14225.02	359.58	0.00	14584.60	3320.00	0.00	491.90	18396.50
	Sub Total	45782.02	6473.66	761.58	53017.26	3320.00	11808.03	35535.49	103680.78
Eastern Region	State	6950.00	100.00	0.00	7050.00	0.00	3537.92	225.11	10813.03
	Private	6375.00	0.00	0.00	6375.00	0.00	399.00	840.74	7614.74
	Central	13876.64	0.00	0.00	13876.64	0.00	1005.20	10.00	14891.84
	Sub Total	27201.64	100.00	0.00	27301.64	0.00	4942.12	1075.85	33319.61
North Eastern Region	State	0.00	427.95	36.00	463.95	0.00	422.00	255.75	1141.70
	Private	0.00	24.50	0.00	24.50	0.00	0.00	25.71	50.21
	Central	520.02	1253.60	0.00	1773.62	0.00	1030.00	5.00	2808.62
	Sub Total	520.02	1706.05	36.00	2262.07	0.00	1452.00	286.46	4000.53
Islands	State	0.00	0.00	40.05	40.05	0.00	0.00	5.25	45.30
	Private	0.00	0.00	0.00	0.00	0.00	0.00	2.21	2.21
	Central	0.00	0.00	0.00	0.00	0.00	0.00	5.10	5.10
	Sub Total	0.00	0.00	40.05	40.05	0.00	0.00	12.56	52.61
ALL INDIA	State	64456.50	7048.95	363.93	71869.38	0.00	29858.00	2004.87	103732.25
	Private	75546.00	10580.60	473.70	86600.30	0.00	3394.00	67141.44	157135.74
	Central	56955.00	7237.91	0.00	64192.91	6780.00	12151.42	1502.30	84626.63
	Total	196957.50	24867.46	837.63	222662.59	6780.00	45403.42	70648.61	345494.61

(Source: www.cea.nic.in/)

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