



ELECTRICAL INSTALLATION ENGINEER

NEWS LETTER

TAMILNADU ELECTRICAL INSTALLATION ENGINEERS' ASSOCIATION 'A' GRADE (Regn. No. 211/1992)
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JANUARY 2017

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EVENTS

L&T Training Programme

Reactive Power & Harmonics Mitigation	2 nd – 3 rd February 2017
Selection of LV Switchgear and Applications	6 th – 10 th February 2017
Switchgear Selection - Motor Control Centre (MCC)	13 th – 14 th February 2017
Switchgear Selection - Power Control Centre (PCC)	15 th – 16 th February 2017
Introduction to Industrial Electrical Systems	15 th – 17 th February 2017
Breaker Maintenance Workshop – C-Power ACB	20 th – 22 nd February 2017
Breaker Maintenance Workshop – U-Power Omega ACB	23 rd – 24 th February 2017
Design of Control Circuits	27 th – 28 th February 2017

Venue: L&T Ltd., Switchgear Training Centre, Nilgiris

Contact Tel.: 0423-2517107 **Fax:** 0423-2517158 **Email:** stc_coonoor@lntebg.com



Events Profile: The International Tradeshow and Conference on Power Generation, Electricals and Industrial Electronics

Date: 9th – 11th MARCH 2017

Venue: BCEC MUMBAI

Website: <http://www.powerelec.co.in/>

ELECTRIC, POWER & RENEWABLE ENERGY MALAYSIA 2017

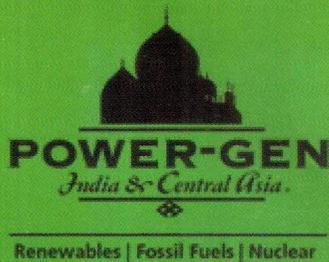
The Region's Flagship Event for Sustainable Power Generation, Energy Efficiency, Transmission and Renewable Technologies

Events Profile: EPRE 2017 is organised by Malaysia's leading exhibition organiser. All World Exhibitions members have been organising trade shows for over 30 years and currently organise over 150 trade exhibitions biennially. These include Asian Elenex (Hong Kong), Elenex Vietnam, Power Mongolia and Electric Power & Renewable Energy (Myanmar).

Date: 15th – 17th March 2017

Venue: Kuala Lumpur Convention Centre, Malaysia

Website: <http://www.epremalaysia.com/>



Events Profile: POWER-GEN India & Central Asia 2017 will bring together industry experts from across the globe to exchange knowledge and share their expertise, as well as showcase the latest power generation technology developments that will ultimately shape and strengthen the Indian power sector

Date: 17 – 19, May 2017

Venue: Pragathi Maidan, NewDelhi

Website: <http://www.power-genindia.com/index.html>

EDITORIAL

Dear Members, Fellow Professionals and Friends

New Year Greetings To One And All!

Greetings For Happy Pongal!!

Republic Day Greetings To All!!!

The New Year commences with continued problems around us, with the uncertainties of day to day life of money and transactions continuing to trouble us. Something drastic needs to be done by the Government and the financial and Banking systems to bring back confidence in the common man and the businesses.

Drought and crop failures and farmers deaths are another very disturbing factor. The State has periodically faced monsoon failures but the situation this time looks a tragedy. As the Wisdom of the wise many times proclaims, let us hope and pray that this time also the crisis around will teach us lessons and we will come out better. We celebrate 68th Republic Day this January which brings to our mind the serious crisis the country faced after the Chinese aggression in the year 1962 which made us realize the need for the Country to be made stronger in its defense and we commenced setting up factories for defense production all over the Country like the Avadi Tank Factory and the Small Arms Factory at Trichy in Tamilnadu and so on. We also went ahead to strengthen our Nuclear and Space capabilities. We have a fairly strong Defense today with much more to be done in the light of the Global threats.

It is interesting that January makes us remember, through their birth and death anniversaries, some of the Great Sons like Swamy Vivekananda, Nethaji Subash Chandra Bose, Lal Bahadur Sastri, Veerapandia Kattabomman and Mahatma Gandhi, our Country produced over the years to serve the Nation and the Mankind at large. There have been ever so many such Greats over the Centuries and let us resolve to uplift our Honesty and Morality in our Personal, Business and Public Life so that our Country will get better and march towards Global Economic Leadership faster. It is an undisputable fact that that our Economic Progress since the 50s and in particular from the 90s has drawn the attention of the World towards our Country in all business dimensions of sourcing, manufacturing and as a market place. This has certainly helped flow of better technologies in all spheres, be it Automobiles or Communication or Entertainment or Agriculture or Milk Production and processing and so on which have helped to improve our quality and standards of life.

We Engineers experience the Quality Movement that has also come along over the years and consciousness towards Energy and Efficiency in all the spheres, but let us remember that we still have to go a long way with regard to improving Productivity and Use of Energy Efficiently. It is also to be remembered that we still have a lot to do with regard to equitable distribution of waters all over the Country and effective use of abundantly available Renewable Energy Sources in our Country which are all Engineering and Technological challenges.

We thank all those members who have helped us by participating in the advertisement appearing for the issue December 2016 – OBO Bettermann India Pvt. Ltd., Kelcon, Power Links, Flir India Pvt. Ltd., Elmetlerr, SPS Transformers Pvt. Ltd., Pentagon Switchgear Pvt. Ltd., Wilson Power and Distribution Technologies Pvt. Ltd., Dehn India Pvt. Ltd., Universal Earthing Systems Pvt. Ltd., Ashlok Safe Earthing Electrode Ltd., Latha Electricals, Safvolt Switchgears Pvt Ltd., Galaxy Earthing Electrodes Pvt. Ltd., Supreme Power Equipment Pvt. Ltd., Consul Neowatt Power Solutions Pvt. Ltd.

EDITOR

The Future depends on what we do in the Present. - MAHATMA GANDHI

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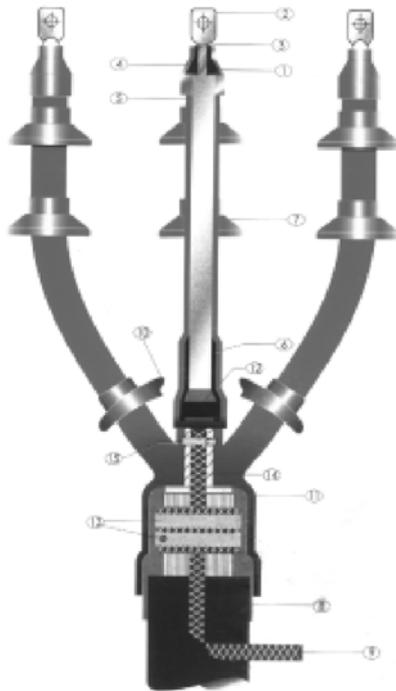
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181.	Hindustan Electro Mech Engg. Co.	Coimbatore	0422-2525382, 94433 49382	EA 1400
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193.	Sastha Electricals	Coimbatore	99428 55114, 94422 89169	EA 2757
194.	Sree Switchgears & Controls	Coimbatore	98430 31816, 97860 31816	EA 1629
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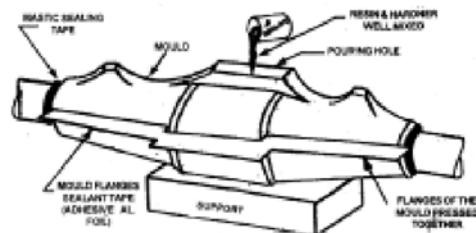
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KNOW THY POWER NETWORK - 112

After a month's gap, we meet again one topic which always draw the attention of the Station Battery users is how to locate the earth faults on DC system without sectionalizing. A battery system is mainly employed to provide a backup or stand by, emergency power source to operate critical equipment or devices. Significant among them are, protective relays, emergency lights, continuous process systems and uninterruptible power supplies. These devices should be in service during emergency situations. In the event of battery failure, it may lead to the operational failure of these essential systems with the consequential monetary loss, damage to equipment and / or injuries to the operating personnel. A floating DC system like station battery network is commonly vulnerable to ground faults. Such faults may be external or internal to the battery DC system but it will lead to a partial or complete short circuit of the battery with the attendant failure on the part of the battery to come to our rescue when its service is urgently needed. So this ground fault condition needs immediate rectification; otherwise the connected system will come to a grinding halt.

Traditionally earth fault indicators or relays are available to indicate that ground faults have occurred in the battery systems. It is difficult to locate battery earth faults because it is elusive and time consuming normally such fault location process involves sectionalizing or interruption of DC branch circuits. Injection of a low frequency AC signal and using that signal to locate the ground in the DC system is one of the modern test methods. This system can be applied without sectionalizing the DC system; that is, the system protection can be in service without any interruption. In this AC injection method, a low frequency (20 Hz) AC signal is put into the system between the station ground and the battery system. The resulting current is then measured at various points by using a clamp-on sensing current transformer. The resistance values are determined by using the in-phase component of the circulating current. When the clamp on CT is connected to the outgoing lead, the total ground resistance present on the battery system will be measured. If the readings indicated are of low resistance values, then it can be safely taken that a resistive fault has occurred on a branch of the battery system. On continuing the tests further on each individual circuit, the resistive fault can be found out. The occurrence of multiple faults can be found out by using the theory of parallel paths. To cite an example, if the total battery system is 1 kilo ohm and that of an individual branch indicates 10k ohms resistive fault, then we can know that a second fault exists. It is because the total system resistance and the branch resistance do not match. By adopting this AC injection method both the faults can be traced. Another use of this battery ground faults location is to find out resistive fault and capacitor charging currents separately. Now let us have the answers to some interesting questions related to Station Batteries.

What are the informations conveyed by the “Float Voltage”?

The float voltage relates to the “Trickle Charger” that keeps the battery in a “float” or “ready” condition. It simply indicates that the battery is in working condition. i.e. its state of charge is good. It does not indicate the health status of the cell. In other words, it shows that the battery is in fully charged condition but never indicates its AH capacity. A low float voltage signals that there is a short in the cell. In the case of lead acid battery, it is fully evident when the charger is set at 2.17V/cell and the float voltage falls below 2.06V/cell. With the charger “off”, the sum total of the voltages of all the cells should be taken. It must be equal to the charger voltage.

What are the recommended maintenance practices for different types of batteries?

IEEE 450 – Flooded Lead Acid Batteries

IEEE 1188 - Valve Regulated Lead Acid Batteries and

IEEE 1106 – Nickel Cadmium Alkali Batteries are the standards generally recommended.

The maintenance needs of any battery system depends upon the battery type, site criticality, site conditions and its use. In places where the ambient temperature is normally high, frequent maintenance is needed. It is because the batteries age at a greater pace at this elevated temperature. Further such a high temperature demands frequent battery replacements also.

What is the role of Intercell Connection Resistance in battery failure?

Loose intercell connections normally heat up and melt open; the problem starts when one or several cells are weak or one or more intercell connectors are loose; further the frequent cycling of lead acid batteries leads to the cold flow at the negative terminals and hence its loose connections. Failure to measure the intercell connection resistance adds to the problem.

What should be periodicity of Impedance Tests?

It depends on the battery type site conditions critical status of the battery and previous maintenance practices. It is preferable to have six months periodicity for flooded lead acid and Ni-cd batteries and quarterly for VRLA Valve Regulated Lead Acid batteries.

What is the conclusive test for the replacement of a cell or battery?

Increasing trend in impedance is a strong indicator of battery's poor health. As a guidance value, it can be stated that 20 percent increase in impedance for flooded lead acid batteries corrected to 80% battery capacity (i.e 20% capacity is lost). In the case of VRLA batteries, 50% increase from the batterie's initial impedance will show that it is in poor health. So base line impedance values have to be established, while preparing the specification for battery purchase.

So far we have made a small trip to the world of "Station Batteries".

Next month, it is planned to visit a new site. Till then stay tuned.

(To be continued...)



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UN PROMOTES COMMERCIALIZING FUEL CELL VEHICLES IN CHINA

Fuel cell vehicles (FCV) in China are expected to develop faster in terms of commercialization following a multilateral project launched by the United Nations Development Programme (UNDP), the Ministry of Science and Technology (MOST), the Ministry of Finance and several provincial governments in Beijing on Aug. 31.

The project, called "Accelerating the Development and Commercialization of Fuel Cell Vehicles in China," is the third phase of a continuous scheme called Global Environmental Facility Fuel Cell Bus Commercialization.

In the first two phases, 12 prototype fuel cell buses manufactured by Daimler-Chrysler, SAIC Motor and Foton completed a combined distance of 262,338 km and served a total of 126,586 passengers during the 2008 Beijing Olympics and the 2010 Shanghai Expo. The 12 buses helped reduce 400 tons of carbon dioxide and significant amount of nitrogen oxides, carbon monoxide and sulfur oxides, according to MOST statistics.

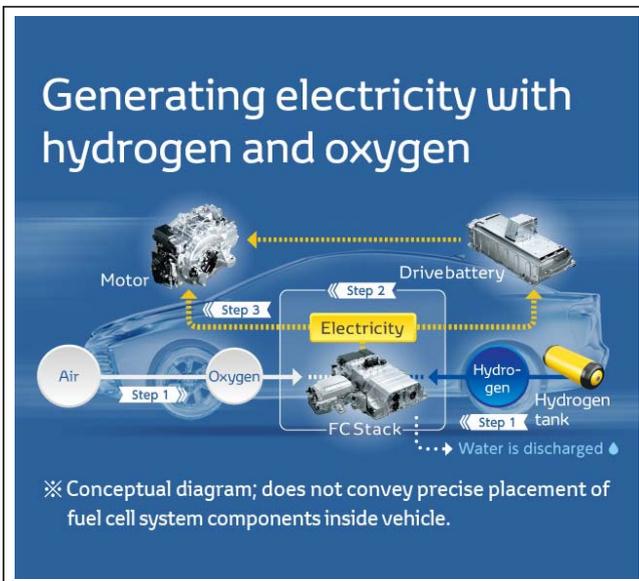
Fuel cells in vehicles use compressed hydrogen and oxygen from the air to generate electricity for the motor. As a result, fuel cell vehicles have zero emissions and only emit water and heat. "With its great dependency on fossil fuels, China faces a great challenge in reducing its greenhouse emissions and tackling its air pollution," said Patrick Haverman, deputy country director of the UNDP China.

Calling FCV a "Futuristic Technology", he said that FCV represents an innovative solution to help mitigate impacts of climate change in China while improving the lives of many.

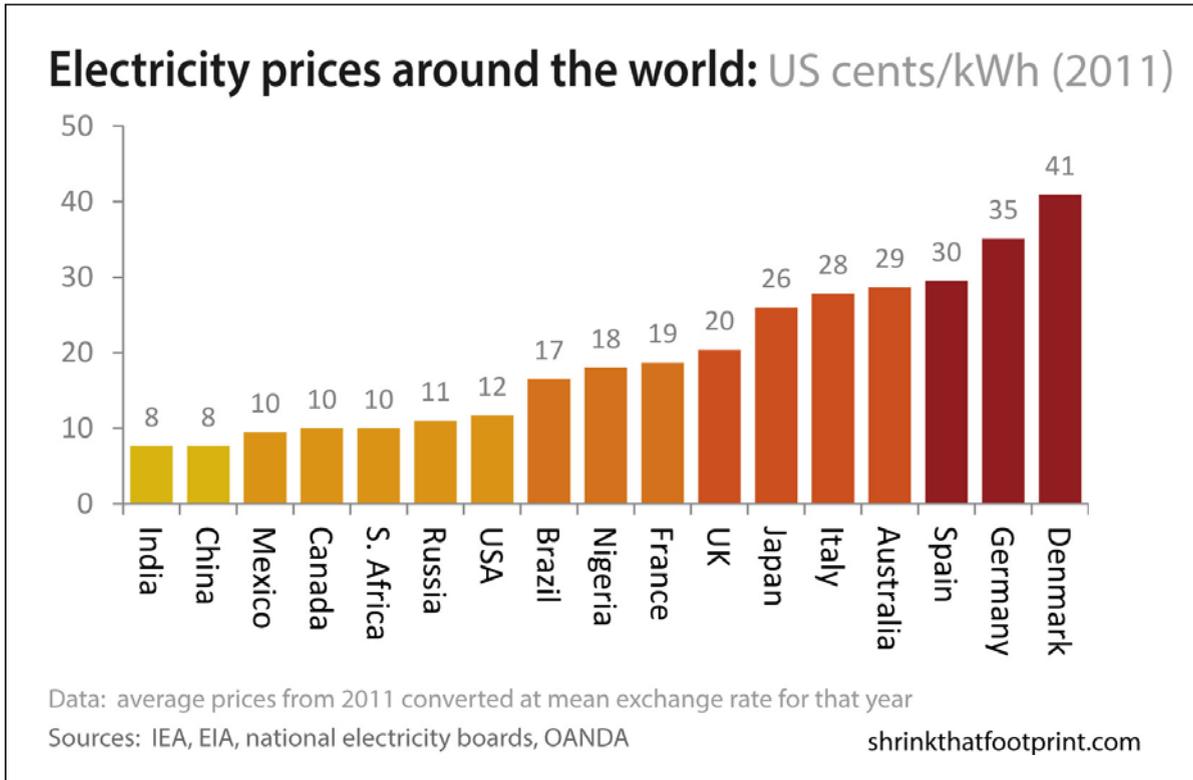
He also addressed that the barriers hindering such progress include flawed hydrogen-based infrastructure, obsolete policies, little legal supporting framework and a lack of public awareness.

Many Chinese automakers already have fuel cell vehicles in their products catalogue. As for infrastructure, China now has three FCV hydrogen filling stations – in Beijing, Shanghai, and Zhengzhou, Henan Province, — with a fourth one currently being built in Foshan, Guangdong Province.

The project will seek to use the FCV for passenger transport, logistics and post services in a handful of cities before promoting them for a wider range of uses nationwide.



INDIA SOLAR POWER TARIFFS HIT NEW LOW OF RS 4 PER UNIT



It's not just oil that is on a slide. While globally crude has slid some 70% in the last year-and-a-half, solar power tariffs too have sank to a new low in India at Rs 4.34 per unit - a third of the going rates a few years back - for a project in Rajasthan.

The new low came in during the online bidding for a 750 mw solar power park being set up at Badhla near Jodhpur with viability gap funding (VGF) from Solar Energy Corporation of India Ltd. The latest quote is lower than the price of power from several thermal power plants built by private firms and slightly higher than tariffs offered by yet others. It is slightly higher than NTPC's tariff for thermal plants.

At a ballpark figure of Rs 6 crore per mw cost, the entire 420-mw project could take up an investment of Rs 4,500 crore. The previous low of Rs 4.34 per unit had been quoted by Fortum India in January for one of the six packets of 70 mw (420 mw total) each bid out by state-run generation utility NTPC for the previous phase of the Bhadla solar park. Rays Power Infra and Solar Direct won two packets each, while the quote from Indiabulls for the sixth project had stood a tad higher at Rs 4.36 per unit.

Before that, Rs 4.63 per unit was the lowest that was offered by SunEdison and SB Energy for two projects of 500 mw and 350 mw, respectively, in Andhra Pradesh.

The ever-declining solar power tariffs have also drew cautionary notes from some industry players who have raised concerns over long-term sustainability. Industry tracker Mercom Capital Group recently said the concerns are rising since the decline in project costs, including those of solar modules that take up half the investments, did not match the rate of slide in tariffs.

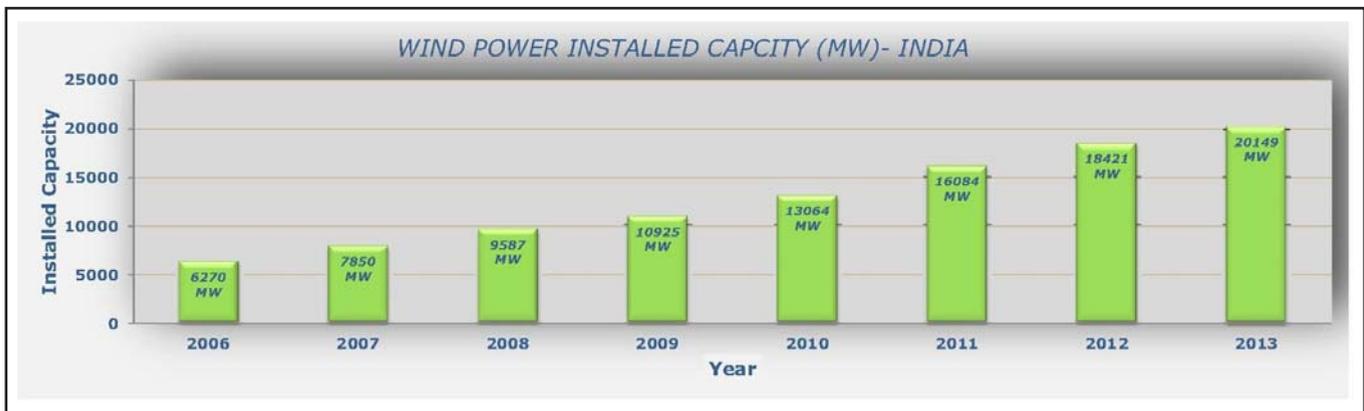
"In our channel checks, we are not seeing a significant enough drop in component prices to justify a 20-30 percent drop in bids. If anything, prices are solidifying as the year-end rush is creating a shortage putting upward pressure on prices. Looking at Chinese module spot price trends in 2015, the price drop is about 8 percent in the first six months after which it has held steady," Mercom Capital had said in a report. The 750-mw project has been divided into two solar parks of 500 mw in Phase III and 250 mw in Phase-IV. Phase-III is being set up by SauryaUrja Company of Rajasthan in five packets of 100 mw each. Phase-IV is being developed by Adani Renewable Energy.

Both the solar park implementing agencies are joint ventures with Rajasthan Renewable Energy Corporation promoted by the state government.

Courtesy : Times of India

WIND POWER GETS A BOOST IN INDIA

A government initiative to establish 1,000 MW wind power projects that will be connected to the electricity grid is expected to invigorate the renewables sector.



The Ministry of New and Renewable Energy (MNRE) has formulated a scheme for setting up of 1,000 MW Central Transmission Utility (CTU) connected wind power projects to provide a framework for inter-state sale of wind power at a price determined through transparent competitive bidding process. This will not only facilitate the non-windy states to fulfill their non-solar renewable purchase obligations (RPO), but also boost investment in the sector, thus achieving the goal of reaching 60 GW of wind power capacity by 2022, a document on draft guidelines for the sector by the MNRE states.

Hailing the move, Sunil Jain, Chief Executive Editor of Hero Future Energies, says competitive bidding is a step in the right direction. "Presently, a lot of states have not been willing to sign wind power purchase agreements, so this will open up the market for wind and we will get an extra capacity of a 1,000 MW. From the Wind Independent Power Producers Association's (WIPPA) side, we welcome this step," he told indiaclimatedialogue.net. Kasturirangian, chairman of Indian Wind Power Association (IWPA), who also welcomes the move, adds, "In India, wind energy is concentrated in eight states. If these states can generate wind power and supply it to the other states, it would help a great deal."

Emphasizing on the need for wind prices to come down, he told indiaclimatedialogue.net, "Unlike solar, the prices of wind have never reduced. In spite of incentives such as subsidies and reduced cost of import duty that go into manufacture of the windmill, their prices have only risen. In 1994, the cost of Wind Energy Generation (WEG) was INR 40 million (USD 0.6 million) per MW and now it is INR 70 million (USD 1 million). Only when the prices of windmills come down will the price of wind power price reduce. For all those in this sector who want to grow and expand, reducing the price of wind is the best bet."

Implementation

Jain reveals that at the stakeholders' consultation meet, there were discussions on how the policy of competitive bidding can be implemented. "There have been a lot of suggestions as to what can be done. Some of them were accepted and we now await release of the revised guidelines."

An official source in the MNRE said that the tariff policy includes competitive bidding, wherein bidding guidelines are to be issued under Section 63 of the Electricity Act. The official declined to be named.

Meanwhile, MNRE has designated Solar Energy Corporation of India as the nodal agency for implementation of the scheme and issued draft guidelines for the purpose. "The scheme will be implemented by wind project developers on a build, own and operate basis. However, the capacity may go higher than 1,000 MW, if there is higher demand from Discoms of non-windy states," the draft states.

It further adds, "In order to facilitate transmission of wind power from these States to other States, provisions have been made in the Revised Tariff Policy published in the Gazette of India on January 28, 2016, to waive off the inter-state transmission charges and losses for inter-state sale of wind power. A news release stated that this will encourage competitiveness through scaling up of project sizes and introduction of efficient and transparent

e-bidding and e-auctioning processes. It will also facilitate fulfillment of Non-Solar RPO requirement of non-windy states. The official source in MNRE told indiaclimatedialogue.net that currently, most states are fulfilling RPO. The long-term trajectory, however, is that the RPO should be uniform throughout India. “The tariff policy was amended on January 28, 2016, by the Ministry of Power (MoP) in consultation with the MNRE. This will ensure that there are no inter-state transmission charges and losses. The MoP has to notify the period for which the inter-state transmission charges will be waived off.”

Guidelines

Emphasizing on the need for guidelines for the wind energy sector, the source in MNRE admits that it has not been done since 1995-96. “Guidelines are important when it comes to factors like decommissioning a plant. The land is taken on lease for 25 years and when it comes to decommissioning, no norms are mentioned. It is also important when it concerns issues like health and safety. If a wind turbine is installed in a residential area, factors such as the level of noise need addressed,” the official told indiaclimatedialogue.net. There are integration issues as well. For this, standards have been revised by the Central Electricity Regulatory Commission and Central Electricity Authority and the machines will have to comply with them. Micro-siting is another aspect which has been included in the guidelines. It mentions how a turbine has to be placed across the area. As per the norms, a larger area is needed, but with improved micro siting, a lesser space with higher capacity is ensured.

Evacuation Infrastructure

Despite attempts being made to revise norms, some challenges continue to plague the sector. Jain believes that the stumbling block could be the availability of a long term open access through different corridors. “The biggest challenge is that today, the South-North Corridor is not available and majority of the wind projects/sites are in the Southern part of India. Also, right now, we have very little corridor to bring the wind from South to North. Rajasthan is also struggling with evacuation and infrastructure. So, that is the area of concern which we need to look into.” Agreeing, Kasturirangian cites the instance of Madhya Pradesh where a 1,000 MW WEG was set up. Now, they are finding it difficult to evacuate all the energy. “The scenario was similar in Tamil Nadu from 2010-12 when windmills of capacity 1000 MW were set up and there was an inadequacy of evacuation lines. This issue needs to be addressed.” Moreover, power from this auction is to be sold to non-windy states only, so that they can fulfill their non-solar RPO obligations. States which already have wind are anyway reluctant to buy this power, adds Jain.

Blocking wind sites

Another issue is that a lot of people have been squatting on wind sites across India for many years. “These sites have to be vacated. People have blocked power evacuation infrastructure and windy sites over the last seven to nine years and have paper allocations without doing any development work,” states Jain. The state governments, he suggests, should come out with some regulations to get these sites vacated and let them go for bidding. “For example, in Karnataka, Rajasthan and Maharashtra, if one visits their websites, the state government’s order has been released to many of the developers over the last few years. In some cases, from 2002-2003, the so-called developers have not developed these sites and not put up any wind turbines.” This point was raised at the meeting and the government taken note of it. However, at best, they can advise the state government to cancel the orders, but ultimately, the powers lie with state governments. In case something comes through, it will help the wind sector grow faster, feels Jain.

Transmission Corridor

Kasturirangian believes that yet another challenge confronting the wind industry is the inadequacy of a transmission corridor. In order to address this issue, laying of transmission lines must be done two years in advance. “Since it takes 2 years to lay these lines, planning must be done in advance and the lines should be laid at windy locations in such a way that it is connected to the consumption area. The windy area must be connected to the load area so that transmission is taken care of.”

Courtesy: Spectrum IEEE

**“People, like nails, lose their effectiveness when they lose direction and begin to bend.” -
WALTER SAVAGE LANDOR**

THE TELANGANA STATE ELECTRICITY REGULATORY COMMISSION

Regulations for connectivity with the Grid and sale of Electricity from the Roof-top Solar Photovoltaic

Regulation No. of 2016

(Continuation from the December issue page no.15)

8 Interconnection with the Distribution Network/Grid: Standards and Safety

8.1 The Distribution Licensee shall ensure that the inter-connection of the Rooftop Solar PV System with its Network conforms to the specifications, standards and other provisions specified in the Central Electricity Authority (CEA) (Technical Standard for Connectivity of the Distributed Generation Resources) Regulations, 2013, the CEA (Measures relating to Safety and Electric Supply), Regulations, 2010 and the State Grid Code. Provided that a variation in the rated capacity of the system within a range of five percent (5%) shall be allowed;

8.2 A Solar Rooftop PV system should qualify the technical requirements for the grid interconnection with the network of the distribution licensee and it shall be separately grounded / earthed.

Provided that an eligible consumer may use his Rooftop Solar PV system in Islanding mode for his own consumption only.

8.3 The connectivity levels at which a Rooftop PV Solar System shall be connected with the grid are as specified below:

S.No.	Connected load of Eligible Consumer	Connectivity level
1	Upto 5 kW	240 V- single phase
2	Above 5 kW and upto 18.65 kW	415 V-Three phase
3	Above 18.65 kW and upto 75 kW/kVA	415 V-Three phase
4	Above 75 kW/kVA	High Tension (HT)

8.4 The connectivity norms at sub-para (8.3) shall be applicable to all the Rooftop Solar PV Systems seeking connectivity with the network of the distribution licensees. The HT consumers may install the Rooftop Solar PV System at Low Tension (LT)/High Tension (HT) voltage and have to connect them to their LT/HT system for interconnection of the Rooftop Solar PV System with the local distribution licensee's grid subject to confirmation to standards at sub- para 8.1.

8.5 The Rooftop Solar PV Energy Generator shall be responsible for safe operation, maintenance and rectification of defect of its system up to the interconnection point beyond which the responsibility of safe operation, maintenance and rectification of any defects in the system including the net meter shall rest with the distribution licensee.

8.6 The eligible consumer/Rooftop Solar PV Energy Generator shall be solely responsible for any accident to human being or animals (fatal/non-fatal/ departmental/non-departmental) that may occur due to back feeding from the Rooftop Solar PV System when the grid supply is off. The distribution licensee reserves the right to disconnect the consumer's installation at any time to prevent any accident or damage to man and material. The Licensee shall not be responsible to pay any ex-gratia on account of fatal accidents or non-fatal accidents occurring on account of the Rooftop Solar PV System in the premises of the eligible consumer.

Provided that the distribution licensee may require the Rooftop Solar PV generator to rectify any defect within two days of intimation to the eligible consumer.

8.7 The tests as per European Norm 50160 (EN 50160) [quality of supply standards] and in accordance with the distribution licensee's standards of the Commission shall be done to ensure the quality of power generated from the Rooftop Solar PV Systems.

8.8 Any alternate source of supply shall be restricted to the consumer's network and the consumer shall be responsible to take adequate safety measures to prevent battery power/diesel generator power/back-up power extending to the distribution licensee's LT/HT grid on failure of the distribution licensee's grid supply.

8.9 The distribution licensee shall have the right to disconnect the Rooftop Solar PV System from its system at any time in the following conditions:

- (i). Emergencies or maintenance requirement of the distribution licensee's electric system;
- (ii). Hazardous conditions existing on the distribution licensee's system due to operation of the Rooftop Solar PV System or the protective equipment as determined by the Distribution Licensee/Transmission Licensee/State Load Despatch Centre (SLDC);
- (iii). Adverse electrical effects, such as power quality problems, on the electrical equipment of other consumers of the distribution licensee caused by the Rooftop Solar PV System as determined by the distribution licensee.

8.10 The Rooftop Solar PV System should be capable of detecting an unintended islanding condition. This System must have anti-islanding protection to prevent any unfavourable conditions including failure of supply. International Electro-technical Commission (IEC-62116) shall be followed to test the islanding prevention measure for the grid connected photovoltaic inverters.

8.11 Every Rooftop Solar PV System shall be equipped with the automatic synchronization device:

Provided that the Rooftop Solar PV System using the inverter shall not be required to have a separate synchronization device, if the same is inherently built into the inverter.

8.12 The Rooftop Solar PV System operating in parallel with the electricity system shall be equipped with the following protective functions to sense the abnormal conditions on the electricity system and cause the Rooftop Solar PV System to be automatically disconnected from the electricity system or to prevent the Rooftop Solar PV System from being connected inappropriately to the electricity system;

- (i). Over and under voltage trip functions if voltage reaches above 110% or below 80% respectively with a clearing time upto two (2) seconds;
- (ii). Over and under frequency trip functions, if frequency reaches 50.5 Hz or below 47.5 Hz with a clearing time upto 0.2 seconds;
- (iii). The Rooftop Solar PV System shall cease to energize the circuit to which it is connected in case of any fault in the circuit;
- (iv). A voltage and frequency sensing and time delay function to prevent the Rooftop Solar PV System from energizing a de-energized circuit and to prevent the Rooftop Solar PV System from reconnecting with the electricity system unless voltage and frequency is within the prescribed limits and are stable for at least sixty (60) seconds; and
- (v). A function to prevent the Rooftop Solar PV System from contributing to the formation of an unintended island, and ceases to energize the electricity system within two (2) seconds of the formation of an unintended island.

8.13 The equipment of the Rooftop Solar PV System shall meet the following safety requirements:

- (i). Circuit Breakers or other interrupting equipment shall be suitable for their intended application with the capability of interrupting the maximum available fault current expected at their location,
- (ii). The Rooftop Solar PV System and the associated equipment shall be so designed that the failure of any single device or component shall not potentially compromise the safety and reliability of the electricity system and
- (iii). Paralleling device of the Rooftop Solar PV System shall be capable of withstanding 220% of the nominal voltage at the interconnection point.

8.14 Every time the Rooftop Solar PV System of the Eligible Consumer is synchronized with the distribution system, it shall not cause the voltage fluctuation greater than $\pm 5\%$ at the point of inter connection.

8.15 After considering the maintenance and the safety procedures, the distribution licensee may require an eligible consumer of a Rooftop Solar PV System to provide a manually operated isolating switch between the Rooftop Solar PV System and the electricity system, which shall meet following requirements:

- i. Allow visible verification that separation has been accomplished;
- ii. Include indications to clearly show open and closed positions;

- iii. Be capable of being reached quickly and conveniently twenty four (24) hours a day by the licensee's personnel without requiring the clearance from the applicant;
- iv. Be capable of being locked in the open position;
- v. May not be rated for load break and may not have a feature of over-current protection; and
- vi. Be located at a height of at least 2.44 m above the ground level.

8.16 Prior to synchronization of the Rooftop Solar PV System for the first time with the distribution system of the licensee, the applicant / eligible consumer and the licensee shall agree on the protection features and the control mechanism.

8.17 The power conditioning unit shall have the features of filtering out harmonics and other distortions before injecting the energy into the system of the distribution utility. The Total Voltage Harmonic Distortion (THD) shall be with the limits specified in the Indian Electricity Grid Code (IEGC). The technical standards, power quality standards and inverter standards shall be specified by the Distribution Licensee before entering into an agreement with the eligible consumer or any other standards as may be specified by the CEA from time to time.

9 Metering arrangement

9.1 The Net Meter shall conform to the standards specified by the Central Electricity Authority (CEA) (Installation and Operation of Meters Regulations), as 2006 amended from time to time. Further, a bi-directional meter of the same accuracy class as the eligible consumer's meter existing before commissioning of the Rooftop solar PV System shall be installed in replacement of the existing meter. A single bi-directional meter shall be installed for export and import. This bi-directional meter should have the following characteristics:

- i. Separate registers for export and import with the Meter Reading Instrument (MRI) downloading facility.
- ii. kVAr, kWh, kVA measuring registers for capacity above 1 KW.
- iii. Advanced Metering Infrastructure (AMI) facility with RS232 (or higher) communication port.
- iv. Class 1 accuracy meters for Rooftop Solar PV Systems up to 10 KW, 0.5 accuracy class meters for Rooftop Solar PV Systems above 10 KW and 0.2 class accuracy meters for High Tension (HT) systems (56 KW and above).
- v. Meters should be certified by the Bureau of Indian Standards (BIS).
- vi. Current Transformer (CT) functionality meters for the Rooftop Solar PV Systems above 50 KW.

9.2 The Net Meter in the premises of the Eligible Consumer may be procured and installed by the Distribution Licensee at its own cost and in accordance with the provisions of the Electricity Supply Code:

Provided that if the Eligible Consumer is within the ambit of Time-of-Day ('ToD') Tariff, the Net Meter installed shall be capable of recording ToD consumption and generation:

Provided further that an Eligible Consumer may opt to procure, at his cost, the Net Meter for testing and installation by the Distribution Licensee.

9.3 The Distribution Licensee shall be responsible for the supply, installation, testing and maintenance of the metering equipment, and its adherence to the applicable standards and specifications.

9.4 An Eligible Consumer shall install, at his own cost, a Solar Generation Meter conforming to the CEA Regulations at an appropriate location to measure the energy generated from the Rooftop Solar PV system, if he is an Obligated Entity and desires that such energy be counted towards meeting its RPO.

9.5 The Distribution Licensee shall install, at its own cost and with the consent of the Eligible Consumer, a Solar Generation Meter conforming to the CEA Regulations at an appropriate location to measure the energy generated from the Rooftop Solar PV System if it desires that such energy be counted towards meeting its RPO.

9.6 The Net Meter and the Solar Generation Meter shall be installed at such locations in the premises of the Eligible Consumer as would enable easy access to the Distribution Licensee for meter reading.

10 Energy Accounting and Settlement

10.1 The accounting of electricity exported and imported by the Eligible Consumer shall become effective from the date of connectivity of the Roof-top Solar PV System with the distribution Network of the Licensee.

10.2 For each Billing Period, the Distribution Licensee shall show separately:-

- a. The quantum of electricity Units exported by the Eligible Consumer;
- b. The quantum of electricity Units imported by the Eligible Consumer;
- c. The net quantum of electricity Units billed for payment by the Eligible Consumer; and
- d. The net quantum of electricity Units carried over to the next Billing Period:

Provided that if the quantum of electricity exported exceeds the quantum imported during the Billing Period, the excess quantum shall be carried forward to the next Billing Period as credited Units of electricity and the eligible consumer shall get a monthly minimum bill;

Provided further that if the quantum of electricity Units imported by the Eligible Consumer during any Billing Period exceeds the quantum exported, the Distribution Licensee shall raise its invoice for the net electricity consumption after adjusting the credited Units of electricity.

10.3 The unadjusted net credited Units of electricity shall be settled by the Licensee twice in a year viz., in June and December. The net export units credited for the six month period shall be settled at its average cost of power purchase as approved by the Commission for that year. The sum so arrived shall be either adjusted in the next month electricity bill or deposited in the bank account of the eligible consumer furnished to the Licensee at the time of filing of the application or at the option of the eligible consumer carry forward the credited units to the next billing cycle.

Provided that at the beginning of each of the Settlement Period, the cumulative quantum of injected electricity carried forward shall be re-set to zero.

10.4 Where an Eligible Consumer is within the ambit of Time of Day (ToD) tariff, the electricity consumption in any time block, i.e. peak hours, off-peak hours, etc., shall be first compensated with the quantum of electricity injected in the same time block. Any excess injection over and above the consumption in any other time block in a Billing Cycle shall be accounted as if the excess injection had occurred during off-peak hours.

10.5 The Eligible Consumer shall have recourse, in case of any dispute with the Distribution Licensee regarding the billing, to the mechanism specified in sub-Sections (5) to (7) of Section 42 of the Act for the redressal of grievances.

10.6 Reporting Requirements by Distribution Licensee (DISCOMs):

The Distribution Licensee shall report the following, by June 1 of each year and shall also be placed on its website:

- a) Total Number of eligible consumer's interconnections at the end of the previous Financial Year;
- b) Total kW capacity of the eligible consumer's interconnected at the end of previous Financial Year;
- c) Total kWh capacity of the eligible consumer from the Distribution Licensee by month and by year for the previous Financial Year;
- d) Total kWh of solar energy generated by the eligible consumer by month and by year for the previous Financial Year;
- e) Total kWh delivered by the eligible consumer to the Distribution Licensee as per billing cycle and by year for the previous Financial Year;
- f) For each eligible consumer interconnection:
 - 1) Solar technology utilized;
 - 2) Gross power rating;
 - 3) Geographic location (District Wise); and
 - 4) Date of interconnection.

11 Solar Renewable Power Purchase Obligation (RPPO)

11.1 The quantum of electricity consumed by an Eligible Consumer from the Rooftop Solar PV System under the Net Metering Arrangement shall qualify towards his compliance of Solar RPPO, if such Consumer is an Obligated Entity.

11.2 The quantum of electricity consumed by the Eligible Consumer from the Rooftop Solar PV System under the Net Metering arrangement shall, if such Consumer is not an Obligated Entity, qualify towards meeting the Solar RPP0 of the Distribution Licensee:

Provided that the Distribution Licensee shall, with the consent of the Eligible Consumer, make all the necessary arrangements, including for additional metering, as may be required for the accounting of the solar energy generated and consumed by the Eligible Consumer.

11.3 The unadjusted surplus Units of the Solar energy purchased by the Distribution Licensee under the provisions of sub-para 10.3 shall qualify towards meeting its Solar RPP0.

12 Applicability of other charges

12.1 The Rooftop Solar PV System under the net metering arrangement, whether self- owned or third party owned installed on the Eligible Consumer's premises, shall be exempted from Transmission Charge, Transmission Loss, Wheeling Charge, Wheeling Loss, Cross Subsidy Surcharge and Additional Surcharge.

12.2 All incentives or subsidy provided by the Government of India through THE Ministry of New and Renewable Energy (MNRE) under the National Solar Mission or other schemes and any incentive or subsidy provided by the Government of Telangana state from time to time shall belong to the eligible consumer or on authorisation of the eligible consumer to the vendor of the Rooftop Solar PV system and can be claimed after installation of the Rooftop solar power net metering from the State Nodal Agency.

12.3 An eligible consumer or a vendor of the Solar PV system on authorisation from an eligible consumer shall produce the latest net metering bills for two months raised by a Distribution Licensee for the release of the subsidy or incentive. These bills shall be counter signed by the concerned Divisional Engineer of the Licensee and the District Manager of the State Nodal Agency. The Nodal Agency shall make the payment of subsidy or incentive within fifteen (15) working days of the receipt of claim of subsidy/incentive, failing which it shall pay interest @ 15% from the end of fifteen (15) working days to the date of payment.

13 Inspection by Licensee

The Distribution Licensee on inspection at the time of release of permission to install the net metering arrangement or at any time thereafter, finds that, the eligible consumer has installed equipment not conforming to the standards published by the International Electro-technical Commission (IEC) or Bureau of Indian Standards (BIS) as a part of the net metering arrangement in the consumer's premises, the vendor of the equipment shall be blacklisted and the same shall be notified to the MNRE. Further, the Licensee reserves the right to withdraw the net metering arrangement with the eligible consumer after giving an opportunity in writing.

14 Sharing of Clean Development Mechanism (CDM) benefits

The Rooftop Solar PV System Developer shall retain the entire proceeds of CDM benefits in the first year after the date of commercial operation of the generating station. In the second year, the share of the Distribution Licensees shall be 10% which shall be progressively increased by 10% every year till it reaches 50%, where after, the proceeds shall be shared in equal proportion by the Rooftop Solar PV System Developer and the Distribution Licensees.

15 Demand Cut

No demand cut shall be applicable to the Residential and the Government consumers. The Industrial, Commercial and Other consumers may be exempted from the demand cut up to 50% of the installed solar capacity at the discretion of the Distribution Licensee.

16 Compensation

In case of failure of the net metering system, compensation shall be payable as per the provisions of the Telangana State Electricity Regulatory Commission (Licensees' Standards of Performance) Regulation, 2016 as amended from time to time.

17 Issue of orders and practice directions

- (1) Subject to the provisions of the Electricity Act, 2003 and this Regulation, the Commission may, from time to time, issue orders and practice directions in regard to the implementation of the Regulation and procedure to be followed and various matters which the Commission has been empowered by this Regulation to specify or direct.

(2) In particular, the Commission may authorize the Commission staff or any independent agency to conduct periodical checks, monitor the compliance of the Standards by the Licensees and report to the commission.

18 Power to remove difficulties

If any difficulty arises in giving effect to any of the provisions of this Regulation, the Commission may, by a general or special order, do or undertake or direct the Licensees to do or undertake things which in the opinion of the Commission are necessary or expedient for the purpose of removing the difficulties.

19 Power to Amend

- (1) The Commission may at any time, vary, alter, modify or amend any provisions of the Regulation.
- (2) In particular the Commission may review these standards after a period of three years or at any other time, if considered necessary. This Regulation shall however continue to be in force till it is modified based on such review.

*Secretary
Telangana State Electricity
Regulatory Commission*

INDIA TO GET ELECTRICITY FROM OFFSHORE WIND ENERGY IN 5 YEARS

India will get electricity generated by wind-propelled plants installed in Gujarat and Tamil Nadu in about five years as part of the country's green energy development programmes, an energy expert has said.

“We are preparing India for offshore wind (and providing MNRE a roadmap for offshore wind for Gujarat and Tamil Nadu,” said Mathias Steck, Executive Vice President and Regional Manager at DNV GL, an international renewable energy group.

“It would take three to five years that we see commercial offshore winds projects in India,” said Steck, who is an expert in renewable energy at DNV GL, which has a 30-consultant team in India and made its entry into the Indian market in 1989.

A 100-megawatt pilot project will likely be installed in ocean off Gujarat in about three years, he said on the sidelines of the Singapore International Energy Week held last week.

It is to kickstart a new power generating sector under the Facilitating Offshore Wind in Industry (FOWIND) programme funded by the European Union.

A FOWIND consortium has done a series of report on wind conditions for wind-generated electricity and its integration into a grid along the coastlines of Gujarat and Tamil Nadu.

FOWIND is supported by Euro 4 million grant from the Indo-European Cooperation on Renewable Energy programme and Euro 500,000 contribution through the Gujarat Power Corp Ltd (GPCL).

The consortium, Global Wind Energy Council (GWEC), comprises GPCL, DNV GL, the Centre for Study of Science, Technology and Policy (CSTEP), and the World Institute of Sustainable Energy (WISE).

The project is being implemented in close cooperation with Ministry of New and Renewable Energy (MNRE) and National Institute of Wind Energy.

“Over the time DNV GL has been in India, we have looked over 50-gigawatt of onshore wind projects,” he said, adding “this is a market leading position” as DNV GL works for a large number of clients in renewable energy projects.

DNV GL is also looking at prospects in solar and tidal wave energies in India, Steck added. PTI



PERTH WAVE ENERGY PROJECT

This project is the world's first commercial-scale wave energy array that is connected to the grid and has the ability to produce desalinated water.

Need - Defence bases and remote islands typically face issues of high power tariffs, freshwater scarcity and reliance on fossil fuels to provide power. Carnegie's CETO Wave Energy technology is capable of producing both zero-emission power and directly desalinated water.

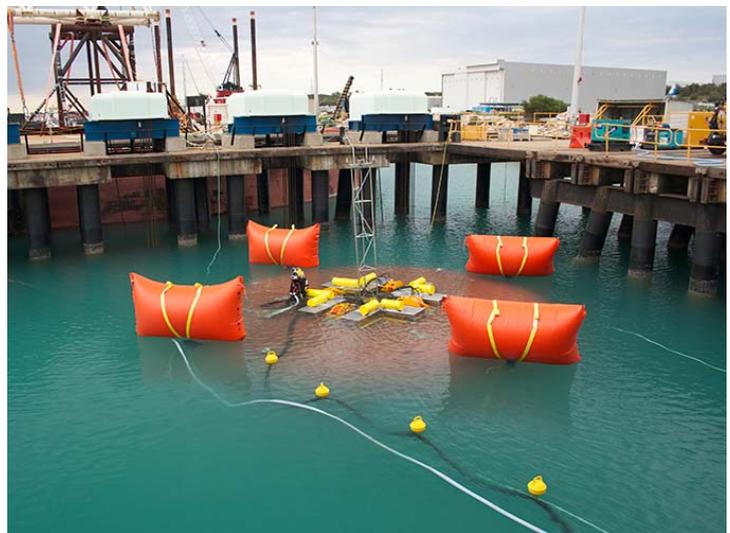
Project innovation - The Perth Wave Energy Project is the world's first commercial-scale wave energy array that is connected to the grid and has the ability to produce desalinated water. The project will also deliver Carnegie's first power revenues through the sale of green electricity to the Department of Defence for HMAS Stirling, Australia's largest naval base located on Garden Island in Western Australia.

The Perth Wave Energy Project utilises Carnegie's 100 per cent owned and invented CETO wave energy technology. The CETO Unit, which consists of a fully submerged buoy (a Buoyant Actuator [BA]) that is tethered to a pump on the seabed, is used to harness the enormous energy present in the ocean's waves.

The CETO BA oscillates in harmony with the ocean's waves, transferring energy through a tether (a marine grade rope) and causing a pump to extend and contract. The pump pressurises fluid which is then sent onshore through a subsea pipeline.

Once onshore the high-pressure fluid is used to operate an off-the-shelf hydroelectric power plant. The resulting low-pressure water is then returned offshore in a closed loop system. In addition to producing zero-emission power, the CETO technology is capable of producing direct desalinated water. The high-pressure water created by the CETO Units can be used to supply a reverse osmosis desalination plant, replacing or reducing reliance on greenhouse gas-emitting, electrically-driven pumps usually required for such plants.

Benefit - The power produced by the Perth Wave Energy Project is clean renewable energy that reduces the reliance on fossil fuels. This clean energy is purchased by the



Australian Department of Defence, as part of a landmark power purchase agreement. It is generating Carnegie's first revenues and is a significant step forward in commercialisation of the CETO wave energy technology. The agreements signed between Carnegie and the Australian Department of Defence also highlight the growing interest of international defence organisations in increasing their renewable energy mix and improving energy security.

The Perth Wave Energy Project is the world's first grid-connected commercial scale demonstration of Carnegie's CETO technology. This is an important step towards unlocking the vast potential of wave energy in Australia and internationally.

IOWA STATE ENGINEERS STUDY THE BENEFITS OF ADDING A SECOND, SMALLER ROTOR TO WIND TURBINES

AMES, Iowa – Hui Hu picked up a 3-D printed model of a typical wind turbine and began explaining two problems with the big, tall, three-bladed machines.

First, said the Iowa State University professor of **aerospace engineering**, check out the base of each blade. They're big, round structural pieces. They're not shaped like an airfoil. And so they don't harvest any wind, reducing a turbine's energy harvest by about 5 percent.

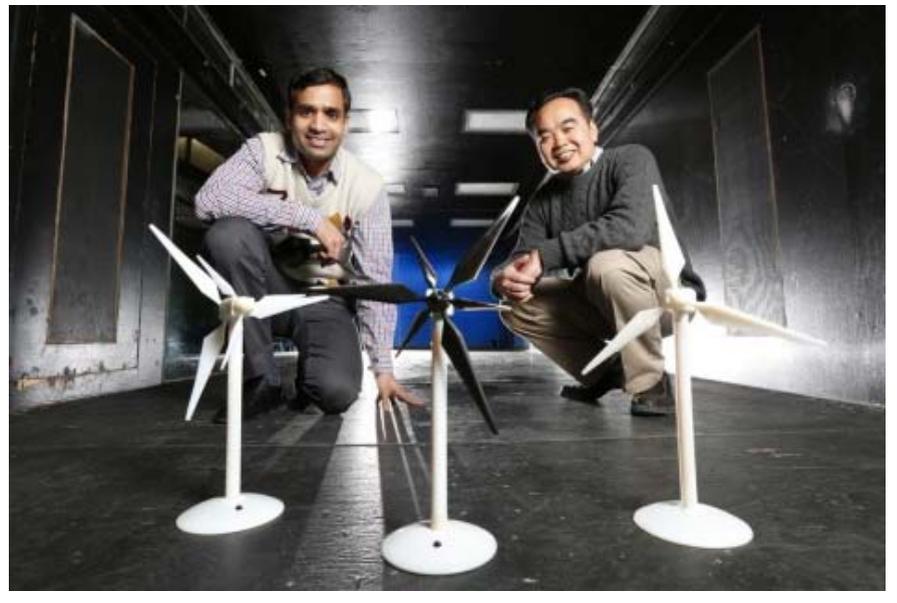
Second, the big blades disturb the wind, creating a wake behind them and reducing the energy harvest of any downwind turbines. Hu said a turbine sitting in the slipstream of another can lose 8 to 40 percent of its energy production, depending on conditions.

Those losses prompted Hu and Anupam Sharma, an Iowa State assistant professor of aerospace **engineering**, to look for a solution. Their data suggest they've found one.

What they've done is add a smaller, secondary rotor. One model had three big blades and three mini-blades sprouting from the same hub. The other had a small, secondary rotor mounted in front of the big rotor, the two sets of blades separated by the nacelle that houses the generating machinery on top of the tower. Using lab tests and computer simulations, Hui and Sharma have found those extra blades can increase a wind farm's energy harvest by 18 percent. "These are fairly mature technologies we're talking about – a 10 to 20 percent increase is a large change," Sharma said.

The **Iowa Energy Center** awarded Hu and Sharma a one-year, \$116,000 grant to launch their study of dual rotors. (The two won the energy center's **2014 Renewable Energy Impact Award** for the rotor project.) The National Science Foundation is supporting continued studies with a **three-year, \$330,000 grant**. Hu is using experiments in Iowa State's **Aerodynamic / Atmospheric Boundary Layer Wind and Gust Tunnel** to study the dual-rotor idea. He's measuring power outputs and wind loads. He's also using technologies such as particle image velocimetry to measure and understand the flow physics of air as it passes through and behind a rotating turbine.

Sharma is using advanced computer simulations, including high-fidelity computational fluid dynamics analysis and large eddy simulations, to find the best aerodynamic design for a dual-rotor turbine. Where, for example, should the second rotor be located? How big should it be? What kind of airfoil should it have? Should it rotate in the same direction as the main rotor or in the opposite direction?



6 BILLION LITRES OF ETHANOL COULD HAVE BEEN GENERATED BESIDES REDUCING SMOG IN DELHI REGION

In early October 2016, according to NASA Earth Observatory, its satellites began to detect small fires in Punjab, and the number of fires increased rapidly in the following weeks. By November, thousands of fires burned across the state, and a thick pall of smoke hovered over India. According to NASA, a staggering amount of 32 million tonnes of agricultural residue were burned in Punjab adversely affecting the air quality.

Since the fires are small, short-lived, and burn at relatively low temperatures, the smoke generally stays near the surface. On November 2, winds carried a stream of smoke-likely mixed with small particles of soil, dust, and partially burned plant material toward New Delhi, pushing the levels of particulate matter in the capital city to unusually high levels. The worsening situation can be gauged by the fact that the Delhi Government has announced 3-day shut down of schools across the city-state.

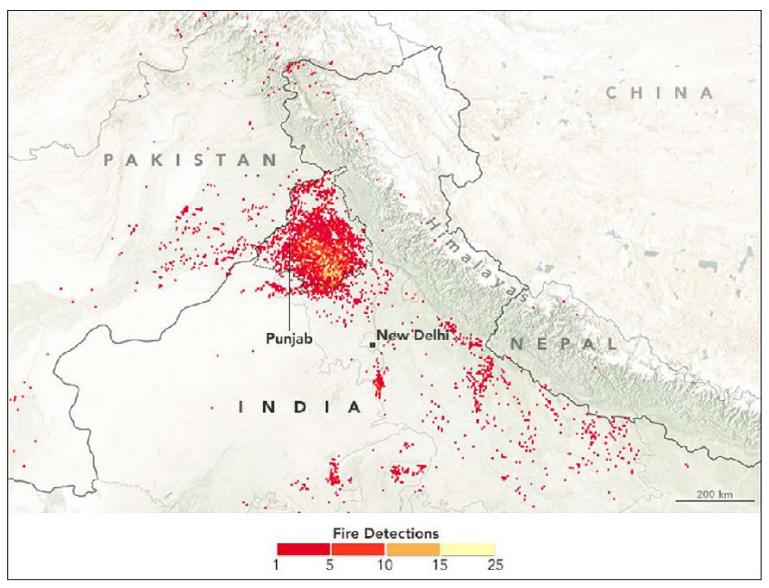
Praj Industries draws inspiration from a tweet dated November 7, 2016 by Mr. Dharmendra Pradhan, Minister of State for Petroleum and Natural Gas: “2nd Generation Ethanol production technology using rice-paddy straw in Punjab & Haryana will be a permanent solution to crop burning problem.”

Praj Industries has developed a long term solution to the farmer’s challenge of disposing off lignocellulosic waste - agri residue in this case - and turning it into 2nd Generation ‘Bio’ Ethanol. This is an efficient technology of converting agri waste into fuel grade ethanol and a permanent solution to the age old agri residue burning.

Typically, 1 tonne of agri residue on dry basis can generate around 250 liters of bio-ethanol. Thus, approximately 6 billion liters of bio-ethanol could have been generated from the cellulosic material burnt in this season alone. This is equivalent to approximately 20% of the total petrol consumption of the country.

Praj Industries is working with a leading equipment manufacturer to handle the collection and baling of biomass for downstream production of 2G Ethanol. Further, Indian Oil Corporation Limited (Indian Oil), India’s flagship national oil company, has selected Praj as technology partner for setting up multiple 2G bio-ethanol plants based on their indigenously developed technology. Indian Oil will be setting up three such 2G bio-ethanol plants, out of which, one plant is expected to be in the state of Haryana. Praj is also in the advanced stage of discussion with another project developer to set up a bio-ethanol plant in Punjab.

Mr. Pramod Chaudhari, Executive Chairman of Praj Industries, said, “Praj is committed to deliver sustainable and clean energy solutions and with the use of our 2G bio-ethanol technology; we can reduce smog levels as well as pollution arising from burning of agri residue to a great extent. Besides, the collection of agriculture waste will create employment for thousands of rural people, which in itself will help create a ‘sustainable’ revenue for the farmers, rural people and the ethanol manufacturers. 2nd Generation Ethanol Technology will



support in achieving 10% blending of ethanol with petrol and thereby reducing the oil import bill. And more importantly, reduce smog formation in future and ensure clean air for our citizens.”

About Praj Industries Limited:

Praj is a global process solutions company driven by innovation and integration capabilities, offers solutions to add significant value to bio-ethanol facilities, brewery plants, water & wastewater treatment systems, critical process equipment & systems, hipurity solutions and bioproducts. Over the past three decades, Praj has focused on environment, energy and agri process led applications. Praj has been a trusted partner for process engineering, plant & critical equipment and systems with over 750 references across five continents. Solutions offered by Praj are backed by its state of the art R&D Center called Praj Matrix. Led by an accomplished and caring leadership, Praj is a socially responsible corporate citizen. Praj is listed on the Bombay and National Stock Exchanges of India.

For more information, visit: <http://www.praj.net>

PUNE, India, November 8, 2016/PRNewswire/

RELIANCE INFRA SELLS 100% STAKE IN TRANSMISSION BUSINESS TO ADANI GROUP

Reliance Infrastructure Limited today said it agreed to sell all its transmission assets to Adani Transmission Limited, the largest private power transmission company operating in India. This acquisition is expected to be completed in current financial year. The entire sale proceeds shall be utilized for debt reduction, said the company. The transaction is in line with the strategic plan of monetizing non-core business and focus on major growth areas like Defence and EPC business, the company added.

The deal will see the 100% acquisition of Western Region

Strengthening System Scheme B (WRSSS B) around 2089 ctkms and Western Region Strengthening System Scheme C (WRSSS C) around 974 ctkms by Adani. The deal will also see Adani acquiring 74% in ParbatiKoldam Transmission Company Limited located in the state of Himachal Pradesh and Punjab in joint venture with Power Grid.

All three transmission projects are completed and revenue generating, said Reliance Infra.

Monetisation of Cement business has been completed and monetisation of Roads & Mumbai Power businesses are in advanced stage. The proposed Transaction is subject to due diligence, definitive documentation, applicable regulatory approvals and certain other conditions. Further announcements will be made at an appropriate stage, the company further added. Mr. Gautam Adani, Chairman of Adani Group, said “Adani Transmission Ltd. has grown its wings in transmission sector with a commitment to maintain its leadership position in the transmission sector of the country. With this acquisition, ATL will enjoy substantial benefit of scale driving and is in sync with the deep-rooted strategy of ATL to enhance the value for the stake holders through both organic as well as inorganic growth

Read more at <https://rtn.asia/r-r/23945/reliance-infra-sells-100-stake-transmission-business-adani-group#YrokETI54LAlSTXV.99>



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CAN SYNTHETIC INERTIA FROM WIND POWER STABILIZE GRIDS?

As renewable power displaces more and more coal, gas, and nuclear generation, electricity grids are losing the conventional power plants whose rotating masses have traditionally helped smooth over glitches in grid voltage and frequency. One solution is to keep old generators spinning in sync with the grid. Another emerging option will get a hearing next week at the 15th International Workshop on Large-Scale Integration of Wind Power in Vienna: synthetic inertia.

Synthetic inertia is achieved by reprogramming power inverters attached to wind turbines so that they emulate the behavior of synchronized spinning masses. Montréal-based Hydro-Québec TransÉnergie, which was the first grid operator to mandate this capability from wind farms, will be sharing some of its first data on how Québec's grid is responding to disruptive events such as powerline and power plant outages.

Québec has about 3,300-MW of wind power today, but Canada's wind industry is calling for 8,000-megawatts more by 2025. Turbine manufacturers are upping their synthetic inertia technology to pave the way. Synthetic inertia is the latest step in a longstanding technology trend, according to Aubut, that has already transformed renewable generators from potential liabilities to power grid stability into substantial contributors to it. The first step, he says, was equipping renewables to remain solid and thus "not harm the grid" during times of grid instability. Modern wind and solar plants are designed to "ride-through" severe faults, such as short-circuit events that drop grid voltage to zero.

Recent ride-through trouble in Australia appears to be an anomaly. Nine Australian wind farms did shut down during a series of storm-induced faults, that blacked-out the state of South Australia in September, and Australia's prime minister attacked renewable energy as a threat to energy security. However, an investigation by the Australian Energy Market Operator blamed errant wind farm control settings, and it says some operators have corrected them.

In fact, most wind and solar farms can do much more than just stick around during trouble. For example, most utility-scale installations—and even some residential rooftop solar systems—are designed to combat voltage sags on power grids. Their electronic inverters can detect brownouts and generate reactive power (AC whose current wave leads its voltage wave) to raise the grid voltage.

Synthetic inertia is about responded to crashing AC frequency, usually after the loss of a big power plant. When a big generator goes offline, it leaves the grid under-supplied. That will cause the AC frequency to fall.

Conventional power plants respond naturally and instantly to frequency dips because the momentum of their spinning turbines, synched to the grid, resist deceleration. This slows the frequency drop, buying precious seconds during which power reserves are mobilized to fill the supply gap.

Aubut says Hydro-Québec began setting requirements for synthetic inertia in 2005. Québec's grid is, electrically speaking, North America's smallest AC zone, with peak power demand under 40,000 MW. Losing a big power plant causes a steeper frequency drop on smaller grids, and more wind power threatened to limit the Québec operator's defenses.

In 2005 the utility amended its grid code, requiring wind farms to pull their weight: it mandated that new wind turbines be capable of delivering a power boost equal to 6 percent of their rated capacity during low-frequency events. Manufacturers responded with synthetic inertia designs, and the first were installed in 2011. Today, inertia-compliant turbines from Germany's Senvion Wind Energy Solutions and ENERCON account for two-thirds of Quebec's wind capacity. To emulate the inertial behavior of massive rotating equipment, a renewable generator must somehow find extra power quick. Québec's wind turbines do so through a collaboration between the turbines' solid-state power electronics and their moving parts. "When the wind turbines see an imbalance between load and generation that causes a frequency deviation on the system they're able to ... extract some kinetic energy that is stored in the rotating masses of the wind turbines," explains Aubut.

During a December 2015 transformer failure that took more than 1,600-MW of power generation offline, synthetic inertia kicked in 126 MW of extra power to arrest the resulting frequency drop. Quebec's AC frequency bottomed out at 59.1 hertz – well below its 60-hertz standard – but Aubut and his colleagues

estimate that it would have dropped a further 0.1-0.2-hz without the synthetic inertia. And they estimate that this was roughly the same contribution that conventional power plants would have provided.

The trouble, says Aubut, is what happens after the frequency drop. In all but the strongest wind conditions providing synthetic inertia will slow a wind turbine's rotor. Re-accelerating to optimal speed thereafter absorbs some of the wind power that the turbine can export to the grid. Data from ENERCON shows power reductions of up to 60 percent in some turbines.

This energy recovery phase delays the grid's frequency recovery. After Québec's December 2015 transformer event, for example, the system frequency flat-lined for several seconds at 59.4 Hz before additional power reserves could push it back to 60. Under different conditions, says Aubut, that post-inertia recovery could have actually caused a "double-dip" in system frequency, increasing the risk of triggering protective relays at substations and causing blackouts.

Hydro-Québec is revising its synthetic inertia to minimize the risk of a double-dip. It plans to limit power reduction during recovery to no more than 20 percent of a wind turbine's capacity. Turbine manufacturers are already testing second-generation synthetic inertia systems that comply with the new standard.

ENERCON presented an upgraded synthetic inertia control scheme at last year's Wind Integration Workshop. Whereas the first generation of ENERCON Inertia Emulation revved rotors back to their optimal speed as quickly as possible, the new scheme uses power estimation and closed-loop control to enable smooth and tunable re-acceleration. Synthetic inertia requirements, meanwhile, may be spreading. Grid operators in Ontario and Brazil have already joined Hydro-Québec's lead, and Fischer says the first harmonized grid code for European generators, which entered into force earlier this year, "opens the doors to European system operators to ask for inertial response from wind."

FUEL CELL: AN ALTERNATIVE RENEWABLE ENERGY SOURCE

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Energy is one of the most complicated networks that one can choose to alter. The latest acute energy crisis of the depletion of fossil fuels demand a necessity to come up with the invention of something that can replace conventional energy production methods and still give more than satisfactory energy results. Fuel cell is the answer to this necessity. Fuel cell is an electrochemical energy conversion device which constantly produces electricity using hydrogen and oxygen. Fuel cell on no account goes dead as long as there is a flow of reactants into the cell. Also the presence of no moving parts inside the fuel cell makes it resistant to wear and tear. Fuel cells generate electricity from an electrochemical reaction between oxygen/air and a fuel. The electricity produced from fuel cells can be used to power all sorts of devices, from cars and buses to laptops mobiles phones. However, there are certain constraints which reduce its performance can be eliminated through suitable modifications. There are several different types of fuel cells, each using a different chemistry. In that, Direct Alcohol Fuel Cell (DAFC) is taken as an example, which directly converts the chemical energy stored in a liquid alcohol fuel, commonly methanol but also ethanol, ethylene glycol, or *n*-propanol, to produce electricity. Because of their simplicity, high energy density when compared to Li-ion battery, instantaneous recharging, and presumably long life, low pollutant emissions, low operation temperature, environmental friendliness, DAFCs have been identified as the most promising candidate to replace batteries in micro power applications or any other electrical appliances.

"If faith in ourselves had been more extensively taught and practiced, I am sure a very large portion of the evils and miseries that we have would have vanished."

- SWAMY VIVEKANANDA

“STARVING” BACTERIA TO DOUBLE ENERGY EXTRACTION FROM SEWAGE

Global efforts to extract energy from sewage in forms such as heat, biogas and even electricity may get a boost thanks to the work of a team of biochemists and microbiologists from Ghent University in Belgium, who are collaborating on a pilot project with DC Water in Washington DC.

Sewage from bathrooms and kitchens is a potential energy source because it contains various organic substances suspended in wastewater. If we want sewage treatment to be truly self-sustaining, the trick will be to find an efficient way to separate the organic



matter from the wastewater – that way the wastewater can be recycled, and the organic matter can be used to generate bioenergy. Currently, the overall principle of most sewage treatment plants revolves around optimizing the way microorganisms such as bacteria, fungi and protozoans feed on the organic contaminants in wastewater. As the microorganisms eat the organic matter, they form particles that clump together and settle at the bottom of a tank, allowing a relatively clear liquid to be separated from the solids and further purified.

This often includes a step called “contact stabilization,” which involves using two aeration tanks to ensure the microorganisms are as active as possible before introducing them to the next batch of effluent needing treatment. At the moment, the overall sewage treatment process recovers around 20 to 30 percent of the organic matter within the sewage mix. Dr Francis Meerburg, a researcher on the Belgian project, said their aim was to improve the way bacteria captures organic material.

“Our approach is unique because we have developed a high-rate variation of the so-called contact-stabilization process,” says Meerburg.

The team discovered they could improve yields within the contact stabilization process by ensuring the bacteria were as “hungry” as possible.

“We periodically starve the bacteria, in a kind of ‘fasting regimen’,” explains Professor Nico Boon. “Afterwards, wastewater is briefly brought into contact with the starved bacteria which are gluttonous and gobble up the organic matter without ingesting all of it. This enables us to harvest the undigested materials for the production of energy and high-quality products. We [then] starve the rest of the bacteria, so they can purify fresh sewage again.” This new method can recover more than 55 percent of the organic matter from the sewage, which is a big improvement over current rates of 20 to 30 percent. According to the team’s calculations, this amount should provide enough energy to completely treat sewage without the need for external electricity sources.

Professor Siegfried Vlaeminck told New Atlas that this could result in lower energy bills for the public, and a more energy-neutral process for wastewater treatment plants. “We’re not going to solve climate change with our process, but every bit helps,” Vlaeminck says. “For comparison: in our region of six million people (in Flanders), the energy usage of our sewage treatment municipality, Aquafin, corresponds to the residential electricity use of more than 690,000 people (more than 10 percent of the population). This gives an idea on the energy saving potential and impact, if all sewage treatment would be energy neutral.” As a clear sign that there’s a strong appetite for more efficient, affordable and sustainable processes in wastewater treatment, the team’s work has gone directly from the lab to a large-scale application in the USA’s capital city.

The researchers are currently collaborating with DC Water (the District of Columbia Water and Sewer Authority) to implement the new process on a part of the plant’s full-scale water treatment installation. The next step is to evaluate how well the process can help achieve more efficient wastewater treatment on a large scale.

Source: Ghent University

LIFTING HOUSES TO ESCAPE CHENNAI FLOODS

Memories of the ruinous floods in Chennai last year, partially blamed on climate change, have prompted many residents to raise the height of their houses to avoid getting inundated. If you cannot beat the flood, rise above it. This has become the mantra for some of the families with houses in the low-lying areas of Chennai that suffered severe flooding in November-December 2015. As the string of low-pressure weather events that constitute the northeast monsoon for Chennai is beginning, the city is hoping that flooding like that of the last year does not occur this year. Communities are also working to build upon the experience gained from the last floods to prevent some of the mistakes and improve on the situation.

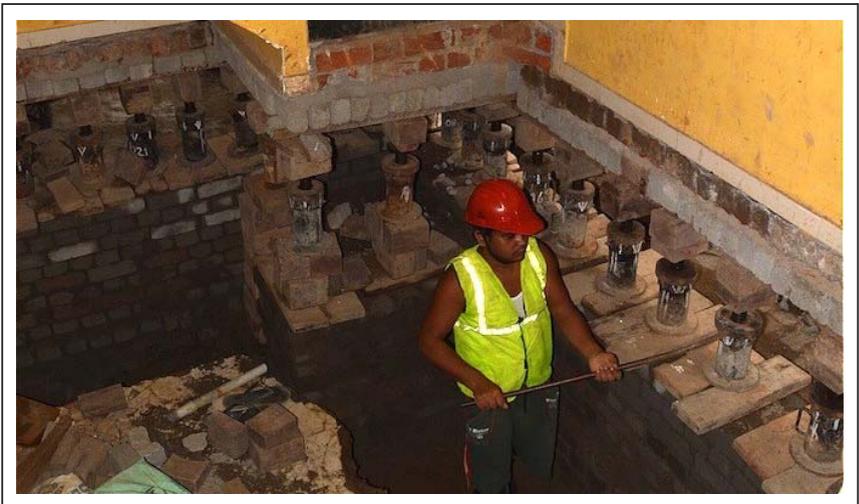
Rain scare

Even though floods of the magnitude that happened in 2015 were unprecedented, it left a scar on residents of Chennai, one that resurfaces every time rain is predicted. In November-December 2015, the city received the highest rainfall in 100 years. This – combined with the reduction of the wetlands and waterways system in the city – led to floods of the kind that left their mark on the walls of buildings and also the minds of people.

Raising homes

Since residents do not have control over the rate at which the roads are laid, they have been looking at ways to increase the height of their floors, according to R.R. Krishnamurthy, professor and head, Department of Applied Geology, University of Madras. It is here that the possibility of getting specialist engineers to raise their homes has attracted the attention of the residents, and many families have opted for it, especially in the low-lying parts of the city. "This is an example of innovative adaptation to a climate-related extreme weather event,"

Krishnamurthy told indiaclimatedialogue.net. His team, in partnership with ETH University of Zurich, Switzerland, is carrying out a Climate Disaster Recovery Planning (CDRP) project in two legislative assembly constituencies of the city — Velachery and Mylapore. The aim of this project is to understand the social, economic and



institutional mechanisms that came to the rescue of the residents during the 2015 floods, and the steps that can be taken to prevent trauma during future events.” Velachery is a new part of the city which was affected badly in the 2015 floods, and Mylapore is the old part of the city that escaped heavy inundation. We chose these locations for a micro study, so that we have an idea of the resilience in different localities,” observed Krishnamurthy. This University of Madras department had earlier prepared the Climate Disaster Resilience Index (CDRI) for Chennai in 2010 for the Chennai Corporation, in collaboration with Kyoto University of Japan. They had followed it up with the Climate Action Plan for the city in 2011.

Faraway companies

Interestingly, the building contractors who have been doing the house lifting work come from as far Yamuna Nagar in Haryana. According to Rajesh Kumar, managing director of MCMD Engineering Works Private Ltd, one of the companies in the lifting business, though they have worked in many parts of the country in 2016, it was from Chennai they got most requests. As a result, the company even opened a branch in the city.” We had good number of enquiries from Chennai after the 2015 floods,” Kumar told indiaclimatedialogue.net. His family’s companies together carried out hundreds of renovations in Chennai during the year, which was like boom business. For instance, on one street in Madipakkam (adjacent to Velachery), the floor heights of four buildings had already been raised and one was in the process of being lifted.

Jacked up

The lifting operation involves placing jacks under the plinth of the house and raising the building by one foot at a time. The raised area is then filled in with masonry, before raising the building by another foot. At Chennai the highest they have raised is six feet, at Madipakkam. Kumar says that their family developed and perfected this method, starting from the time of his father in 1991. At a three-storeyed building being lifted in Madipakkam, construction supervisor Bachan Das and his team have placed a series of jacks along the walls of the house. Their aim is to lift the floor of the building by five feet, so that it is above the water even if it floods. As a lead worker shouts out instructions, workers turn each of the jacks by a predetermined amount. Das told indiaclimatedialogue.net that it is critically important to lift all the jacks by the same amount, so that cracks do not develop on the walls. Once the building is lifted and the new walls built, soil is filled and concreting done to build the floor of the bottom floor afresh. The rest of the floors remain as they were before the renovation. According to Das, the idea behind such renovations is to keep buildings intact at a cost less than a quarter of what would be required to construct afresh. At present they charge Rs 250 per square foot per floor for their work. Even with the cost of material being extra, house lifting provides an opportunity to owners to keep their floors above water without having to demolish and build afresh.

“This building is only eight years old and that is the reason we opted for this renovation,” said K. Sridhar, owner of one of the three apartments in the building. “When we built this house our floor was higher than the road. Now the road is higher so we need to lift our floor.”

Adapting to climate change

Chennai residents’ opting for building-lifting technologies is a kind of adaptation to climate change. Due to its flat terrain and short spells of heavy rainfall, the residents of many parts of the city are used to water logging during the rainy season. However, the floods of 2015 went beyond what the city had experienced before, and hence the residents have started resorting to this innovative adaptation technique.

The United Nations Framework Convention on Climate Change Secretariat defines adaptation as “adjustments in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts. It refers to changes in processes, practices, and structures to moderate potential damages or to benefit from opportunities associated with climate change.”

According to the Tamil Nadu State Action Plan on Climate Change, though the frequency of tropical cyclones may decrease in the future, they are likely to increase in intensity. Further, the trend in the state also shows that rainfall during the southwest monsoon has decreased whereas rainfall during the northeast monsoon has been increasing. The combined impact could mean more events like the 2015 floods. Keeping the floor above water would be a way of dealing with it.

Courtesy : S. Gopalakrishna Warriar, Indian Climate Dialogue.

“A particular shot or way of moving the ball can be a player’s personal signature, but efficiency of performance is what wins the game for the team.” - PAT RILEY



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ENERGY CONSERVATION THROUGH ENERGY EFFICIENCY – 22

Pumping Systems and Energy Efficiency and Conservation:

Motors Driven Pumping Systems are an important area of use of Energy, be it Industries or Buildings or Homes or Agriculture. It will also be interesting and relevant to understand some basics about types of Pumps and Pumping and their evolution and uses as they play a very important role in deciding the “**Overall Efficiency**” of the Pumping System. We are commencing to discuss about Pumps used in Building Services and most of the types of pumps discussed will also be common to Industries and Agriculture and homes as well.

Pumps Used in Building Services can be classified as follows.

- a) Sump Pumps
 - Monobloc Pumps
- b) Bore well Pumps
 - Submersible Pumps
 - Jet Pumps

All the above, in principle, are ‘Centrifugal Pumps’ which have the following characteristics

- a) Very simple design
- b) Two main parts are the impeller and the diffuser
- c) Impellers - and they could be of one of the following metals
 - Bronze
 - poly carbonate
 - cast iron
 - stainless steel

Pressure developed by the Pump and the duty performed depends upon

- Impeller diameter
- No. of impellers
- size of the impeller eye
- shaft speed

The Size of the pump for the duty to be performed will depend on

- Head
- Capacity

Some of the advantages of centrifugal Pump can be identified as

- Very efficient
- Produce smooth and even flow
- Reliable with good service life

And the disadvantages can be identified as -

- Loss of priming easily
- Efficiency depends upon operating design head & speed.

One of the important developments of Centrifugal Pumps are Submersible Pumps which have been evolved to overcome the ‘Suction Head’ limitations of Centrifugal Pumps and to be able to operate submerged into the liquid or water. They can be of both types suitable for use in ‘Bore Wells’ and in deep open wells. They have the following characteristics.

- Centrifugal pump closely coupled with motor

- Does not require long drive shaft
- Motor operates at a cooler temperature.
- Noiseless operation.
- **High efficiency**
- Smooth and even flow

The main advantage is the High Efficiency but in case of repair, full pump will have to be removed from under. Another important development of Centrifugal Pumps are the “Jet Pumps”, again with the purpose of overcoming the ‘Suction Head’ limitations of Centrifugal Pumps. These have the following Characteristics.

- Combination of a surface centrifugal pump, nozzle and venturi arrangement.
- Used in small diameter bore wells.
- Simple design
- Low purchase and maintenance cost.
- Easy accessibility to all moving parts.
- **Low efficiency.**

Though the main advantage is that it does not have to be submerged and thus less risky, the main disadvantage is its (very) low efficiency.

Before we proceed to examine some actual case studies which are comparative ‘Tests’ carried out to establish the Energy Conservation potentials focusing on selection of more ‘Efficient Solutions’, it will be apt to understand the basic ‘Pump Performance calculations’.

- Overall Efficiency = Hydraulic power (P2) X 100/ Power input (P1)
- Pump efficiency = Hydraulic power (P2) X 100/ Power input to pump shaft (P3)
- Hydraulic Power (P2) = Q X Total Head (hd - hs) X p X g / 1000
- Q = discharge in m³/s
- p = density of fluid in kg/ m³
- g = acceleration due to gravity (m/s²)
- P1 = 1.732 X V X I X pf
- P3 = P1 X eff. of motor.

The key Parameters that determine the efficiency are the following

- Flow
- Head (total of suction and delivery)
- Power

The measurement of flow and Discharge (Q) is an important task which can be done by one of the following Techniques.

- Tracer Method
- Ultrasonic flow measurement
- Tank filling method
- Installation of online flow meter

Determination of total head of suction and delivery or discharge heads which include the friction head or the extra pressure requirements caused by the friction in the pipes of flow.

a) Suction head

- measured from pump inlet pressure gauge reading

b) Discharge head

- This is taken from the pump discharge side Pr. gauge

PUMP EFFICIENCY CALCULATION EXAMPLES

SI No	ITEM	Pump1	Pump2	Units
1	Voltage	406	407	volts
2	Current	6.0	6.6	amps
3	P.F	0.83	0.82	
4	Power input	3.5	3.48	KW
5	Dis. Head	22.2	22.2	m
6	Suc. Head	2.2	2.2	m
7	discharge	8	8	L/s
8	Hyd. Power	1.57	1.57	KW calculated from head and discharge
9	Pump Effi.	44.85	45.10	percent

The following cases of comparative studies of types of Pumps or solutions will illustrate the saving potentials through right choices.

Case 1 – Bore well

Comparative tests were conducted in the same bore well by installation of Pump sets alternatively. The discharge measurements were through ‘Tank Fill’ method.

Test were conducted at the same Bore well

a) Jet Pump

- HP of Pumpset : 2HP
- Head pumped : 150’ + 40’
- Energy consumption measured for pumping 2000 Ltrs = 4.10 units



b) 4 inches Oil Filled Submersible Pump set

- HP of pump set is 1.25HP 12 stage
- Head pumped 150’+ 40’
- Energy measured for pumping 2000 Ltrs = 0.9 units



Energy saving potential through use of submersible pump set in place of jet pump is 77%

Case 2 – Deep open well

Test conducted at the same well

a) Jet Pump

- HP of Pumpset : 1HP
- Head pumped : 60’
- Energy measured for pumping 2000 Ltrs = 1.0 units



b) Open Well Submersible Pump set - (HMPS)

- HP of Pumpset : 1HP
- Head pumped : 60’
- Energy measured for pumping 2000 Ltrs = 0.46 units



Energy saving potential through use of submersible pump set in place of jet pump is 54%.

(To be continued)



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Dont stop when you are tired. Stop when you are done! - MARILYN MONROE



ANAND MAHINDRA
Mahindra



It was under Anand Mahindra's management that his group successfully set up global objectives and standards for achieving success.

Born on 1st May, 1955 in Mumbai, India into a well-known business family, Anand showed keen interest in his grandfather KC. Mahindra's business and subsequently joined it. He finished his graduation from Harvard and earned the degree of MBA from Harvard Business School, Boston, Massachusetts in 1981.

Mahindra became the MD of M&M in 1997 and Chairman in 2003 on his own merits. He has single handedly elevated the Mahindra Group from a mere jeep and truck producing firm to a multi-national entity with Utility Vehicles, Multi Utility Vehicles and Sports Utility Vehicles. He was also a co-promoter of **Kotak Mahindra Finance Ltd**, which became one of the leading private sector banks in 2003. Under his leadership, the Mahindra group has grown rapidly through both acquisitions and Greenfield business development with several high-profile mergers, including **Satyam Computer Services (2009)**; **Reva Electric Motors (2010)** and **Sangyong Motor company (2010)**. In 2002, the company launched an indigenously developed SUV, the Scorpio, which today has gone global. Not only has he a charismatic presence as a vocal industry leader, but also made M&M into a Rs 87,450 crore conglomerate, employing more than 1,50,000 people in 100 countries. M&M became the third largest passenger vehicles company in India after Maruti Suzuki and Hyundai in February 2013. Anand's important awards include **knight of the Order of Merit by the President of the French Republic in 2004**, **Entrepreneur of the Year Awarded by Ludhiana Management Association in 2006**, **Business Leader of the Year (2008-2009) by the Economic Times and Indian Entrepreneur of the year 2009 by Ernst & young**. He gave USD 10 million to Harvard's Humanities Center. He is a Trustee of the KC Mahindra Education Trust, which provides scholarships to students. He initiated the Nanhi Kali program in 1996 to provide free education to economically underprivileged girl children in India. He is among the top 10 influential Twitter personalities in India. On India Today's High & Mighty Power List 201, he has been ranked No.3.

HUMOUR - PARAPROSDOKIANS...

Here is the definition: "A figure of speech in which the latter part of a sentence or phrase is surprising or unexpected; frequently used in a humorous situation."

"Where there's a will, I want to be in it." - is a paraprozdokian.

So, now enjoy these:

1. Do not argue with an idiot. He will drag you down to his level and beat you with experience.
2. The last thing I want to do is hurt you. But it's still on my list.
3. Light travels faster than sound. This is why some people appear bright until you hear them speak.
4. If I agreed with you, we'd both be wrong.

5. We never really grow up, we only learn how to act in public.

6. War does not determine who is right - only who is left.

7. Knowledge is knowing a tomato is a fruit. Wisdom is not putting it in a fruit salad.

8. Evening news is where they begin with 'Good Evening, and then proceed to tell you why it isn't.

9. To steal ideas from one person is plagiarism. To steal from many is research.

10. A bus station is where a bus stops. A train station is where a train stops. On my desk, I have a work station.

BIG, BEAUTIFUL AND SUSTAINABLE – 10 OF THE WORLD’S MOST ENERGY EFFICIENT OFFICES - 6

POWERHOUSE KJØRBO, OSLO (NORWAY)



The Powerhouse Kjørbo in Oslo, Norway was nominated in 2014 for the Norwegian Technology Award for its outstanding energy performance. The complex is made up of two renovated buildings that were rebuilt around their existing structures using recycled materials. The renovation reduced the building’s energy need by a staggering 90% and the solar panels built on the structures roof produce twice the amount of energy needed to power the building. The complex uses ground wells in a

nearby park to provide heating for its radiators, water supply and ventilators.

As well as interior modifications the building’s exterior also plays a huge part in its energy efficiency with its facades being made of charred wood which provides an environmentally friendly and maintenance free material to reduce the cost of the building upkeep. It also has exterior sun shading screens that are automatically activated to avoid the building overheating; these are transparent to avoid obstructing the view.

(To be continued...)

THE WORLDS TOP 10 MOST INNOVATIVE COMPANIES IN ENERGY - 6

DOW CHEMICAL



For redesigning the notion of the solar home with dead-simple shingle arrays. Speeding up the adoption of solar power is not just a challenge of bringing down costs by increasing efficiencies; it’s also a matter of design. How do we integrate energy production into our homes with ease, and with

tolerable aesthetics? Dow’s Powerhouse Solar Shingles, which can slash energy bills by up to 60%, are a crucial step in solving this problem: Rather than install bulky photovoltaic superstructures, customers have an electrician attach the Solar Shingles to their roof in the place of conventional shingles. Demand is clearly increasing among consumers—Dow has continued rolling out the award-winning systems across U.S. markets, most recently in Maryland, Washington, D.C., and Virginia. *(To be continued...)*

அளவிட முடியாத நன்மைகளை அள்ளிதரும் பீன்ஸ்

இன்றைய தலைமுறையினர் காய்கறிகளை சரியாக சாப்பிடாமல் ஐங்க்.புட் உணவுகளை மட்டும் அதிகம் உட்கொள்வதால் அவர்களின் உடலில் ஊட்டச்சத்து குறைபாடு ஏற்பட்டு, இதன் மூலம் அடிக்கடி நோய்வாய்ப்படுகின்றனர்.



மேலும் வீட்டில் உள்ளோர் எவ்வளவுதான் காய்கறிகளை வாங்கி நன்கு சமைத்துக் கொடுத்தாலும், அதை சாப்பிடுவதில்லை. குறிப்பாக பீன்ஸ் பொறியல் என்றால் பலர் சாப்பிடாமலேயே இருப்பார்கள்.

புற்றுநோயைத் தடுக்கும்:

பீன்ஸ் சாப்பிட்டு வந்தால் அதில் உள்ள .:பிளேவோனாய்டுகள் புற்றுநோயை உண்டாக்கும் செல்களின் வளர்ச்சியைத் தடுத்து புற்றுநோய் வருவதற்கான வாய்ப்பைத் தடுக்கும்.

நீரிழிவை கட்டுப்படுத்தும்:

இரத்தத்தில் உள்ள சர்க்கரையின் அளவைக் கட்டுப்பாட்டுடன் வைப்பதற்கு பீன்ஸ் பெரிதும் உதவியாக இருக்கும். ஏனெனில் அதில் உள்ள கார்போஹைட்ரேட்

மெதுவாக கரைவதால் அது இரத்தத்தில் அளவுக்கு அதிகமாக சர்க்கரை சேர்வதைத் தடுக்கும்.

வைட்டமின்கள் மற்றும் கனிமச் சத்துகள்:

பீன்ஸில் ஆன்டி ஆக்ஸிடன்ட்டுகள், புரோட்டீன், நார்ச்சத்து, காம்ப்ளக்ஸ், கார்போஹைட்ரேட், வைட்டமின்கள் மற்றும் கனிமச் சத்துக்களான பொட்டாசியம், .:போலேட், காப்பர், இரும்புச்சத்து, மாங்கனீஷ், பாஸ்பரஸ் மற்றும் மக்னீசியம் இருப்பதால், இது உடலில் ஊட்டச்சத்து குறைபாடு ஏற்படுவதைத் தடுத்து உடலை ஆரோக்கியமாக வைத்துக் கொள்ள உதவும். இதயத்திற்கு சிறந்தது.

பீன்ஸில் உள்ள சிலிகான் என்னும் கனிமச்சத்து எலும்புகளை வலுவாகவும், ஆரோக்கியமாகவும் வைத்துக் கொள்ள உதவும். மேலும் மற்ற காய்கறிகளை விட இந்த காய்கறியில் உள்ள சிலிகான் எளிதில் உறிஞ்சப்படுவதோடு, செரிமானமும் அடையும்.

சிலருக்கு கோதுமை, பார்லி போன்ற தானியங்களில் உள்ள க்ளுடனால அலர்ஜி ஏற்படலாம். அத்தகையவர்கள் தானியங்களுக்கு பதிலாக பீன்ஸ் சாப்பிட்டால், தானியங்களால் கிடைக்கக் கூடிய சத்துக்களை பீன்ஸ் மூலம் பெறலாம்.

முதுமையை எதிர்த்துப் போராடும்:

பச்சை பீன்ஸில் உள்ள கரோட்டினாய்டுகள் சருமத்தின் தரத்தை அதிகரித்து, முதுமையை எதிர்த்துப் போராடும்.

வெந்நீர் குடிப்பதன் நன்மைகள்

சுக்கு கலந்த வெந்நீரை அடிக்கடி குடித்து வந்தால், வாயுத்தொல்லையே இருக்காது.



அடிக்கடி வெந்நீர் குடிக்கும் பழக்கம் உள்ளவர்களுக்கு அஜீரணத்தால் ஏற்படும் தலைவலி வரவே வராது. வெந்நீர் ரத்தத்தில் உள்ள நஞ்சை வெளியேற்றுகிறது.

வயிற்றுப் புண்ணினால் ஏற்படும் வலியைக் குறைக்க, மிதமான சூடான வெந்நீரைச் சிறிது சிறிதாகக் குடிப்பது நல்லது.

நல்ல பலமான விருந்து சாப்பிட்ட பிறகு வெந்நீரைக் குடித்தால், சாப்பிட்ட விருந்தானது எளிதில் ஜீரணமாகிவிடும்.

மிருதுவான சருமம் பெற, பார்லி ஒரு தேக்கரண்டி போட்டு வேகவிட்ட வெந்நீரை அடிக்கடி குடித்து வரவேண்டும்.

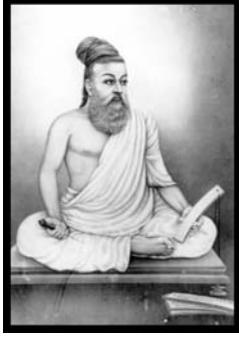
கால் பொறுக்கும் அளவுக்கு வெந்நீரை ஒரு டப்பில் விட்டு, அதில் கல் உப்பையும் போட்டுக் கலக்கவும். அந்த வெந்நீரில், கால் பாதங்களைப் பதினைந்து நிமிடங்கள் வைத்து எடுத்தால் கால் வீக்கம் குறையும்.

பித்த வெடிப்பு உள்ளவர்கள் வெந்நீரில் கால் பாதங்களை வைத்து எடுத்த பிறகு, பாதங்களை பியூமிஸ் ஸ்டோன் கொண்டு தேய்த்தால், நாளடைவில் பித்த வெடிப்பு குணமாகி விடும்.

தாகம் எடுத்தால் பச்சைத் தண்ணீரைக் குடிக்காமல், பொறுக்கும் அளவு சூடான வெந்நீரைக் குடித்து வந்தால், உடம்பில் உள்ள வேண்டாத கழிவுகள் வெளியேறும்.

சாப்பிடுவதற்கு அரை மணி நேரம் முன்பு ஒரு டம்ளர் வெந்நீர் குடித்து வந்தால் உடல் எடை குறையும்.

TIRUKKURAL AND MANAGEMENT IN A 'NUTSHELL' - 45



It is very unfortunate that the current situation in the Country is raids and searches of highly placed men in society, places and institutions and establishments to unearth illegal activities, moneys and other forms of wealth accumulated and hoarded. All these create disturbances in Economic activities and ultimately disturb common life and also shatters the confidence of the common men. The problems can be identified in two important dimensions of 'Lack of Arivillar Theyruthal Responsibilities'. Tiruvalluvar has brought out these morals in many of his Kurals and a few selected below will illustrate the Wisdom.

Perumaikkum Enaich Chirumaikkum

Thaththam

Karumame Kattalaik Kal

Kural 505

பெருமைக்கும் ஏனைச் சிறுமைக்கும் தத்தம்
கருமமே கட்டளைக் கல். குறள் 505

**"By the touchstone of deeds is seen
If any one is great or mean."**

*Atraaraith Theyruthal Oombuga; Matruavar
Patrilar Naanaar Pazhi Kural 506*

அற்றாரைத் தேறுதல் ஓம்புக; மற்றுஅவர்
பற்றிலர் நாணார் பழி குறள் 506

**"Choose not those men without kinsmen
Without affine or shame of sin."**

*Kaadanmai Kandaarivuariyarth Theyruthal
Pethaimai Ellam Tharum Kural 507*

காதன்மை கந்தா அறிவுஅறியார்த் தேறுதல்
பேதைமை எல்லாம் தரும் குறள் 507

**"On favour leaning fools you choose;
Folly in all its forms ensues."**

HOME FESTIVALS - 2

மாசி - Masi (February/March)



Above, this is the month of Mahasivaratri, Siva's great night. In the above painting four stories associated with the festival are told. At

lower left a hunter has been cornered in a tree-top by wild beasts, where he must spend the night. To avoid sleep he plucks leaves from the bilva tree, sacred to Lord Siva, and drops them upon a sivalinga below—a traditional form of worship. Many undertake fasts and stay awake the whole night, praying to Lord Siva both at home and in temples (lower right). The home observance of Karadainombu (upper right) derives from the story of Savitri and her husband, Satyavan. They enter a forest, where he dies. When Lord Yama, the God of Death, comes to take his life, Savitri persuades Yama to let him live. The intent of the observance is that wives not be separated from their husbands. Another explanation of this festival (upper left) is that on this day Lord Siva tied a thread to parvati's right hand after their marriage as a sign of protection and fidelity.

(To be continued)

***Time is not measured by the passing of years but by what one does,
what one feels, and what one achieves.***

- PANDIT JAWAHARLAL NEHRU

THE SHANGHAI TOWER

The Shanghai Tower was designed by the American architectural firm Gensler, with Chinese architect Jun Xia leading the design team.

The tower takes the form of nine cylindrical buildings stacked atop each other, totalling 121 floors, all enclosed by the inner layer of the glass façade. Between that and the outer layer, which twists as it rises, nine indoor zones provide public space for visitors. Each of these nine areas has its own atrium, featuring gardens, cafés, restaurants and retail space, and providing 360-degree views of the city.

Both layers of the façade are transparent, and retail and event spaces are provided at the tower's base. The transparent façade is a unique design feature, because most buildings have only a single façade using highly reflective glass to lower heat absorption, but the Shanghai Tower's double layer of glass eliminates the need for either layer to be opaqued. The tower is able to accommodate as many as 16,000 people on a daily basis.

The Shanghai Tower joins the Jin Mao Tower and SWFC to form the world's first adjacent grouping of three supertall buildings. Its 258-room hotel, located between the 84th and 110th floors, is to be operated by Jin Jiang International Hotels as the Shanghai Tower J-Hotel, and at the time of its completion it will be the highest hotel in the World. The tower will also incorporate a museum. The tower's sub-levels provide parking spaces for 1,800 vehicles.

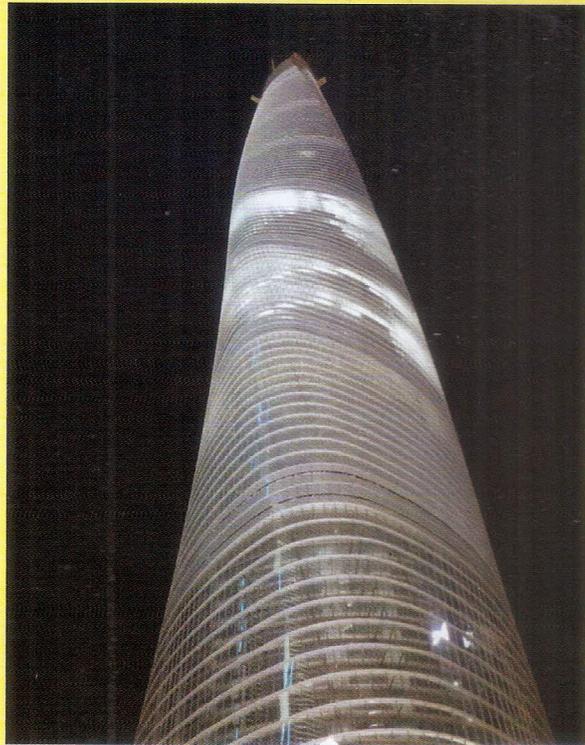
Vertical Transportation System

The vertical transportation system for Shanghai Tower was designed by an American consultant, Edgett Williams Consulting Group with principal Steve Edgett as primary consultant. Working closely with Gensler's design and technical teams to create a highly efficient core, Edgett created an elevator system in which office floors are served via four sky lobbies each served by double-deck shuttle elevators. Access to the hotel is through a fifth sky lobby at levels 101/102. Each two-level sky lobby serves as a community center for that zone of the building, with such amenities as food and beverage and conference rooms. Local zones are served by single deck elevators throughout the tower, and the Observation Deck at the top of the tower is served by three ultra-high speed shuttle elevators which travel at 1080 mpm, which is the highest speed ever developed for commercial building use. These three shuttle elevators are supplemented by three fireman's elevators which will significantly increase the visitor throughput to the observation deck at peak usage periods. In the event of a fire or other emergency, the building's shuttle elevators are designed to evacuate occupants from specially-designed refuge floors located at regular intervals throughout the height of the tower.

In September 2011, Mitsubishi Electric Corp. announced that it had won a bid to construct the Shanghai Tower's elevator system. Mitsubishi Electric supplied all of the tower's 149 elevators (108 of which are lifts), including three high-speed models capable of travelling at 1,080 metres (3,540 ft) per minute – the equivalent of 64.8 kilometres (40.3 mi) per hour, or 18 metres/second. At the time of their installation in 2014, they were the world's fastest single-deck elevators (18 metres/second) and double-deck elevators (10 metres/second). As of 10 May 2016, a Mitsubishi press release noted that one of the three shuttle elevators had been installed to travel 1230 m per minute - the equivalent of 73.8 kilometres per hour (46 mph), the highest speed ever attained by a passenger elevator installed in a functioning building. The building also broke the record for the world's furthest-travelling single elevator, at 578.5 metres (1,898 ft), surpassing the record held by the BurjKhalifa. The Shanghai Tower's tuned mass damper, designed to limit swaying at the top of the structure, was the world's largest at the time of its installation.

The design of the tower's glass facade, which completes a 120° twist as it rises, is intended to reduce wind loads on the building by 24%. This reduced the amount of construction materials needed; the Shanghai Tower used 25% less structural steel than a conventional design of a similar height. As a result, the building's constructors saved an estimated US\$58 million in material costs. Construction practices were also optimised for sustainability. Though the majority of the tower's energy will be provided by conventional power systems, vertical-axis wind turbines located near the top of the tower are capable of generating up to 350,000 kWh of supplementary electricity per year. The double-layered insulating glass façade was designed to reduce the need for indoor air conditioning, and is composed of an advanced reinforced glass with a high tolerance for shifts in temperature. In addition, the building's heating and cooling systems use geothermal energy sources.

THE SHANGHAI TOWER



SITE

Location: Lujiazui Finance and Trade Zone, Pudong district, Shanghai, China
Area: 30,370 square meters (7.5 acres)

TOWER

Height: 632 meters (2,073 ft)
Stories: 121 occupied floors
Area: 410,000 square meters above grade (4.4M sf)
 166,000 square meters below grade (1.8M sf)
Program: Office, luxury hotel, entertainment, retail and cultural venues

PODIUM

Height: 36.9 meters (121 ft)
Stories: 5 stories above grade
Area: 46,000 square meters (495,000 sf)
Program: Retail, banking, restaurant, conference, meeting and banquet facilities. Below-grade levels will house retail, 1,950 parking spaces, service and MEP functions.

TALLEST BUILDING IN CHINA

Shanghai Tower is the tallest building in China—and 2nd tallest in the world.

120-DEGREE TURN

From base to top, the tower makes a rotation that is optimal for minimizing wind loads. This geometry saved \$58 million in costly structural materials.

43 SUSTAINABLE TECHNOLOGIES

The design adopts strategies that reduce energy consumption by 21 percent.

ECONOMICAL SKIN

The circular inner-glass façade required 14 percent less glass than a square building of the same total floor area.

6-METER-DEEP (18 FOOT) MAT FOUNDATION

Trucks pumped 61,000 cubic meters of concrete during a continuous 63-hour pour in March 2010.

POWER GENERATION

A 2,130-kW natural gas-fired cogeneration system on the site will provide electricity and heat energy for the low zone areas.

Raychem RPG 

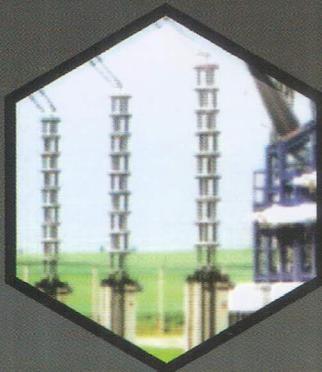
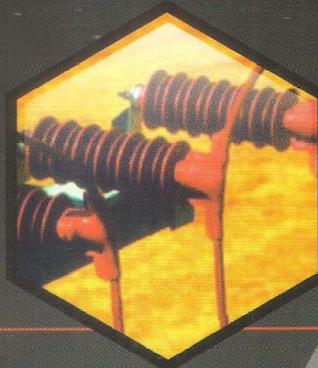


Low Voltage Surge Arresters

Provide Protection for LV overhead lines, consumer in-house supplies, distribution transformers and other appliances

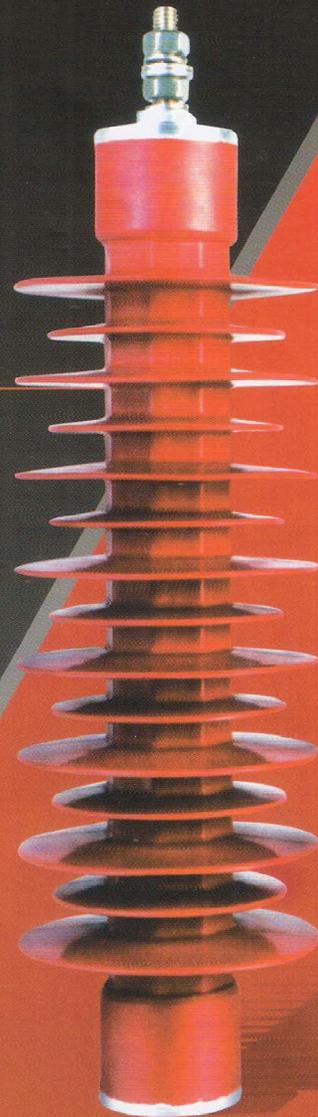
Medium Voltage Surge Arresters

For indoor and outdoor applications, for protection of overhead lines, DC locomotives, switchgear applications and motor protection



High Voltage Surge Arresters

For protection of transmission systems up to 800 kV



Polymeric Surge Arresters

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