



# ELECTRICAL

## INSTALLATION ENGINEER

### NEWS LETTER

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

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JANUARY 2016

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## EDITORIAL

Dear Members, Fellow Professionals and Friends,

*Happy New Year!*

*Happy “Pongal”!!*

*Happy Republic Day!!!*

The year 2015 ended with over dose of rains in almost all parts of Tamilnadu, with a historical down pour in Chennai dislocating normal life completely. Things have got back to normal in most parts of Chennai. The fast restoration of Electricity in almost all parts of Chennai with minimum delay is also commendable. There are problems in some low lying areas which are probably not meant for Housing. Like every crisis results in better understanding and planning properly, we sincerely hope that Government will take proper steps to correct and streamline things. **As reported vary widely, the sensitivity and response of common public and Service organizations have been remarkable and the participation and contribution by the Youth in particular is wonderful. The Nation is celebrating the National Youth Day on the 12<sup>th</sup> of January and let us all Hail them and support their Good Work.**

January is also marked by the Pongal Festival, which is a Festival to celebrate Good Harvest and also to show our respects to the cattle which farms a part of our rural life. Like India is a Land of Agriculture, we also possess a huge cattle wealth and India has certainly shown its capabilities through “**Green Revolution**” and “**White Revolution**”. It is also important to remember that even now, the yield per Acre in Agriculture and Milk yield per cow in Dairies are very low compared to the Best of the World and World averages, It is important to focus on increasing Productivity in view of increasing populations and decreasing land area etc.

Both in Agriculture and other Industrial and Commercial activities, the overall efficiency levels in terms of Energy Consumption is still low, though the efforts are continuously going on to introduce Energy Efficient Equipments, Appliances and Solutions. Focus on improving productivity in all areas can help reduce “**Specific Energy Consumption**” levels appreciably.

We all proudly celebrate the 66<sup>th</sup> Republic Day on the 26<sup>th</sup> of January and closely looking at the ground realities, we realize that some of the measures initiated by Government for “**Clean India**”, “**Make in India**” and widening the base of Banking, Insurance and Finance can go a long way in increasing the living standards of people. However, we feel sad to notice the domination of self interest resulting in falling standards in Politics and persons in Public Life as well as persons in Services. It is time that we all realize the values of Pride and Patriotism and contribute to the betterment of our Great India. 30<sup>th</sup> January is remembered as “Martyrs Day” and we remember Mahathma Gandhi, taken away from our midst on this date, but India can never forget the Ideals for which the Mahathma lived and gave his life. The most important of his messages are Patriotism, Truthfulness and Ahimsa. Let us all resolve to contribute our mite for the Nation Building.

**We thank all those members who have helped us by participating in the advertisements appearing for the issue December 2015 – OBO Bettermann India Pvt. Ltd., JL Seagull Power Products, Universal Earthing Systems Pvt. Ltd., Power Links, Ashlok Safe Earthing Electrode Ltd., Dehn India Pvt. Ltd., Elektrotec 2016, Cape Electric Pvt. Ltd., Wilson Power and Distribution Technologies Pvt. Ltd., Abirami Electricals, FLIR Systems India Pvt. Ltd., Galaxy Earthing Electrodes Pvt. Ltd., Supreme Power Equipment Pvt. Ltd., Sun Sine Solution Pvt. Ltd.**

**EDITOR**

**SAVE ENERGY, SAVE MONEY, SAVE PLANET**

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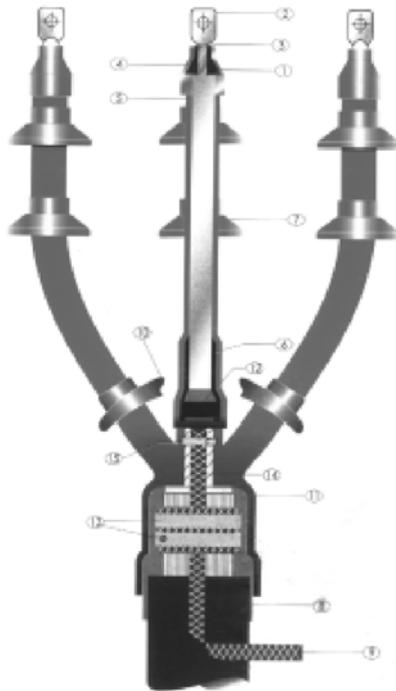
S.No.	Company Name	District	Contact No.	License No.
1.	Subash Electricals	Ambur	04174-242289, 98946 11410	EA 1299
2.	T. Abdul Wahid & Company	Ambur	04174-242286, 93810 15762	EA 1297
3.	Sri Balaji Engineering	Aravaimozhi	04652-262996, 97888 60491	ESA 386
4.	Devi Priya Electricals	Arcot	90430 96001, 98940 99601	EA 2645
5.	Micron Electricals	Bangalore	080-39908600, 9342400554	ESA 412
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7.	A.R.S. Electricals P. Ltd.	Chennai	044-23724105, 97104 49401	EA 2868
8.	Aiswarya Power Corporation	Chennai	044-25910032, 93810 99313	EA 2008
9.	Akash Electricals	Chennai	044-24743963, 94440 39282	EA 2705
10.	Al Ansari Power Technologies (I) P. Ltd.	Chennai	044-28364244, 98408 33146	ESA 376
11.	Anand Electricals	Chennai	044-23811060, 94442 86189	EA 1712
12.	Ananth Enterprises	Chennai	95511 55559, 72000 06010	EA 2791
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15.	AVB Technologies	Chennai	044-24804267, 98405 92128	EA 2808



## POWER LINKS

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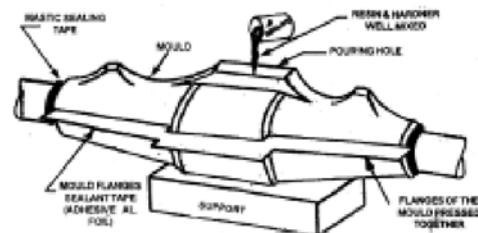
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## EVENTS

### L&T Training Programme

Switchgear Selection - Motor Control Centre (MCC)	1-2 February 2016
Switchgear Selection - Power Control Centre (PCC)	3-4 February 2016
Introduction to Industrial Electrical Systems	3-5 February 2016
Breaker Maintenance Workshop - C Power ACB	8-10 February 2016
Breaker Maintenance Workshop - U Power Omega ACB	11-12 February 2016
Selection of LV Switchgear and Applications	15-19 February 2016
Reactive Power & Harmonics Mitigation	22-23 February 2016
Design of Control Circuits	25-26 February 2016
Electrical Safety	29 February 2016

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

**Contact Tel.:** 0423 251 7107 **Fax:** 0423 251 7158

**Email:** stc\_coonor@lntebg.com



# GRIHA

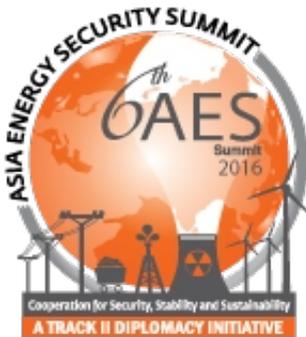
### 7<sup>th</sup> The Griha Summit

**Events Profile:** The GRIHA Summit 2016 will be a landmark event, involving hundreds of community members. The conference theme would be '**Cities of the Future**' and the sessions would be designed around enhanced efficiency of built environment both at city and building scale.

**Date:** 16<sup>th</sup> – 20<sup>th</sup> February 2016

**Venue:** India Habitat Center (IHC), New Delhi

**Website:** <http://grihaindia.org/grihasummit/index.php#home>



**Events Profile:** For the year 2016, IPPAI will host the 6<sup>th</sup> Asia Energy Security Summit where government, industry leaders, regulators, policymakers, academicians and think tanks from across the world discuss and debate issues relating to the entire energy spectrum, particularly the emerging issues and challenges in the energy landscape of Asia. The proceedings from the previous conclaves are carried forward for review and discussion.

**Date:** 1<sup>st</sup> – 3<sup>rd</sup> March 2016

**Venue:** Radisson Goa Candolim, Goa, India

**Website:** <http://asiaenergysecurity.com/Welcome.aspx>



**Sustainable Energy & Technology Asia 2016**  
Securing Asia's Energy Future

**23<sup>rd</sup>-25<sup>th</sup> March 2016**  
BITEC (Bangkok International Trade & Exhibition Centre)  
Bangkok, Thailand

**Events Profile:** Sustainable Energy & Technology Asia exhibition & conference, developed specifically for international, governmental and industry discussions and collaboration on developing sustainable energy policies for the region's future economic development.

**Date:** 23<sup>rd</sup> – 25<sup>th</sup> March 2016

**Venue:** BITEC (Bangkok International Trade & Exhibition Centre), Bangkok, Thailand

**Website:** <http://www.seta.asia/about-seta/seta-2016/>

## LONG-LASTING, WATER-BASED NUCLEAR BATTERY DEVELOPED

A new nuclear-powered, water-based battery may one day be used as a dependable power supply in vehicles, spacecraft, and other applications

Researchers working at the University of Missouri (MU) claim to have produced a prototype of a nuclear-powered, water-based battery that is said to be both longer-lasting and more efficient than current battery technologies and may eventually be used as a dependable power supply in vehicles, spacecraft, and other applications where longevity, reliability, and efficiency are paramount.



“Betavoltaics, a battery technology that generates power from radiation, has been studied as an energy source since the 1950s,” said associate professor Jae W. Kwon, of the College of Engineering at MU. “Controlled nuclear technologies are not inherently dangerous. We already have many commercial uses of nuclear technologies in our lives including fire detectors in bedrooms and emergency exit signs in buildings.”

Utilizing the radioactive isotope *strontium-90* to enhance the electrochemical energy produced in a water-based solution, the researchers have incorporated a nanostructured titanium dioxide electrode acting as a catalyst for water decomposition. That is, the catalyst assists the breakdown of water in conjunction with the applied radiation into assorted oxygen compounds. As a result, when high-energy beta radiation passes through the platinum and the nanoporous titanium dioxide, electron-hole pairs are produced within the titanium dioxide, creating an electron flow and a resultant electric current. “Water acts as a buffer and surface *plasmons* created in the device turned out to be very useful in increasing its efficiency,” Kwon said. “The ionic solution is not easily frozen at very low temperatures and could work in a wide variety of applications including car batteries and, if packaged properly, perhaps spacecraft.”

By no means the first-ever nuclear battery – the *NanoTritium device from City Labs* being one recent notable example – this is the first nuclear battery that has been produced to exploit the inherent advantages of radiolysis (water-splitting with radiation) to produce an electric current, at higher energy levels and lower temperatures than previously possible. And at much greater claimed efficiencies than other water-splitting energy production techniques.

This is because, unlike other forms of *photocatalytic* methods of water-splitting to produce energy, the high-energy beta radiation in the MU device produces free radicals in water such that the kinetic energy is recombined or trapped in water molecules so that the radiation can be converted into electricity – using the platinum/titanium dioxide electrode previously described – to achieve water splitting efficiently and at room temperature.

As a result, whilst solar cells use a similar mechanism for the transference of energy via hole-electron pairs, very few free radicals are produced because the photon energies are principally in the visible spectrum and subsequently at lower levels of energy.

Beta radiation produced by the strontium source, on the other hand, with its ability to enhance the chemical reactions involving free radicals at greater electron energy levels, is a much more efficient way to produce extremely long-lasting and reliable energy. So much so, that the water-based nuclear battery may well offer a viable alternative to the solar cell as a sustainable, low-pollution energy source.

***“Oh Beautiful for smoggy skies, insecticided grain,  
For strip-mined mountain’s majesty above the asphalt plain.  
Oh! My Country, man sheds his waste on thee,  
And hides the pines with billboard signs, from sea to oily sea.” - GEORGE CARLIN***

# KNOW THY POWER NETWORK - 100

**Glad to reach the “Hundredth Milestone” of my contribution.** As stated earlier, power network is very vast and beyond our comprehension and we can always enjoy its various sites, when we move across it. *I always wonder “what it is”. Let us continue our journey further.*

## B. Time Vs Resistance Test

As studied earlier, during the course of the IR test, the electrons in the insulation material try to move stealthily, which leads to the flow of electric charges viz. current. The insulation behaves as a capacitor at first; then gradually the structure achieves its orientation and so the effects of charging and dielectric absorption get reduced i.e. the current through the insulation attains a steady value after sometime. But the leakage current brought by the moisture or deterioration of the insulation conveys different information. It tries to show its significance by way of higher current and lower resistance. The effect of this leakage current will be low in the case of good insulation and hence its IR value will be high. But in the case of moist / contaminated insulation, the effect and leakage current will be predominant and it gets reflected in its “low” IR value. So in such cases due to the masking effects of high leakage currents, no spot conclusion can be arrived. It demands the reckoning of other contributing factors like “time”. To understand its role, the current values have to be measured at regular time gap of one minute with in a total testing time of 10 minutes i.e. the IR value is measured for every one minute in the time interval for 10 minutes. In the case of a good insulation, a smooth rising curve will be obtained; a flat graph will be got in the case of deteriorated insulation. One more point in support of this time vs resistance test this test gives good results without any need for temperature corrections nor old records for comparative study.

## C. Polarisation Index Test (PI Value Test)

This test is mainly meant for “*Rotating machineries and it helps to assess the equipment insulation in ten minutes*”. This index is nothing but a ratio obtained by dividing the one minute IR reading by ten minute IR value.

A sudden increase in PI values (more than 20 percent) when maintenance tests are carried out after a long interval, conveys that some thing is wrong with the equipment insulation and needs immediate check up. It is normal to perform PI tests on higher capacity equipment before subjecting them for voltage withstand tests.

PI test results depend on the rigid structures of insulating material and the final alignment of its molecules when a voltage field is applied. It is difficult to meet this test requirement in oil-filled equipment like transformers and reactors, where convection currents continuously swirl the oil. So this test cannot be effectively applied to fluid oil filled equipment. In general this test is helpful in identifying the problems in an equipment that suffers from moisture – ingress / oil contamination.

## D. Step Voltage Test

When the voltage applied across the test piece is increased, a point will be reached where ionization will be started in the weak spots (cracks or cavities) of the insulation and it results in an increase in current and there by produces a fall in resistance. Since the ionization of defects is our aim, the test voltage need not be applied continuously so as to reach the final withstand level of the equipment. This step voltage method is also useful in identifying the defective insulation. Standard procedure of this test - Increase the applied voltage in five equal, one minute increments and note down the IR value at each level. Any notable reduction in resistance points out the weakness in the insulation. A stuttering of the Megger pointer provides an early warning of this condition.

**Interpretation of Test Results :** No markable changes in the test results — Insulation is in healthy condition; Appreciable difference or fall in values – The insulation in point is “suspect” and suffers from defects and requires attention and reconditioning, if need arises. A deviation of 25 percent or more is an indication of moisture ingress - or other contamination.

This self-evaluating test is free from the influence of external factors like temperature and humidity.

## E. Dielectric Discharge Test

In this test, the current that flows during the discharge of the test piece is employed. It occurs at the end of the IR test of 30 minutes duration when the fully charged test specimen is discharged through the discharge resistors of the testing device. The capacitive charge gets discharged rapidly within one minute, where as a portion of total current viz. dielectric reabsorption still left, as it requires a longer time several minute to die down. *This current indicates the health condition of the insulation.*

### The information furnished by PI tests

PI Value - Condition to Insulation
< 1 - Poor
1 - 2 - Questionable
2 - 4 - Agreeable / Acceptable
> 4 - Good

### Typical DD values as Bench Mark

DD value	Insulation condition
> 7	Bad
4 - 7	Poor
2 - 4	Questionable / suspect
< 2	Good

A low DD index shows that the reabsorption current decays quickly and hence the insulation is in reliable condition.

$$\text{DD Value (Index)} = \frac{\text{Current flow through discharge resistors after 1 minute}}{\text{Test voltage (in volts) x Capacitance in } \mu\text{f}}$$

This test is useful for locating faults in a multilayered insulation Viz. generating units and it is temperature dependent.

#### IV Insulation Resistance Tests with Megger – A Sum up

- To have a good understanding it is desirable to sum up what we have learnt so far.
- Megger is a DC tester. It helps to measure the insulation resistance of any electrical equipment (AC or DC). This IR test is a general “Go – No Go test” – not an end point of insulation health status.
- Purchase - Selection of Megger needs a careful study and analysis.
- During IR test four currents in the beginning and one steady current in the end are observed
- Speed of the pointer movement has to be monitored carefully - smooth movement of pointer indicates – A healthy insulation
- Alternate rise and fall of the Megger pointer shows the presence of minor arcings in the test piece; continuous jitter or oscillations of the meter needle shows that the test is not yet over and required more time.
- Role of environmental factors like temperature and humidity on the test results or significant.
- Possible tests (diagnostic tests) that can be carried out to predict insulation break down and their significance:-
  - (i) *Trending Spot test – Helps a general check of equipment insulation health.*
  - (ii) *Time Vs Resistance test – Identifies a moist and contaminated insulation – a pass – fail test.*
  - (iii) *Step voltage test – Reveals localized damages like pin holes and cracks suffered by aged insulation.*
  - (iv) *Dielectric discharge test – Problems in the single layer of a multi layer insulation (e.g) Generator, Motor*

Let us conclude this topic Viz. Insulation resistance with the understanding of the roles played by interference and temperature on the test results.

#### (a) Role Played by Interference During Tests

Besides surrounding temperature, interference or electrical noise is one of the troublesome sources that make on-site or field measurements a difficult one and also frequently cause incorrect and off the mark test results. Interference is produced at a variety of frequencies and present in the sample during testing. *This common phenomenon is nothing but induced currents / voltage brought by equipment existing in the vicinity of test piece, especially in HV/EHV substations where it can go upto the level of several milliamps at 50Hz. Essentially, the insulation tester used for our works should be provided with filters and other means to filter out these interference signals i.e. the Megger used should be matched to the level of interference expected.*

#### (b) Role of Temperature on IR Test Results

Temperature of the environment surrounding the testing place has a significant role on the test results. We all know that the behaviour of various insulating materials is different. None exhibit the same or identical patterns. Resistance values always drop markedly with an increase in temperature of the testing place for the same piece of equipment. So we need a graph exhibiting the temperature correction factors to get a clear view of the IR of the equipment. To get temperature correction quickly at site, it may be taken that for every 10°C increase in temperature the resistance gets halved of its original value (e.g) a 100 GΩ IR at 20°C becomes 25Ω G at 40°C. Temperature correction is an essential need when tests are carried out with higher voltages and at higher levels of sensitivity.

By monitoring the variations in the behaviour of the characteristic features of HV insulation systems like Tan delta, Insulation Resistance, Dissipation Factor, Temperature and Voltage withstand levels and Partial Discharge, the insulation breakdowns can be predicted. However it is difficult to carry out PD tests at site. The field problems met with Partial Discharge test are mainly due to interference or electrical noises produced in the HV substation yards. The significance of PD tests lies in the fact that it is much useful in identifying the weak points in the insulation of HV equipment in the incipient stage itself. So it becomes essential for us to have a good understanding of this topic viz. Partial Discharge also.

The next article will deal with this phenomenon till then, kindly stay tuned.

*(To be continued...)*



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## 2015 SET TO BE HOTTEST YEAR ON RECORD: UN (UPDATE)

The year 2015 is shaping up to be the hottest on record, the UN's weather agency said Wednesday, a week ahead of a crucial climate change summit in Paris.

"2015 is likely to be the hottest year on record, with ocean surface temperatures at the highest level since measurements began," said Michel Jarraud, head of the World Meteorological Organization. "This



is all bad news for the planet," he added in a statement.

The WMO said data from the first 10 months of the year suggested temperatures over land and sea would tick in at their highest level ever measured this year, after already reaching record highs in 2014. The UN agency said the preliminary data showed the global average surface temperature has reached "the symbolic and significant milestone" of 1.0 degree Celsius (1.8 degree Fahrenheit) above mid-19th century levels. Global surface temperatures this year are also about 0.73 degrees Celsius above the 1961-1990 average of 14 degrees Celsius, WMO said.

The UN agency usually waits to have data stretching over a full year before drawing any conclusions, but said it wanted to release its preliminary findings "to inform negotiators at the UN Climate Change Conference in Paris." More than 145 world leaders are set to gather in the French capital Monday to launch the 12-day conference aimed at securing a rescue pact for the global climate aimed at capping global warming at two degrees Celsius (3.6 degrees Fahrenheit) above the pre-industrial era. China had its warmest January-to-October period on record, Africa is experiencing its second warmest year on record, while temperatures have also soared in western North America, large parts of South America, Africa and southern and eastern Eurasia. Severe heatwaves have hit India and Pakistan, as well as Europe, North Africa and the Middle East. The soaring temperatures this year appear to be part of a trend, with WMO indicating that the years 2011-2015 marked the hottest five-year period ever measured.

The past five years have been 0.57 degrees Celsius (1.01 degrees Fahrenheit) above the 1961-90 average, it said, referring to preliminary data up to the end of September, WMO said, explaining that its five-year analysis provides a better indication of how the climate is changing over time than its annual reports.

The five-year period had seen numerous extreme weather events that were influenced by climate change, WMO said, adding that the warming climate had increased the probability of heat waves by a factor of 10 or more in some cases. The pending heat records come after concentrations of carbon dioxide and other greenhouse gases in the atmosphere hit record highs in 2014, prompting WMO earlier this month to warn that climate change was moving the world into "uncharted territory."

Read more at: <http://phys.org/news/2015-11-weather-agency-hot-year.html#jCp>

**"What we are doing to the forests of the world is but a mirror reflection of what we are doing to ourselves and to one another." - CHRIS MASER, Forest Primeval: The Natural History of an Ancient Forest**

# ALSTOM T&D INDIA EXPANDS BIHAR ELECTRICAL TRANSMISSION NETWORK

Alstom T&D India has signed three orders worth approximately €30 million (INR 2202 million) to build two 220 kV and four 132 kV air insulated substations (AIS) for Bihar State Power Transmission Company Limited (BSPTCL). This project is part of India's 12th Five Year Plan to strengthen Bihar's 220 kV transmission network. Built across various locations in Bihar state, these substations aim to enhance the capacity of power evacuation systems and improve the power situation. The substations will strengthen the transmission network at 220 kV level with a potential to be further upgraded to 400 kV in future.



Alstom T&D India will construct the 220/132/33 kV turnkey substations as well as the two units of associated 132 kV bay extension in Supaul. Alstom will provide control and relay panel based on the *SCADA* system, for 16 units of 220 kV bays, 39 units of 132 kV bays plus 52 units of 33 kV bays and other auxiliary equipment. All major equipment will be supplied from Alstom T&D India's manufacturing facilities.

RathinBasu, Managing Director, Alstom T&D India said, *"Bihar is one of the rapidly growing states in India. The state aims to build the T&D infrastructure for the future in the coming years to transport electricity across the entire state. Alstom T&D India is proud to be chosen as the supplier of choice to provide advanced products and solutions towards building the electrical infrastructure of Bihar."*

As per the Census of India 2011, only 16.4 per cent of Bihar's 19 million households have access to electricity. Anticipating growth in the energy sector, both state and central government have planned major investments in T&D sector to improve the power situation in the state.

## **About Alstom**

*Alstom is a global leader in the world of power generation, power transmission and rail infrastructure and sets the benchmark for innovative and environmentally friendly technologies. Alstom builds the fastest train and the highest capacity automated metro in the world, provides turnkey integrated power plant solutions and associated services for a wide variety of energy sources, including hydro, nuclear, gas, coal and wind, and it offers a wide range of solutions for power transmission, with a focus on smart grids. The Group employs 93,000 people in around 100 countries. It had sales of over €20 billion and booked €21.5 billion in orders in 2013/14.*

*Alstom T&D India (globally known as Alstom Grid), is a market leader in the Indian power transmission sector. It has over 100 years of expertise in building the transmission infrastructure for the country. Alstom has a strong portfolio of products, solutions and services, comprising the entire range of transmission equipment up to Extra and Ultra High Voltages (765 kV and beyond) including air-insulated switchgear (AIS) and locally manufactured power transformers and gas-insulated switchgear (GIS). It also provides power electronics solutions (HVDC, FACTS) to create super highways and offers highly advanced power management Smart Grid solutions for transmission and distribution including renewable energies integration. With over 3,500 employees and eight world class manufacturing units, Alstom T&D India is future ready to support the rapidly evolving transmission sector in India.*

*Courtesy : Alstom India*

**"Wildness is the preservation of the World."**

**HENRY DAVID THOREAU, Walking**

# SOLAR – A PROMISING INDIA

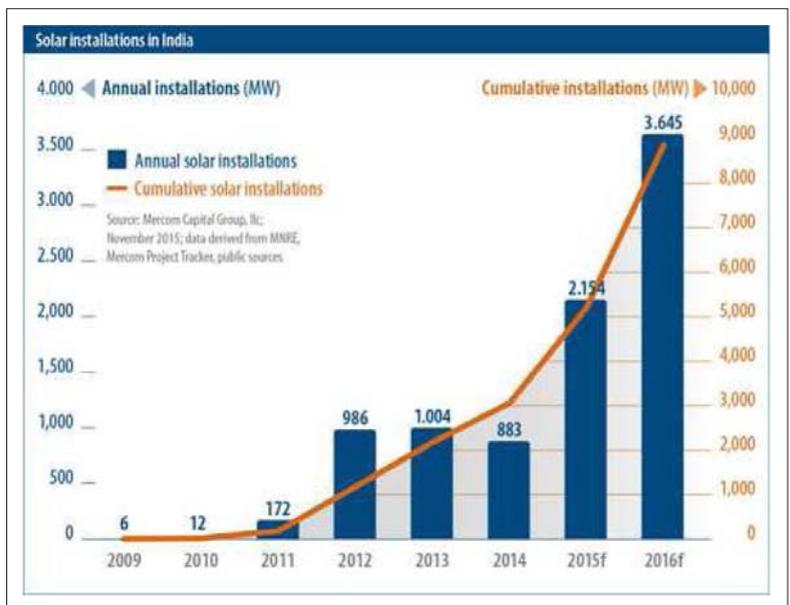
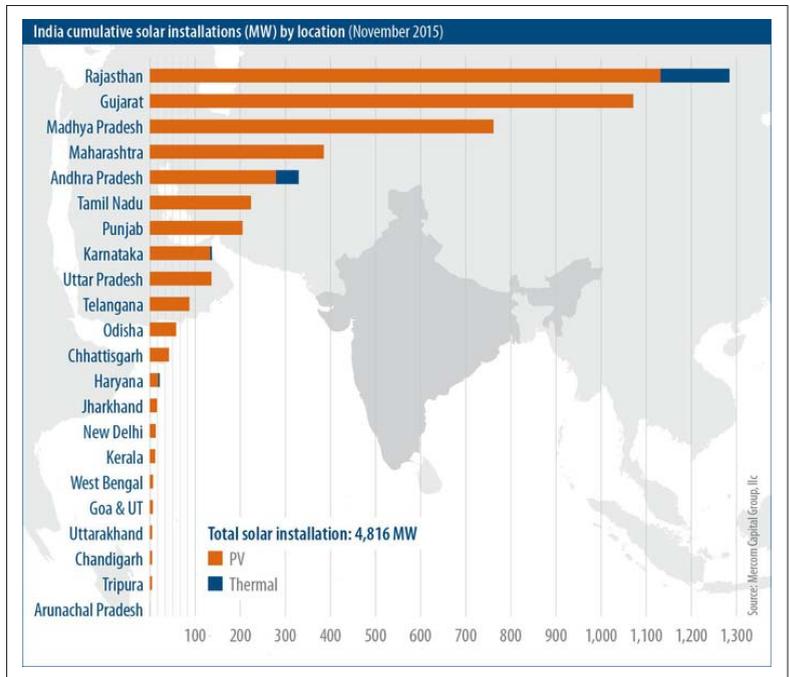
Interest in the National Solar Mission has never been greater, but this hot market is pushing solar tariffs to record – and some believe, unviable – lows, writes Raj Prabhu of Mercom Capital. Across the country, most states are pressing ahead with tenders and new policies that are slowly transforming India’s energy landscape.

There has been increased activity in the Indian solar sector over the past quarter, with tenders and auctions beginning to occur more frequently along with some important policy announcements. Year-to-date (YTD) solar installations have reached 1,652 MW with cumulative solar installations totaling 4,816 MW. Mercom Capital expects 2015 calendar year installations to total approximately 2,150 MW – which is slightly below the previous estimate – and is forecasting 2016 installations to reach approximately 3,645 MW. After several delays, the National Thermal Power Corporation (NTPC) has begun calling for tenders as part of the 3,000 MW Phase II Batch 2 JNNSM program. The first auction under this program was highly competitive, concluding recently with SunEdison coming out on top with a winning bid of INR 4.63/kWh (\$0.071) for 500 MW, the lowest recorded bid in India so far.

There is, however, widespread concern throughout the industry as to the direction the market is headed: Most agree that bids at these levels are unsustainable. Industry participants are worried that if this continues, India might be headed in the same direction as infrastructure/road projects where a similar “lowest bid wins” concept has been a disaster, with many winning bids resulting installed or abandoned projects because they were financially unviable from the start.

In a fight for market share, bids are falling much faster than component prices and interest rates. In fact, solar module prices have held steady this year and inventories are tightening, which could lead to prices holding steady or even slightly increasing. Mercom Capital was surprised to find that many solar company executives who openly stated that tariff levels below INR 5/kWh (\$0.077) were unworkable, have not taken their own advice, bidding below that mark. If this continues, it will set the industry back several years. In Mercom’s view, the lowest bid does not equal a fall in project costs, as touted by the media and government officials. We have already seen some projects being abandoned as developers realize that they could not build a profitable project at the price they bid. There is significant pent up demand to build projects from a large number of developers that have invested millions to set up operations in India, but have not seen many projects to bid for. When projects do come up, competition at these auctions is intense. We have to watch this development closely as many banks will pull back lending for projects at these low tariff levels.

The Indian Solar Manufacturers Association has mentioned that their antidumping complaint against foreign manufacturers has been accepted. We believe that it is highly unlikely that the government will re-litigate this issue. At the current bid levels we are seeing in the auctions, any increase in component prices will effectively kill the market.



In a positive development, the Union Cabinet just gave its approval for a new program called ‘UDAY’ (Ujwal DISCOM Assurance Yojana), which is focused on the financial turnaround of power distribution companies. The government of India has recognized that unless the distribution companies are solvent and maintain good credit ratings, reaching renewable energy installation goals and providing a 24 hour power supply will be impossible. Therefore, the government is proposing that individual state governments take over 75% of DISCOM debt and a reduced interest rate for the remaining 25%. This is an improvement over the previous government’s unsuccessful turnaround plan in 2013. If successful, this could remove one of the toughest obstacles that has plagued the power sector in India for decades.

Between NTPC and the Solar Energy Corporation of India (SECI), there are about 5,500 MW of projects that are due to be auctioned off over the next few months and Mercom Capital hopes that some rationalization will kick into the bidding process. If not, it will continue to be a race to the bottom.

### JNNSM – Phase II Batch 1

700 MW were scheduled to be completed by May 2015 under this batch. We have confirmed that 650 MW have been commissioned. The remaining 50 MW, including 20 MW in the DCR and 30 MW in the Open category, are yet to be commissioned.

According to our sources, a 10 MW project is likely to be cancelled and 30 MW of projects are expected to be commissioned by the end of November.

### JNNSM – Phase II Batch 2

The Ministry for New and Renewable Energy (MNRE) has been calling for tenders for Batch 2 for 3,000 MW of PV projects, which will be implemented by NTPC through open competitive bidding. These projects will be developed in solar parks established by central and state agencies on land provided by state governments or identified by project developers in their respective states. So far, tenders amounting to 2,750 MW have been announced, and a reverse auction has been completed for the 500 MW Ghani Solar Park. SunEdison won the auction at a tariff of INR 4.63/kWh (\$0.071). MNRE has been allocating these projects to various states that had shown interest or requested capacity allocation. The states of Haryana, Punjab and Jammu & Kashmir, which had earlier requested projects, have now backed out. MNRE has been allocating these projects to other states. NTPC has been issuing tenders in the batches outlined in Table 1 above.

### JNNSM – Phase II Batch 3 (SECI)

The SECI, the implementing agency setting up 2,000 MW of grid-connected solar PV power projects under JNNSM Phase II Batch 3 – “State Specific VGF Scheme” in solar parks, has called for tenders amounting to 1,190 MW.

### Other announced programs

Ultra mega projects: According to the latest updates, 21 states have agreed to set up

27 solar parks with a combined capacity of 18,418 MW as part of MNRE’s plan to set up individual solar parks with capacities of 500 MW and above to fulfill the 20,000 MW capacity target within a five year span beginning in FY 2014-15.

JNNSM Phase II Batch 5: Under Batch 5, Central Public Sector Undertakings (CPSUs) and Government of India organizations’ self-use, third-party sale or merchant sale calls for the development of 1,000 MW of grid-connected solar PV power projects with mandatory DCR and VGF over a span of three years from FY 2014-15 to 2016-17.

MNRE approved projects under this scheme in Categories A, B and C based on their stages of development.

Category A: Projects approved and already under development: NTPC – 50 MW; and BHEL – 6.5 MW.

Category B: Projects to be approved in the next three months (70 MW): SECI – 5 MW; Vishakapatnam Port Trust (VPT) – 10 MW; NHPC – 50 MW, and RashtriyaIspat Nigam Limited (RINL) – 5 MW.

Category C: Projects to be sanctioned that have yet to issue tenders (778 MW). The list of interested CPSUs under this category will be officially announced once the tenders are issued.

<b>Utility-scale solar projects in India Operational and under development (November 2015) Capacity (MW)</b>	
<b>In operation</b>	
Solar PV	4,607
Solar Thermal	209
Total	4,816
<b>Under development</b>	
Solar PV	7,494
Solar Thermal	280
Total	7,774

Source: Mercom Capital Group, llc

Projects by defense sector: Under this plan, more than 300 MW of grid-connected and off-grid solar PV power projects are proposed to be set up by Defense Establishments under the Ministry of Defense, with mandatory DCR and VGF in five years between 2014 and 2019. According to our sources, 160 MW has been approved by MNRE. The Ordnance Factory Board under the Ministry of Defence is developing 150 MW, and the Border Security Force is currently developing 10 MW.

Grid PV on canals: MNRE launched a program for the development of 100 MW of grid-connected solar PV power projects on canal banks and canal tops. Projects under this scheme are under development in eight different states (50 MW canal banks and 50 MW canal tops). Only a single 1 MW canal top project in Andhra Pradesh is expected to be commissioned by the end of 2015.

### **State program updates**

Uttar Pradesh: Currently, three different batches of projects totaling more than 500 MW are in various stages of development in the state. Uttar Pradesh signed PPAs for 130 MW of PV projects in December 2013, of which 40 MW have been cancelled and 90 MW are currently in operation. A Request for Proposal (RFP) to set up 300 MW of solar PV projects through reverse auction was announced in August 2014. PPAs were signed for 105 MW of projects in April 2015 with tariffs ranging from INR 8.93-9.27/kWh (\$0.129-0.143). Projects below 20 MW in size are expected to be commissioned in 13 months; projects above 20 MW in 18 months. Another RFP to set up 215 MW of solar PV projects was announced in June. The letter of intent (LoI) was announced in September; PPAs are expected to be signed this month. Projects below 20 MW are expected to be commissioned in 13 months; projects above 20 MW in 18 months.

Andhra Pradesh: About 750 MW of Solar projects are being developed under two different programs. Developers were allowed to build solar projects in the state at a fixed tariff of INR 6.49/kWh (\$0.099) under the first programme in 2013; 140 MW of these projects are still under development. About 59 MW has been commissioned to date and 65 MW is expected to be commissioned by March 2016. Another 2 MW project is expected to be commissioned by the end of 2015. The status of the remaining 11 MW is undetermined as the developers have been unavailable for comment. Andhra Pradesh DISCOMs have signed PPAs to develop 619 MW of solar projects with a first year tariff of INR 5.25/kWh (\$0.081) at an annual escalation of 3% for 10 years. They are expected to be commissioned by April 2016.

Punjab: In Punjab, more than 1,000 MW of PV projects are in various stages of development. Phase I has about 195 MW commissioned as part of the 250 MW Phase I program. For Phase II, an LoI has been signed to develop 282 MW of large-scale solar, and another 53 MW of rooftop projects are expected to be commissioned by the end of 2016. In another programme, RfPs for 500 MW of projects were announced in June. Five developers won the bids with tariffs ranging from INR 5.09-5.98/kWh (\$0.078-0.092); PPAs are yet to be signed.

Kerala: 11 MW of rooftop solar has been commissioned, with another 1 MW expected to be by the end of 2015.

Madhya Pradesh: There are 260 MW of solar projects installed under Madhya Pradesh's state policy (200 MW under RPO and 60 MW for Phase II). Another 60 MW of projects under Phase II are expected to be commissioned in early 2016.

Haryana: A tender inviting bids for 50 MW of solar PV projects was issued by the utility Uttar Haryana Bijli Vitran Nigam (UHBVN) in May 2014, but PPAs were signed for just 23 MW Haryana Power Purchase Centre, on behalf of UHBVN and Dakshin Haryana Bijli Vitran Nigam (DHBVN), invited tenders for 150 MW of solar projects with the deadline for opening financial bids extended to the end of November 2015.

Maharashtra: The state recently announced a renewable energy policy through which they expect to develop 7,500 MW of solar by 2020. New bids are expected to be invited in 2016.

Chhattisgarh: Chhattisgarh State Power Distribution Company Limited (CSPDCL) announced bid results for 100 MW of solar projects in early 2014. We have confirmed just 66 MW of projects have signed PPAs as of November. Of that figure, 32 MW is commissioned and 34 MW is expected to be commissioned by March 2016.

Karnataka: More than 1,300 MW of solar projects have been announced so far by the state.

Batch I. PV projects totaling 40 MW have been commissioned to date; 20 MW are likely to be cancelled. A 10 MW Concentrated Solar Power (CSP) project under Batch I is expected to be commissioned at the end of 2016. Batch II. PPAs were signed to develop 120 MW of solar projects in early 2014. Of this, 59 MW has been commissioned and 10 MW has been cancelled. Projects totaling 30 MW are expected to be commissioned by the end of November and a 3 MW project is due to be commissioned by January 2016. Mercom Capital also has confirmation that a 10 MW project was abandoned and another 10 MW project has filed a petition for a tariff revision. The status of another 8 MW is unavailable. Batch III. Under this batch, PPAs were signed for projects totaling 50 MW; a 10 MW project has been commissioned and the remainder is expected to be completed in 2016. Batch IV. Karnataka Renewable Energy Development Ltd. (KREDL) signed PPAs for 500 MW in early

2015. They are expected to be commissioned by the end of 2016. Karnataka announced 600 MW of projects to be developed especially by farmers and unemployed youth. Under this scheme, the state allotted solar energy projects of 258 MW to farmers and signed PPAs in July for a tariff of INR 8.40/kWh (\$0.129). The projects are expected to be commissioned within 18 months. Another 300 MW is expected to be announced for allotment to unemployed youth.

Telangana: 515 MW were auctioned off in March 2015 through reverse bidding: of this, a 25 MW project has been commissioned and the remaining projects are expected in the first half of 2016. The Southern Power Distribution Company of Telangana (TSSPDCL) invited 2,000 MW of solar bids on a 'Build-Own-Operate' basis in April. Although the LoI was expected to be issued in August, there has been a delay due to technical issues regarding the transmission of the power.

Bihar: 100 MW of solar projects are expected to be commissioned by the second half of 2016. Project financing is difficult in Bihar due to offtaker risk.

Tamil Nadu: According to our sources, Tamil Nadu Generation and Distribution Corporation (Tangedco), the state utility, was to develop projects of over 2,000 MW for a tariff of INR 7.01/kWh (\$0.108) with the projects expected to be commissioned by March 2016. The PPAs were to be signed on the basis of a priority list. We were informed that the state is overriding this priority list and signing PPAs randomly. This action has caused enormous concern among the developers who have already started work on the projects because they would not be eligible to receive the attractive INR 7.01/kWh (\$0.108) tariff after March 2016. It has also been reported that one project developer is opposing this issue legally.

Uttarakhand: Uttarakhand Renewable Energy Development Agency (UREDA) issued an RfP in October to develop solar projects. The list of selected bidders was announced to set up 181.4 MW of solar projects. The lowest tariff was INR 5.57/kWh (\$0.086) and the highest was INR 5.99/kWh (\$0.092).

Read more: [http://www.pv-magazine.com/archive/articles/beitrag/low-tariffs-but-a-hot-market-\\_100021990/86/?tx\\_ttnews\[backCat\]=273&cHash=2a762fe43b0b7ea891f64c9a80808bb1#ixzz3vsiafI9d](http://www.pv-magazine.com/archive/articles/beitrag/low-tariffs-but-a-hot-market-_100021990/86/?tx_ttnews[backCat]=273&cHash=2a762fe43b0b7ea891f64c9a80808bb1#ixzz3vsiafI9d)

## DELHI METRO SIGNS AGREEMENT TO SET UP 500 MW SOLAR POWER PROJECT

The Delhi Metro Rail Corporation is making progress towards its goal to go 100% solar as far as power procurement is concerned.

The Delhi Metro Rail Corporation (DMRC) has signed an agreement with the Solar Energy Corporation of India (SECI) to source electricity from solar power projects. The DMRC is looking to ensure low-cost, escalation-free electricity for a period of several years to ensure financial and operational efficiency.

The DMRC intends to source around 1,000 million kWh of electricity from ground-mounted solar power projects every year.

A solar PV project of around 600 MW capacity will be able to deliver that much power. A project of 500 MW capacity has been planned to be commissioned over the next 3 years. As Delhi neither has the land nor high solar radiation, the project may well come up somewhere in the nearby states like Uttar Pradesh or, more likely, Rajasthan.

The SECI will facilitate the entire process of tendering and finalizing the developer(s). The DMRC shall then sign a power purchase agreement with the project developer.

The DMRC currently buys power from a number of utilities in Delhi and has to pay very high tariffs. As frequent hikes in fare may cause political storms in the national capital, the annual increase in electricity tariffs dents DMRC's profitability.

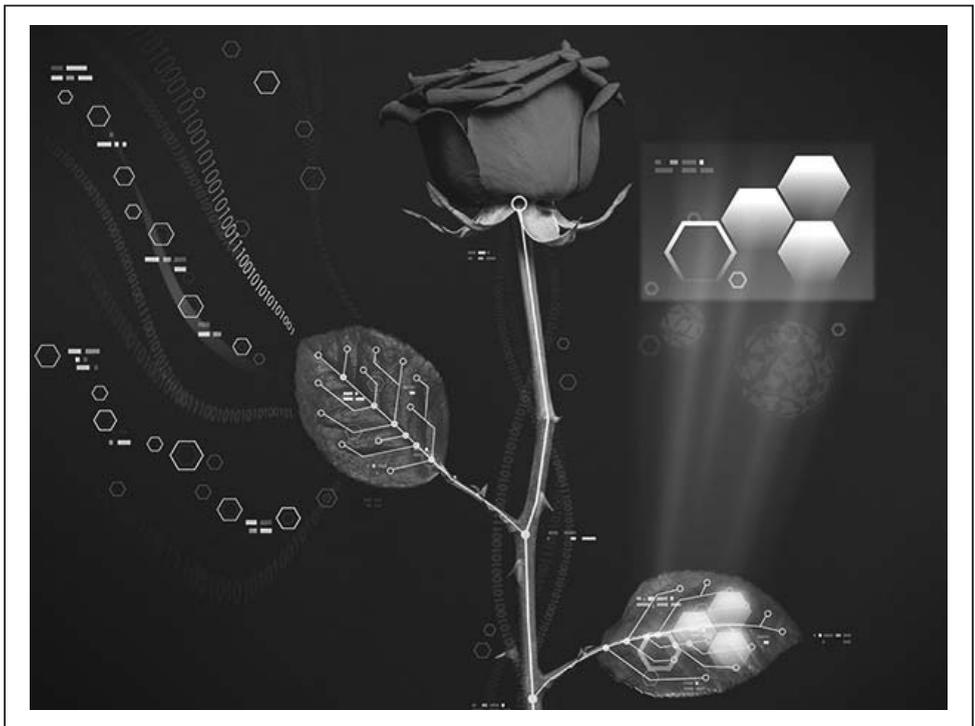
The Corporation has already gone solar by setting up several rooftop solar power projects at its stations. This program is expected to be expanded to more stations over the coming months. However, the rail network of DMRC is set to expand at a much faster rate compared to the planned solar power capacity addition. A new line, the largest so far, is expected to be operational over the next few months while the DMRC plans to expand further into the neighbouring states of Uttar Pradesh and Haryana over the next few years.



# REWIRED ROSE PLANT BECOMES LIVING CYBORG

Swedish researchers have been working on ways to regulate plant growth, using electronic wires grown inside the plants own nutrient channels to host sensors and drug-delivery systems. The aim is to provide just the right amount of plant hormones at just the right time. Such efforts could provide even more precise human control over plant production and agriculture.

A separate but no less exciting project involves embedded biofuel cells that could literally turn plants into solar power plants. If all goes well, sensors and other devices could someday harvest electricity from the natural process of photosynthesis that enables plants to turn sunlight



into chemical energy. It's not often that such a sweet-smelling prospect begins with a humble garden rose. But that's where the first successful steps toward electronic plants has begun. A team at Linköping University in Sweden has taken a huge step forward with the first experiments demonstrating electronic circuits within the living bodies of plant stems and leaves. Their research is detailed in the 20 November 2015 issue of the journal *Science Advances*.

They grew electronic wires as long as 10 centimeters within garden rose stems and turned leaves into patchy electronic displays capable of changing colors between light and dark on demand. They also built working transistors—the basic switches at the heart of modern electronics—based on the wires embedded within the plants.

“In a sense, we are then introducing a nervous system into the plants,” says Magnus Berggren, a professor of organic electronics at Linköping University in Sweden.

But the researchers didn't perform Frankenstein-style surgery to implant the wires. Instead, they made use of the xylem, plants' natural system of channels that typically carry water and nutrients from the roots to stems, leaves, and flowers.

The team's early attempts to thread conductive polymer wires through the xylem led to the xylem being clogged or the plants exhibiting severe toxic reactions. But the researchers eventually discovered that a liquid solution containing a polymer called poly(3,4-ethylenedioxythiophene), or PEDOT, could readily be taken up by the xylem and distributed evenly throughout. What's more, they found, it would eventually form a solid wire capable of conducting electricity. The presence of such "xylem wires" still allows the channels to carry the necessary water and nutrients for plant survival.

Berggren explained how the liquid solution containing dissolved chains of PEDOT-S:H—a chemical variation of PEDOT—was able to form solid wires with the help of both the xylem's vascular channels and the plants' delayed immune response:

After some time, the plant reacts against this unknown material. A common reaction against pathogens or toxic materials involves exchange of monovalent ions with divalent ones. The increase of divalent ions promote self-organization and formation of the actual conducting wires along the inner walls of the xylem channels. In a sense, the plant is helping us to separate the event of distribution of the conducting and electronic materials from the event of film formation along the xylem walls.

Successful creation of the xylem wires also allowed the researchers to create “organic electrochemical transistors” within the plants; these transistors convert chemical signals into electronic outputs. Such transistors could form the basic hardware for more sophisticated plant cyborg devices. The team even used the plant circuitry to

demonstrate digital logic gates—the building blocks for performing more complex electronic and computing operations.

Other experiments turned the leaves of roses into living electronic displays. The Swedish researchers accomplished this by encapsulating a leaf in a syringe filled with a different PEDOT solution. When the syringe's plunger was pulled up, it created a vacuum that sucked gas out of the leaf through the "stomata" pores on the leaf surface. Once the syringe plunger was pushed down, the PEDOT solution rushed into the pores to fill the spaces between the leaf's veins.

The result was a patchy network of conductive material within the leaf. Researchers sandwiched the leaves between PEDOT films to create electrical contacts with the PEDOT inside the leaves. That enabled the team to remotely manipulate the material within the leaves, changing their color between lighter and darker patterns. The switch between light and dark typically took about 20 seconds. The researchers observed that a pattern, whether light or dark, would remain visible for about 10 minutes.

The researchers mostly experimented with cut rose stems and leaves, but what works in garden roses could also help create other electronic plants, Berggren said. The basic structure of roses resembles those of larger plants such as trees, which means trees could also theoretically become living plant cyborgs or "e-plants."

*Courtesy: Spectrum IEEE.org*

## GREEN NANOTECH TO POWER CARS: IIT-M RESEARCHERS SHOW HOW

CHENNAI: At a time when India has pledged to reduce carbon emissions by 33% to 35% by 2030 and is looking for non-fossil fuelbased sources to generate electricity, Indian Institute of Technology-Madras researchers have come up with what they say is an alternate cost-effective green nanotechnology to power vehicles like hybrid cars and bikes.

It involves use of solar cells (photovoltaic method) that convert solar energy into electricity, a fuel cell device that generates power through a chemical reaction and a lithium ion (li-ion) battery that stores excess electricity produced by the other two.

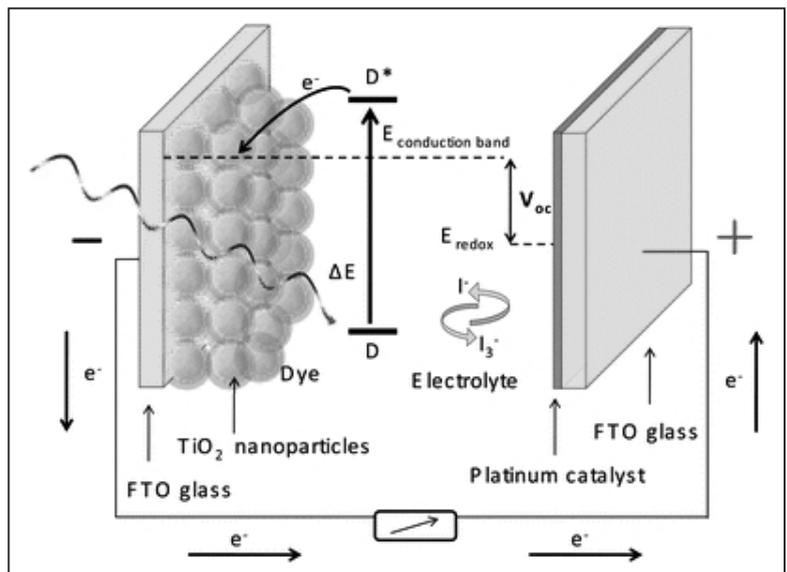
The technology is not new but the nanoparticles not only act as a catalyst but enhance efficiency significantly while reducing cost, says professor and head, alternative energy and nanotechnology laboratory, Sundara Ramaprabhu. The technology can also be used in agriculture and other industries.

In Delhi, considered one of the country's most polluted cities, experts say diesel-operated vehicles contribute 60% of the main air pollutants as most don't adhere to emission norms. While a ban was imposed on registration of new diesel vehicles in Delhi, IIT-M researchers believe their nano based technology can go a long way in being an effective alternative and also cut down on emissions.

For applications like a four-wheeler, researchers have integrated photovoltaic (PV) cells, fuel cell and li-ion batteries. While PV cells can be used during the day, the other two can be used at night. "It can definitely be an alternate to fuel vehicles. The engines used in such technology are similar to those in electric vehicles," said Ramaprabhu.

The photovoltaic method, for long, has been seen as a source of clean sustainable energy. Researchers have now enhanced its efficiency with use of titanium nanoparticles. Fuel cell through an electrochemical process converts hydrogen and oxygen into water and in the process generates electricity. While it releases hot water, a fuel cell application in transport requires storage of hydrogen and oxygen in cylinders. Here again, researchers have used platinum nanoparticles dispersed in fuel cell device to improve productivity. Tanks that store hydrogen for this process have nanomaterial graphene layers to increase storage level.

Researchers have found that use of nanoparticles like silicon or graphene can improve its performance, shelf life and reduce time required for a recharge.



தமிழ்நாடு  
உயர்மின்  
அழுத்த மின்  
ஒப்பந்தகாரர்கள்  
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சங்கம்  
(TNEIEA)  
சார்பில்  
கடலூரில்  
வெள்ள  
நிவாரணம்  
வழங்கும்  
நிகழ்ச்சி  
நடைபெற்றது.

## வெள்ளத்தால் பாதிக்கப்பட்ட மக்களுக்கு கடலூரில் எல்.இ.டி., பல்பு வழங்கல்

கடலூர், டி.ச. 27-  
தமிழ்நாடு உயர்மின் அழுத்த  
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வருகிறது.



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நிகழ்ச்சியில் முன்னாள்  
எம்.எல்.ஏ., அய்யப்பன், சங்க

■ தமிழ்நாடு உயர்மின்னழுத்த மின் ஒப்பந்தகாரர்கள் பொறியாளர்கள் சங்கம்  
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வழங்கினார். அருகில் முன்னாள் எம்.எல்.ஏ., அய்யப்பன், பூங்குன்றன்.  
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செய்திருந்தார்.

தேதி: திமலர், புதுச்சேரி. 27.12.2015

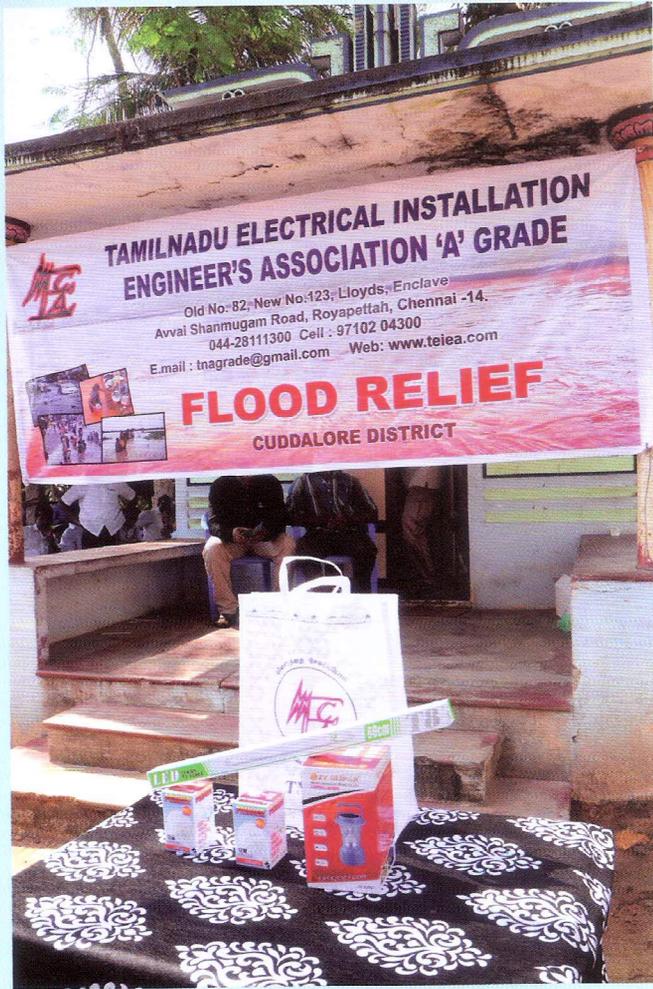
டிசம்பர் 2015 தமிழ்நாட்டின் வடமாவட்டங்களில் வரலாறு காணாத மழை பெய்த காரணத்தால், கடலூர், சென்னை, காஞ்சிபுரம் மற்றும் திருவள்ளூர் மாவட்டங்கள் மிக மோசமாக பாதிக்கப்பட்டது. இந்த பாதிப்பு மக்களின் இயல்பு வாழ்க்கையை புரட்டிபோட்டது. மக்களின் வாழ்வாதாரத்தையே கேள்விக்குறி ஆக்கியது. இந்தப் பேரிடரை மக்கள் சந்திக்க, தமிழ்நாடு அரசு போர்க்கால நடவடிக்கை எடுத்தது. பொதுமக்களும் மற்றும் பல நலச்சங்கங்களும் தாங்களால் இயன்ற உதவியை மக்களுக்கு செய்தவண்ணம் உள்ளனர். நம் மின் ஒப்பந்தகாரர்கள் சங்கமும், (TNEIEA) தங்களின் சார்பாக மின் உபகரணங்களை பாதிக்கப்பட்ட மக்களுக்கு வழங்கிட முடிவு செய்யப்பட்டு, அனைத்து ஏற்பாடுகளும் சங்கத்தின் சார்பில் செய்யப்பட்டது. 26.12.2015 அன்று நம் மின் ஒப்பந்தகாரர்கள் சங்கம் (TNEIEA) சார்பாக சூரிய LED விளக்கு, LED பல்புகள் மற்றும் 2அடி குழல் LED விளக்கு, சுமார் 1200 பயனாளிகளுக்கு வழங்க தீர்மானிக்கப்பட்டது. இந்த நிவாரணத்தை கடலூரில் மிக பாதிக்கப்பட்ட இரண்டாயிரவிளாகம், அழகிய நத்தம் மற்றும் திருப்பணம்பாக்கம் ஆகிய கிராமங்களில் வழங்க முடிவு செய்யப்பட்டது.

இந்த உதவி நிவாரணம் வழங்கும் நிகழ்ச்சியை மாண்புமிகு திரு. எம் சி. சம்பத், வணிகவரி மற்றும் பத்திரபதிவுத்துறை அமைச்சர் தலைமை ஏற்று மின் உபகரணங்களை பாதிக்கப்பட்ட மக்களுக்கு அளித்து நிகழ்ச்சியை சிறப்பித்தார்.

இந்நிகழ்ச்சியில் TNEIEA சங்கத் தலைவர் திரு. U. பாஸ்கரன், செயலாளர் திரு. K. கண்ணன், பொருளாளர் திரு. P. சுயம்பு, துணைத்தலைவர் திரு. B. பழனிக்குமார், திரு. N. வாசு, துணைச் செயலாளர் திரு. S. கோபாலகிருஷ்ணன், மற்றும் திரு. N.N. பரணிதரன், திரு. S. கண்ணன், திரு. G. வெங்கடேஷ், (ரோட்டரி உறுப்பினர் திரு. கிருபாநிதி) ஆகியோர் நிகழ்ச்சியில் கலந்துக்கொண்டார்கள். மேலும் திரு. S.D. பூங்குன்றன், உபதலைவர், கடலூர், TNEIEA, நிகழ்ச்சியை திறம்பட ஏற்பாடு செய்திருந்தார்.

தமிழ்நாடு உயர்மின் அழுத்த மின் ஒப்பந்தகாரர்கள் பொறியாளர்கள் சங்கம் 1979ம் ஆண்டு, உயர் அழுத்த மின் ஒப்பந்தகாரர்களின் நலனுக்காக தொடங்கப்பட்டது. தொடங்கப்பட்ட ஆண்டிலிருந்து இன்று வரை உயர் அழுத்த மின் ஒப்பந்தகாரர்கள் அனைவரையும் ஒருங்கிணைத்து அவர்களின் நலனுக்காக இயங்கி வருகிறது. சங்கத்தின் உறுப்பினர்களுக்கு மட்டுமின்றி பேரிடர் காலத்தில் ஏற்படும் இன்னல்களுக்கும், சங்கம் தங்களால் இயன்ற உதவியை மக்களுக்கு செய்து வருகிறது. சுனாமி, தானே புயல் போன்ற பேரிடரின் போதும் சங்கம் தங்களின் பங்களிப்பை அளிக்க தவறவில்லை.

# Flood Relief at Cuddalore on 26.12.2015







## NEW YEAR MEET



**Mr. U. Baskaran, President; Mr. K. Kannan, Secretary; Mr. S.D. Poongundran, VP;**  
*honouring Er. V. Jayavel, CEIG*



**Mr. U. Baskaran, President; Mr. K. Kannan, Secretary; Mr. P. Suyambu, Treasurer;**  
**Mr. S.D. Poongundran, VP; Mr. B. Paalanikumar, VP & Mr. J.R.K. Anandaraman,**  
*Committee Member honouring Er. P. Manohar, Senior Electrical Inspector*

# SOLARTOWN OFFERS ROOFTOP SOLAR SYSTEM ON LEASE BASIS

SolarTown Energy Solutions has installed a solar rooftop system on a 2,400 square foot multi-level residential property located in Filmnagar, Hyderabad under a residential lease programme.

It is estimated to save the homeowner about Rs. 4 lakh over the 20-year-lease period. The residential lease programme, comes with zero up-front costs and fixed monthly rates lower than discoms, shielding homeowners against increasing electricity prices, with a 17 per cent savings starting on Day 1.



The 6 kW rooftop system offsets a major portion of the customer's energy consumption. Under this solar lease programme, the homeowner will pay a fixed monthly lease to SolarTown for the 20-year term. The solar rooftop system consists of 24 solar modules and one 6 kW inverter, capable of powering all loads in the house including air conditioning and water pumps.

"SolarTown's lease option was the obvious answer for having my own system installed, especially without any out-of-pocket costs. The biggest benefit is that my electricity monthly payments are fixed at a significantly lower rate than the Discom. For the next 20 years I do not have to worry about my power bills," homeowner VinothPoddar said in a statement.

"Until now, residential solar was believed to be economical only when coupled with subsidies. With this lease model, we are making solar an affordable and practical option for residential customers across India," Vikram Dileepan, CEO and co-founder of SolarTown, said.

Significant upfront costs have kept residential customers away from rooftop solar systems. Innovative financial options make rooftop solar a viable alternative to rising and unpredictable electricity prices.

With over 100 installations, SolarTown customers include Infosys and Renault-Nissan.

## **What is a SolarPPA?**

A Power Purchase Agreement is a contract to buy solar power based on a set rate that is usually equal to or less than market rate from your local utility company. Because your solar electric rate is locked in, you can also protect yourself from the volatility of future utility rate increases.

As a SolarPPA customer, you only pay for solar power, not the solar equipment or installation. Solartown installs, maintains and owns the solar system on your rooftop or property.

## **Advantages for the customer**

- a. Go Solar with minimal investment
- b. Savings increase over the year
- c. Complete Operation & Maintenance
  - Assured generation and system up-keep
  - Repair Service
  - Insurance Coverage

## **Advantages for the Project Financiers**

- Assets in the balance sheet
- Tax Credits
- Assures returns over 15 years ( ~IRR of 15 %, higher than equity return - return over this time period)

# REVIEW OF BUILDING INTEGRATED SOLAR PHOTOVOLTAIC TECHNOLOGY AND ITS APPLICATIONS

Building Integrated Photovoltaic (BIPV) systems is one of the most promising technologies and has recently been experiencing a technological growth. There is a consensus that these advancements may lead us to novel methods for domestic energy generation. Technical improvements, governmental policy supportive and financial aids are some of the contributors to this development. However, the amount of building integrated solar power generation as compared to other forms of solar electricity generation methods is still negligible. In this study, a review is presented including the amount of work done in this area and their findings. It summarizes the current state-of-art of these systems.

## 1.0 INTRODUCTION

Global applications of renewable energy are growing rapidly due to enhanced public concerns for adverse environmental impacts. Renewable energy sources have the potential to play a significant role in fulfilling the future electrical energy requirements. The application of these nonconventional energy sources offers great potential to satisfy energy demand at remote sites, where it is relatively expensive to run a transmission line from distant ac mains.

In terms of renewable energy generation, *currently India* holds an fifth place *in* the world with the installed capacity of renewable energy 32,269.6 MW or 12.95% of the total potential available in the country, as on March 31, 2014. The increasing energy demand and need to go for sustainable ways of energy generation are the motivation for looking for alternative ways of energy generations. Among the renewable energy sources, solar is the most prominent in case of Indian scenario as in most of our areas have almost 360 clear sunny days in a year. The wide availability, energy needs and the reduction in the prices associated with the manufacturing of solar cells makes it suitable for us.

The building integrated solar photovoltaic technologies are finding increasing applications as in small isolated power systems and being increasingly recognized for electricity generation in both small and large electric power systems.

Building integrated photovoltaic (BIPV) systems, where solar cells are integrated within the original structure of buildings and utilizing solar radiation to produce electricity is emerging as a sustainable solution with respect to the aesthetical, economical and technical aspects. The BIPV is forming an important part of market in future segment, mainly because it does not occupy additional space, which is required by the solar panels mounted on existing or newly build structures.

In spite of all positive factors, these are facing problem of efficient energy conversion and adaptability. This paper deals with the studies of BIPV in order to discuss and categorize its barriers and their proposed solutions and finally summarize their associated pros and cons. This review will address related issues on applications of BIPV systems and the popularity to growth rate of PV in recent years and its future prospects.

## 2.0 DESIGN CONSTRAINS IN ADAPTABILITY OF BIPV

In BIPV the solar- PV cells are mounted above the existing structure or a new base is prepared for fixing the solar cells. The solar cells are not transparent thus it provides a shade as well generates power. The only issue in adapting these panels in building walls is to have isolation from the environmental factors such as corrosion, structural strength and snow, rain water penetration. Figure 1(a-b) shows the typical installation of BIPV.

In general, the BIPV are used in roof surface of the building because it provides high value of solar radiation and conventional structure can be used to install but the windows and facades are the other areas that can also be used. The design constraints in BIPV are classified into following categories and discussed as follows.



FIG. 1 (A-B) TYPICAL BIPV INSTALLATION IN RESIDENTIAL BUILDINGS

## 2.1 Technical Parameters

The technical parameters responsible for lesser ratio of BIPV installations are common features such as technology used, storage facility, power loss, system efficiency and output power quality.

The power loss estimation is an important factor to be included in the design of a BIPV. The power loss due to dust, air moisture on the panels, voltage drop in the connected cables, shading assessment due to upcoming nearby building structures is required to be considered. The output power in case of partial shading may cause a severe damage to the system if it remains for a long period or a constantly one part of the installation comes under the shadow. The tilt factor of the panel is also a parameter causing an effect on the output of the BIPV, thus the fixed tilt is no longer advised to be used in place of that a manual or electronic tilt mechanism are introduced. The system cost optimization prefers the manual step tilting setup, which can be used to tilt the panels at two or three different angles as per the seasons.

The other parameter in technical section is the output power quality of the designed system. The basics of power quality are the harmonics, variation in the voltage and frequency. The power converter *holds* a significant *role* to play in case of power quality of the BIPV. The generated power from the solar is a DC power, an inverter is used to convert this power into AC power and the same is fed to the consumer loads. Thus the design and selection of inverter should be made as per the output DC voltage and current range of the solar-PV array. The generated harmonics from the BIPV may affect the other connected system as well.

The consumer loads which are expected should be carefully studied and the nonlinear loads must have taken into accounts. However it is suggested to use an additional dc-dc converter in the system to regulate the variation in the output voltage of solar-PV panel and provide a constant DC supply voltage to the inverter for improved power quality. Harmonic filter are also be suggested to use with inverter for an improved power quality at the AC consumer loads. Table 1 - Shows the classifications of power converters as per the application range.

Table 2 presents the inverters selection options in such installations. The other part of the system is MPPT controller, which needs a significant attention. The performance of the BIPV highly depends on the tracking efficiency and response time of the used MPPT controller.

**TABLE 1 – POWER CONVERTER CLASSIFICATION**

S. No.	Power Converter Topology	Ratings
1	Flyback Converter	200 W
2	Cuk Converter	500 W
3	SEPIC Converter	500 W
4	ZETA Converter	500 W
5	Half Bridge Converter	600 W
6	Push-pull Converter	1000 W
7	Boost Full Bridge Converter	1500 W

**TABLE 2 – INVERTER SELECTION PARAMETERS**

Parameter	Central Inverter Installation	String Inverter Installation
No. of Inverters	One	Higher
MPPT	Less effective	Higher
Partial shading conditions effect	Higher	Lower & can be easily handled
Installation & Maintenance	Higher	Lower
System Cost	Higher	Moderate

The MPPT controllers are responsible for force the system to operate on optimum power point under varying environmental conditions.

The critical conditions such as partial shading, which is considered often in case of a BIPV installation, the MPPT controller plays a major role. Different algorithms are presented in the literature for MPPT control of a BIPV installation.

The anti-islanding is another feature which is required in BIPV installations. The islanding scenario includes a condition, where the loads and distributed resources connected through a grid are energized from a BIPV, while the remaining parts are disconnected.

It is required that this condition should be sensed within 2 seconds and immediately the system should be disconnected as specified in the IEC 61727 standard.

**Figure 2 shows the proposed circuit configuration adopted for such systems.**

Figure 2 (a) and (b) presents the system proposed configurations for BIPV installations in residential and grid connected applications. Figure 2 (a) presents the system installation for the residential application of a low power system upto 5kW, which is not connected to the grid and is used for feeding the power to the local loads. Figure 2 (b) shows the system that can be used as a grid connected system.

## 2.2 Economic Constraints

The economic constraint is the major issue which comes into the picture, when we talk about BIPV. As in case of a BIPV project of 5kW with storage facility, the payback period calculated is more than 15 years and includes a high capital investment, thus the role of financial support becomes a factor to be considered. The higher payback period is the parameter which requires an effort to convince the industry as well as the end user to recommend the BIPV installation.

In a country like India, where the demand of energy is increasing exponential, efforts are being made to promote the renewable energy sector for meeting the future energy demands. The MNRE (Ministry of New and Renewable Energy) has launched a JNNSM (Jawaharlal Nehru National Solar Mission) with the targets deployment of 20 GW of grid connected solar power by 2022 in three phases and to create an enabling policy & regulatory environment under the Mission to promote grid connected solar power generation. Under the JNNSM central financial assistance upto 30% of the benchmark cost of the project is provided for setting up of the solar rooftop systems which generate the power and are connected to the grid.

The total cost of BIPV should be estimated and compared to the traditional installation for the economic viability of the installation.

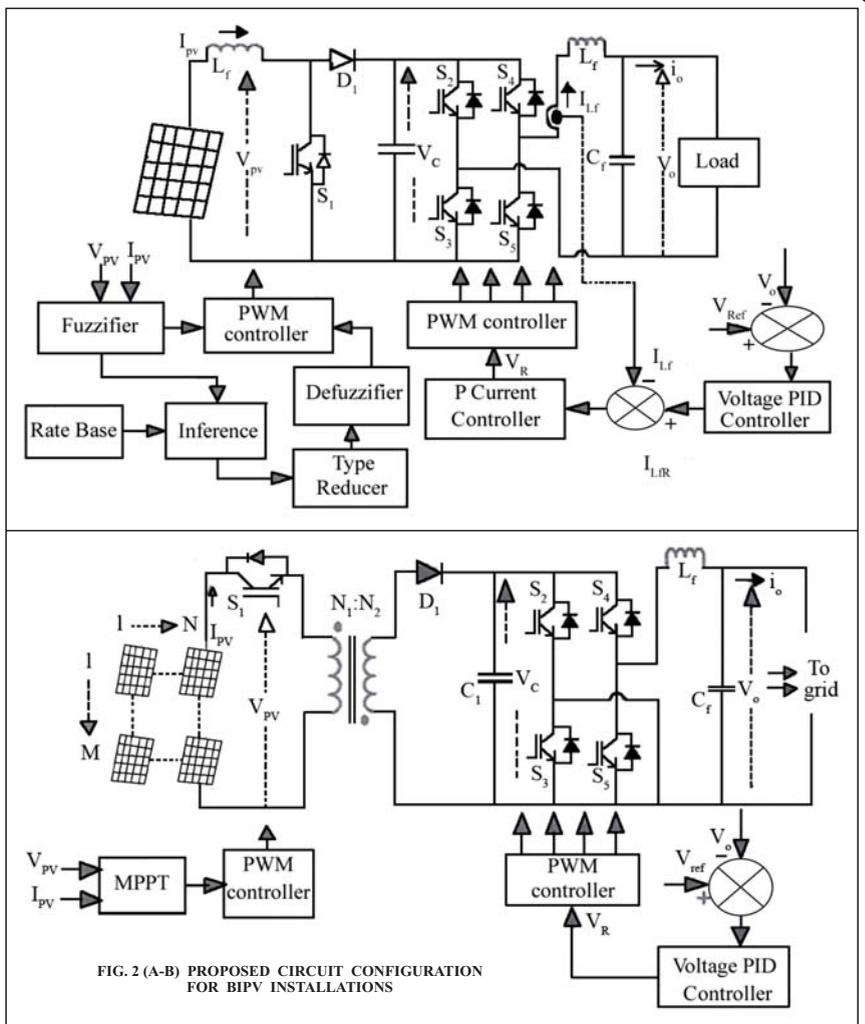
The system cost consists of balance of system (BOS) components, which include inverters, an electricity storage system, and/or a grid-metered connection, fault protection, cabling, and wiring. Table 3 shows the area required (sq.ft) for installation of BIPV using different types of solar panels. Figure 3 shows the approximate area required in the installation of a BIPV system with grid connected configuration.

Figure 4 shows the approximate system installation cost of 1kW BIPV, it does not contain available subsidy and the land cost and involved in the conventional installation of 1kW SPV system.

These costs, as well as the costs of integration design and installation, should be evaluated. The technology of BIPV is stated to be in very early stage, however the cost is constantly decreasing due to rapid declination in the manufacturing of PV panels during last decades. It is recommended to include BIPV at early stage as any kind of structure altering cause an extra expenditure of the overall project cost. It is reviewed and concluded in the literature, that planning at the design stage of building makes a difference of additional 5-10% in the construction cost of a building compare with the traditional one.

## 2.3 General awareness and appearance

The major share of BIPV installation depends on its awareness and acceptance by the consumers. Because of high capital cost and low conversion efficiency these systems are facing issue of applicability. The appearance of such system is required to be improved and success stories are needed to be projected for wider adaptability. The



**TABLE 3 – AREA REQUIRED IN BIPV INSTALLATIONS (SQ. FT)**

Type of Panels	System ratings		
	100 W	2 kW	5 kW
Monocrystalline	8	160	400
Polycrystalline	10	200	500
Thin Film	15	300	750

proposed a 3 dimension method consisting of socio-political acceptance, market acceptance, and community acceptance is needed to be reviewed in case of BIPV installations.

The aesthetic appearance of the BIPV is a factor that may be used to improve the system applications. Different types of BIPV panels based on crystalline silicon and thin film technologies that can be incorporated in the buildings include: Transparent PV panels, Flexible PV Panel and Opaque - Fixed PV panels.

BIPV system installed in a building provides a visible expression of the company towards its environmental commitment. The adoption level of BIPV technology is gradually growing in India with increasing number of system, and showcase of developments in this area. Therefore, BIPV is a cost effective solution for introduction of solar PV into building envelope and is one the crucial step in starting a concept of Net Zero Energy building infrastructure.

### 2.4 Policy and Support Framework

Regulation and policies in favor of BIPV are current need for the market. In terms of BIPV as explained earlier the installation cost and payback period are higher side, thus the tariff differentiation becomes important in this scenario. The two different tariffs can be specified for buying and feed-in tariffs. These factors if included in form of policies will make a difference in this sector.

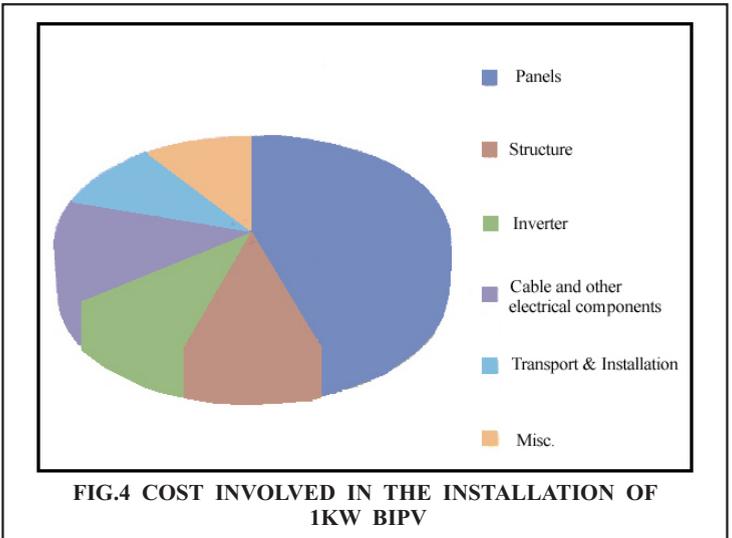
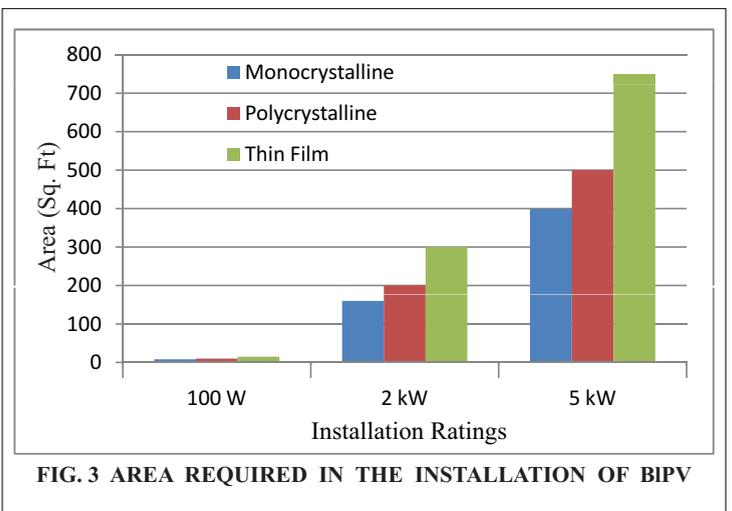
In Indian scenario the introduction of Electricity Act, 2003 and National Electricity Policy and Tariff Policy has addressed various issues such as Renewal Procurement Obligation (RPO) and introducing Renewal Energy Certificate (REC) mechanism. This has regulated the availability of renewable energy sources and requirements of targets to meet the obligated quantities in other places. This along with the JNNM has resulted in the growth of renewable sector in last few years.

The financial support from the Govt. is available in various forms such as installation subsidy, feed-in tariffs, tax rebates, and low interest loans. The Govt. has identified the research and development as an important factor for developing this sector. R&D subsidy is 100% of a project's cost in government R&D institutions, and 50% in the private sector. The R&D subsidy for the private sector may be enhanced for initial stages of technologies that have longer time- horizons.

The Indian Govt. has also started the schemes, which provides funds for town and city level renewable energy planning. This local information infrastructure, comprising of local awareness, urban design, laws and smooth functioning processes, is an important step towards integrating renewable energy into economic life, and improving power delivery in the last kilometer. In addition to improving investment opportunities, this may also bring about greener, better designed and less polluted cities.

### 3.0 CONCLUSION

Aiming to address the issues in applications of BIPV, the review and state of art of BIPV technologies is presented and this study has shown issues and potential of BIPV systems. This article presented current trends and the issues in the application of BIPV in Indian market. The constraints are categorised into four groups and discussed in detail. The number of design considerations and constraints are discussed with reference to the technical, economical and policy perspectives. Therefore it is suggested that, to unlock the available potential of BIPV and its wider application policy and support framework is required to be structured. The development in BIPV technologies with reference to the power quality and reliability is a factor to be addressed using optimized system design and planning.



Courtesy: Neha Adhikari, Engineering Officer  
CPRI Journal, Sep 2014

## PM MODI FLAGS OFF THE FIRST ELECTRIC BUS IN INDIA

India's symbolic gift of democracy to Afghanistan - its new parliament building - is nearly complete with plans in the works for Prime Minister Narendra Modi to visit Kabul in the near future for the official inauguration, reported Afghan news agency TOLO News. A standard electric bus uses about one unit of electricity for one kilometer, which is much cheaper than diesel.

Such buses would "not only significantly contribute in minimizing pollution, but would encourage younger generation to come into research and making of batteries". Congratulating Nitin Gadkari, Road Transport and Highways Minister on his contribution to technology and environment leading to the refurbished bus with no pollution, PM Modi suggested that the technology can be used in public transport as well. He said



ISRO is making Lithium -Ion batteries which will cost only Rs 5 lakh as against the Rs 50 lakh cost of imported batteries.

The bus has been converted from a diesel bus to a battery-operated electric bus. The converted buses will cost about one-fourth of the cost of a new electric bus. Annually, the state road transport undertakings in India buy about 10,000-15,000 new buses. The project will demonstrate the Government's commitment to reduce vehicular pollution while opting for strong environment friendly mobility solutions.

Experts opined that the India's objective behind the project was to reflect its position in the region as the main development partner of **Afghanistan**, adding that Modi wants to emphasize India's role as a major player in the region. "Moreover, they will cost less and 20 buses will be run on a pilot project". Environment Minister Prakash Javadekar, Minister for Heavy Industries Anant Geete besides others.

The Prime Minister presented the keys of the first retrofitted bus to Hon'ble Speaker Smt Sumitra Mahajan who was also present on the occasion. "There is a challenge before the mankind to find a solution to this problem", Modi said. US, France and India have together taken this initiative.

## DESERT SAND CAN STORE SOLAR THERMAL ENERGY - MASDAR INSTITUTE

A research project implemented by Masdar Institute has proven that desert sand from the UAE can store energy up to 1,000 degrees Celsius generated by concentrated solar power (CSP) plants.

The goal of the Sandstock project is to develop a sustainable and low-cost, gravity-fed solar receiver and storage system, with sand particles acting as the heat collector, heat transfer and thermal energy storage (TES) media. Using inexpensive sand as a replacement for typical heat storage materials used in TES systems can boost plant efficiency and therefore cut costs, Masdar Institute explained in a statement.

"The availability of this material in desert environments such as the UAE allows for significant cost reductions in novel CSP plants, which may use it both as TES material and solar absorber," said Nicolas Calvet, Assistant Professor, Department of Mechanical and Materials Engineering.

Researchers at the institute have analysed the sand chemical composition with X-ray fluorescence (XRF) and X-ray diffraction (XRD) techniques, and also tested a laboratory-scale prototype with a small solar furnace in France.

The next phase of the project will focus on testing an improved, pre-commercial scale prototype at the Masdar Institute Solar Platform (MISP), using the beam down concentrator.

*Courtesy : See News Renew*

# ENERGY CONSERVATION THROUGH ENERGY EFFICIENCY – 10

## Electrical Losses - $I^2R$ losses

We have seen in the earlier Parts, some details and dimensions of Load Losses or  $I^2R$  losses, which are varying losses, depending on the Load or the Value of 'I'. This is present in all situations of Current "I" being carried through a conductor either in Transmission and Distribution Systems or internally in windings of equipments like Transformers, Motors and other control and measuring equipments. The summary of all measures to reduce  $I^2R$  losses, is to reduce R by optimizing the Conductor sizes, lengths, and materials and reducing "I" through selection of right levels of Voltages, addressing Power Factor and through improvements of Efficiencies of all Equipments connected with Transmission, Distribution and Utilization of Electrical Power.

## Electrical Losses - Magnetization Losses

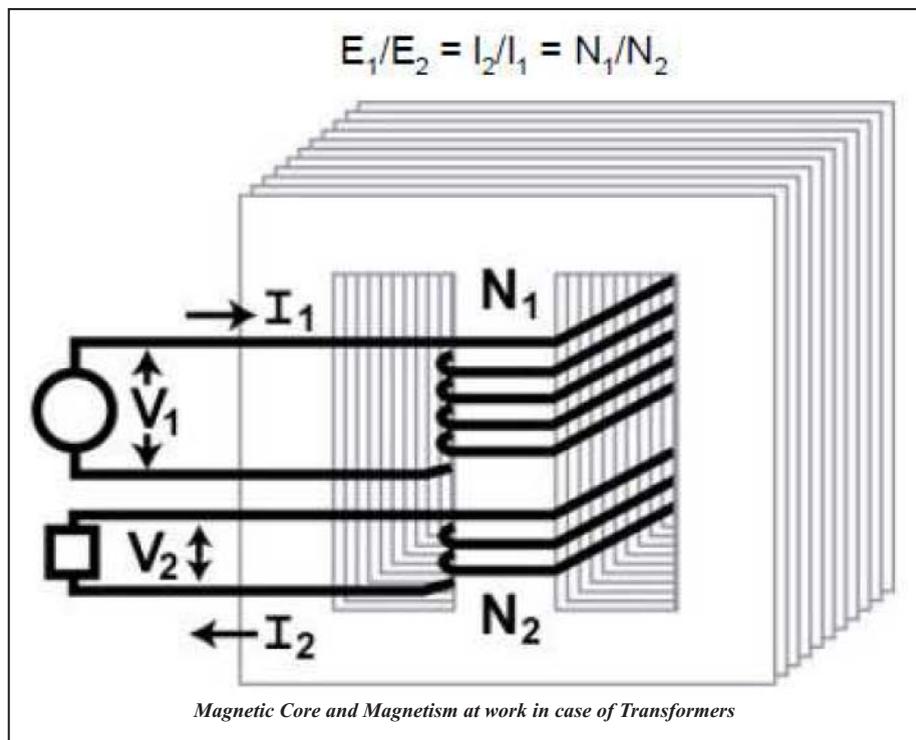
'Magnetization Losses' is another important area of Electrical losses. In the Electrical System of Transmission or Distribution or Utilization or Controls or Measurements, where ever Electro Magnets are involved in the System, Magnetization losses occur. These are fixed losses unlike the varying  $I^2R$  losses, are also known as **Core Losses or Iron Losses or 'No Load Losses'**.

Again looking at some of the statistics to quantify the Electrical losses, we assumed that in the current Indian context, the total T & D Losses is about 300 Billion Units. In the light of the fact that Millions of Transformers, particularly a very large number of them at the distribution end level are involved, the losses in Transformers can be assumed as 100 Billion Units. The Fixed losses or Magnetization losses can be assumed as about 10 to 13% of the Transformer losses, due to the presence of huge number of end level Distribution Transformers with low KVA Ratings. The total Magnetization losses in Transformers work out to a figure of about 12 Billion Units.

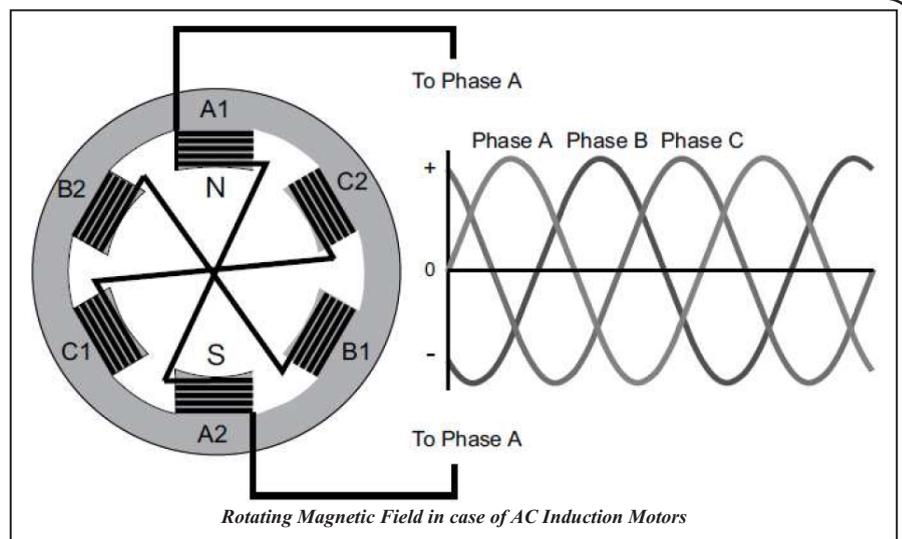
In case of Motors, which is another important area of occurrence of Magnetization losses, the estimates can be made as under:

In the current Indian scene, out of the total consumption of 700 Billion Units, about 70 to 75% are consumed through Motors or say about 500 Billion Units. Average Efficiencies of Motors can be assumed as 85%, as a very large number of them are small and medium ratings. Total Motor losses could be around 75 Billion Units. The average Magnetization losses in Motors being around 20%, the total Magnetization losses in Motors works out to about 15 Billion Units.

Assuming a figure of about 3 Billion Units of losses in all the Controls and Measurement areas, the total Magnetization losses in the entire Electrical system is estimated at around 30 Billion Units.



No-load losses are caused by the magnetizing current needed to energize the Core of the Transformer or Motor and do not vary according to the loading on the Transformer or Motor. They are constant and occur 24 hours a day, 365 days a year in case of Transformers and whenever the Equipments are switched on in case of others, regardless of the load, hence the term no-load losses. All Magnetization losses can be Categorized into five components: hysteresis losses in the core laminations, Eddy current losses in the core laminations,  $I^2R$  losses due to no-load Current, stray eddy current losses in core clamps, bolts and other core Components and dielectric losses. Hysteresis losses and eddy current Losses contribute over 99% of the no-load losses, while stray eddy current, Dielectric losses, and  $I^2R$  losses due to no-load current are small and consequently often neglected. Thinner lamination of the core steel reduces Eddy current losses.



The biggest contributor to no-load losses is hysteresis losses. Hysteresis Losses come from the molecules in the core laminations resisting being magnetized and demagnetized by the alternating magnetic field. This resistance by the molecules causes friction that results in heat. The Greek word, hysteresis, means “to lag” and refers to the fact that the magnetic flux lags behind the magnetic force. Choice of size and type of core material reduces hysteresis losses.

Rating (kVA)	No Load Loss (W)		Load Loss (W)		Efficiency (%)	
	Amorphous	CRGO	Amorphous	CRGO	Amorphous	CRGO
250	180	570	3200	4000	98.7	98.2
500	250	900	4800	6550	99	98.53
630	200	1000	5200	8000	99.1	98.54
730	365	1250	6050	9000	99.2	98.65
1000	450	1500	7650	11800	99.2	98.68

Indicative Losses Details in small Distribution Transformers		
KVA	N/L Loss Watts	Load Losses Watts
25	100	685
50	150	1020
63	180	1235
100	260	1760

**Pattern and Distribution of losses in case of Motors:**

- #55% to 60% - Stator and Rotor Copper Loss
- #20% to 25% - Core Losses
- #2% to 12% - Friction and Windage
- #4% to 5% - Stray Losses

**Reduction of Magnetization Losses in Motors:**

*Magnetic core losses* arise from hysteresis effects, eddy currents and magnetic saturation, all of which take effect in the steel laminations. Magnetic losses can account for up to 20% of total losses. With proper design, use of better materials and stringent quality control, these losses can be reduced considerably. The most effective means to reduce hysteresis and saturation losses is to utilize steels containing up to 4% silicon for the laminations in place of lower-cost plain carbon steels. The better magnetic properties offered by silicon steels can reduce core losses by 10% to 25%. Reducing the laminations’ thickness also helps: substituting 26-ga or 29-ga steel for the 24-ga steel found in standard efficiency Motors lower core losses by between 15% and 25%. Lengthening the lamination stack, which reduces the flux density within the stack, also reduces core losses. Eddy current losses can be reduced by ensuring adequate insulation between laminations, thus minimizing the flow of current (and  $I^2R$  losses) through the stack.

(To be continued)



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# TAMILNADU ELECTRICAL INSTALLATION ENGINEERS ASSOCIATION 'A' GRADE

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**Harsh Bhaskar is a RARE DALIT ENTREPRENEUR who built a Knowledge Business - With KOTA TUTORIALS**

Having created one of Agra’s most-recognized brands in engineering and medical entrance coaching, and a private college, Bhaskar, 35, has come far enough to put caste prejudices behind him. He is the face of Kota Tutorials, credited with shaping the careers of many youngsters in his city. He is also the rare Dalit who is in the knowledge business. The credit is entirely his, since he has done this through his own endeavours and without support from anybody else.

Hailing from the Jatav caste, he had the option to join his family’s traditional leather shoe-making business. But a rebellious streak led him elsewhere. He had always set his thoughts high. That focus led him to gain admission to IIT Roorkee (then University of Roorkee) in 1995. The shy, small town boy transformed into a confident young man. After completing his engineering in 1999, Bhaskar joined HCL in Noida as a software developer. But he found the work too routine and mind-numbing. A year later, he got together seven colleagues to start a software firm out of Katwaria Sarai near the IIT Delhi campus. The company folded up in the wake of the global technology meltdown. Bhaskar returned to Agra to start a franchise of Kota-based Career Point in engineering and medical coaching. Three years later, he launched his own coaching centre and christened it Kota Tutorials. Today, there are two buildings in Agra which house 11 air-conditioned classrooms with a capacity to teach 2,000 students. There are two hostels nearby to accommodate 250 students, most of whom come from under-privileged backgrounds in rural Uttar Pradesh. The number of employees is 250. Kota Tutorials is now in 12 cities - including Dehradun, Aligarh and Bhatinda - through franchisees.

Current revenues are estimated at Rs. 10 crore. Despite annual fees of Rs 50,000 - higher than many competitors - Kota Tutorials has 1,200 students, and growing. Demand evidently outstrips supply in Agra, which has emerged as an important coaching hub after Kota (Rajasthan) and Kanpur (UP). Last year, Bhaskar realised another dream: he opened the Edify Institute of Management and Technology at Farah in Mathura district, using his own money and some borrowed funds from friends and relatives.

**20 MOST PEACEFUL COUNTRIES IN THE WORLD - 14**

**CANADA**



Having one of the best standards of living in the world, **Canada** is also one of the most peaceful countries on Earth. It has a population of approximately 33 million people, yet it’s the second largest country in the world by area. With clean and safe cities, spectacular scenery and extremely friendly people, Canada is a wonderful and peaceful country to live in. The largest strike against the peace score of Canada is that it has a comparatively high military capability, though it currently is not involved in any conflict.

*(To be continued)  
Courtesy: Amerikanki*

# முதல் (சுதந்திரப் போராட்ட) தற்கொலை பெண் போராளி குயிலி!

## வேலு நாச்சியாரின் மெய்க்காப்பாளர்

இரண்டாம் உலகப் போரில் இருந்துதான் தற்கொலைப் போராளிகளின் பங்களிப்பு தொடங்குவதாக உலக வரலாறு கூறுகிறது. ஆனால் இரண்டாம் உலகப் போர் தொடங்குவதற்கு கிட்டத்தட்ட நூற்றைம்பது ஆண்டுகளுக்கு முன்பே தமிழகத்தைச் சேர்ந்த ஒரு வீரப்பெண்



ஆங்கிலேயருக்கு எதிரானப் போராட்டத்தில் தற்கொலைப் போராளியாக உயிர்நீத்த வீரவரலாறு இன்றுவரை சரியாகப் பதிவு செய்யப்படாமல் இருக்கிறது.

ஆங்கிலேய ஏகாதிபத்தியத்தை எதிர்த்து வீரப்போர் செய்த வீரமங்கை வேலுநாச்சியாரின் வீரம், துணிச்சல், போர்க்குணம், நாட்டுப்பற்று இவற்றை பற்றியெல்லாம் பல வரலாற்றுச் செய்திகளைப் பள்ளிப் பருவத்திலேயே வரலாற்றுப் பாடத்தில் படித்திருப்போம். அதே நேரம் இந்த வீரமங்கைக்கு மெய்க் காப்பாளராகவும், தாய் மண்ணின்மீது தான் கொண்ட காதலை நிரூபிக்கும் வகையில் முதன் முதலாகத் தன் உடலையே ஆயுதமாக்கிப் போராடி உயிர்த்தியாகம் செய்த முதல் தற்கொலைப் பெண் போராளியாகவும் விளங்கிய குயிலியைப் பற்றி நம்மில் எத்தனை பேருக்குத் தெரியும்? சிவகங்கையின் மன்னராக இருந்த முத்துவடுக நாதரை ஒரு கட்டத்தில் ஆங்கிலேய அரசு சுட்டுக் கொன்றது. அதைத் தொடர்ந்து முத்துவடுகநாதரின் மனைவியான வேலுநாச்சியார் எட்டு ஆண்டுகள் தலைமறைவாக இருந்தார். அப்படி அவர் தலைமறைவாக இருந்த காலத்தில், இவரது நம்பிக்கைக்குரியவரான சிலம்பு வாத்தியார், இவரை எதிரிகளிடம் காட்டிக் கொடுக்கும் துரோகச் செயலில் ஈடுபட்டார். வேலுநாச்சியார் பற்றிய இரகசியங்களை எதிரிகளுக்குக் கடத்தினார்.

இதைத் தெரிந்து கொண்ட பதினெட்டு வயதே ஆன இளம்பெண் குயிலி இரகசியம் கைமாறுவதற்கு முன்பு சிலம்பு வாத்தியாரை வாள்வீசிக் கொலை செய்தார். இந்தச் சம்பவத்தைக் கேள்வியுற்ற வேலுநாச்சியார் இளம்பெண்ணின் இந்த வீரச் செயலையும், தன்மீதும், நாட்டின்மீதும் குயிலி வைத்திருக்கும் பற்றுதலையும் கருத்தில் கொண்டு குயிலியைத் தனது மெய்க்காப்பாளராக நியமித்தார்.

இதற்குக் கடுமையான எதிர்ப்புக் கிளம்பியது. எதிர்ப்புக்குப் பல காரணங்கள், ஒடுக்கப்பட்ட சாதியைச் சேர்ந்தவர் குயிலி என்பதும், அவள் ஒரு பெண் என்பதும், அனுபவமோ போதுமான துணிச்சலோ இல்லாத வெறும் பதினெட்டு வயதே ஆன இளம் பெண் என்பதும் சில முக்கியமான காரணங்கள். ஆனால் இவை எந்தக் காரணங்களையும் பொருட்படுத்தாமல் குயிலியைத் தன்னுடைய மெய்க்காப்பாளராக வைத்துக் கொண்டார் வேலு நாச்சியார்.

ஒரு நாள் இரவு உறக்கத்திலிருந்து வேலு நாச்சியாரைக் கொலை செய்ய அரண்மனைக்குள் வந்த ஓர் அந்நியனைத் தன் துணிச்சலால் தடுத்து நிறுத்தி அவனோடு சண்டையிட்டாள் குயிலி. ஆனாலும் மிக மோசமாகக் கத்திக் குத்துக் காயம்பட்டு மயங்கிச் சரிந்தாள்.

தன் உயிரைக் கொடுத்தேனும் தன் தாய் நாட்டைக் காக்கப் போராடும் வேலுநாச்சியாரின் உயிரைக் காக்க வேண்டும் என்ற குயிலியின் விருப்பத்தையும் உறுதியையும் இந்தச் சம்பவம் மூலம் புரிந்து கொண்டார் வேலுநாச்சியார். அன்று முதல் குயிலியைத் தனது பெண்கள் படைக்குத் தளபதியாக உயர்த்தினார். வேலுநாச்சியார் பெண்களை மட்டும் கொண்ட தனி படைப்பிரிவை அப்போதே வைத்திருந்தார் என்பதை இந்த இடத்தில் கவனிக்க வேண்டும்.

சுமார் எட்டு ஆண்டுகள் சிறப்பான போர்ப்பயிற்சி எடுத்தது வேலு நாச்சியாரின் போர்ப்படை, போருக்குத் தேவையான ஆயுதங்களையும் கணிசமான அளவுக்கு இந்தக் காலக்கட்டத்தில் சேகரித்தனர். வெள்ளையனையும், வெள்ளையனுக்குத் துணைநிற்கும் சில நயவஞ்சகக் குறுநில மன்னர்களின் படைகளையும் போரில் நேருக்கு நேர் சந்திக்கும் அளவுக்குத் தன்னைத் தயார் படுத்திக் கொண்டது வேலு நாச்சியாரின் போர்ப்படை.

1780 ஆம் ஆண்டு ஐப்பசி 5 ஆம் நாள் விருப்பாச்சிப் பாளையத்திலிருந்து வேலுநாச்சியார் தன் படையுடன் சிவகங்கையை மீட்பதற்காகப் போர் முரசு கொட்டிப் புறப்பட்டார். இந்தப் போரில் பெண் வீரர்களை மட்டும் கொண்ட தனிப் படையைத் தளபதியாக இருந்து வழிநடத்திச் சென்றவர் குயிலி.

வீறு கொண்டு விரைந்து வந்த இந்தப் பெரும் போர்ப்படையை மதுரை கோச்சடையில் மல்லாராயன் என்கிற நயவஞ்சகன் தன் படையுடன் தடுத்து நிறுத்த முயற்சித்தான். வேலுநாச்சியாரின் கணவரான முத்துவடுகநாதர் ஆங்கிலேயர்களால் படுகொலை செய்யப்படக் காரணமாக இருந்த துரோகிதான் இந்த மல்லாராயன் என்பது குறிப்பிடத்தக்கது.

வெறும் ஒருமணி நேரப் போரிலேயே மல்லாராயனைக் குத்திக் கொலைசெய்து தோற்கடித்துவிட்டுத் தொடர்ந்து முன்னேறியது வீரமங்கை வேலுநாச்சியாரின் போர்ப்படை சிவகங்கை நோக்கி.

அடுத்ததாகக் காளையார் கோயில் பகுதியில் தங்களை எதிர்த்து நின்ற தளபதி ஜோசப் ஸ்மித் தலைமையிலான ஆங்கிலப் படையையும் அடித்து துவம்சம் செய்து தோற்கடித்துத் தொடர்ந்து முன்னேறிச் சென்றது வேலுநாச்சியாரின் படை. ஆனால் காளையார் கோயிலிலிருந்து சிவகங்கைவரை ஒரு அடிக்கு ஒரு சிப்பாய் நிறுத்தப்பட்டு மிகவும் கெடுபிடையானப் போர் உத்தியை அமைத்திருந்தான் ஆங்கிலேயக் கொடுங்கோல் தளபதி பாஞ்சோர்.

எல்லா சிப்பாய்களும் துப்பாக்கி ஏந்தியிருந்தார்கள். அரண்மனையைச் சுற்றிலும் பீரங்கிகள்

நிறுத்தப்பட்டிருந்தன. ஆயிரக்கணக்கானத் துப்பாக்கிகளும் ஆயுதங்களும் பீரங்கிகளும் ஆயுதக் கிட்டங்கியில் வைக்கப்பட்டிருந்தன.

வேலுநாச்சியாரின் வீரமிகுந்த படை ஆங்கிலேயர்களின் நவீன ஆயுதங்களை எதிர் கொள்வது எப்படி என்று தெரியாமல் தயங்கி பின்வாங்கி நின்றது. வேலுநாச்சியார் உட்பட ஒட்டுமொத்த படையினரையும் உற்சாகப்படுத்தும் வகையில் அந்த நேரத்தில் ஒரு வயதான பாட்டி ஒரு அருமையான போர் விபூகம் அமைத்து அதைப் பற்றி வேலுநாச்சியாரிடம் விளக்கம் அளித்தார். அதை கேட்ட வேலுநாச்சியாரும் படையினரும் புத்துணர்ச்சி பெற்றனர். தான் அமைத்துக் கொடுத்த போர் விபூகம் ஏற்றுக் கொள்ளப்பட்டப் பிறகே தான் யார் என்பதைத் தன் பாட்டி வேடத்தைக் கலைத்துக் காட்டினார் குயிலி. வயதான வேடமணிந்து சிவகங்கை நகருக்குள் தன்னந்தனியாளாகச் சென்று உளவு பார்த்து எப்போது எப்படிப் போர் தொடுக்கலாம் என்பவை பற்றிய தகவல்களைச் சேகரித்து அதன் அடிப்படையில் போர் விபூகம் அமைத்து அதை வேலுநாச்சியார் உட்பட அனைவரும் ஏற்றுக் கொள்ளும் வகையில் விளக்கமளித்தார் குயிலி என்பது குறிப்பிடத்தக்கது.

குயிலி உளவு பார்த்து வந்து போட்ட திட்டத்தின் படியே ஆயுத பூஜை விழாவன்று பெண்கள் மட்டும் சிவகங்கை ஊருக்குள் இருக்கும் ராஜ ராஜேஷ்வரி அம்மன் கோயிலுக்குள் நுழைய ஆங்கிலேய அரசு அனுமதித்திருந்தது. இதைப் பயன்படுத்திக் கொண்டு வேலுநாச்சியாரும் போர்ப்படையில் இருக்கும் மற்ற பெண் போராளிகளும் சாதாரண பெண்கள் போல் உடையணிந்து கொண்டு பூஜைக்குரிய பொருட்களையும் மாலைகளையும் எடுத்துக் கொண்டு ஊருக்குள்ளிருக்கும் கோயிலுக்குச் சென்றார்கள். கூடவே, ஆங்கிலேயச் சிப்பாய்கள் அறியாத வகையில் மாலைகளுக்கு நடுவே கத்திகளையும் குறுவாளையும் மறைத்து எடுத்துக் கொண்டு போருக்குத் தயாராகப் போனார்கள்.

அன்று ஆயுத பூஜை என்பதால் ஆயுதங்கள் அனைத்தும் ஆயுதக் கிட்டங்கில் பூஜை செய்வதற்காகக் கிடத்தப்பட்டு இருந்தன. ஒரு சில வீரர்கள் மட்டும் கையில் துப்பாக்கி ஏந்தி நின்றிருந்தார்கள்.

இந்தக் தருணத்தைச் சரியாகப் பயன்படுத்திக் கொண்ட வேலுநாச்சியார் ஆங்கிலேய சிப்பாய்களை எதிர்த்துப் போர் தொடங்கும்படி தனது படையினருக்குத் தகவல் சொல்லும் வகையில் வீரவேல் வெற்றிவேல் என்று முழங்கியபடியே மாலைகளுக்கு நடுவே ஒளித்து வைத்திருந்த கத்தியை

எடுத்துப் போரைத் தொடங்கினார். இதைக் கேட்ட மற்ற பெண்வீரர்களும் தாங்கள் மறைத்து வைத்திருந்த வாளால் சிப்பாய்களைத் தாக்க ஆரம்பித்தனர்.

அரண்மனையின் மேல்மாடத்தில் நின்று கொண்டு எதிர்த்துத் தாக்குங்கள் என்று தனது சிப்பாய்களுக்குக் கட்டளையிட்ட ஆங்கிலத் தளபதி பாஞ்சோரைத் தாக்குவதற்காக மேல்மாடத்தை நோக்கிப் பயிந்தார் வேலுநாச்சியார். ஆயுதக் கிட்டங்கியில் கிடத்தப் பட்டிருக்கும் ஆயுதங்களை எடுப்பதற்காக ஆயுதக் கிட்டங்கியை நோக்கி ஆங்கிலேய சிப்பாய்கள் ஓடிவரத் தொடங்கினர்.

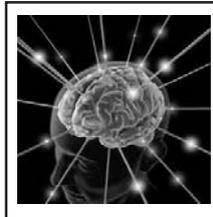
அந்தக் நேரத்தில், அரண்மனையே அதிரும்படியும், வாணைக் கிழிக்கும் பெரும் ஓசையுடனும் மீண்டும் வீரவேல் வெற்றிவேல் என்றொரு முழக்கம் பெண்குரலில் கேட்டது. தன் உடல் முழக்க எரிநெய்யைத் தடவிக் கொண்டு தன் மீது தானே நெருப்பு வைத்துக் கொண்டு எரியும் உடலுடன் வீர முழக்கம் செய்து கொண்டே பெண் ஒருத்தி அரண்மனையின் மேல்மாடத்திலிருந்து ஆயுதக் கிட்டங்கிக்குள் குதித்துக் கொண்டிருந்ததைப் பார்த்த அத்தனைபேரும் செய்வதறியாமல் திகைத்து நின்றனர். யார் அந்தக் பெண் என்று யோசித்த போதுதான், நான் வெற்றிக்கு வழிகாட்ட ஒளியூட்டப் போகிறேன். என்று முழங்கியபடி தன் உடல் முழுவதும் எரிநெய்யைப் பூசிக் கொண்டு, கோயிலிலிருந்து ஒரு எரிபந்தத்தைக் கையில் ஏந்தியபடி அரண்மனையின் உட்பரிக்கையை நோக்கி, குயிலி ஏன் போனான் என்பது வேலுநாச்சியார் உட்பட அவரது படையினர் எல்லாருக்கும் புரிந்தது.

ஆயுதக் கிட்டங்கியில் வைக்கப்பட்டிருந்த ஆயுதங்கள் பெருமளவில் தீப்பிடித்து எரிந்தும் வெடித்தும் சேதமாயின. ஆங்கிலச் சிப்பாய்களால் அங்கிருந்து எந்த ஆயுதத்தையும் எடுக்க முடியவில்லை. போரிட முடியவில்லை. ஆங்கிலச் சிப்பாய்களும் தளபதி பாஞ்சோரும் நிராயுத பாணிகளாகப் போரிடத் தொல்விடிற்றனர்.

சிவகங்கைக் கோட்டை மீண்டும் வேலுநாச்சியாரின் வசம் வந்தது. **இந்த வெற்றியைச் சாத்தியமாக்கியப் பெருமை ஆயுதக் கிடங்கை தன் உடலாலும் உயிராலும் அழித்த வீரமங்கை முதல் தற்கொலைப் போராளி குயிலியையே பெரும்பகுதி சேரும்!** *Courtesy: Pesot, November 2015*

## POWER YOUR MIND - WE ARE ALL ONE

Don't hate a person because he is A rogue, but have pity for him.  
Don't hate a person because he is A low-caste, but have love for him.  
Don't hate a person because he is Poor, but try to serve him.  
Don't hate a person because he is Rich, try to enlighten him.  
Don't hate a person because he is A miser, try to motivate him.



*Courtesy: Swami Srikantananda*

Don't hate a person because he is Disobedient, try to listen to him.  
Don't hate a person because he is Ugly, try to encourage him.  
Don't hate a person because he is Dull, try to improve him.

*For we are all members of God's family and therefore are Closely related to one another.*

***Nobody doubts that he exists, though he may doubt the existence of God. If he finds out the truth about himself and discovers his own source, this is all that is required. - SRI RAMANA MAHARSHI***

## உடல் நலம் - இரத்தம்

### இரத்தத்தில் உப்பு குறைய

நெருஞ்சில், சீரகம், சோம்பு, சிறுபிளை வேர் ஆகியவை சம அளவு எடுத்து காய வைத்து பொடி செய்துக் கொள்ளவேண்டும். இந்த பொடியை இரண்டு கிராம் எடுத்து காலை, இரவு என இரண்டு வேளை சுடு தண்ணீர் அல்லது தேனில் கலந்து சாப்பிட்டு வந்தால் இரத்தத்தில் அதிகமாக உள்ள உப்புச் சத்து குறையும்.

### இரத்தம் தூய்மையடைய

1. செம்பருத்திப்பூவின் இதழ்களை எடுத்து சுத்தம் செய்து காய வைத்து பொடி செய்து வைத்து கொண்டு தினமும் காலை, மாலை 1 டம்ளர் வெந்நீரில் 1 ஸ்பூன் கலந்து குடித்து வந்தால் உடலில் பலவீனம் குறைந்து இரத்தம் தூய்மையடையும்.
2. 1 டம்ளர் ஆப்பிள் பழச்சாறு எடுத்து அதில் கேரட் சாறு மற்றும் இஞ்சிச்சாறு கலந்து குடித்து வந்தால் உடல் சோர்வு குறைந்து இரத்தம் சுத்தம் பெறும். உடல் பலம் அதிகரிக்கும்.
3. திராட்சை பழத்தை கழுவி சாப்பிட்டு வந்தால் சுரத்தை தணித்து மலச்சிக்கலை போக்கி இரத்தம் சுத்தமடையும்.
4. கேரட் சாறு, ஆப்பிள் பழச்சாறு, மாம்பழச்சாறு சாப்பிட இரத்தம் தூய்மை அடையும்.

### இரத்த கோளாறுகள் குறைய

நன்னாரி வேரை இடித்து சாறு எடுத்து பாலில் கலந்து சாப்பிட்டு வந்தால் இரத்த கோளாறுகள் குறையும்.

### இரத்த ஓட்டம் சீராக

ஓரிதழ் தாமரையை அரைத்து சாப்பிட்டு வந்தால் இரத்த ஓட்டம் சீராகும்.

### ஒற்றை தலைவலி குறைய

1. ஒற்றை தலைவலி ஏற்படும் போது 1 டம்ளர் கேரட் சாறில் சிறிது வெள்ளரிக்காய் சாறு மற்றும் பீட்ரூட் சாறு கலந்து குடித்து வந்தால் ஒற்றை தலைவலி குறையும்.
2. சந்தனத்தூளை எடுத்து நீர் விட்டு குழைத்து நெற்றியில் தடவி நன்கு காய்ந்ததும் கழுவி வந்தால் ஒற்றை தலைவலி குறையும்.
3. ஒற்றை தலைவலி ஏற்படும் போது 1 டம்ளர் கேரட் சாறு எடுத்து கால் டம்ளர் பசலைக்கீரை சாறு, கால் டம்ளர் பீட்ரூட் சாறு கலந்து குடித்து வந்தால் ஒற்றை தலைவலி குறையும்.
4. முட்டைகோஸ் இலைகளை நன்கு நசுக்கி ஒரு சுத்தமான துணியில் கட்டி, அதைக் கொண்டு தலையின் மீது ஒத்தடம் கொடுத்தால் ஒற்றைத் தலைவலி குறையும்.
5. 200 மில்லி பசலைக்கீரை சாறு மற்றும் 300 மில்லி கேரட் சாறு இந்த கலவைகளை தினமும் குடித்து வந்தால் ஒற்றைத் தலைவலி குறையும்.
6. கவிழ்தும்பை வேர், கறி மஞ்சள் இரண்டையும் சம அளவு எடுத்து அரைத்துத் துணியில் தடவித் திரியாக்கி நெருப்பில் கொளுத்தி அந்த புகைச் சுவாசிக்க தலைவலி, மண்டைக்குத்து, ஒற்றைத் தலைவலி ஆகியவை குறையும்.

7. மாமரத்தின் பூவை நிழலில் உலர வைத்து பின்பு தண்ணை தனியாக எடுத்து அதில் உலர்ந்த மாமரப் பூவைப்போட்டு அதிலிருந்து வரும் புகையை சுவாசித்தால் ஒற்றைத் தலைவலி பூரணமாக குணமாகும்.

### முதுகு வலி குறைய

1. 3 கிராம் வெட்டிவேரின் புல்லை எடுத்து 2 கிராம் கற்கண்டு சேர்த்து நன்றாக அரைத்து 1 டம்ளர் பாலில் கலந்து குடித்து வந்தால் முதுகு வலி குறையும்.
2. முதுகு வலி அதிகமாக இருப்பவர்கள் 5 மிளகு, 5 கிராம்பு மற்றும் 1 கிராம் சுக்கு சேர்த்து நீர் விட்டு தேநீர் செய்து தினமும் 2 வேளைகள் குடித்து வந்தால் முதுகு வலி குறையும்.
3. வெற்றிலைகளை எடுத்து சாறு பிழிந்து தேங்காய் எண்ணெயில் கலந்து வலி இருக்கும் இடத்தில் தடவி வந்தால் இடுப்பு வலி மற்றும் முதுகு வலி குறையும்.
4. வாதநாராயணன் இலைகளை எடுத்து விளக்கெண்ணெயில் வதக்கி முதுகில் வலி உள்ள இடத்தில் ஒத்தடம் கொடுத்தால் முதுகுவலி குறையும்.
5. பல் பூண்டை தோல் நீக்கி 50 மில்லி நல்லெண்ணெய் சேர்த்து, 20 நிமிடம் கொதிக்க வைத்து வடிகட்டி முதுகு வலியுள்ள இடத்தில் 10 நிமிடம் தேய்த்தால் முதுகு வலி குறையும்.
6. சிறிது உலர்ந்த இஞ்சி பொடியுடன் இரண்டு கருப்பு மிளகு, தேவையான அளவு வெண்ணெய் சேர்த்து சாப்பிட்டால் முதுகு வலி குறையும்.
7. மனோரஞ்சித வேரை பொடித்து தேனுடன் குழப்பி சாப்பிட முதுகு தண்டு வலி குறையும்.
8. மனோரஞ்சித வேரை நிழலில் உலர்த்தி, பொடித்து, 2 கிராம் எடுத்து தினமும் இரண்டு வேளை தேனுடன் குழப்பி சாப்பிட முதுகு தண்டு வலி குறையும்.
9. பப்பாளி, முருங்கை, ஆரஞ்சு, மாதுளை, நெல்லி, பேரீச்சை, தேன், கேரட், ஆப்பிள், மா, பலா, தேங்காய், இளநீர் இவைகளை சாறு எடுத்து குடித்துவர முதுகு வலி குறையும்.
10. முருங்கை வேரின் சாற்றுடன் பால் சேர்த்து கொதிக்க வைத்து அளவாக அருந்தினால் முதுகுவலி குறையும்.

### மெடிடேசன் செய்தால் இதயநோய், பக்கவாதம் வராது: ஆய்வில் தகவல்

தினசரி இரண்டு முறை மந்திரம் ஜெபித்து மெடிடேசன் செய்தால் உயர் ரத்த அழுத்தம் கட்டுப்படும் என்று சமீபத்திய ஆய்வு ஒன்றில் கண்டறியப்பட்டுள்ளது. மேலும் மாரடைப்பு, இதயநோய், பக்கவாதம் ஏற்படாது என்கின்றனர் ஆய்வாளர்கள்.

தினசரி இருவேளை இருபது நிமிடங்கள் வரை மெடிடேசன் செய்பவர்களுக்கு 48 சதவீதம் வரை மாரடைப்பு,

பக்கவாதம் மூலம் மரணம் சம்பவிக்கும் வாய்ப்பு குறைகிறது என்கின்றனர் ஆய்வாளர்கள். மெடிடேசன் மூலம் அதிகம் கோபப்படுவது கட்டுப்படுத்தப்படுகிறது. இதனால் ரத்தக் கொதிப்பு, மன அழுத்தம் ஏற்படுவதும் கட்டுப்படுத்தப்படுகிறது என்கின்றனர் ஆய்வாளர்கள். 59 வயதுடைய 201 நபர்கள் இருபிரிவாக பிரிக்கப்பட்டு ஆய்வு மேற்கொள்ளப்பட்டது. ஆய்வில் ஒரு பிரிவினரின் வாழ்க்கை முறையை மாற்றும் உடற்பயிற்சி உணவு வழங்கப்பட்டது. மற்றொரு பிரிவினருக்கு மது மற்றும் புகை பிடிப்பதை நிறுத்திவிட்டு மெடிடேசன் செய்யுமாறு அறிவுறுத்தப்பட்டனர். 32 வகுப்புகளுக்குப் பின்னர் அவர்களின் பிஎம்ஐ பரிசோதிக்கப்பட்டது. இருபிரிவினரையும் பரிசோதித்ததில் உடற்பயிற்சி டயட்டில் இருந்தவர்களுக்கு உடல் எடை குறைந்திருந்தது. தினசரி மெடிடேசன் செய்தவர்களுக்கு மாரடைப்பு, பக்கவாதம் வரும் வாய்ப்பு குறைவாக இருந்ததாக ஆய்வாளர்கள் தெரிவித்தனர். இந்த ஆய்வினை மேற்கொண்ட ஆய்வாளர், மெடிடேசன் மூலம் உடலும், மனமும் இணைந்து செயலாற்றுகிறது. உடலின் செயல்பாட்டை மனம் கட்டுப்படுத்துகிறது என்று கூறியுள்ளார். எனவே இதயநோயாளிகளுக்கு மெடிடேசன் முறையை மருத்துவர்கள் பரிந்துரைக்கலாம் என்று ஆய்வாளர்கள் கூறியுள்ளனர். இந்த ஆய்வு முடிவு இதயநோய் மருத்துவ இதழ் ஒன்றில் வெளியிடப்பட்டுள்ளது.

### இதயநோயை தடுக்கும் வால்நட்!



வால்நட் எனப்படும் அக்ரூட் கொட்டை உடல் கொழுப்பை எளிதில் கரைத்து இதயநோய்களை தடுக்கிறது என்று கண்டுபிடிக்கப்பட்டுள்ளது. உடலில் கொழுப்பின் அளவு அதிகரிதால் மாரடைப்பு உள்ளிட்ட இதய பாதிப்புகள் தாக்கும் அபாயம் ஏற்படும். உடல் பருமன் மற்றும் கொழுப்பு சத்தால் பாதிக்கப்படுவோர் எண்ணிக்கை அதிகரித்து வருகிறது. இதற்கு உணவு முறைகளே முதல் காரணமாக கூறப்பட்டாலும் போதிய உடற்பயிற்சி இன்மையும் ஒரு காரணம். உடலில் உள்ள அதிகப்படியான கொழுப்பை கரைத்து ஆரோக்கியத்தை அதிகரிப்பதில் அக்ரூட்டுக்கு முதலிடம் கொடுக்கின்றனர், ஆராய்ச்சியாளர்கள். வால்நட் எனப்படும் அக்ரூட் கொட்டை உடல் கொழுப்பை எளிதில் கரைத்து ஆரோக்கியத்தை அதிகரிப்பது சமீபத்திய ஆய்வு ஒன்றில் கண்டுபிடிக்கப்பட்டுள்ளது. பென்சில்வேனியாவில் உள்ள ஸ்க்ராட்டன் பல்கலைக்கழக ஆராய்ச்சியாளர்கள் இது தொடர்பாக ஆய்வு மேற்கொண்டனர். உடலில் கொழுப்பு அதிகம் இருந்த ஆண், பெண் ஏராளமானோர் வயது வித்தியாசமின்றி தேர்வு செய்யப்பட்டனர். முதல் கட்ட பரிசோதனைகளை தொடர்ந்து ஒரு வார காலம் அக்ரூட் பருப்புகள் கொடுத்து கண்காணிக்கப்பட்டனர். அதன் பின்னர் மேற்கொள்ளப்பட்ட சோதனையில் ரத்தத்தில் உள்ள கொழுப்பின் அளவு குறைந்திருந்தது. இதன்மூலம்

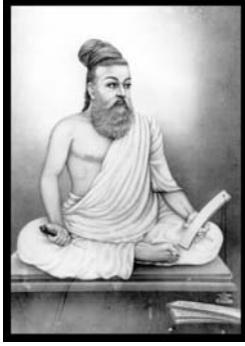
கொழுப்பை அக்ரூட் கரைக்கும் என்பது உறுதி செய்யப்பட்டதாக ஆராய்ச்சியாளர்கள் கூறுகின்றனர். முந்திரி, பாதாம் உள்ளிட்ட சுமார் 7 வகையான கொட்டைகளுடன் ஒப்பிடும் போது அக்ரூட்டில்தான் ஆன்டி ஆக்சிடன்ட்கள் அதிகம் உள்ளது. குறிப்பாக பாலிபெனால் என்ற ஆன்டிஆக்சிடன்ட் அபரிதமாக இருப்பதுதான் இதற்கு காரணம், இவை கொழுப்பை எளிதில் கரைக்க வல்லது என்பதுடன் உடலின் நோய் எதிர்ப்பு சக்தியையும் அதிகரிக்கும். இது நோய்த்தாக்குதலில் இருந்து பாதுகாப்பு அளித்து ஆரோக்கியத்துக்கு வகை செய்யும். **உடலில் கொழுப்புச்சத்து அளவாக இருப்பது அவசியம், உணவு முறைகளே உடலில் கொழுப்பு அதிகரிக்க முக்கிய காரணம், அக்ரூட், உடல் கொழுப்பை எளிதில் கரைக்கும் என்று ஆய்வாளர்கள் தெரிவித்துள்ளனர்.**

### உடல் நலம் பேணுவீர்!

1. ஒவ்வொருவரும் அறுசுவை உணவு உட்கொள்ள வேண்டும். அறுசுவை உணவு சந்தோசத்தை கொடுக்கும் மற்றும் மருந்தாக பயன்படும். உணவில் அறுசுவை கலந்தால் மட்டுமே உட்கொள்ளும் உணவு இரத்தமாக உருவாகும், இல்லையேல் மலமாகவும் நச்சு பொருளாகவும் மாறிவிடும்.
2. முதலில் இனிப்பு சாப்பிட வேண்டும்.
3. நாக்கு மட்டுமே சுவையின் மூலம் உடலுக்கு பிராண சக்தியை உருவாக்குகிறது.
4. உண்ணும் போது உணவில் மட்டுமே கவனம் வைத்து உண்ண வேண்டும்.
5. வாயை மூடிக்கொண்டு உணவை நன்றாக மென்று உமிழ் நீர் நன்கு உணவுடன் கலந்து முழுங்க வேண்டும். (உண்ணும் உணவு நன்றாக உமிழ் நீருடன் கலந்தவுடன் உணவு சுவையற்ற தன்மைக்கு மாறும், பிறகுதான் விழுங்க வேண்டும்).
6. சாப்பாடினது முன் முகம், கை, கால் அலம்பி விட்டு உண்ண வேண்டும்.
7. உணவிற்கு அரை மணி நேரம் முன்பும், உண்ணும் போதும், உணவு உண்ட அரை மணி நேரம் பின்பும் தண்ணீர் அருந்த கூடாது. (வேண்டும் என்றால் ஓரிரு வாய் நீர் மட்டுமே அருந்தலாம்)
8. குளித்து முக்கால் மணி நேரத்திற்கு பின்பும் உண்ட பின் இரண்டரை மணி நேரம் பின்பு மட்டுமே உணவு உட்கொள்ள வேண்டும்.
9. தாகம் எடுத்தால் மட்டுமே நாக்கு விரும்பும் வரை நீர் அருந்த வேண்டும்.
10. மண்பானையில் ஊற்றி வைத்த தண்ணீரை மட்டுமே அருந்த வேண்டும். (எக்காரணம் கொண்டும் கொதிக்கவைத்த, நவீன கருவிகளால் சுத்தம் செய்யப்பட்ட நீரை அருந்த கூடாது.)
11. கொசு வத்தி மற்றும் லிகுடைடோர் உபயோகப்படுத்தக்கூடாது.
12. எப்போதும் சம்மணம் இட்டு மட்டுமே அமர வேண்டும். (நாற்காலியில் அமர்ந்தால் கூட சம்மணம் இட்டுதான் அமர வேண்டும்).
13. 12 மற்றும் காபி அருந்த கூடாது.
14. உடல் உழைப்பு அவசியம்.

Courtesy: Pesot, October 2015

## TIRUKKURAL AND MANAGEMENT IN A 'NUTSHELL' - 32



In Management, attaining and continuously improving the Knowledge and Wisdom to perform Effectively and Efficiently is very important. Tiruvalluvar calls it as "Thaguthi". The confident capable Manager should also develop value towards "Equanimity" meaning, ability to view Events equally. Success or Failure does not disturb the balance. Valluvar deals with this Quality in the following Kurals.

*Kedum Perukkamum Illalla; Nenjaththuk  
Kodamai Sandrorckku Ani Kural 115*

கேடும் பெருக்கமும் இல்லல்ல; நெஞ்சத்துக்  
கோடாமை சான்றோர்க்கு அணி குறள் 115

Whether winning or losing  
Wisdom balances mind

*Samanseythu Seerthookkum Kolpol Amainthuorupal  
Kodamai Sandrorckku Ani Kural 118*

சமன்செய்து சீர்தூக்கும் கோல்போல்  
அமைந்து ஒருபால்  
கோடாமை சான்றோர்க்கு அணி குறள் 118

Balanced as unbiased scales  
Wisdom's illustrious ornament

*Sorkkottam Illathu Seppam Oruthalaiyaa  
Ulkkottam Inmai Perin Kural 119*

சொற்கோட்டம் இல்லது செப்பம் ஒருதலையா  
உள்கோட்டம் இன்மை பெறின் குறள் 119

When equipoise fills minds  
Words lilt untilting

*Thaguthi Enavonru Nanre Paguthiyal  
Parppatuu Ozhugap Perin. Kural 111*

தகுதி எனவன்று நன்றே பகுதியால்  
பாற்பட்டு ஒழுகப் பெறின் குறள் 111

"Merited eminence regards impartially;  
Enemies, friends, outsiders"

## HOME FESTIVALS - 2

மாசி - Masi (February/March)



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

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

(To be continued)

**Members of society are tied together in a number of cohesive bundles called castes, and all these bundles are tied together with the common bond called religion. Caste and religion are meant to keep society together in a strong bond of camaraderie so that all the component members will strive for the general welfare of the community as a whole, in an atmosphere of mutual respect and cooperation. It is not meant to create hatred and conflicts. We should strive to lead a sinless life, uphold human brotherhood and earn the grace of Iswara. - H.H. Shri Paramacharya**

## THE EDGE, AMSTERDAM

Located in Amsterdam, the building achieved a BREEAM NL New Construction certification of 'Outstanding'. OVG worked in close partnership with the building's principle occupier, leading global professional services firm Deloitte. By employing innovative smart technology, the 40,000 square metres (430,000 square foot) Grade A office building achieved a score of 98.36%.

BREEAM (short for Building Research Establishment Environmental Assessment Methodology) is an approach for assessing and rating the sustainability of buildings. It is licensed for use by independent assessors around the world and is claimed to be "the world's foremost environmental assessment method and rating system for buildings." Among the criteria considered during a building's assessment are energy and water use, transport links, materials used, waste and management processes.

According to the building's designers PLP Architecture, The Edge is the second largest building to ever achieve BREEAM's Outstanding certification. The building covers 40,000 sq m (430,000 sqft), and features a mix of passive temperature control and energy-efficient design, and generates its own electricity, too.

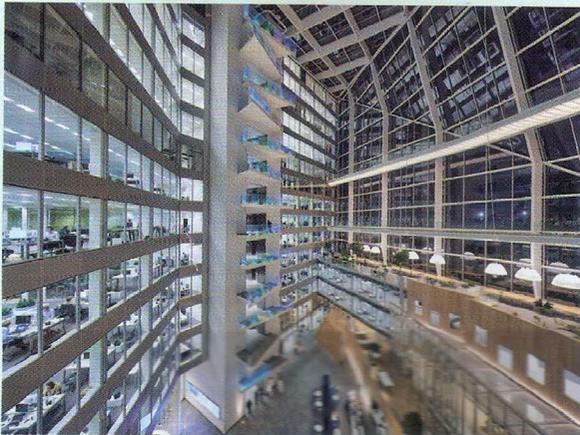
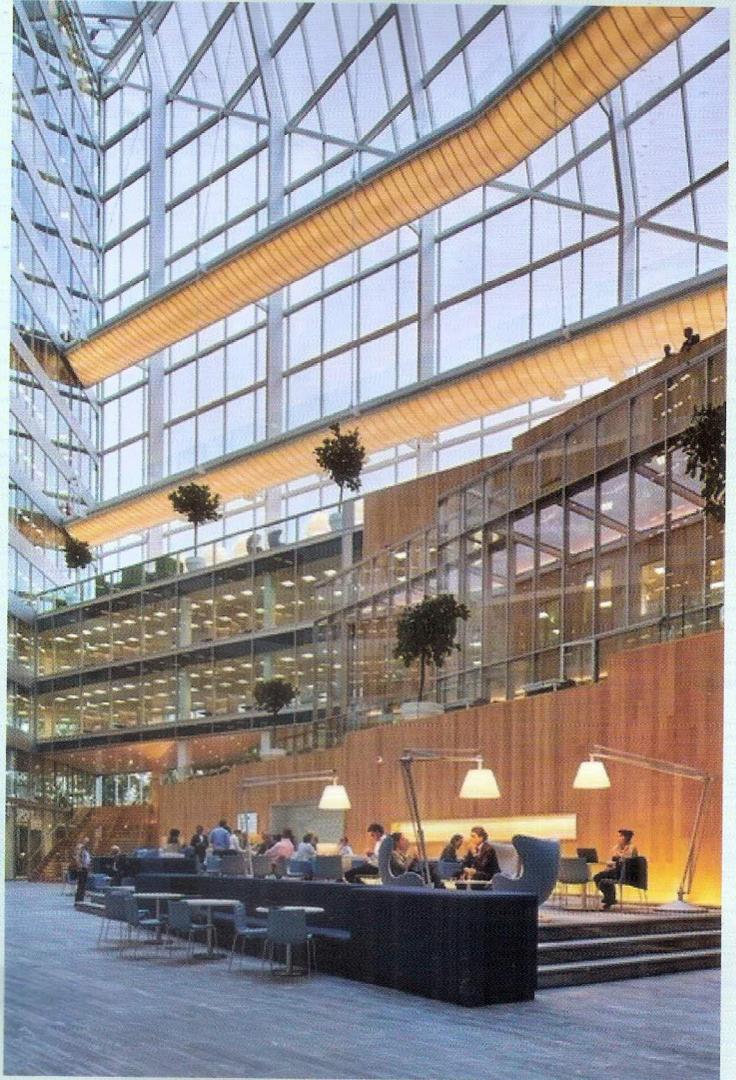
The building's south façade is covered with solar panels on all surfaces that aren't windows. In order to generate enough electricity to meet its level of consumption, though, developers OVG partnered with the University of Amsterdam and the Amsterdam University of Applied Sciences to install a further 4,100 sq m (44,100 sqft) of solar panels on the rooftops of the schools.

The heating and cooling of the building is catered for in part by orienting it to benefit passively from the path of the sun and also by using an aquifer thermal energy storage system. Such systems use one well to provide heating during the cool periods and another to provide cooling during warm periods. When it is warm, water is extracted from one well, pumped through a heat exchange and pumped back into the well for storage until a cooler time when it can be used to heat the building. The second well is used in reverse to provide cooling when it is warm.

Among its other features, OVG says The Edge was the first building to make use of Philips' Ethernet-powered LED connected lighting for offices. As well as providing power to the lighting, the system is able to transmit data. As such, lights can be paired with sensors and used to monitor aspects like movement, light and temperature throughout the building, helping to inform energy management.

Elsewhere, rainwater is collected for use flushing the building's toilets and watering its green areas. There is good access to public transport links and the local cycle route network, with 500 bicycle parking spaces on-site.

# THE EDGE, AMSTERDAM





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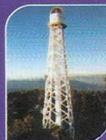
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