



# ELECTRICAL

## INSTALLATION ENGINEER

### NEWS LETTER

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

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## EDITORIAL

Dear Members, Fellow Professionals and Friends,

*Seasons Greetings To All !*

*Best Wishes For Happy And Safe Deepavali !!*

The last day of October made us remember two more Great Indian Personalities namely Sardar Vallabai Patel and Smt. Indira Gandhi on their Jayanthi and Martyrdom Days respectively. We are going to be remembering Jawaharlal Nehru on his Jayanthi on the 14<sup>th</sup> of this month. We cherish and celebrate their memories for their great contribution in Uniting the Nation, Building the Nation and bringing Honour to the Nation. The efforts have continued by all the Leaders who took the mantle one after the other till today, that we have grown with pride as a Nation aspiring to become an 'Economic Super Power', a Technically advanced Country and a Manufacturing Hub for the World in the years to come. It is the envy of the World that we have remained united as a Great Democracy of the World for over 70 years, in spite of various problems, mostly due to the inherent strengths of our Country and the people and our Great Heritage.

In a recent Engineering and Technology Convention at Chennai, an elected representative holding position of responsibility in Government expressed an important point to wake up Engineering Fraternity of its responsibility in the efforts of Building our Nation towards growth and progress. He mentioned that currently there are oppositions for all kinds of growth proposals by vested interests, in the guise of public interest and mass public protests are order of the day. He sadly expressed that as elected representatives, they have no option but to go with the masses and all Green Developments are painted Red. He therefore suggested that all eminent Engineering Groups and Associations could form multi disciplinary expert groups and voice neutral and unbiased views on various proposals and objections in the interest of the state and the Nation, weighing all the pro and cons.

The Law and the Courts are very much in the news all the time these days, not only due to growing disputes but also due to people trying to take law in their hands in the name of 'Rights' and resorting to all sorts of protests to paralyze normal life. Very appropriately both World Legal Services Day and National Law Day are observed on the 9<sup>th</sup> and the 26<sup>th</sup> of November. We are aware that Judiciary and the Legal System in the Country is one of the important pillars of Democracy which increases the confidence and faith of the people in Democracy. Serious efforts are made continuously to establish the Fairness of Law and Legal Functioning and the strict implementation of Law and Legal Provisions, with due consideration of our Culture, Social Life, Faiths and beliefs. This can help to create Social Harmony and create confidence in people about Law and Order in the Country. This will help people to focus on working towards betterment of their own lives and the Country through Fair Ways.

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**EDITOR**

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## KNOW THY POWER NETWORK - 134

This article focuses on a killer Electrical Wave called “Switching Surges”. We had read about tsunami waves in the story titled “Living God” but we had experienced its real destructive power only in the year “2004”. Likewise power system engineers knew about the Switching surges in early years but only witnessed it in the year “1957”, when they came face-to-face with it. Then many encounters with it had happened in USA and European continent. Then the engineers had witnessed its ugly facets. During this period, transmission voltage levels were also raised in the order of 735-763 KV.

It is not out of place to state that everything in the nature expresses itself the way it is. It cannot be changed (e.g.) Sun means heat and light; water is noted for its coolness. Switching surges is no exception to this rule. It always bring “Destructions”. It has a twin brother (Sibling) called Power frequency temporary over voltage. It is more powerful than the Switching surges – a system generated waves. During the years “1980 – 1982”, TNEB engineers had witnessed its destructive power at Singaperumal Koil 230KV substation, located near Chengalpet.

*In this context, let us make a simple comparison between “these waves and the players in the (Soccer) football game”. In this game, the aim of the forward players is to score “the goal” while that of the defence players is prevent the goal by the opposite team. Likewise the objective of the killer electrical waves like Switching Surges” is to cause maximum damages to the power network and its connected equipment, while that of the protective chain / shield is to thwart their goals and help the system / equipment to survive without any damage. So the question that stands before us is how to implement our plans. Now let us go deep in the subject.*

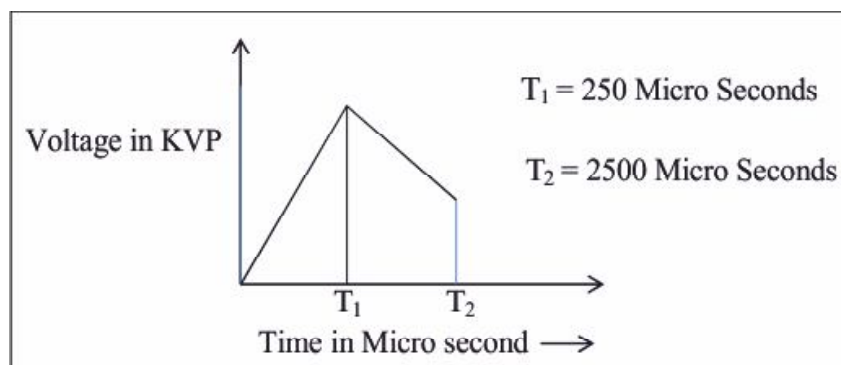
### **(1) Origin – How Switching surges are formed**

These surges are generated during the Switching operations carried out in the system. It is mainly due to the reaction of the system when its operating status is suddenly disturbed either by equipment Switching in or Switching out operations. These surges commonly occur during the “Switching on and off” of the equipment like transformers, capacitors, shunt reactors and EHV cables and EHV OH lines.

It is generally known that Switching operations in an electrical system involves either applying voltage (and current) or removing voltage (and current) from the system. All electrical circuits contain inductance, capacitance and resistance. When the current flows through an inductance, it produces magnetic flux. Any effort to change this magnetic flux, with the attendant current, will be vehemently opposed by the inductance by producing a counter emf. Higher the rate of change of flux (current), greater will be the counter emf. During the interruption of current in an electrical circuit, the current that flows through the inductance as stated above. Now it tries to flow through the capacitance present in the circuit. This step results in the transfer of the energy stored in the inductive medium to the capacitor as capacitive energy. This leads to energy oscillations till all the stored energy in the inductive medium is consumed by the resistance present in the circuit. It takes the period of several cycles. This is the genesis of the Switching surges. The presence of resistance leads to damped oscillatory voltages waves, which have very high energy content. It is mainly due to the time factor associated with the generation of these waves.

Now you can understand how these slow moving (milliseconds) surges are made highly destructive. This phenomenon commonly occurs in all switches, isolators and circuit breakers where the current is normally interrupted. But their effect is predominantly noticed only in EHV networks. The phenomenon of the Switching surges, like lightning is a random one. It never follows any pattern. The severity of the Switching surge depends upon the instant of power frequency voltage, when the switch is opened. It also depends upon the dynamic characteristics of the “arc” which appears during the separation of switch contacts. Unlike lightning, it is amenable for control / moderation. Its formation can either be controlled at the source of its origin by adopting controlled Switching (source side) or at the receiving end by providing suitable means light surge arrestors with high energy discharge capabilities and low protective level. The irony of this phenom is that the circuit breakers which generate these killer wave forms are the first victims to them. i.e. the hunted now becomes the hunter. *In this context kindly recall the Hindu mythological story of Lord Siva, who granted the boon to Padmasuran and later became his victim, i.e. the first test price of the boon obtained by him.*

### Characteristic features of Switching Surge



#### 1. Wave form

#### 2. Main drivers of Switching surges

- Switching operations in capacitive circuits
- Energization / De-energization of buses with disconnect switches
- Energization of transmission lines with / without transformer terminations
- Re-energization of lines with trapped charges.
- Re-energization of lines, cables, capacitor banks without shunt connected transformers and shunt reactors.
- Voltage magnification that occurs while Switching shunt capacitor banks
- Switching faulted lines
- Switching unloaded transformers
- Sudden loss of loads involving long transmission lines and connected transformers
- Out of phase Switching
- Ferro resonance phenomenon
- Broken conductors / single phasing in a three phase network / neutral instability phenomenon

3. **Magnitude:** Its magnitude lies in the range of 2-4 PU. Energy content is very high. Required Basic Switching Surge Level of the equipment that exists in the circuit (BSL) 83-85 percent of its Basic Impulse Insulation level (BIL)
4. **Protective measures that are commonly adopted to shield the equipment from Switching surges.**
5. **Source Side** – Provision of contact resistance in the circuit breakers concerned; controlled Switching of circuit breakers connected with shunt capacitors and shunt reactor.
6. **Receiving Side** - Surge Arrestors inclusive of line entrance arrestors and Shunt capacitors. As stated earlier, these waves can bring greater havoc because of their capacity to release a large quantum of energy in a very short time frame (micro seconds). While designing equipment and other accessories for the transmission and distribution of electric power, the over voltages brought by lightning waves gain prime importance for the system voltage levels upto 300 KV; beyond this level upto 750 KV Switching surges are warrant prominent attention. Beyond 750KV (VHV level) power frequency temporary voltages demand pointed focus / attention of the designers.

To repeat you may be aware that the lightning surges are not amenable for any control. But in the case of Switching surges, it is not so. Being system generated waves, we can easily control / moderate it either by proper design of the Switching equipment or placing reliable Metal oxide surge arrestors and Capacitors. Though many reasons / factors are fingered for the happening of Switching surges, the items given below occupy prominent place.

- Capacitor Switching
- Broken conductors / single phase Switching
- Neutral instability
- Ferro resonance phenomenon

In the next article, the temporary over Voltages will be dealt with.

Till then kindly stay tuned.



*(To be continued...)*  
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## IMPORTANT RENEWABLE ENERGY NEWS

### **Petroleum Minister to launch SATAT initiative to promote Compressed Bio-Gas as an alternative, green transport fuel**

Shri Dharmendra Pradhan, Union Minister of Petroleum and Natural Gas & Skill Development and Entrepreneurship will kick off an innovative initiative in New Delhi on 1<sup>st</sup> October, 2018, with PSU Oil Marketing Companies (OMCs), i.e. IOC, BPCL and HPCL) inviting Expression of Interest (EoI) from potential entrepreneurs to set up Compressed Bio-Gas (CBG) production plants and make available CBG in the market for use in automotive fuels. This significant move has the potential to boost availability of more affordable transport fuels, better use of agricultural residue, cattle dung and municipal solid waste, as well as to provide an additional revenue source to farmers.

Titled *SATAT*, the initiative is aimed at providing a Sustainable Alternative Towards Affordable Transportation (SATAT) as a developmental effort that would benefit both vehicle-users as well as farmers and entrepreneurs.

To be launched on the penultimate day of the ongoing *Swachhta Hi Seva* fortnight, a mass movement to fulfil Mahatma Gandhi's vision of a Clean India, this initiative holds great promise for efficient municipal solid waste management and in tackling the problem of polluted urban air due to farm stubble-burning and carbon emissions. Use of CBG will also help bring down dependency on crude oil imports and in realising the Prime Minister's vision of enhancing farmers' income, rural employment and entrepreneurship.

#### **Background**

Bio-gas is produced naturally through a process of anaerobic decomposition from waste / bio-mass sources like agriculture residue, cattle dung, sugarcane press mud, municipal solid waste, sewage treatment plant waste,

etc. After purification, it is compressed and called CBG, which has pure methane content of over 95%. Compressed Bio-Gas is exactly similar to the commercially available natural gas in its composition and energy potential. With calorific value (~52,000 KJ/kg) and other properties similar to CNG, Compressed Bio-Gas can be used as an alternative, renewable automotive fuel. Given the abundance of biomass in the country, Compressed Bio-Gas has the potential to replace CNG in automotive, industrial and commercial uses in the coming years.

There are multiple benefits from converting agricultural residue, cattle dung and municipal solid waste into CBG on a commercial scale:

- Responsible waste management, reduction in carbon emissions and pollution
- Additional revenue source for farmers
- Boost to entrepreneurship, rural economy and employment
- Support to national commitments in achieving climate change goals
- Reduction in import of natural gas and crude oil
- Buffer against crude oil/gas price fluctuations

The potential for Compressed Bio-Gas production from various sources in India is estimated at about 62 million tonnes per annum.

Compressed Bio-Gas plants are proposed to be set up mainly through independent entrepreneurs. CBG produced at these plants will be transported through cascades of cylinders to the fuel station networks of OMCs for marketing as a green transport fuel alternative. The 1,500-strong CNG stations network in the country currently serves about 32 lakh gas-based vehicles. The Working Group on Biofuels, set up under the National Policy on Biofuels 2018, is in the process of finalising a pan-India pricing model for Compressed Bio-Gas.

The entrepreneurs would be able to separately market the other by-products from these plants, including bio-manure, carbon-dioxide, etc., to enhance returns on investment.

It is planned to roll out 5,000 Compressed Bio-Gas plants across India in a phased manner, with 250 plants by the year 2020, 1,000 plants by 2022 and 5,000 plants by 2025. These plants are expected to produce 15 million tonnes of CBG per annum, which is about 40% of current CNG consumption of 44 million tonnes per annum in the country. At an investment of approx. Rs. 1.7 lakh crore, this initiative is expected to generate direct employment for 75,000 people and produce 50 million tonnes of bio-manure for crops.

The National Policy on Biofuels 2018 emphasises active promotion of advanced bio-fuels, including CBG. The Government of India had launched the GOBAR-DHAN (Galvanising Organic Bio-Agro Resources) scheme earlier this year to convert cattle dung and solid waste in farms to CBG and compost. The scheme proposes to cover 700 projects across the country in 2018-19. The programme will be funded under Solid and Liquid Waste Management (SLWM) component of *Swachh Bharat Mission-Gramin*(SBM-G) to benefit households in identified villages through Gram Panchayats. The Ministry of New and Renewable Energy has notified Central Financial Assistance (CFA) of Rs. 4 crore per 4,800 kg of CBG per day generated from 12,000 cubic metres of biogas per day, with a maximum of Rs.10 crore per project.

Compressed Bio-Gas can be produced from various bio-mass/waste sources, including agricultural residue, municipal solid waste, sugarcane press mud, distillery spent wash, cattle dung and sewage treatment plant waste. The other waste streams, i.e, rotten potatoes from cold storages, rotten vegetables, dairy plants, chicken/poultry litter, food waste, horticulture waste, forestry residues and treated organic waste from industrial effluent treatment plants (ETPs) can be used to generate biogas.

Going forward, Compressed Bio-Gas networks can be integrated with city gas distribution (CGD) networks to boost supplies to domestic and retail users in existing and upcoming markets. Besides retailing from OMC fuel stations, Compressed Bio-Gas can at a later date be injected into CGD pipelines too for efficient distribution and optimised access of a cleaner and more affordable fuel.

*We have to shed mutual bickering, shed the difference of being high or low, develop a sense of equality and banish untouchability. We have to restore the conditions of Swaraj prevalent prior to British rule. We have to live like children of the same father.*

– SARDAR VALLABAI PATEL

# IDEAL MIX OF THERMAL AND RE IS THE FUTURE FOR POWER GENERATION – POWER MINISTER SHRI R.K. SINGH

“We are in times of change and growth and with the growth of economy and increase in per capita income, the power demand is also increasing at over 6% and will grow multi-folds in coming times. It is therefore, imperative that we increase use of renewable energy for the importance of Sustainability and Preservation of Environment”, Shri R.K. Singh, Union Minister of State (I/C) – Power and New & Renewable Energy, said, while inaugurating the NTPC’s conference on “Power Plant Flexibility: Paving way for Green Grid”. Shri Ajay Kumar Bhalla, Secretary (Power); Shri Pankaj Batra, Chairman, CEA and Shri Gurdeep Singh, CMD, NTPC were also present on the occasion.



Our commitment is that 40% of total capacity will come from renewables and by 2030 we will be able to cross that, Shri Singh added. He emphasised that Renewable and Thermal shall both be added to the Power Generation fuel mix and such forums are ideal to discuss the viability to bring about the Flexibility and integration of renewables in the power plant. There is a need to strengthen the mining activities, for uninterrupted thermal power generation and boost the economy benefitting the lowest strata of the society.

Shri Singh also launched the Web portal, which is an e-registration of Generating units across the country, which will act as a database of all operating power plants.

Shri Ajay Kumar Bhalla, Secretary (Power) in his address spoke about the importance of flexibility policies of Govt. of India in coal linkages, getting the coal supply from nearest places and blending of coal with renewables. He further emphasised for large induction of renewables and increased storage investment and making the plants flexible”.

Speaking on the occasion, Shri Pankaj Batra, Chairman, CEA, said, “CEA is aggressively planning in optimal way to integrate RE. There is a huge amount of coal capacity, which is yet to be optimally used. CEA along with NTPC is working on studies on the subject for the success of integration of RE and optimal use of coal in power plants.”

Sharing his thoughts on the conference, Mr. Gurdeep Singh, CMD, NTPC said, “Flexibilization of power plant is the need of the hour and it is very important for all the power generators. We also have to reduce our carbon footprint and generate more from the renewables. Integration of renewables is important. We have limited resource of Hydro and coal based plants are now being redesigned or refurbished to meet the requirement and support for reliable and affordable power.”



## MATERIALS “SANDWICH” BREAKS BARRIER FOR SOLAR CELL EFFICIENCY

The National GEM Consortium has produced myriad amazing academics and STEM (science, technology, engineering, and math) professionals since its inception in 1976, and Professor André D. Taylor of New York University’s Chemical and Biomolecular Engineering Department is among the top on that list.

Dr. Taylor was awarded with prestigious GEM Fellowships for his Master’s degree from Georgia Tech and his PhD degree from the University of Michigan. Both awards were helpful in enabling Dr. Taylor to pursue his advanced work in energy and materials design.

Prior to joining New York University’s faculty, Dr. Taylor was the first chaired African-American professor in Yale University’s school of Engineering & Applied Science. Dr. Taylor’s has received numerous awards, including the prestigious GEM Fellowship.

Specifically, his research group, the Transformative Materials and Devices Laboratory, develops innovative architectures for energy applications. Dr. Taylor realized that solar cells have great potential as a source of clean electrical energy, but they are not cheap, light, and flexible enough for widespread use. Dr. Taylor’s and his research team at NYU have now found an innovative and promising way to improve solar cells and make their use in many applications more likely.

Most organic solar cells use fullerenes, spherical molecules of carbon. The problem, explains Taylor, is that fullerenes are expensive and don’t absorb enough light. Over the last 10 years he has made significant progress in improving organic solar cells, and he has recently focused on using non-fullerenes, which until now have been inefficient. However, he says, “the non-fullerenes are improving enough to give fullerenes a run for their money.”

Think of a solar cell as a sandwich, Taylor says. The “meat” or active layer — made of electron donors and acceptors — is in the middle, absorbing sunlight and transforming it into electricity (electrons and holes), while the “bread,” or outside layers, consist of electrodes that transport that electricity. His team’s goal was to have the cell absorb light across as large a spectrum as possible using a variety of materials, yet at the same time allow these materials to work together well. “My group works on key parts of the ‘sandwich,’ such as the electron and hole transporting layers of the ‘bread,’ while other groups may work only on the ‘meat’ or interlayer materials. The question is: How do you get them to play together? The right blend of these disparate materials is extremely difficult to achieve.”

Using a squaraine molecule in a new way — as a crystallizing agent — did the trick. “We added a small molecule that functions as an electron donor by itself and enhances the absorption of the active layer,” Taylor explains. “By adding this small molecule, it facilitates the orientation of the donor-acceptor polymer (called PBDB-T) with the non-fullerene acceptor, ITIC, in a favorable arrangement.” This solar architecture also uses another design mechanism that the Taylor group pioneered known as a FRET-based solar cell. FRET, or Förster resonance energy transfer, is an energy transfer mechanism first observed in photosynthesis, by which plants use sunlight. Using a new polymer and non-fullerene blend with squaraine, the team converted more than 10 percent of solar energy into power. Just a few years ago this was considered too lofty a goal for single-junction polymer solar cells. “There are now newer polymer non-fullerene systems that can perform above 13 percent, so we view our contribution as a viable strategy for improving these systems,” Taylor says.

The organic solar cells developed by his team are flexible and could one day be used in applications supporting electric vehicles, wearable electronics, or backpacks to charge cell phones. Eventually, they could contribute significantly to the supply of electric power.

### **About GEM**

The National GEM Consortium provides full-tuition scholarships to exceptional scholars from under represented groups, who are pursuing their Masters and PhDs in STEM-related disciplines. GEM also provides its Fellows with paid internships and full-time positions upon graduation with the organizations within its consortium, e.g., IBM, SAP, Intel, Adobe, Amazon, MIT-Lincoln Labs, Lawrence Livermore Laboratory, Aerospace, etc. The GEM’s alumni include myriad leaders in academia and the executive ranks, such as former Xerox CEO Ursula Burns, two of the four female engineering school deans, chaired MIT professor Christine Ortiz, former Booz Allen EVP Reginald Van Lee, and NASA senior scientist Powtawche Williams Valerino.

## SIEMENS PRESENTS THE CONTROL CENTER OF THE FUTURE

With the Dyna Grid Center project, Siemens worked alongside partners in science and research to develop the next generation of grid control centers. For the first time, assistant systems visualize dynamic processes that bring the energy transition to the power grid and provide targeted recommendations for actions to optimize the grids and prevent blackouts. “In the future, we’ll need control centers that can independently regulate the highly dynamic power grid with an autopilot functionality and keep it stable,” said Prof. Dr. Rainer Krebs, head of the Consulting Unit for the Operation and Protection of Power Grids in the Siemens Energy Management Division. “The dynamic control center is therefore an indispensable part of a successful energy transition. It controls the increasing grid dynamics, maintains grid stability, and provides specific recommendations for action to prevent blackouts.” The control center of the future will therefore become a key component of the power grid action plan that was introduced by the German federal government in August 2018.

As the number of decentralized generating plants continues to grow while the capacity of conventional power plants shrinks, the electrical power supply system is becoming ever-more susceptible to disturbances. And this means that the time window for responding to critical faults is getting smaller all the time. Improved control and regulation techniques for the control centers that monitor the grid and control it remotely are therefore absolutely necessary.

In the DynaGridCenter project, Siemens is studying ways to visualize dynamic processes triggered by the uneven load distribution in the grid and figuring out how to systematically respond to them. The company is developing assistant systems for the transmission grid. Like a car, the systems have two key functions: The first is to automatically regulate the system so as to maintain the smoothest and most stable “ride” or grid operation possible. The second function is the early detection of obstacles or malfunctions so that they can be “driven around” or avoided. Operators in the dynamic grid control center work to identify the grid dynamics, and they have access to tools that allow them to do what’s not yet possible today: systematically respond to verified dynamic grid states.

To monitor the grid, the scientists used a lab grid control center at the Ilmenau Technical University and coupled it to a simulated power grid operated by the Otto-von-Guericke University Magdeburg. Phasor measurement units (PMUs) transmit the level and phase angle of current and voltage at 20 millisecond intervals and therefore add a highly dynamic component to the measured values, which are currently transmitted in the range of seconds. PMU data is synchronized in time and so can be compared directly, allowing unwanted vibration and transient processes in the grid to become visible.

“Until now, we’ve been able to avoid the dangerous dynamic processes in the grid that can lead to blackouts only by taking preventive measures,” Krebs said. Grid operators have to intervene in the schedules of power plants to prevent imminent bottlenecks. Known as “re-dispatch,” this intervention incurs costs in the range of up to € billion per year. It’s easier and, most importantly, more economical to optimize line capacity utilization and take curative measures only in the event of an overload. The new monitoring and control programs can do this, because not only do they visualize the dangerous situations that arise during an overload, they also take the necessary counter-measures much more quickly than can a plant’s human staff.

Projected for a three-year period, the DynaGridCenter research project began on October 1, 2015. The project partners were Siemens, the Otto-von-Guericke University Magdeburg, the Ilmenau Technical University, the Ruhr University Bochum, the Fraunhofer Institute for Factory Operation and Automation (IFF) in Magdeburg, and the Fraunhofer Institute of Optics, System Technologies, and Image Exploitation, Advanced System Technology Branch (IOSB-AST) in Ilmenau. The transmission grid operators 50Hertz Transmission, TransnetBW, TenneT, and Amprion were associated project partners. Siemens was responsible for coordinating the project. The project is part of the Future-Oriented Power Grids initiative and received approximately € million in funding from the German Federal Ministry for Economic Affairs and Energy (BMWi). A subsequent project known as InnoSys2030 is now planned to show whether the systems will also work in actual power grids. Another follow-up project will be dedicated to the dynamic digital twin of power grids.

## INGETEAM OPENS NEW INDIAN HIGH-TECH PRODUCTION FACILITY FOR ELECTRICAL WIND ENERGY COMPONENTS

Spain, October 9, 2018. Ingeteam, an independent global supplier of electrical conversion and turbine control equipment, announced today that it just opened a new facility in the vicinity of Chennai to satisfy the demand for wind power converters and control cabinets by both local and international OEMs with operations in India.

Located in the Tamil Nadu region, Ingeteam's new 3,500 m<sup>2</sup> facility is equipped with state-of-the-art production technology. The production plant in India will manufacture electrical components following the same stringent standards and processes as Ingeteam's other production facilities in Spain, USA and Brazil.



The new facility has been specially developed to meet the needs of a promising and demanding market, such as India. This highly efficient as well as cost-effective production center is based on a modular design and can be easily modified. The production lines are extremely agile, so they can quickly be adapted to meet new client requirements. In addition, the floor space availability will enable Ingeteam to expand the facility on demand. Production at the new facility started in August, with first deliveries made in September. Serial production started in October.

*"With this new plant, we are able to increase our delivery of reliable and quality products to wind turbine manufacturers in India's extremely competitive market. The decision to manufacture locally was marked by the potential of the Indian market, by its protectionism and by the high potential of its people",* said Ana Goyen, Director of Ingeteam Wind Energy. *"We will be there to serve our clients with the same parameters of quality, reliability and competitiveness that have always been at the core of Ingeteam. This is a further strategic step to positioning ourselves in this rapidly growing but legally secure market as the world's leading supplier of wind power converters,"* she continued.

Ingeteam entered the emerging Indian wind energy sector very early on, and now holds a 9% market share in the country. In 2017, a staggering 35% of the 4,148 MW wind capacity installed in India that year was equipped with Ingeteam's technology.

*"Although the Indian wind market has slowed down due to regulatory and commercial issues, we have no doubt that it will pick up again and continue with the positive overall growth trend it has set over the past few years. The fundamentals of growth are there and this market remains a key area of investment for Ingeteam in the long run,"* commented Goyen.

India is a developing country with a growing need for energy and with limited fossil resources. For this reason, the Indian government has prioritized the development of renewable energies, particularly wind and solar energy. The drastic reduction in energy prices has demonstrated the success of this policy. The Indian market is expected to resume its fast development, as the government seeks to meet its targets of 175 GW of renewable capacity by 2022, with 60 GW of that coming from wind energy alone.

## About Ingeteam

The Ingeteam Group specialises in power and control electronics, generators and motors (marketed under the Indar brand) and electrical engineering and automation projects. In the wind sector, Ingeteam offers solutions for wind turbines of up to 15 MW, including power converters, generators, turbine controllers, Condition Monitoring Systems (CMS), Smart SCADA management systems and O&M services. The company is the world's number one independent converter supplier for wind applications. Ingeteam currently employs 3,900 professionals and its global presence includes production plants in Europe, Asia, North America and South America, and sales and service centers strategically located throughout the world. Ingeteam is characterized by its commitment to R&D and development of proprietary technology to meet customers' needs.

## EESL TO FACILITATE IMPLEMENTATION OF 5,00,000 SOLAR WATER PUMPING SYSTEMS

Energy Efficiency Services Limited (EESL), a joint venture of PSUs under the Ministry of Power, Government of India, has been selected by the International Solar Alliance (ISA) to facilitate implementation of 5,00,000 Solar Water Pumping Systems. These Solar Water Pumping Systems will be rolled out in ISA Member Countries that are participating in its 'Scaling of Solar Application for Agricultural Use' programme.

EESL will be responsible for the overall successful implementation of the programme in the participating countries that include India, Bangladesh, Sudan, Uganda, Senegal, Mauritius among others.

ISA, an alliance of more than 121 countries, has aggregated demand for over 500,000 Solar Water Pumping systems from 13 Member Countries. ISA's first Programme "Scaling of Solar Application for Agricultural Use" aims to promote decentralised solar applications for agricultural and rural use.

Commenting on this development, Sh. Rajneesh Rana, General Manager, EESL said "We look forward to replicating the success of our ongoing solar projects and agricultural pumps programme in the Member Countries of ISA. We will leverage the wealth of our experience in implementing large-scale energy-efficiency and renewable energy programmes in India and combine that experience with ISA's long-term vision. Our aim is to help the farmers in getting easy and affordable day-time access to irrigation. This is a major step towards decentralized power solutions that also help in reducing carbon emission."

ISA, which is an international inter-governmental treaty-based organization headquartered in Gurugram, aims to provide a platform for prospective member countries to collaborate and address the identified gaps through a common agreed approach. ISA has been envisioned as a dedicated platform that aims to contribute towards the common goal of increasing utilization and promote solar energy and solar applications in the prospective member countries to help the world transform to a low-carbon and greener society.

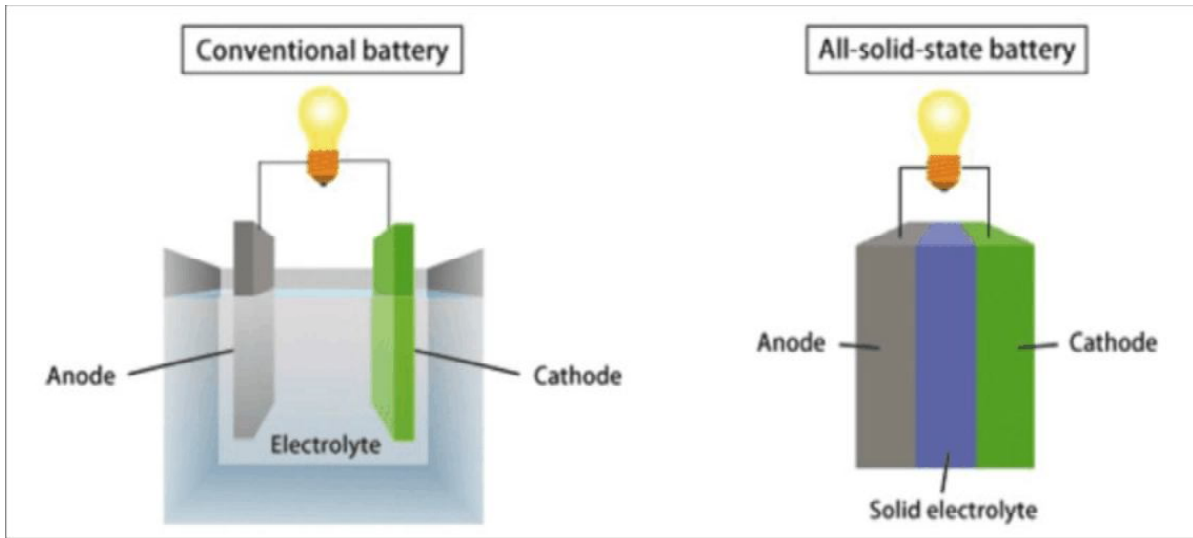
EESL is implementing multiple energy efficiency projects across sectors including LED, buildings, smart-meters, streetlights, solarisation of agricultural feeders, solar lamps, agricultural pump sets, and electric vehicles.

Going by the track record of EESL, aggregation of demand and efficient bid management leads to reduction in procurement costs. With the similar practice, ISA and EESL expect to bring down the cost of Solar Water Pumping System to catalyze scaling up of the programme and encourage other member countries, as well, to submit their demand to ISA for this programme. In addition, through this arrangement, member countries will also be able to implement the project effectively through in-built monitoring mechanisms and thereby, develop large number of local employment opportunities within the country.



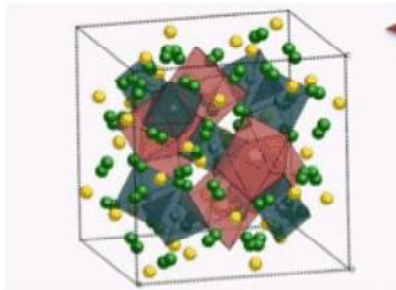
# SOLID STATE BATTERY

Solid-state battery startup Solid Power, based in Louisville, Colorado, just won \$20 million in a Series A investment round from Hyundai, Samsung Venture Investment, Sanoh Industrial, Solvay Ventures and A123 Systems. Late last year, Solid Power announced a partnership with BMW to work jointly on automotive batteries.



The company claims that its battery technology provides “substantially higher energy than conventional lithium-ion” while also reducing the system-level costs of safety precautions.

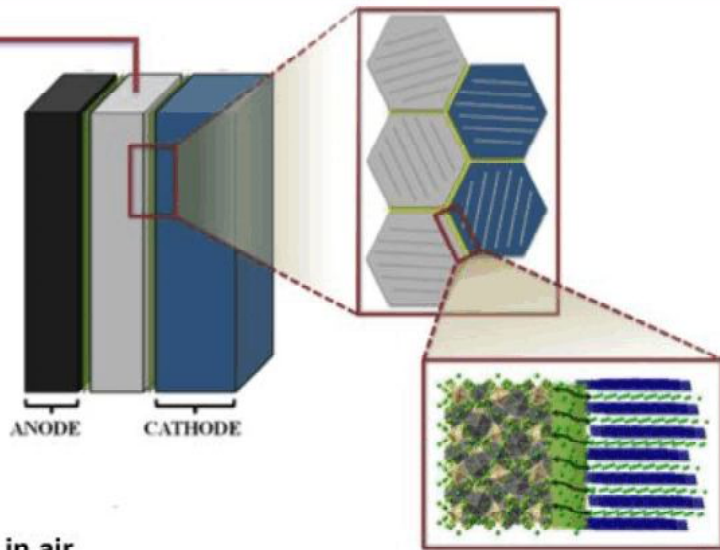
## Solid-state batteries



Fast Li-ion conducting ceramic

### ***Pros and cons***

- + ) Could enable Li metal anodes
- + ) Could enable > 5V cathodes
- + ) No organics to degrade
- + ) Components can be fabricated in air
- + ) Could reduce peripheral mass & cost
- + ) Non-flammable
- + ) Performance improves with increasing temp
- ) Low temperature performance?
- ) Density; ~1.8-5X >liquid electrolyte



### ***Key knowledge needed:***

- ? ) How do solid electrolyte-electrode interfaces work?
- ? ) How to manufacture cells economically for large-scale deployment

With the level of investment and excitement in automotive and consumer battery markets, one might forgive a battery startup for using such aspirational language as “a multi-MWh roll-to-roll facility, which will be fully constructed and installed by the end of 2018,” or writing, “The company’s ultimate objective is to displace lithium-ion as the battery of choice.”

But the company’s claim that its technology provides “2 to 3X higher energy vs. current lithium-ion” really raises a red flag in the world of battery improvements.

Solid Power co-founder and CEO , Campbell told GTM that state-of-the-art nickel-manganese-cobalt (NMC) cathodes with metallic lithium in a rechargeable chemistry can result in a 50 percent to 100 percent improvement in watt-hours per kilo compared to conventional graphite-based anodes and liquid electrolytes.

The CEO also noted that the startup is working on a more advanced chemistry, a conversion reaction cathode instead of the NMC formulation. This was the technology the startup initially licensed from the University of Colorado, and according to Campbell, when combined with metallic lithium, it can “credibly reach 2x to 3x” improvements. The CEO added that his firm’s chemistry requires fewer safety precautions and less stringent cooling requirements. According to a Cornell University paper on conversion reaction materials for batteries, “Current battery technologies are mostly based on the use of a transition metal oxide cathode (e.g., LiCoO<sub>2</sub>, LiFePO<sub>4</sub>, or LiNiMnCoO<sub>2</sub>) and a graphite anode, both of which depend on intercalation/insertion of lithium ions for operation,” while “[c]onversion reaction materials have been identified/proposed as potentially high-energy-density alternatives to intercalation-based materials. Transition metal compounds such as transition metal oxides, sulfides, fluorides, phosphides, and nitrides can undergo conversion reactions yielding materials with high theoretical capacity. “

One of Solid Power’s patents mentions sulfide solid electrolytes. An industry expert told GTM, “Certain sulfide materials can transport lithium as quickly as a traditional liquid electrolyte even while offering the structural support of a solid material. Faster transport of lithium means faster charging relative to some other solid electrolyte materials such as oxides.” The major challenges confronting any solid-state battery that employs sulfide electrolyte cells are electrochemical stability of the sulfide electrolyte and mechanical stability of the electrolyte-electrode interfaces.

As Josh Garrett, CTO of Solid Power, noted in an earlier interview, “One of the main challenges with lithium-ion type technologies is, you can increase the energy and power, or you can improve or maintain your safety, but you can’t do both,” he said. “Solid-state is really the one known viable path toward increasing both at the same time.”

Ionic Materials’ plastic-like polymer serves as an electrolyte, and can work with active battery materials like lithium, zinc and aluminum. Last year, Ionic Materials claimed its technology can be used to build a low-cost solid-state rechargeable alkaline battery.

Sion Power of Tucson, Arizona has been working on advanced batteries for decades and received \$50 million in funding for rechargeable lithium sulfur battery technology back in 2011. Board members include investors from Topspin Partners and Renaissance Technologies. Sion has also received grants from DOE and ARPA-E, and has collaborated on battery materials with BASF. Sion claims that its lithium-sulfur materials system has the highest theoretical gravimetric and volumetric energy densities of any battery system, as well as superior low-temperature operation. The rapid growth of a viable EV industry is driving the advanced battery industry to new heights in revenue and technological progress. This is why corporate investors and venture capitalists are eager to invest in batteries, relative to, say, solar hardware. Assorted forecasters peg the 2025 market for electric car batteries as ranging from \$36 billion to \$125 billion a year. That’s big enough to get any investor’s attention.

***The negligence of a few could easily send a ship to the bottom,  
but if it has the wholehearted co-operation of all on board  
it can be safely brought to port. – SARDAR VALLABAI PATEL***

## SUZLON INSTALLS AND COMMISSIONS INDIA'S TALLEST HYBRID CONCRETE TUBULAR TOWER

- New 140 meters Hybrid Concrete Tower provides lower cost for utility scale projects
- 140 meters hub height combined with new S120 2.1 MW turbine increases performance
- Continues Suzlon's focus to make more sites in India economically viable for renewable energy

Pune, India: Suzlon Group, India's largest renewable energy solutions provider, today announced the installation and commissioning of India's tallest Wind Turbine Generator (WTG) with a Hybrid Concrete Tubular (HCT) Tower. The first prototype of S120 - 140m HCT has been commissioned at the Tirunelveli site in Tamil Nadu.

The 140m HCT tower is a combination of concrete base and foundation supporting a tubular steel tower that enables higher hub heights while avoiding exponential increase in the weight and costs of an all steel tubular towers. The new HCT tower will make low wind sites viable. The concrete tower was constructed onsite, using pre-cast in-situ ensuring control on quality and internally reinforced with high strength steel cables. The HCT tower is a perfect fit in the new competitive bidding regime, where large scale utility projects of 200 - 500 MW are being installed and commissioned. Constructing on site can be leveraged when 100 - 200 WTGs are being installed at one wind farm, as molds can be re-used and logistics costs are greatly reduced.

The new S120 capitalizes on Suzlon's 2.1 MW platform and offers an increased rotor diameter of 120 meters. The S120 rotor incorporates 4th generation rotor aerodynamics and enhanced pitch control systems to reduce overall loads. This technology allows the increase from the S111 to S120 while maintaining the same nacelle. The S120-WTG features the time tested Doubly Fed Induction Generator (DFIG) technology that efficiently integrates wind turbines into the utility network, to meet the grid requirements. Suzlon's newest next generation turbine combines the production efficiencies and parts commonality of the 2.1 MW platform along with superior wind regimes available at 140m to support the competitive tariff environment in India while protecting customers return on investment (ROI).

J.P. Chalasani, Group CEO, Suzlon Group said "The Indian wind energy market is evolving due to the transition to competitive

to the transition to competitive bidding and it has become crucial for us to offer technologically advanced products that are best suited for sites in India and ensure higher return on investment (ROI) to our customers. We continue to invest in R&D with an aim to develop innovative products that reduce the levelised cost of



energy (LCoE). We pioneered the country's first Hybrid Lattice Tubular (HLT) Tower in 2014 and now introduce the country's tallest Hybrid Concrete Tubular Tower."

Duncan Koerbel, Chief Technology Officer (CTO), Suzlon Energy, said "Our R&D efforts are concentrated on innovation across the board, be it in tower technology, blades or control systems, with a single point focus on reducing the LCoE. Suzlon does not believe in one size fits all and is providing solutions for the whole country. We are capitalizing on tried and tested 2.1 MW platform and manufacturing operations and making it even better with a new 120 meter rotor. We have had huge success with our Hybrid Lattice Tubular (HLT) tower technology and the newly developed HCT tower will broaden our portfolio."

#### **About Suzlon Group:**

Suzlon Group is one of the leading renewable energy solutions provider in the world with an international presence across 18 countries in Asia, Australia, Europe, Africa and Americas. Headquartered at Suzlon One Earth in Pune, India; the Group is comprised of Suzlon Energy Limited (NSE & BSE: SUZLON) and its subsidiaries. A vertically integrated organization, with over two decades of operational track record, the group has a cumulative installation of ~17.9 GW of wind energy capacity, over 7,600 employees with diverse nationalities and world-class manufacturing facilities. Suzlon is the only Indian wind energy company with a large in-house Research and Development (R&D) set-up in Germany, the Netherlands, Denmark and India. Over 11.9 GW of the Group's installation is in India, which makes up for ~35% of the country's wind installations, making Suzlon the largest player in this sector. The Group is the custodian of over 11.9 GW of wind assets under service in India making it the second largest Operations and Maintenance company (over 8,000 turbines) in Indian power sector. The Group also has around 4 GW of wind assets under service outside India.

## **SMA PRESENTS NEW CENTRAL INVERTER AT REI**

The German inverter giant says its latest central inverter offering has a capacity of 4.6 MW and offers the ability to connect AC and DC battery storage systems.

At Renewable Energy India Expo 2018, German-based inverter giant SMA announced the release of its latest central inverter, Sunny Central UP. At a capacity rating of 4.6 MW, the company touts that it is the world's most powerful central inverter, and has made a 50% leap in power compared to the capacity of SMA's previous top of the range central inverter.

Furthermore, the inverter works with 1,500 V DC voltage and has the capability for connected storage systems, on the AC and the DC side, or both at the same time, depending on system layout. To this end, the inverter has a fully integrated hardware and software solution, rendering installation of battery storage systems easy without the need for additional componentry.

"With the new Sunny Central UP, SMA is helping to create a situation where the share of electricity from photovoltaics will play a central role in the future energy supply," said Boris Wolff, executive vice president of the Utility business unit at SMA. "Sustainable and efficient PV power plant solutions from SMA with the new Sunny Central UP offer EPC companies, operators and investors higher energy yields and more flexibility in implementing projects and considerably lower the operating costs in large PV power plant projects."

Additionally, the inverter fulfills a range of safety standard protocols, to comply with all international requirements. For example, the inverter is certified by the IEE standard 2030 and UL standard 2900-2-2, which reportedly underscores the inverters high cybersecurity standard. According to SMA the inverter is ready for ordering following its release at REI 2018.



***There is something unique in this soil, which despite many obstacles  
has always remained the abode of great souls.***

**– SARDAR VALLABAI PATEL**



## TATA POWER AND HPCL SIGN MOU FOR SETTING UP COMMERCIAL-SCALE EV CHARGING STATIONS ACROSS INDIA

Tata Power, India's largest integrated power utility and Hindustan Petroleum Corporation Limited (HPCL), a Navratna Oil & Gas Public Sector Undertaking, announced the signing of a Memorandum of Understanding (MoU) recently for setting up commercial-scale charging stations for Electric Vehicles at the HPCL retail outlets and other locations across India.



Tata Power and HPCL, through this new landmark MoU, have agreed to collaborate in planning, development and operation of charging infrastructure for electric vehicles (e-cars, e-rickshaws, e-bikes, e-buses, etc.), at suitable locations across India. Both entities also intend to additionally explore areas of opportunities & collaboration in related fields like Renewable Energy.



Mr. Praveer Sinha, CEO & Managing Director, Tata Power, said, “We are delighted to announce our partnership with HPCL. It is a significant move towards expanding our services to our customers beyond conventional boundaries. By servicing electric vehicles through the proposed charging stations across India, Tata Power will be playing a crucial role in enabling a stronger penetration of EVs in the country, thus fulfilling our commitment to power India’s future in an environmentally sustainable way.”

Rahul Shah, Chief-Strategy, New Business Services, Business Excellence, Tata Power, said, “Tata Power has been the front runner to propagate the change towards sustainable energy. We aim to continuously grow our EV charging infrastructure footprints by installing charging stations at strategic locations. Our association with HPCL will help us to scale our EV infrastructure at the national level as well as provide our customers with world-class services”.

Mr. Rajnish Mehta, Executive Director, Corporate Strategy Planning and Business Development, HPCL said, “At HPCL, we are a firm believer in business diversification and being future ready. A major impediment to electric vehicles adoption is the range anxiety which needs to be addressed through establishment of nationwide charging infrastructure. We believe that a robust network of charging stations is very critical for market acceptability of EVs which will also ensure last mile connectivity and thereby facilitate widespread adoption of EVs. Tata Power with its focussed approach towards sustainable and clean energy and wider outreach across the power value chain, provides an excellent opportunity for an integrated Oil and Gas company like HPCL to collaborate for promoting the e-mobility initiative. We intend to leverage on our vast marketing infrastructure network in the form of Retail Outlets and other locations for setting up of electric vehicle charging stations on pan India basis”.

#### **About Tata Power:**

Tata Power is India’s largest integrated power company and, together with its subsidiaries & jointly controlled entities, has an installed capacity of 10857 MW. A pioneer in the field, it has a presence across the entire power value chain: Generation of renewable as well as conventional power including hydro and thermal energy; transmission & distribution, trading and coal & freight logistics. With renewable energy assets in solar and wind accounting for 22% of the company’s portfolio, Tata Power is a leader in clean energy generation. In line with the company’s view on sustainable and clean energy development, Tata Power is steering the transformation of utilities to integrated solutions by looking at new business growth in EV charging & storage, distributed generation & rooftops, microgrids and home automation & smart meters.

It has successful public-private partnerships in generation, transmission & distribution in India namely: ‘**Tata Power Delhi Distribution Ltd.**’ with Delhi Vidyut Board for distribution in North Delhi; ‘**Tata Power Ajmer Distribution Ltd.**’ with Ajmer Vidyut Vitran Nigam Ltd. for distribution in Ajmer; ‘**Powerlinks Transmission Ltd.**’ with Power Grid Corporation of India Ltd. for evacuation of Power from Tala hydro plant in Bhutan to Delhi; ‘**Maithon Power Ltd.**’ with Damodar Valley Corporation for a 1050 MW Mega Power Project at Jharkhand. Tata Power is serving more than 2.6 million distribution consumers in India and has developed the country’s first 4000 MW Ultra Mega Power Project at Mundra (Gujarat) based on super-critical technology.

With growing international focus, Tata Power’s global presence includes strategic investments in Indonesia through a 30% stake in the coal company PT Kaltim Prima Coal (KPC); 26% stake in mines at PT Baramulti Suksessarana Tbk (BSSR); in Singapore through Trust Energy Resources; in South Africa through a joint venture called ‘Cennergi’ to develop projects in sub-Sahara Africa; in Zambia through a 50:50 joint venture with ZESCO for 120 MW Hydro project; in Georgia through AGL which is a joint venture with Clean Energy, Norway & IFC for development of 187 MW hydro project; in Bhutan through a hydro project in partnership with The Royal Government of Bhutan.

With its 103 years track record of technology leadership, project execution excellence, world-class safety processes, customer care and driving green initiatives, Tata Power is poised for multi-fold growth and committed to ‘**lighting up lives**’ for generations to come.

## IoT SENSORS REVEAL NEW WAYS FOR MANUFACTURERS TO CUT ENERGY USAGE

The next big effort to reduce carbon emissions and hold the line on climate change will be enabled by the Internet of Things. Companies can rethink their costs of operations, taking into account the energy used, with a combination of more granular data from cheap sensors and faster, more in-depth analytics from cheap computing.

At Schneider Electric's factory in Lexington, Ky., workers make electric components, including load centers and switches. The plant is four years into a company-mandated five-year goal to reduce energy consumption by 5 percent each year. The first two years, it achieved that goal. Then, management decided to deploy sensors and richer analytics to take a closer look at the mix of products made in the plant and the order in which those products were manufactured. They realized that by changing the production mix and order, they could save a lot of energy.

How much? After tweaking the production mix, the plant reduced consumption by 12 percent in year three and 10 percent in year four. "The entire group had been focused on the processing side, and now every process decision is dictated by energy savings," says Andy Bennett, former senior vice president of Schneider Electric's EcoStruxure platform, which drove the factory innovations. "What has changed in the last five years is the technology and the drive and need to have a sustainable message."

Bennett says that despite the United States pulling out of the Paris Agreement, many U.S. business leaders are still focused on reducing carbon emissions. Reduced energy consumption improves the bottom line, but it's something that manufacturers hadn't focused on because they didn't have the tools or impetus.

A similar shift in thinking played out in the 2000s in data centers, as companies such as Amazon, Facebook, and Google realized that power was a significant aspect of their costs of doing business. To address this, they prioritized the metric of performance per watt and forced Intel and Advanced Micro Devices, their suppliers, to focus on that metric.

The results were impressive. In 2016, a report by Lawrence Berkeley National Laboratory showed that energy consumption in those companies' data centers had remained flat, despite the growth in computing power, and had saved them roughly US \$60 billion in energy costs each year.

Now it's the manufacturing world's turn. Schneider Electric isn't the only company using sensor data and artificial intelligence to optimize its energy conservation. This year at the Bosch Connected World IoT conference, in Berlin, the German industrial giant exhibited software that tracks the energy consumption of industrial processes and calculates how much energy they require.

Ikea, another huge European company, also tracks its energy use, and has gone a step further, calculating the energy used in production to determine whether it should make the product at all. The company, famous for its conservation efforts, looks at energy consumption used in manufacturing and the expected lifetime of a product. If something requires a lot of energy or can't be recycled effectively, it doesn't get made, according to Lena Pripp-Kovac, Ikea's sustainability manager.

Ikea may have an entire business unit dedicated to sustainability, but that's not feasible for many manufacturing companies. Fortunately for them, the Internet of Things will allow them to re-create similar analyses with much less fuss. And that will be good for all of us.

*Take to the path of dharma - the path of truth and justice. Don't misuse your valour. Remain united. March forward in all humility, but fully awake to the situation you face, demanding your rights and firmness. – SARDAR VALLABAI PATEL*

# USING DIELECTRIC AND ELECTRICAL HAZARD SHOES

There are two basic names for shoes that have some protection from electrical shock: Dielectric (DI) and Electrical Hazard (EH) rated. The differences between the standards are not usually understood, even by electrical specialists. Few guidelines exist on when and where to use the shoes in either standard. This paper offers some assistance on which standards relate to which shoes.

## Hazard Assessment Guides

### OSHA PPE General Guide

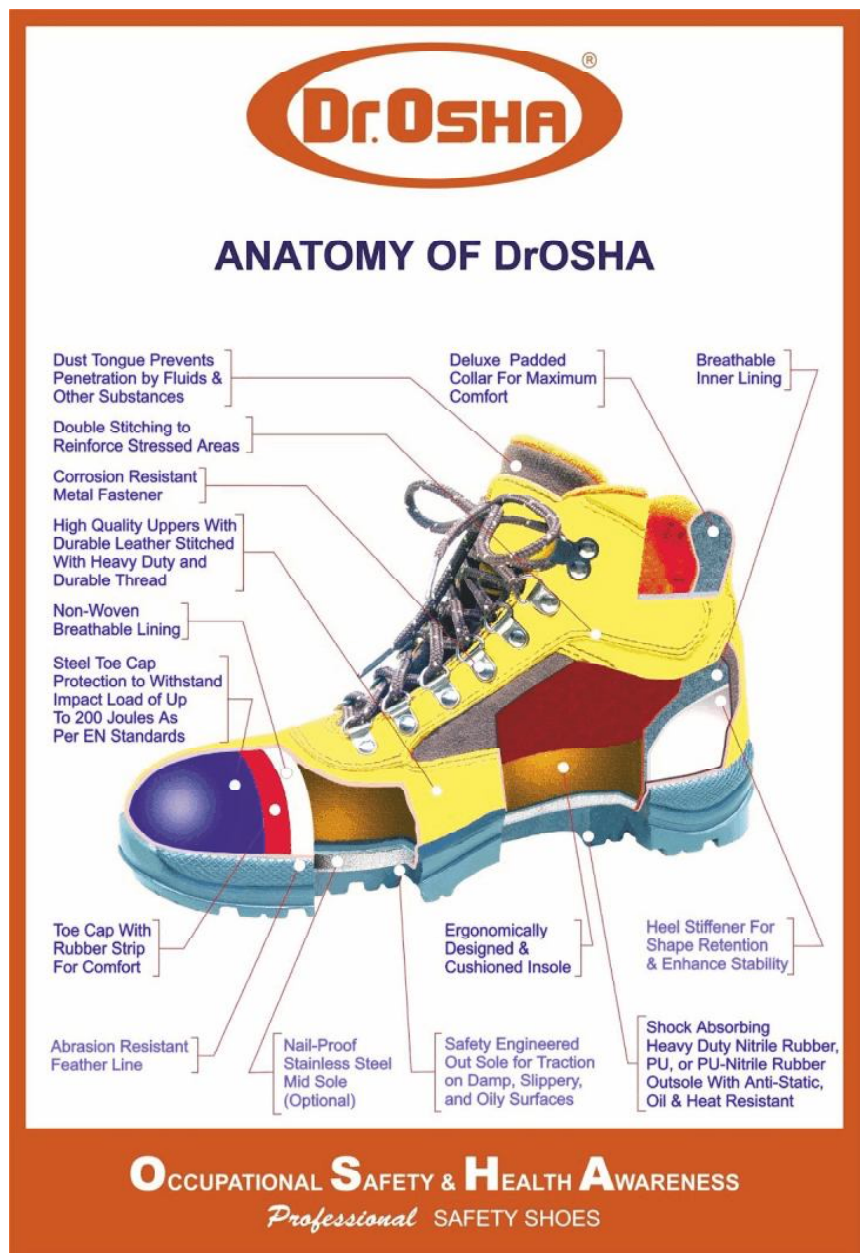
According to 29 CFR 1910.136(a): "Each affected employee shall wear protective footwear when working in areas where there is a danger of foot injuries due to falling or rolling objects, or objects piercing the sole, and where such employee's feet are exposed to electrical hazards." Appendix B of Subpart I identifies the following occupations for which foot protection should be routinely considered: shipping and receiving clerks, stock clerks, carpenters, electricians, machinists, mechanics and repairers, plumbers, assemblers, drywall installers and lathers, packers, wrappers, craters, punch and stamping press operators, sawyers, welders, labourers, freight handlers, gardeners and grounds keepers, timber cutting and logging workers, stock handlers and warehouse labourers.

OSHA 29 CFR 1910.269, which applies to the transmission, distribution, and generation of electricity, cites ASTM F1117 shoes in the standards document but gives no guidelines as to when they are needed.

OSHA gives little guidance and really mentions the EH shoes only in the general PPE guide for small businesses. OSHA states, "Electrical hazard, safety-toe shoes are nonconductive and will prevent the wearers' feet from completing an electrical circuit to the ground. These shoes can protect against open circuits of up to 600 volts in dry conditions and should be used in conjunction with other insulating equipment and additional precautions to reduce the risk of a worker becoming a path for hazardous electrical energy. The insulating protection of electrical hazard, safety-toe shoes may be compromised if the shoes become wet, the soles are worn through, metal particles become embedded in the sole or heel, or workers touch conductive, grounded items. Note: Nonconductive footwear must not be used in explosive or hazardous locations."

### NFPA 70E Guidelines

NFPA 70E attempts to give guidelines for using DI or EH shoes, but it suffers from some of the same issues as the OSHA guides. It is better in the sense that it does make use mandatory in a few cases but is still unclear about the role, if any, for EH shoes.



### Electrical Hazard (EH) Shoes

Table 130.7(C)(8) Standards on Protective Equipment lists both ASTM F1117 and F2413 under the footwear section but does not mention EH shoes. The ASTM F1117 standard is cited by the F2413 standard as the standard specification for DI shoes, so the citation of F2413 does not imply that EH shoes are required by NFPA 70E.

Table 130.7(C)(10) Protective Clothing and Personal Protective Equipment (PPE) calls for all Hazard/Risk Categories (HRC) to include “leather shoes,” which in no case can be dielectric shoes. **“Leather shoes” are not equivalent to “EH” shoes.**

130.7(C)(13)(d) “Foot Protection. Heavy-duty leather work shoes provide some arc flash protection to the feet and shall be used in all tasks in Hazard/Risk Category (HRC) 2 and higher and in all exposures greater than 4 cal/cm<sup>2</sup>.” This would imply that DI shoes alone are not acceptable but does not exclude EH shoes.

### Dielectric (DI) Shoes

“130.7(C)(7) Foot Protection. Where insulated footwear is used as protection against step and touch potential, dielectric overshoes shall be required. Insulated soles shall not be used as primary electrical protection.”

130.5(E)(3) Dielectric overshoes are required when performing “equipment grounding near power lines.”

Only dielectric footwear is listed in 250.1 Maintenance Requirements for Personal Safety and Protective Equipment.

320.8 Personal Protective Equipment for Battery Rooms requires protective overshoes but doesn’t indicate why they are used. If they are for acid protection, then they would need to meet an applicable part of F2413. But if for electrical hazards, they would need to meet ASTM F1117.

In 310.5 (D)(2)(1) for protecting employees working around electrolytic cells, such as in smelting operations, shoes are listed for “wet service” and if 130.7(C)(7) is understood, the use of dielectric shoes/overshoes or boots is required.

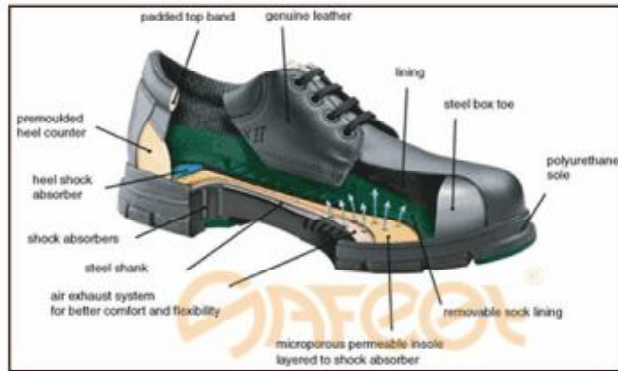
### NFPA 70E Guideline Summary

Dielectric shoes are required for wet service and step potential hazards in any application and EH shoes are optional, but leather is mandatory in HRC 2-4.

### OSHA Guideline Summary

OSHA letters of interpretation present EH shoes positively but do not require them. In higher voltages or higher risks (1910.269), OSHA cites ASTM F1117 for dielectric shoes — *not* ANSI Z41 or ASTM F2413.

## Anatomy Diagram of Safety Shoes



Anti-Static



Cold insulating



Composite toe cap



Energy absorption



Heat resistant



Resistance to oil and chemical



Steel mid-sole



Steel toe cap



Water-repellent

## Shoe Standards

ANSI Z41 was the old, general safety shoe standard. It used to include EH shoes, but now shoes must meet ASTM 2413-2005.

<http://www.astm.org/Standards/F2413.htm>

The ASTM F2413-05 standard covers minimum requirements for the design, performance, testing, and classification of protective footwear. Footwear certified as meeting ASTM F2413-05 must meet the minimum requirements of Section 5.1 "Impact Resistant Footwear" and Section 5.2 "Compression Resistant Footwear." Additional sections have requirements of specialty shoes, such as metatarsal protection, conductive protection, electric shock protection, static dissipative protection, and protection against punctures. ASTM specification must be marked with the specific portion of the standard with which it complies. One shoe of each pair must be clearly and legibly marked (stitched in, stamped on, pressure sensitive label, etc.) on either the surface of the tongue, gusset, shaft, or quarter lining. An example of ASTM style markings for protective footwear is:

### ASTM F2413-05 MI/75/C/75/Mt75 PR EH

First line: ASTM F2413-05 means the protective footwear meets the performance requirements of ASTM F2413 issued in 2005.

Second line: MI/75 C/75 Mt75. M in this case means the footwear is designed for a Male (F would be Female). I denotes impact resistance followed by the impact resistance rating (75 or 50 in foot-pounds). C denotes compression resistance and the compression resistance rating (75 or 50, which correlate to 2,500 pounds and 1,750 pounds of compression, respectively). Mt means this shoe has metatarsal protection and rating (75 or 50 foot-pounds).

Third and optional fourth line: PR EH. The last two lines are used to identify footwear made to offer protection from other specific types of hazards referenced in the standard. They designate conductive (Cd) properties, electrical insulation properties (EH), static electricity dissipative (SD), puncture resistance (PR), chainsaw cut resistance (CS), and dielectric insulation (DI), if applicable. The last line is used only when more than three sections apply.

Electrical Hazard (EH) footwear is manufactured with non-conductive, electrical shock-resistant soles and heels. The outsole can provide a secondary electrical shock resistance protection to the wearer against the hazards from an incidental contact with energized electrical circuits or parts. Testing ensures the materials are capable of withstanding 14,000 v at 60 Hz for one

## Personal Protective Equipment (PPE)

WORK  
SAFE

Select and use the appropriate PPE to help minimize exposure to physical, chemical, mechanical, electrical, radiological & other workplace hazards.

BE  
SAFE



### Head Protection

Hard hats help provide protection from head impact, penetration injuries, and electrical injuries. Ensure hard hats fit properly and are well maintained.



### Eye/Face Protection

Evaluate potential hazards and use spectacles, goggles, side shields, faceshields, or special shields and helmets to help provide eye and face protection.



### Hearing Protection

Single-use earplugs, pre-formed or molded earplugs, and earmuffs can help prevent hearing damage, as well as reduce the physical and psychological stress of a noisy work environment.



### Respiratory Protection

Perform a hazard assessment and select the proper respirator to help protect against the effects of harmful dusts, gases, smokes, fumes, mists, fogs, sprays or vapors.



### Body Protection

Choose the proper clothing and gear for protection from heat, radiation, hazardous materials or wastes, scalding liquids, body fluids, and more. Include fall protection equipment and high visibility clothing when needed.



### Hand Protection

Select the right gloves for the job to minimize injuries, such as cuts, lacerations, abrasions, chemical and thermal burns, and prevent harmful substances from absorbing into the skin.



### Foot/Leg Protection

Foot guards, safety shoes, and leggings can help prevent injuries from sharp objects, falling or rolling objects, molten metals, electrical hazards, hot surfaces, and slippery surfaces.

minute with no current flow or leakage current in excess of 3.0 mA, under dry conditions. (This is *not* usually acceptable for wet service or higher voltages.). ASTM 2413 cites ASTM F1117 for dielectric shoes.

CAN/CSA-Z195-M92 Section 4.3 is similar to the ASTM 2413 standard but more stringent in its leakage and voltage requirements. The CSA standard is also a “wet sole test.”

ASTM F1116-03 (Reapproved 2008) is the ASTM test method for dielectric shoes. It has three procedures that differ according to the section of the footwear tested. (To purchase ASTM standards, see <http://www.astm.org/>.)

ASTM F1117-03 (Reapproved 2008) is the specification for dielectric footwear and is a quite stringent standard. Only one boot and overshoe currently meets the F1117-08 specification.

The most important thing to be aware of is that ASTM F2413 is a standard designed primarily for impact and compression protection. Some dielectric shoes cannot pass the compression portion of that standard because many are designed as overshoes and don't have a steel toe, but the overshoes can be worn with compression-resistant shoes if needed.

Note: Steel toes have never been shown to conduct electricity as long as the toe is still covered with the shoe material.

ASTM F-1117 refers to the boots and overshoes as “supplementary protection” because the shoes have no “in-use” standard. In-use standards normally require re-testing, so shoes should never be relied on as primary protection. An in-use standard is not planned at the current time by the ASTM F18 committee.

### Which Standard Do I Choose?

First, choose the protection level or specific standard you need: Dielectric or Electrical Hazard levels. Second, choose the standard: ASTM F1117, ASTM F2413, or CSA Z41. Third, look into the unique hazards of the work environment. The higher the overshoe, the less likely it is that water, grass, or other energized materials contact the worker. Also, look closely at the heel and sole design. This is especially true for climbing poles, ladders, and stairs. A deep heel is needed to climb safely, while the normal shallow heel works well for walking. Fit and the ease of donning and doffing the footwear warrant consideration, especially on overshoes.

### Problems to Consider

Most testing applies only to the sole of the footwear, which usually begins degrading quickly. Minute holes in the soles of the footwear are the biggest area of concern in the protection scenarios. Footwear, unlike the rubber gloves used for primary protection in utilities, has nothing to protect it from the effects of walking and from the effects of ozone and UV light. The makers and users of dielectric shoes point out this fact. They also note that some utilities attempt to lessen the chances of sole degradation by stamping a date on the footwear and replacing them after one year or less, depending on the frequency of use. All manufacturers and users recommend regular visual inspections and replacement when any sign of excessive wear exists.

### Summary

With OSHA early documents falling on the side of EH shoes for electrical work, companies would do well to consider them for all electrical workers and other workers exposed to electrical hazards or damp locations. These shoes rarely add more than \$5 to the cost of the shoe and have been known to save lives. They should be considered for low-voltage (<750V) and low-risk tasks.

**High-risk tasks, environments, and medium and high voltages require more and more stable protection. ASTM F1117 shoes provide this type of protection and are the preferred step potential PPE option in both OSHA 1910.269 and NFPA 70E.**

## WHAT YOU NEED TO KNOW

### Personal Protective Equipment at Work Regulations 1992

In situations where risks cannot be controlled by other means such as systems of work or engineering controls, employers are required to protect their employees from risks to health and safety by providing suitable personal protective equipment (PPE).



#### THE EMPLOYER MUST:

- Provide suitable protective equipment free of charge.
- Maintain PPE in working order and good condition.
- Provide relevant training in the use of PPE.
- Consult with employees on the suitability of the PPE to be provided.

#### THE PPE PROVIDED MUST:

- Be relevant to the work being undertaken.
- Protect effectively against the particular risks involved.
- Comply with relevant standards.
- Fit the user properly and comfortably and adjust where necessary.
- Should not hinder the performance of the task or add to the risks involved.

#### THE EMPLOYEE MUST:

- Use the PPE provided.
- Report any loss, defects or damage to PPE.
- Take care to correctly store the PPE when not in use.

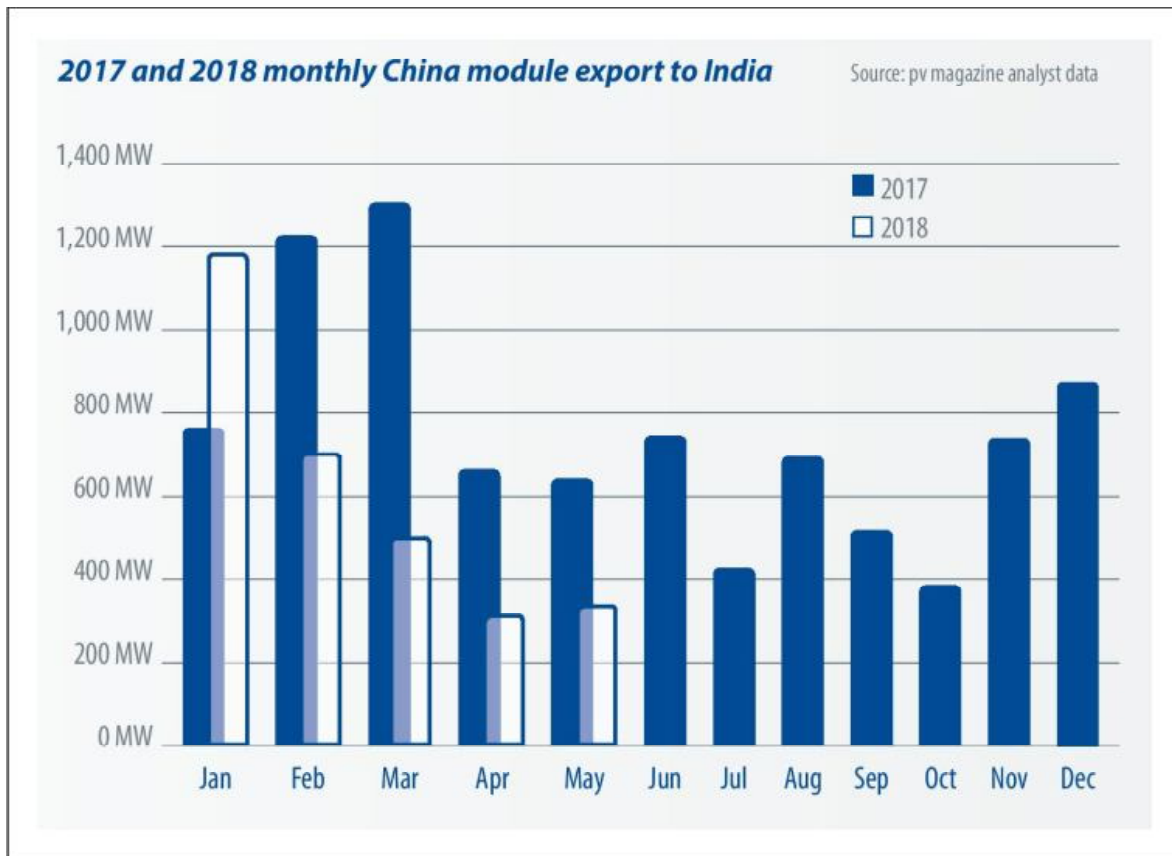
## INDIA'S TRADE WAR WILL HAVE GLOBAL REPERCUSSIONS

Earlier this month, India's Directorate General of Trade Remedies (DGTR) recommended imposing a safeguard duty on imports of "solar cells whether or not assembled in modules or panels" from China and Malaysia, among other developed countries, over a two-year period, starting at 25% in year one. A duty of 20% will be imposed in the first six months in year two, and 15% for the rest of the year.

This recommendation needs to be reviewed by a committee formed by the Department of Energy and Ministry of Commerce and Industry, where a decision will be made on whether to implement, or adjust, this recommendation. Once the decision has been taken, it will be sent to the Ministry of Finance for approval.

India still aims to achieve a PV installation capacity of 100 GW by 2022, and this has sparked arguments from Indian manufacturers and PV project developers on whether to impose the duty, because the domestic PV demand is currently undersupplied.

### Imbalance



Last year, India's PV installations amounted to between 10 and 11 GW, and this year's number was originally expected to increase. However, with numerous trade war investigations taking place since last year, India's module demand in 2018 may decrease to as low as 9-11 GW. Looking at module suppliers, China has been the country's largest module supplier, shipping over 9 GW of modules to India in 2017 – or around 90% of India's module imports.

However, so far this year, China's module export to India has largely decreased, due to concerns about the trade war. Even during the typical high season of India in Q1, China only shipped 2.4 GW of modules and 0.4 GW of cells. In addition, the slow progress of India's projects has resulted in



just 3.1 GW of modules shipped to India between this January and May. This is a 33% decrease, compared to the same period in 2017, and is fast becoming one of the major factors for causing an imbalance in the 2018 PV market.

India currently has a module capacity of over 6 GW, mainly contributed by Adani, Vikram Solar, and Warree. For cells, India holds 2.5 GW, mainly contributed by Adani, Jupiter, and TATA.

#### Slow progress

The slow progress of projects this year, and decreasing imported module prices, have stopped local cell makers from adding new capacity. Longi is planning to build 1 GW of cell and module capacity, respectively, in India, but the DGTR recommendation also includes the rule that “other developing countries cannot import modules accounting for over 3%, and cells accounting for 9%, of India’s total imports. “

Countries surpassing these limits will be excluded from the list of exempted countries. This will limit the help from Vietnam and Thailand, which combine to deliver nearly 10 GW of cell capacity. Generally speaking, the goal of meeting the 10 GW annual demand for modules appears unachievable, without China and Malaysia’s PV cells and modules.

On another note, India’s advantage in cost and price will still not be clear, even with a 25% safeguard duty imposed on China, Malaysia, and other developed countries’ cells and modules.

#### Economies of scale

Looking at India and China’s overall module costs, most Indian module makers’ production capacities do not have economies of scale that the Chinese makers do. Also the yield rates and the conversion efficiencies of Indian manufactured cells and modules are all slightly lower than current Chinese products. Therefore, India’s production costs are not low enough, compared to the Chinese.

For China, with the extreme oversupply situation caused by this year’s new policies, the country’s entire supply chain has witnessed another dramatic price drop. Not only did polysilicon plummet to CNY 80 (US\$10.3)/kg for multi-Si wafer use, and CNY 93 (\$12)/kg for mono-Si wafer use, but mono-Si and multi-Si wafer prices went down as well.

Because Indian manufacturers all purchase wafers and cells, the difference in production costs between Indian and Chinese modules happens at both the cell and module production level.

Following the 31/5 notification, China’s module assembly costs have decreased to just \$0.1-0.11/W, pulling the overall cost of top-tier vertically integrated manufacturers’ conventional multi-Si modules down to \$0.23-0.24/W.

#### Unclear

After the recommended 25% duty, China’s module costs will still be lower than India’s. As a result, whether the safeguard duty can protect Indian manufacturers or not, is not clear. However, it will negatively impact India’s PV project development, such as raising the construction costs of PV power plants, or reducing the efficiency of modules.

Looking at July, with undecided duties on cells and modules, and the spot price currently in decline, Chinese module makers and Indian PV project developers have not shown signs of hoarding.

For 2019, China’s demand is likely to stay as low as this year, and it will have difficulties bouncing back. Therefore, the global market demand will need India’s growth, in order to once again exceed 100 GW.

Furthermore, the question of whether India’s trade war will be rolled out is the question concerning manufacturers from across the globe. Should the safeguard recommendation become a reality, manufacturers planning to establish production lines in India will speed up their progress; also, the higher costs of PV projects will affect the Indian government’s planned installation volume.

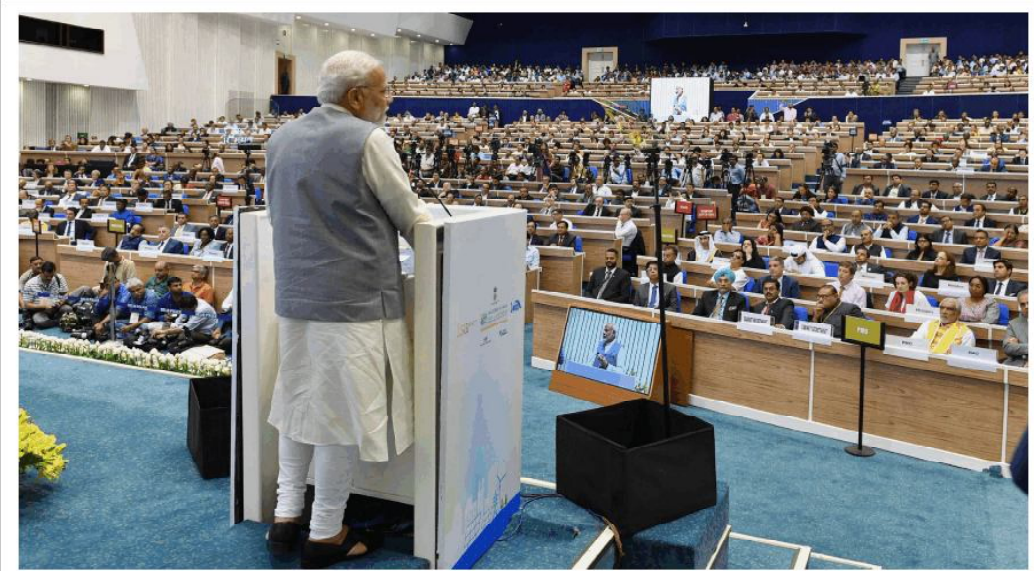
***Manpower without unity is not a strength unless it is harmonized and united properly, then it becomes a spiritual power – SARDAR VALLABAI PATEL***

## PM INAUGURATES FIRST ASSEMBLY OF THE INTERNATIONAL SOLAR ALLIANCE

The Prime Minister, Mr. Narendra Modi, today inaugurated the first Assembly of the International Solar Alliance at Vigyan Bhawan. The same event also marked the inauguration of the second IORA Renewable Energy Ministerial Meeting, and the 2nd Global RE-Invest (Renewable Energy Investors' Meet and Expo). The Secretary General of the United Nations, Mr. Antonio Guterres, was present on the occasion.



Addressing the gathering, the Prime Minister said that in the last 150 to 200 years, mankind has depended on fossil fuels for energy needs. He said nature is now indicating that options such as solar, wind and water, offer more sustainable energy solutions. In this context, he expressed confidence that in future, when people talk of organisations for the



welfare of mankind established in the 21st century, the International Solar Alliance will be at the top of the list. He said this is a great forum to work towards ensuring climate justice. He said the International Solar Alliance could replace OPEC as the key global energy supplier in the future.

The Prime Minister said that the effect of increased use of renewable energy is now visible in India. He added that India is working towards the goals of the Paris Agreement through an action plan. He said that the target is to generate 40 percent of India's total energy requirements in 2030, by non fossil fuel based sources. He said India is developing with a new self-confidence of **"Poverty to Power."**

The Prime Minister said that besides solar and wind power, India is working on biomass, biofuel and bio-energy. He said efforts are being made to make India's transport system clean fuel based. He said that by converting bio-waste to biofuel, India is converting a challenge into an opportunity. He emphasized that if the dream of **"One World, One Sun and One Grid"** is followed, uninterrupted power supply can be ensured.

Mr. Modi announced plans to launch a National Energy Storage Mission that will look at manufacturing, deployment, technology development and policy framework.

Addressing the gathering, Secretary General of United Nations, Mr. Antonio Guterres said that climate change is an existential threat for all. He emphasized that the International Solar Alliance represents the future of energy scenario the world over. Pointing out that the world is witnessing a global renewable energy revolution, the UN Secretary General hoped that the age of fossil fuels will end with a replacement for them. Mr. Guterres said that he would convene a Climate Summit next December to bring climate action to the top of international agenda.

Speaking on the occasion, Union Minister of External Affairs, Ms. Sushma Swaraj said that the International Solar Alliance is an endearing reality. She pointed out that the goal of the three events inaugurated today is to promote sustainable development for a better world.

A short film on the “**Journey of Renewable Energy in India**” was screened. Another film on Student Initiative on Solar Lamp was also shown on the occasion. 100 students from various schools lit the Solar Study Lamp at the inaugural function.

Minister of State (Independent Charge) of Renewable Energy and Power, Mr. R.K Singh presented saplings to the dignitaries on the occasion. Mr. R.K Singh also delivered the vote of thanks.

The Business and Technical Sessions of ISA Assembly, IORA Meet and RE-INVEST 2018 Expo will be held at India Expo Mart, Greater Noida, Uttar Pradesh from October 3-5, 2018.

### **INTERNATIONAL SOLAR ALLIANCE**

International Solar Alliance (ISA), an alliance of 121 solar resource rich countries lying fully or partially between the Tropics of Cancer and Capricorn. ISA was jointly launched by the Prime Minister, Mr. Narendra Modi, and the then President of France, Mr. François Hollande, on November 30, 2015 in Paris, France on the side-lines of the 21st Conference of Parties (CoP 21) to the United Nations Framework Convention on Climate Change. The ISA Framework Agreement was opened for signature on 15 November 2016 in Marrakech, Morocco, on the side-lines of CoP-22.

The vision and mission of the International Solar Alliance is to provide a dedicated platform for cooperation among solar resource rich countries that lie completely or partial between the Tropics of Capricorn & Cancer, the global stakeholders, including bilateral and multilateral organizations, corporates, and industry to make a positive contribution to assist and help achieve the common goals of increasing the use of solar energy in meeting energy needs of prospective ISA member countries in a safe, convenient, affordable, equitable and sustainable manner.

In conformity with the ISA Framework Agreement, 30 days after ratification by the 15th country, on December 6, 2017, ISA became the first full-fledged treaty based international intergovernmental organization headquartered in India. Through this initiative, the countries, inter alia, share the collective ambition: (i) to address obstacles that stand in the way of rapid and massive scale-up of solar energy; (ii) to undertake innovative and concerted efforts for reducing the cost of finance and cost of technology for immediate deployment of competitive solar generation; and (iii) to mobilise more than 1000 Billion US Dollars of investments by 2030. The Government of India has committed Rs.175 crore for setting up of ISA and till date released a sum of Rs 145 crore for creating a corpus fund, building infrastructure and meeting day to day recurring expenditure.

On March 11, 2018, the Prime Minister of India, Shri Narendra Modi and the President of France, Mr. Emmanuel Macron co-hosted the founding conference of the International Solar Alliance (ISA). 48 countries, including 25 Heads of States participated in this conference. In addition, there were representations from the United Nations, multilateral development banks, energy-related think tanks, corporate sector and civil society.

The Delhi Solar Agenda, adopted in the Founding Conference of the ISA, states that the ISA member States *inter-alia* have agreed to pursue an increased share of solar energy in the final energy

consumption in respective national energy mix, as a means of tackling global challenges of climate change and as a cost-effective solution by supporting and implementing policy initiatives and participation of all relevant stakeholders, as applicable, in respective States.

Till date, out of 121 prospective member countries that lie either fully or partially between the Tropics of Cancer and Capricorn, 70 countries have signed the Framework Agreement of the ISA. 44 of these countries have ratified the ISA treaty.

The first Assembly, in a way, will lay the foundation for global Solar Agenda. The Assembly, as supreme decision making body of the ISA, will steer the process to significantly harness solar energy for achieving universal energy access at affordable rates. The Assembly will adjudicate upon various administrative, financial and programme related issues. Hon'ble Ministers from ISA countries have been invited for the Assembly. The countries that have ratified the ISA Treaty Framework will attend the Assembly as Members. Countries that have signed but are yet to ratify the ISA Treaty Framework will attend the Assembly as Observers. Till date, 75 country delegations have confirmed participation. This includes 36 member countries, 24 observer countries, 12 prospective member countries and 3 partner country. Ministerial level participation has been confirmed from 22 member countries, 10 observer countries and 3 prospective member countries.

### **THE INDIAN OCEAN RIM ASSOCIATION**

The Indian Ocean Rim Association was set up with the objective of strengthening regional cooperation and sustainable development within the Indian Ocean Region with 21 Member States and 7 Dialogue Partners. India will be hosting 2<sup>nd</sup> IORA Renewable Energy Ministerial meet. In this meeting, Ministers from 9 member countries and delegates from all 21 member countries are expected to participate. India, Australia, Iran, Indonesia Thailand, Malaysia, South Africa, Mozambique, Kenya, Sri Lanka, Tanzania, Bangladesh, Singapore, Mauritius, Madagascar, UAE, Yemen, Seychelles, Somalia, Comoros and Oman are members of IORA.

### **2<sup>ND</sup> RE-INVESTMENT**

The 2<sup>nd</sup> RE-INVEST aims at accelerating the world wide effort to scale up renewable energy and connect the global investment community with Indian energy stakeholders. 2<sup>nd</sup> RE-INVEST will include a three-day Conference on renewables, cleantech and future energy choices, and an Expo of renewables-related manufacturers, developers, investors and innovators.

The 2<sup>nd</sup> RE-INVEST will provide a great opportunity to various countries, states, business houses & organisations to showcase their business strategies, achievements and expectations. It would facilitate collaboration and cooperation with key stakeholders in India, which has today emerged as one of the world's largest renewable energy markets.

The 2<sup>nd</sup> RE-INVEST is expected to be attended by Ministerial Delegations from across the world including ISA and IORA Member Countries, over 600 global industry leaders, and 10,000 delegates. 15 Indian states will participate, there will be 7 focused country presentations, and over 150 speakers including 55 international speakers from 15 countries will speak at the event. RE-INVEST includes 50 plenary and technical sessions, a special Chief Ministerial plenary session, exhibition with over 100 exhibiting companies, and focused sessions on Start-ups and Human Resource Development.

Globally, India stands 5<sup>th</sup> in renewable power, 4<sup>th</sup> in wind power and 5<sup>th</sup> in solar power installed capacity. India is one of the world's largest green energy markets, with exponential increase in demand and supply. Renewable energy development and deployment has received proactive policy support, including 100% foreign investment. The Government of India is aiming to exceed the set target of 175 GW renewable energy capacity by 2022.

**RE-Invest** is a global platform to explore strategies for development and deployment of renewables. It showcases India's green energy market and the Government's efforts to scale up capacity to meet the national energy demand in socially, economically and ecologically sustainable ways. The **2nd Global RE-Invest** will build upon the success of RE-Invest 2015 and provide an international forum to established players as well as new segments of investors and entrepreneurs to engage, ideate and innovate.

***Little pools of water tend to become stagnant and useless, but if they are joined together to form a big lake the atmosphere is cooled and there is universal benefit.***

**– SARDAR VALLABAI PATEL**

# ENERGY, ELECTRICAL ENERGY AND RENEWABLE ENERGY – 14

**Sustainable Growth, Sustainable Electrical Energy and Renewable Energy**

**Thermo Chemical and Biochemical Technologies**

**Bio Energy and various Gases and Energy uses**

**Biomass and GAS: Continued.....**

**Uses of Bio Gas and Economics:**

We have seen in detail about the various uses of Biogas as Heat, Fuel and Electricity and the Technologies involved in making the Bio Gas suitable for these different uses. The Capital costs of Equipments and systems will vary quite considerably, the least probably for use of the Gas for heating purpose.

Let us just look at the Value of the Bio Gas uses and Products generally based on present day price levels.

1 Cub. M. of Biogas for HEAT Application = Rs 35/- (Equivalent to 0.5 Kg of CNG/ LPG)	1 Cub.M. of Biogas for Electricity Generation = Rs 10/- 1 Cub.M of Bio Gas can generate 2 Units of Electricity and 2@ Rs 5/- per unit	1 Cub.M. of Biogas for conversion to CBG can yield 0.5 Kg of CBG and the Value can be taken as Rs 23/- (Rs 46/- per Kg as offered by Government proposal)
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As can be seen from the above that the best value recovery is when it is used for Heating, and the least economical is to produce Electricity.

**Bio Mass and Gas – Thermo Chemical – Producer Gas and Syn Gas:**

The table below shows the two important technologies involved – Bio Chemical and Thermo Chemical - in generation of Bio Energy Gas, with different names depending on the Technology and the Process.

BIO MASS BIO ENERGY GAS	BIO CHEMICAL PROCESS ..... THERMO CHEMICAL PROCESS	BIO METHANATION ..... Gasification – controlled oxygen Gasification – Oxygen free Plasma Gasification	BIO GAS ..... Producer Gas  Syn Gas  Syn Gas	HEAT FUEL ELECTRICITY ..... HEAT FUEL ELECTRICITY
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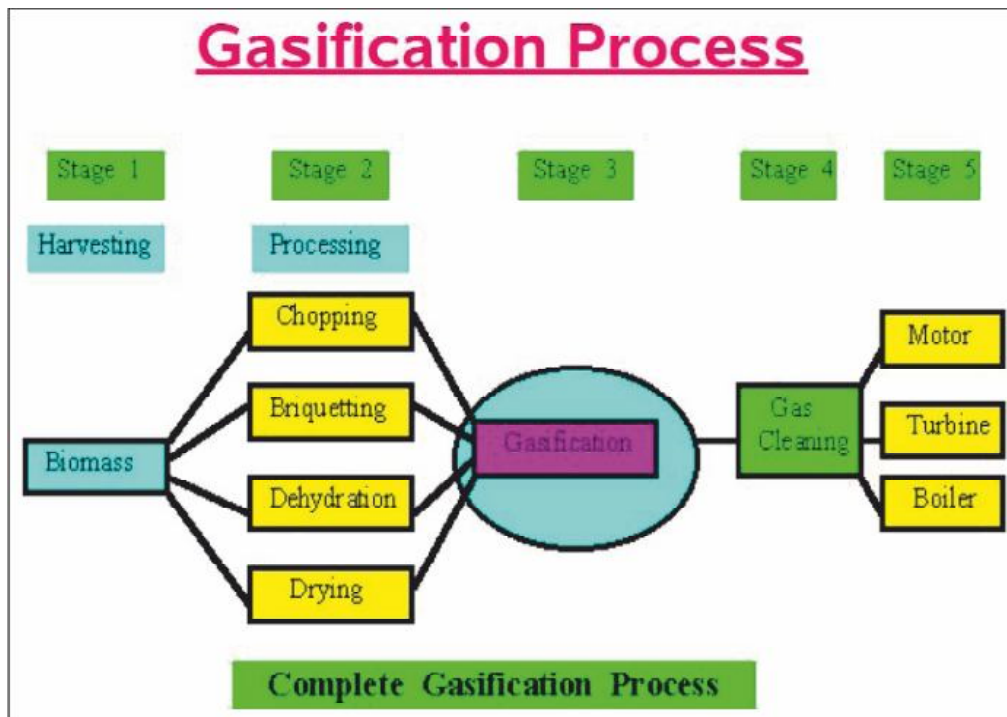
The Table below shows the different thermal values of different Gases.

	Composition	Calorific Value
<b>Methane</b>	<b>Methane (100%)</b>	<b>9000 k Cal/cum.</b>
<b>Natural gas</b>	<b>Methane (95%) + Ethane, Propane, Butane.....</b>	<b>8600 k Cal/cum.</b>
<b>Biogas</b>	<b>Methane (~55%) + carbon dioxide (~35%) + hydrogen (~5%) + Hydrogen di-Sulphide..</b>	<b>4700 k Cal/cum.</b>
<b>Producer gas</b>	<b>Carbon monoxide (~ 20 %) +Hydrogen (~ 20%) + Methane (~ 2%) + Carbon dioxide (~15%) + balance Nitrogen</b>	<b>1100 kCal/ cum.</b>
<b>LPG</b>	<b>Mainly Butane + Isobutane + Propane</b>	<b>10880 k Cal/kg.</b>

**Biomass Gasification – Controlled Oxygen Types**

Gasification with controlled supply of oxygen is used for Conversion of solid fuels into combustible gas mixture called Producer Gas ( $\text{CO} + \text{H}_2 + \text{CH}_4$ ) with composition seen in the chart earlier. This actually Involves partial combustion of biomass because of limited oxygen supply.

A Schematic Diagram is shown below to illustrate the process of Gasification and the distinct processes.



- Four distinct processes in the gasification block shown above are
  - Drying
  - Pyrolysis
  - Combustion
  - Reduction

In terms of structure and types there are different types with Top, Bottom and Central Feeding types and what is shown in the schematic below is a Top Loading type which is commonly used

Technologies mostly in use India at present are Technologies with controlled Oxygen supply and are successful with Dry Woody Biomass and other materials like husk, straw etc with moisture contents of 10% or less The Challenges revolve around use of mixed and difficult Biomass and with varying moisture levels etc

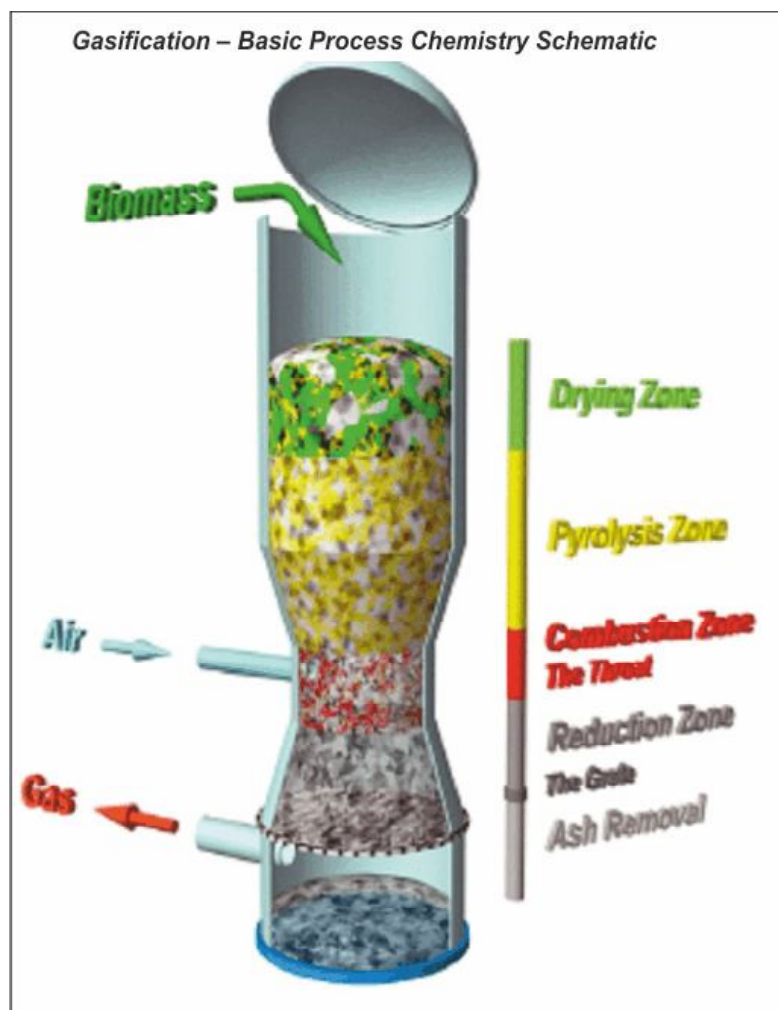
**Applications of Biomass Gasifiers:**

**Power Generation**

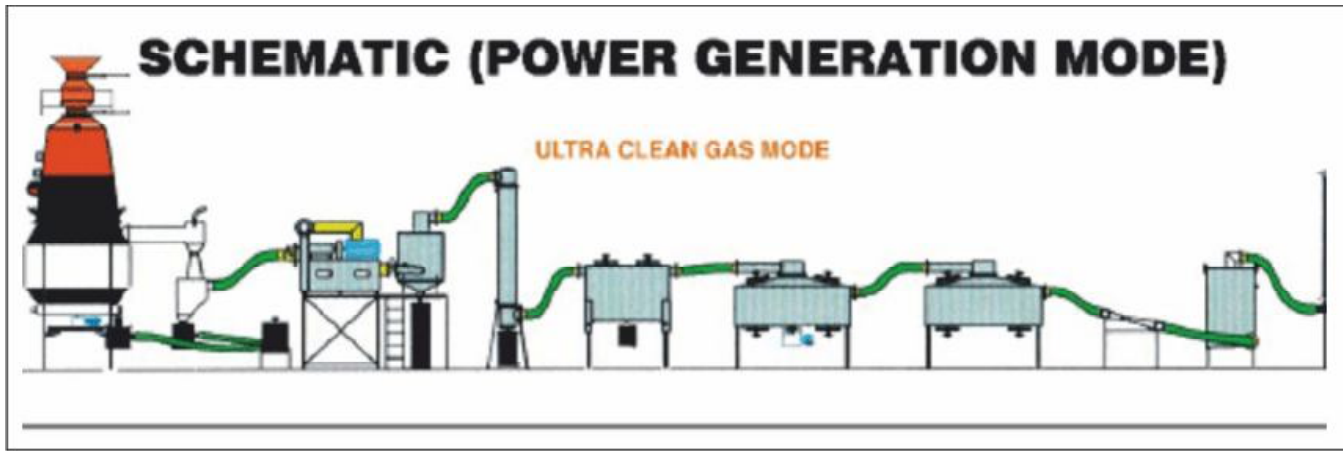
- o Irrigation Pumping
- o Village Electrification
- o Captive Power (*Industries*)

**Thermal Applications**

- o Hot Air Generators
- o Dryers
- o Boilers



- o Grid-fed Power
- o Simultaneous Charcoal and Power Production
- o Thermic Fluid Heaters
- o Ovens
- o Furnaces & Kilns



**Traditional Gsifier Engine Generator in use in India**

- Gasifier systems convert the biomass materials into a combustible gas which can either be burnt in an appropriate burner or which can be fed into diesel engines for saving of liquid fuels like F.O., LDO, HSD etc.
- For most cases, one litre of oil can be saved through use of either 3.5 to 4 kg. of wood or approximately 5.5 kg. of rice husk. The economics in terms of reduction in fuel cost can be worked out by checking the likely price of the material to be used and also by knowing the cost of liquid fuels. These numbers can also be used to work out the requirement of the biomass for any given application.
- In case of thermal application, the only limitation is the fact that maximum flame temperature using the gas can only be 1100°C if combustion air is not heated. In case of equipments where flue gas-to-air recuperators are used and combustion air is at relatively high temperatures, the flame temperatures could be higher.
- In case of engine gensets, the specific details of engines are important as engine parameters play an important role in deciding if gas can be fed to such engines. In such applications, only about 65% to 70% of the normal diesel consumption can be substituted as some diesel is required to initiate combustion in the engines. This generally means that each unit of electricity requires about 80-100 c.c. of HSD and 0.9 kg. of wood or approximately 1.4 kg. of rice husk etc. Once again, the economics and biomass consumption can be worked out on the basis of data given above.
- In case of engine gensets running on 100 % producer gas, the per unit consumption of woody biomass comes out to be just 1.5 kgs.



*(To be continued)*



*S. Mahadevan, B.E., F.I.E., M.B.A.,  
 Consultant, Energy and Energy Efficiency,  
 Mobile: 98401 55209*



**MANISH VYAS**  
*Vyas Institute*



*I get a feel good factor when entrepreneurs are becoming edupreneurs and are converting education into a recognized business.*

Choosing a college is one of the most important decisions that you will ever make, it can be the key that

opens the door to a life time of opportunities for grow and service.

Manish Vyas, when 14, started working with a Hindi newspaper in Jodhpur and learnt a lot to become “educated” and street smart which helps any entrepreneur in the years to come. He travelled a lot, all over India to get experience and exposure and with the help of Rajasthan Finance Corporation launched the first tabloid in Jodhpur, “**Teesra Pahar**”.

He saw an opportunity in exporting granite, marble and import Italian modular furniture. However, he was wise enough to realize to give it up when it did not “take off”! Peter F. Drucker has wisely said that an entrepreneur should try and try again and if it does not work, to give it up! With a new entrepreneurial mind set he got into education. Rajasthan government had allowed privatization of higher education and nursing courses were in great demand in rural part of India. In 1999, he was successful in establishing his first nursing school under his brand name of **Vyas Nursing Institute**. He established Rajasthan Vikas Sansthan (RVS) to create a new education hub with a motto of “WE CREATE” and “you dream, we have the power to shape it”.

**Now, under its umbrella he has nurtured Vyas Dental College & Hospital, Vyas Institute of Management, Vyas Institute of Eng. & Technology, Vyas Engineering College for Girls, Vyas B.Ed. College, Vyas Nursing Institute and Vyas College of Commerce and Business Administration.** All these institutes are making a difference in the lives of people in and around Jodhpur, Rajasthan. About 2000+ students with 300+ faculties are genuinely doing their bit to establish the brand name of Vyas in the education world of India. Education today has become very essential and when entrepreneurs like Manish get involved, it will surely bring in good results over the years. Education is not only the job of our government, but of everyone-you and me too.

**HOW TO TALK**

- Talk to **mother** lovingly.
- Talk to **father** respectfully.
- Talk to **wife** truthfully.
- Talk to **brother** heartfully.
- Talk to **sister** affectionately.
- Talk to **children** enthusiastically.

- Talk to **relatives** empathetically.
- Talk to **friends** jovially.
- Talk to **officials** politely.
- Talk to **vendors** strictly.
- Talk to **customers** honestly.
- Talk to **workers** courteously.
- Talk to **Politicians** carefully.



## SMART PHONE

I was marking my students' homework one night after dinner.



My husband was sitting nearby, playing "Candy Crush Saga" on his phone.

Suddenly, tears welled up in my eyes.

Why are you crying my dear?" my husband asked.

Yesterday I gave my class a writing assignment called, "My Wish," I told him.

"OK, and what's making you cry?" he asked again, keeping one eye on his game.

"The last paper moved me so much, it made me cry."

"What about it made you cry?"

"Listen, I'll read it to you," I replied, wiping my eyes.

"My parents love their smartphones very much. They care about their smartphones so much, that sometimes they forget to care about me.

When my father comes home from work tired, he has time for his smartphone but not for me.

When my parents are doing some important work and their phones ring, they will answer it right away, but they will not answer me... even when I'm crying.

They play games on their phones, but not with me.

When they are talking to someone on their phones, they never listen to me, even if I'm telling them something important.

***So, my wish is to become a smartphone.***

Now it was my husband who wiped his eyes.

"Who wrote this?" he asked quietly.

I looked up at him and said..."Our Son".

***Let us not sacrifice our family and relationships over the pursuit of material things. Smartphones are here to make our lives easier but not to control us, make us addicted and unsociable. It's not too late to return to a real family life, back to the old days when we didn't have the Internet and computer games. Put down that phone for a while.***

Talk to your children, your spouse or your friends. Set a good example for your children. Whatever you do, they will also do. Talk to the people you love and make sure they feel loved. And you can receive love from them too.

Can your phone give you love?

## THINK BEFORE YOU JUDGE ANYONE

A doctor entered the hospital in hurry after being called in for an urgent Surgery.

He answered the call asap, changed his clothes and went directly to the Surgery block.

He found the boy's father pacing in the hall waiting for the doctor.

On seeing him, the father yelled, "why did you take all this time to come? Don't you know that my son's life is in danger? Don't you have any sense of responsibility?"

The doctor smiled and said, "I am sorry, I wasn't in the hospital and I came as fast as I could after receiving the call and now, I wish you'd calm down so that I can do my work."

"Calm down?! What if your son was in this room right now, would you calm down?"

If your own son dies while waiting for the doctor than what will you do?" said the father angrily.

The doctor smiled again and replied, "We will do our best by God's grace and you should also pray for your son's healthy life".

"Giving advises when we're not concerned is so easy" Mumbled the father.

The surgery took some hours after which the doctor went out happy, "Thank goodness! your son is saved!"

And without waiting for the father's reply he carried on his way running by saying "if you have any question, ask the nurse".

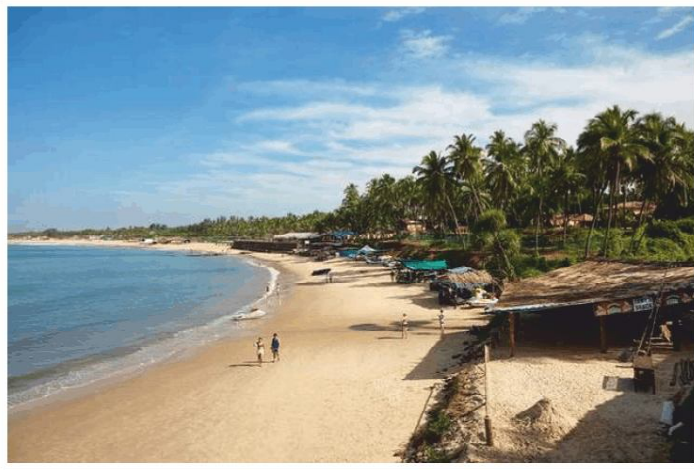
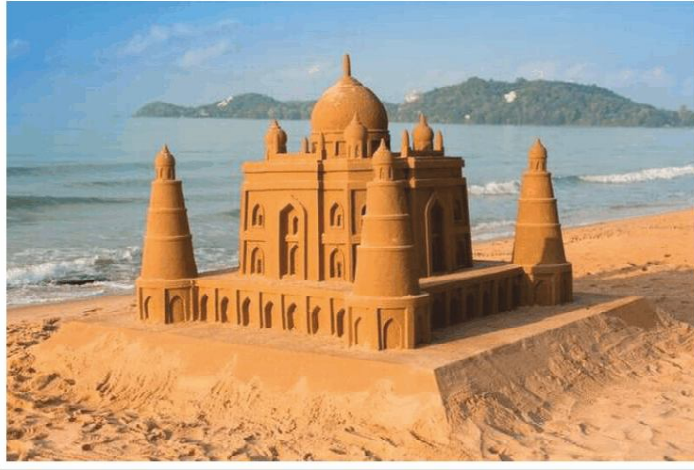
"Why is he so arrogant? He couldn't wait some minutes so that I ask about my son's state" Commented the father when seeing the nurse minutes after the doctor left.

The nurse answered, tears coming down her face "His son died yesterday in a road accident, he was at the burial when we called him for your son's surgery. And now that he saved your son's life, he left running to finish his son's burial."

***Moral: Never judge anyone because you never know how their life is and what they're going through.***

# வியப்பூட்டும் இந்தியா - 11

## கடற்கரைகளின் தேசம்



இந்தியாவின் மிகச் சிறியதும் மிகக் குறைந்த மக்கள் தொகை கொண்டதுமான மாநிலம் கோவா. 14-ம் நூற்றாண்டில் டெல்லி சுல்தான்களிடமிருந்த கோவா விஜய நகர மன்னர்களின் வசம் வந்தது. 1510-ல் வணிகத்துக்காக வந்த போர்த்துகீசியர்கள் பிஜப்பூர் மன்னரைத் தோற்கடித்து கோவாவைக் கைப்பற்றினர். நீண்ட காலம் கோவா அவர்கள்

வசம் இருந்ததால், மக்களின் வாழ்க்கை முறை, இசை, நடனம், கலை, கட்டிடக்கலை, மதம், மொழி, இலக்கியம், சமையல் போன்ற அனைத்திலும் போர்த்துகீசியர்களின் தாக்கம் அதிகம் இருக்கிறது.

அழகிய கடற்கரைகளும் புகழ் பெற்ற தேவாலயங்களும் கோவாவின் அடையாளங்கள். உலகம் முழுவதிலுமிருந்து சுற்றுலாப் பயணிகள் ஆண்டு முழுதும் வந்துகொண்டே இருக்கிறார்கள்.

வட கோவாவிலும் தென் கோவாவிலும் ஏராளமான கடற்கரைகள் இருக்கின்றன. சூரிய உதயத்தையும் சூரிய அஸ்தமனத்தையும் கடற்கரையில் இருந்து பார்க்கும்போது, அற்புதமாக இருக்கும். சில கடற்கரைகளில் நீர் விளையாட்டுகள் விளையாடப்படுகின்றன. ஏப்ரல், மே மாதங்களில் இந்தக் கடற்கரைகளில் மணல் சிற்பத் திருவிழாக்கள் நடத்தப்படுகின்றன. உலகின் பல நாடுகளில் இருந்தும் கலைஞர்கள் இதில் பங்கேற்கிறார்கள்.

கல்சிபாகா கடற்கரையில் ஆலிவ் ரிட்டலி ஆமைகள் அதிக அளவில் இனப்பெருக்கம் செய்ய வருகின்றன. கடலில் இருந்து ஆமைகள் வருவதும், கடற்கரை மணலில் முட்டைகளை இட்டுச் செல்வதையும் பார்ப்பது புதிய அனுபவத்தைத் தரும். சில கடற்கரைகளில் கம்பீரமாக இருக்கும் கோட்டைகளைப் பார்ப்பதற்குச் சுற்றுலாப் பயணிகள் ஆர்வம் காட்டுகிறார்கள்.

கோவாவின் உலகப் பாரம்பரியச் சின்னங்களில் ஒன்று பசிலிகா டிபாம் ஜீஸஸ் எனப்படும் தேவாலயம், இந்தியாவின் மிகவும் பழமையான தேவாலயமாக இது கருதப்படுகிறது. கி.பி. 1552-ம் ஆண்டு மறைந்த செயின்ட் பிரான்சிஸ் சேவியர் என்ற புனிதரின் உடல் இங்கே வைக்கப்பட்டுள்ளது.

சே கதீட்ரல் தேவாலயம் புனித கேத்தரீன் அவர்களுக்கான நினைவுச் சின்னமாக உள்ளது. ஆசியாவிலேயே மிகப் பெரிய தேவாலயமாகக் கருதப்படுகிறது. இங்குள்ள ஓவியங்களும் மிகப் பெரிய மணியும் பார்வையாளர்களைப் பெரிதும் கவர்கின்றன.

தொடர்புக்கு: ஆம்பூர் மங்கையர்க்கரசி,  
[mangai.teach@gmail.com](mailto:mangai.teach@gmail.com)

Courtesy: தி இந்து, தேதி: 27.12.2017

**cyf Gi fapi y vj hGg j pdk;**

neQi r Ji sj j hYk; neQr pDs; Ji sj j hYk; - **tpi sT mopTj hd!**



**Gi fi a kwgNghk;. Gj J a ph ngWNthk!**

**Gi fg; goffj j j eWjj p j k; v d d el fFk?**

➤ **Gi fggij eWjj p 20 e k p j j py;..**  
 , j a J bg G > u j j m O j j k ; , a y G e p i y f : F t U k ; u j j X l : k ; r h F k ;

➤ **12 kz p Neuj j py;..**  
 c l y p y ; f h G d ; N k h d h f i j L m s T F i w e J > M f : j p [ d ; m s T c a u j ; n j h l q : F k ;

➤ **xU ehs py;..**  
 u j j m O j j k ; r h f p k h u i l g G f : f h d t h a g G g b g : g b a h f F i w a n j h l q : F k ; c l w g a p w r p f s ; v s j j h F k ;

➤ **xU khj j j py;..**  
 E i u a l y p d ; n r a y g h L N k k g L k ; K O i k a h f R t h r p f : f , a Y k ; R t h r f ; N f h s h W f s ; e b : F k ;

➤ **Xuhz b y;..**  
 , j a k ; t Y t h F k ; , j a N e h a : f S f : f h d r h j j p a f : \$ W g h j p a h f F i w A k ;

➤ **5 Mz Lfs py;..**  
 G i f g ; g o f f j j h y ; R U q : f p a u j j f ; F o h a : f s ; t p h p t i l A k ; j b N u h f ; V w g L k ; t h a g G F i w A k ;

➤ **10 Mz Lfs py;..**  
 E i u a l y ; G w W N e h a : f : f h d t h a g G g h j p a h f F i w A k ; t h a > n j h z i l G w W N e h a ; t h a g G k ; F i w f p w J .

➤ **20 Mz Lfs py;..**  
 G i f a h y ; k u z k ; V w g L k ; f z : l j ; i j f l e : J t p l y h k ; . E i u a l y ; N e h a > G w W N e h a : f : f h d t h a g G f S k ; V w f : F i w a , y i y .

Courtesy: j p , e J > N j j p . 31.05.2018

**HUMOUR**

*Some Quotes that make you Laugh!*

**My luck is so bad that if I bought a cemetery, people would stop dying.**

- *Rodney Dangerfield*

**Money can't buy you happiness .... But it does bring you a more pleasant form of misery.**

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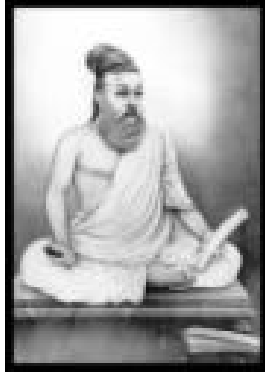
**By the time a man is wise enough to watch his step, he's too old to go anywhere.**

- *Billy Crystal*

*The negligence of a few could easily send a ship to the bottom, but if it has the wholehearted co-operation of all on board it can be safely brought to part. – SARDAR VALLABAI PATEL*

## TIRUKKURAL AND MANAGEMENT IN A 'NUTSHELL' - 67

We are witnessing today that people look for power in democracy to amass wealth by all means and it is the duty of every responsible citizen to exercise all care in the choice of persons for positions of power and responsibility.



Continuing with the task of identifying people for positions or to lead us in the Democratic set up, there are many more important characteristics to look into and another paramount one is the strong and unwavering mind giving the ability to abstain from coveting under any circumstance and focus on activities for the good of the people. Valluvar devotes lot of Kurals for stressing this aspect in persons to hold positions and some are dealt below:

*“Ilam Endru Vekkhudal Seyyar Pulam  
Vendra Punmaiyl Katchiyavar Kural 174*

**“Behold the men that have mastered their senses and enlarged their vision: they covet not saying, Lo we are in want.”**

*Akhki Agandra Arivennum Yarmattum  
Vekhki Veriya Seyin? Kural 175*

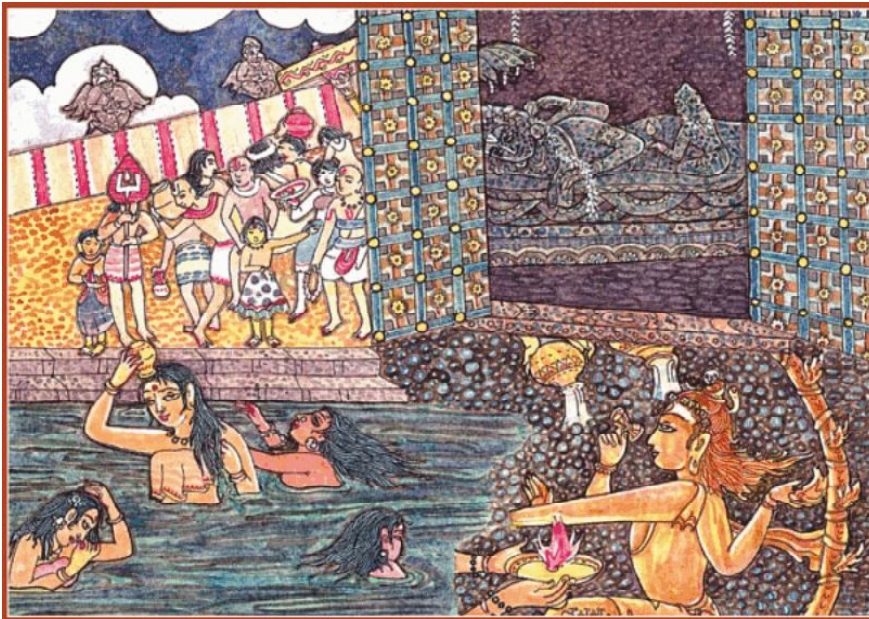
**“Of what avail in a mind that is subtle and comprehending, if it yieldeth unto greed and consenteth unto insensate deeds?”**

*“Iral Eenum Ennathu Vekhkin Viral Eenum  
Vendamai Enum Serukku Kural 180*

**“The greed that looketh not beyond engendereth destruction: but the greatness that sayeth, I desire not. triumpheth over evil”**

## HOME FESTIVALS - 12

### khHfop - Markali (December/January)



During Tirupuval (below, in upper left of painting), people bathe (lower left) and gather in the early morning to go on procession singing devotional Vaishnava songs (upper left). Especially popular are those of the 9<sup>th</sup> century lady saint Andal, venerated as one of South India's greatest devotional poets. On **Vaikunth Ekadasi**, the 11<sup>th</sup> day of the lunar month, the doors

of the huge temple of Srirangam are opened to devotees from morning to night for darshan of Rangam, an aspect of Lord Vishnu, sleeping on Adishani, the serpent king (upper right). Another famed festival is **Ardra Darshana**, when Siva Nataraja is decorated and taken from the temple in procession throughout the community (lower right). Especially the ill and those of old age seek to have a glimpse of Nataraj. A renowned sweet, **aurudra kalli**, is made with vegetables on this day.

*“All of these festivals are earnestly conducted. People wait for the day with their mind on God. The purpose is to gather in the home and worship for the prosperity of the family and of all mankind.”*

*(To be continued)*

## உலக புகையிலை எதிர்ப்பு தினம்

நெஞ்சை துளைத்தாலும் நெஞ்சினுள் துளைத்தாலும் - விளைவு அழிவுதான்!



புகையை மறப்போம்.. புத்துயிர் பெறுவோம்!  
புகைப் பழக்கத்தை நிறுத்தியதும் என்ன நடக்கும்?

- புகைப்பதை நிறுத்திய 20 நிமிடத்தில்...  
இதய துடிப்பு, ரத்த அழுத்தம் இயல்பு நிலைக்கு வரும். ரத்த ஓட்டம் சீராகும்.
- 12 மணி நேரத்தில்...  
உடலில் கார்பன் மோனாக்சைடு அளவு குறைந்து, ஆக்ஸிஜன் அளவு உயரத் தொடங்கும்.
- ஒரு நாளில்...  
ரத்த அழுத்தம் சீராகி, மாரடைப்புக்கான வாய்ப்பு படிப்படியாக குறைய தொடங்கும். உடற்பயிற்சிகள் எளிதாகும்.

- ஒரு மாதத்தில்...  
நுரையீரலின் செயல்பாடு மேம்படும். முழுமையாக சுவாசிக்க இயலும். சுவாசக் கோளாறுகள் நீங்கும்.
- ஓராண்டில்...  
இதயம் வலுவாகும். இதய நோய்களுக்கான சாத்தியக்கூறு பாதியாக குறையும்.
- 5 ஆண்டுகளில்...  
புகைப் பழக்கத்தால் சுருங்கிய ரத்தக் குழாய்கள் விரிவடையும். ஸ்டிரோக் ஏற்படும் வாய்ப்பு குறையும்.
- 10 ஆண்டுகளில்...  
நுரையீரல் புற்றுநோய்க்கான வாய்ப்பு பாதியாக குறையும். வாய், தொண்டை புற்றுநோய் வாய்ப்பும் குறைகிறது.
- 20 ஆண்டுகளில்...  
புகையால் மரணம் ஏற்படும் கண்டத்தை கடந்துவிடலாம். நுரையீரல் நோய், புற்றுநோய்க்கான வாய்ப்புகளும் ஏறக்குறைய இல்லை.

Courtesy: தி இந்து, தேதி. 31.05.2018

## HUMOUR

### Some Quotes that make you Laugh!

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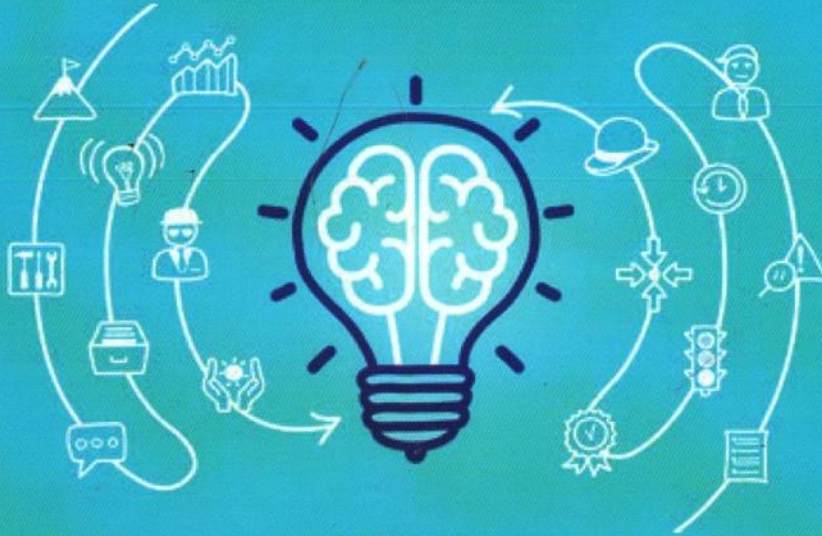
- Phyllis Diller

By the time a man is wise enough to watch his step, he's too old to go anywhere.

- Billy Crystal

*My only desire is that India should be a good producer and no one should be hungry, shedding tears for food in the country. – SARDAR VALLABAI PATEL*

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