



# ELECTRICAL

## INSTALLATION ENGINEER

### NEWS LETTER

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

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## EDITORIAL

Dear Members, Fellow Professionals and Friends,

*Seasons Greetings To One And All!*

*Happy Independence Day!!*

It is with great pride and happiness that **we celebrate the 71<sup>st</sup> Independence Day** this year with installations of the New President and the Vice President for the Country. We are also experiencing bold Economic moves, in the past three years, with wide spread effects and with Benefits and Promises for a '**Bright Future**', be it Banking for all, Insurance for all, Demonetization, Digitization, 'e' Governance or the recent introduction of GST. Though there are criticisms galore, we are able to see a fair measure of '**Success**' for all the moves, because of the extraordinary levels of co-operation extended by the Public at Large, even withstanding good measure of inconveniences, with the fond hope that it will result in Betterment for all and the Nation at large. Though our Country seems to have ensured co-operation and appreciation from many large and advanced countries of the World, we seem to continue to have nagging problems and threats from our neighbors, which is very unfortunate. But in an overall sense, looking at our Growth and Development over the last 70 years, we can certainly feel proud about our advancements, be it in Economics or Defence or Space or IT or Communication or overall Wealth and Trade and Infrastructure or even in Sports at present. We are also aware that though '**The Largest Democracy**' we are, have survived and stabilized, the ills like corruption, misuse of power and black money and divisive forces like Caste, Language, Religion and Regionalism have all grown out of proportion over this period. We can see the hard struggle by the Government and the Judiciary to keep things under check.

We are growing steadily, but with much greater potentials yet to be tapped, be it in Agriculture or Industrial Production or any other field. Our per hector yield of agricultural production, our per cattle production of Milk, our productivity levels in Industries, our levels of Energy spent per Unit of GDP Production or in many such measurements we are lagging far behind, which also gives us great hopes for a Great Future if we can correct them. Energy Conservation Act passed by the Government in 2001 is a Good Example which has enabled lot of steps forward in conservation of resources, but we are aware that we still have a long way to go. Some of the Priorities can be to speed up measures to distribute the Waters of Country for all (we see all over the Country today large areas under floods and large areas in drought as well), to tap the renewable Energy potentials in the Country much more, and to step up Efficiency and Productivity levels in all activities. It is also very essential that we bring corruption and black money under greater check with speedy enforcements of law and punishments.

**Our City of Chennai Celebrates its Birth Day on the 21<sup>st</sup> August**, and we can rightly feel proud about the enviable place it has attained both as a Cultural Capital and as an **Automobiles Capital of India**. It was known as 'Madras' for a long time – even our Association was started as MECA and Madras University continues to hold on to the name – and later on changed to Chennai after the name of Chennappa Naicker who originally owned this area. There are many more interesting things to feel proud about our great city and let us all join the celebrations spread over few weeks these days.

**We thank all those members who have helped us by participating in the advertisement appearing for the issue July 2017 – Ashlok Safe Earthing Electrode Ltd., Alfa Switchgear (I) Pvt. Ltd., FLIR Systems India Pvt. Ltd., Dehn India Pvt. Ltd., Supreme Power Equipment Pvt. Ltd., Universal Earthing Systems Pvt. Ltd., Pentagon Switchgear Pvt. Ltd., Pentagon Power Solutions, Power Cable Corporation, Safvolt Switchgears Pvt Ltd., Wilson Power and Distribution Technologies Pvt. Ltd., Galaxy Earthing Electrodes (P) Ltd., Elmetlerr, Consul Neowatt Power Solutions Pvt. Ltd.**

**EDITOR**

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# RAM NATH KOVIND

**Ram Nath Kovind**, the former governor of Bihar, has been elected as the **14th President of India**. Kovind was nominated as the presidential nominee by the NDA, the ruling party of India. In the elections, Ram Nath Kovind defeated Meira Kumar. While Kovind bagged 65.65 percent of the total votes, Meira Kumar got just 34.35 percent of the votes. Kovind is a Dalit leader who hails from Uttar Pradesh.

Kovind may have kept a low profile during his stint as a Rajya Sabha Member, but he has had an illustrious career wherein he has worked towards the upliftment of the marginalised society, especially the Dalits. Colleagues in Parliament remember him as a gentle, soft-spoken and yet a focused person.



Before entering the world of politics, Kovind practiced as a lawyer in the Delhi High Court and the Supreme Court for 16 years. He made a debut into the world of politics when he was elected as the Rajya Sabha Member from Uttar Pradesh in 1994.

Kovind served for two consecutive terms as a Rajya Sabha MP from 1994 till 2006. During his appointment as the member of Rajya Sabha, Ram Nath Kovind has had the honour of representing India in New York as well as addressing the United Nations General Assembly in October 2002.

Kovind has always worked towards uplifting the lives of the marginalised society. During his parliamentary tenure Kovind emphasised on the requirement of basic infrastructure for education in the rural areas. He helped in the construction of school buildings in Uttar Pradesh as well as Uttarakhand under the Member of Parliament Local Area Development (MPLAD) Scheme. Kovind has also been an active member of parliamentary committees like Parliamentary Committee on Welfare of Scheduled Castes/Tribes, Parliamentary Committee on Social Justice and Empowerment, etc.

He has also held the office as a member of the Board of Management of Dr. B.R Ambedkar University, Lucknow, and Board of Governors of the Indian Institute of Management, Kolkata.

## **Humble Beginning**

Ram Nath Kovind represents the rural, agrarian, and economically and socially underprivileged sections of the society. Apart from belonging to the Dalit caste, Kovind has very humble beginnings. He is the son of a farmer and belongs to a lower middle class background. However, even at a young age Kovind knew the importance of education and armed himself with a Bachelor's Degree in Commerce and an LLB from Kanpur University.

## **Family**

Ram Nath Kovind is married to Savita Kovind and has two children - a son, Prashant Kumar and a daughter, Swati.

## **Career**

After completing his LLB, Kovind proceeded to Delhi to prepare for the civil services examination. However, after clearing it in the third attempt, he opted out as he was selected for an allied service instead of IAS. He started practicing law. In 1971 Kovind was enrolled as an advocate with the bar council of Delhi. Kovind provided free legal aid to the weaker sections of the society including women, minority, as well as the poor under the Free Legal Aid Society in New Delhi.

Ram Nath Kovind became an advocate-on-record of the Supreme Court of India in 1978. He served as the personal assistant of the Prime Minister Morarji Desai in the period 1977-78.

Since then he has held other prestigious positions including that of the Central Government Advocate in the Delhi High Court from 1977 to 1979, Central Government standing counsel in the Supreme Court for more than a decade from 1980 to 1993. Kovind practiced in the Delhi High Court and Supreme Court for about 16 years until 1993.

## Political Career

Kovind's journey in the political world began in 1991 when he joined the Bharatiya Janata Party. Since then he has been a loyal member of the party and even donated his ancestral home in Derapur to the RSS. As a member of BJP, Kovind served as the President of the BJP Dalit Morcha between 1998 and 2002, and President of the All-India KoliSamaj. He was also the national spokesperson of the party. Kovind contested from Ghatampur and Bhognipur (Uttar Pradesh) assembly constituencies on the BJP ticket but lost both the elections.

He was elected as a Rajya Sabha MP in 1994 and held this illustrious position for two terms till 2006. During his stint as the Rajya Sabha MP, Kovind has travelled to Thailand, Nepal, Pakistan, Singapore, Germany, Switzerland, France, the United Kingdom and the United States on study tours.

Kovind was appointed as the Governor of Bihar on 8 August 2015 by the President of India, and since then he held the office till he resigned after being nominated for the office of the President of India. As the Governor of Bihar, Kovind has had a quiet innings but his non-confrontational conduct prompted the Bihar Chief Minister Nitish Kumar, who has been battling the BJP in the state, to praise him for his exemplary work as the Governor of Bihar. During his stint as the Governor of Bihar, Kovind constituted a judicial commission to investigate irregularities in promotion of undeserving teachers, mismanagement of funds and appointment of undeserving candidates in universities, for which he received a lot of praise and accolades from all fronts.

## Kovind As The President Of India

The Office of the President of India, barring a couple of episodes, has been non-controversial since India gained independence in 1947. Kovind, with a gentle temperament, affable nature, an in-depth knowledge of the Constitution of India, and organisational skills is certain to fit smoothly into the job. His exposure to global politics while he served as a Rajya Sabha MP will also come handy because as the President of India he will receive and interact with leaders from across the globe.

## TANGEDCO EVACUATES 5,079MW OF WIND POWER, SETS NATIONAL RECORD

**Tangedco** at 7pm on Monday **evacuated 5,079MW** of wind power, **a new record in wind power** evacuation in **Tamil Nadu** and **India**. It was a two hour sustained supply of over 5,000MW on Monday.

For nearly 3 hours, Tangedco put 3 thermal units with a total capacity of 1,020MW on stand-by mode and also advised other power sources to operate at 50% of their capacity. "We were thrilled on Monday evening when the wind power generation started increasing. Immediately, we put private thermal units on standby and evacuated wind power to the maximum," a senior Tangedco official told TOI. The previous record in Tangedco's wind energy evacuation was 4,600MW. "On May 31 this year, we evacuated 4,600MW of wind power; the total wind power consumption on that day was around 99.46 million units," said the official.

The total power demand for Tamil Nadu on Monday evening was less than 14,000MW, thus more than one-third of the total power supply in Tamil Nadu was met by wind energy.

This year the average wind power evacuation in Tamil Nadu has increased to nearly 3,500MW per day. Wind power evacuation has been better in recent years due to better forecast. Compared to a few previous years, wind power generation increased by nearly 1,000MW this year. In 2016, wind power generation picked up in April when the total evacuation touched 1,848MW. But in 2015, due to heavy rain in May, the wind power evacuation touched only 22MW in mid May.

**"The cost of wind power is lower compared to other power sources and due to better wind power evacuation, we save several crores on purchase of power," said the official.** Tangedco is ready to sell wind power to other states. "It is only to make wind power available for other states that we sought a separate corridor from Union power minister PiyushGoyal during his recent visit to Chennai," said the official.

*Condemn none: if you can stretch out a helping hand, do so. If you cannot, fold your hands, bless your brothers, and let them go their own way.*

**- SWAMI VIVEKANANDA**

# NATIONAL ANTHEM

**Congratulation to all of us.** Our national anthem “**Jana Gana Mana...**” is declared as the “**BEST ANTHEM OF THE WORLD**” by UNESCO.

*Very proud to be an INDIAN.*

Please try to understand the meaning and pronounce it clearly.

**Word by word meaning.**



<b>Jana</b>	-	People	<b>Tava</b>	-	Your
<b>Gana</b>	-	Group	<b>Shubh</b>	-	Auspicious
<b>Mana</b>	-	Mind	<b>Naame</b>	-	name
<b>Adhinayaka</b>	-	Leader	<b>Jage</b>	-	Awaken
<b>Jaya He</b>	-	Victory	<b>Tava</b>	-	Your
<b>Bharata</b>	-	India	<b>Shubha</b>	-	Auspicious
<b>Bhagya</b>	-	Destiny	<b>Aashisha</b>	-	Blessings
<b>Vidhata</b>	-	Disposer	<b>Maage</b>	-	Ask
<b>Punjaba</b>	-	Punjab	<b>Gaahe</b>	-	Sing
<b>Sindhu</b>	-	Indus	<b>Tava</b>	-	Your
<b>Gujarata</b>	-	Gujarat	<b>Jaya</b>	-	Victory
<b>Maratha</b>	-	Marathi Maharashtra	<b>Gatha</b>	-	Song
<b>Dravida</b>	-	South	<b>Jana</b>	-	People
<b>Utkala</b>	-	Orissa	<b>Gana</b>	-	Group
<b>Banga</b>	-	Bengal	<b>Mangala</b>	-	Fortune
<b>Vindhya</b>	-	Vindhyas	<b>Dayaka</b>	-	Giver
<b>Himachal</b>	-	Himalay	<b>Jay He</b>	-	Victory Be
<b>Yamuna</b>	-	Yamuna	<b>Bharata</b>	-	India
<b>Ganga</b>	-	Ganges	<b>Bhagya</b>	-	Destiny
<b>Uchchhala</b>	-	Moving	<b>Vidhata</b>	-	Dispenser
<b>Jaladhi</b>	-	Ocean			
<b>Taranga</b>	-	Waves			

**Jay He, Jay He, Jay He, Jay Jay Jay Jay He -**  
Victory, Victory, Victory, Victory Forever...

**JAI HIND - வந்தே மாதரம்**

## MEMBERS DETAILS

S.No.	Company Name	District	Contact No.	License No.
1.	Subash Electricals	Ambur	04174-246289, 98946 11410	EA 1299
2.	T. Abdul Wahid and Co.,	Ambur	04174-242286, 93810 15762	EA 1297
3.	Sudhakar Fabrications	Ambur	04174-246289, 98945 44552	EA 2957
4.	Arken Solutions P. Ltd.	Bangalore	99000 86363, 98450 20875	ESA 443
5.	Micron Electricals	Bangalore	080-39908600, 93424 00554	ESA 412
6.	A.K. Engineering Services	Chennai	044- 28261100, 94441 12269	EA 2258
7.	ABB India Ltd.	Chennai	044-28291550, 97909 94025	ESA 232
8.	Aiswarya Power Corporation	Chennai	044-25910032, 93810 99313	EA 2008
9.	Akash Electricals	Chennai	044-24743963, 94440 39282	EA 2705
10.	Alfa Associates	Chennai	044-22452232, 98840 43144	EA 2336
11.	Anand Electricals	Chennai	044-23811060, 94442 86189	EA 1712
12.	ARS Electricals P. Ltd.	Chennai	044-23724105, 97104 49401	EA 2868
13.	Aruna Electricals	Chennai	98404 14956, 98401 13544	EA 2628
14.	Arunai Electricals P. Ltd.	Chennai	044-65486111, 96770 62111	EA 3021
15.	Ashok Power Planning	Chennai	044-25731353, 94442 04129	EA 1961

## KNOW THY POWER NETWORK - 119

### “Awakening of Awareness about Electrical Accidents”

The journey continues. This time we shall deal with an entirely different topic. Frequent electrocutions caused by snapped conductors or down live electricity lines are a concern for all. So there is an urgent demand for the “**Awakening of Awareness about Electrical Accidents**”; hence it becomes our next site to visit.

Why do electrical accidents with dire consequences occur frequently? There are many reasons for it; chief among them is the “**lack of preparation or failure to follow safety measures**”. So awakening or recasting of our focus on this vital topic is the need of the hour. If we focus or concentrate our attention on this essential issue, we can understand its various dimensions and finally end up with apt solutions.

An insight to any human issue always reveals something very clearly and helps to analyse it in depth or bring a new view or dimension that will throw more light on it. All these will help to get the reality or real view of the matter. Then it is easier to find the required solutions. This philosophy is followed in the present case also.

There is no denying the fact that the common man has no knowledge about electricity, and control over its delivery system. All that he/she knows is that it is an essential requirement of his/her day-to-day routine and without it, it is difficult to lead a comfortable and calm life. Most of the common people do not know how it is produced, transmitted and finally delivered at their premises / doorsteps. *All that they know is that electricity is a “deadly energy conveyor” and it is a good servant and very bad master similar to atomic energy. All their concerns / demands finally ends in one simple point. Viz.” safe delivery of electrical energy at their premises for their use”.*

Before delving deep into our main topic viz. Electrical accidents, let us understand what is electricity and what its role in energy transfer. *In this context, please note that “Energy is the fourth dimension of human living in this world (the other three are Air, Water and Food) and it is defined as the moving force or field that supports all our activities.* It is invisible but it can be felt or experienced. It totally surrounds us. It is available in renewable or non renewable energy forms. Sunlight, Solar heat, Wind, Heat energy from hot water springs, Hydel power brought by rains, Biomass are some of the naturally occurring energy sources. It also appears as stored energy in coal, petroleum oil, natural gas, nuclear energy in uranium i.e. the stored energy available in “matter” can be converted into any energy form by adopting proper means. The maximum energy that could be extracted is in the range of 30-40 percent (maximum) and it is uni-directional i.e. it can never be sent back to its original

source viz. Matters. Finally the energy thus created can be converted from one form to another. Under no circumstances, we have the power either to create or destroy the energy forms. i.e. we act only as a **“Energy Converter”**; nor as a **“creator / destroyer of energy”**.

Now let us turn our attention to the role of **“Electricity”**. It is nothing but a secondary **“Energy Form”** a movement of electrons. These electrons work as slaves or followers of primary energy forms like heat, light and chemical energy and acts only as a carrier or courier or transporting agent of energy. It carries or transports energy from one destination to another destination at a velocity we cannot imagine  $3 \times 10^8$  m/sec (speed of light). It takes its quota a share of energy from the total energy by way of  $I^2R$  loss. i.e. it takes payment for its work from the total energy carried or conveyed by it. It never stops at any place during its work. It is always on the **“Move”**, just like a courier vender after delivering the energy at our premises, it simply returns back. It means that the energy delivering electrons are always on their toes and deliver the **“Energy Packets”** in nano / micro seconds.

Let us proceed further. An illustration for the role of electricity for energy transfer is given. At thermal power plants the chemical energy stored in the coal is extracted and converted into various energy forms like Heat and Mechanical and finally exported in the form of **“Electrical Energy”** at the terminals of the generator for delivery at our premises / industrial locations. Upon receipt at our door steps, with the aid of various converting devices / equipment like Motors, Heaters, Pumps, Fans and Light bulbs / fittings. We enjoy the energy thus extracted from coal Same processes are adopted while getting the essence of energy from uranium based nuclear power plants, Water based Hydel power plants and Wind based wind electric generators. Thus we see how electricity plays the role of a carrier or transporting agent and not as a primary energy forms like heat or light. All this understanding about electrical energy helps to initiate various measures to handle it properly while it performs its assigned duty / work. We have to take steps to avert its leakages / pilferages while it carries energy from one end to the another. We should help its navigation without much obstacles or destructions or interference. When human beings interrupt or stand in its flow path, it acts violently and brings elocutions or electrical fires or other forms of destructions. As far electricity is concerned, human body is another conductor that needs its energy transfer. As it transfers the energy it carries to the human beings they are forced to taste the flow of electrons through them and suffer. So the problem lies only with the humans not with the electricity. We need to respect its basic character and never try to interfere its movement and carefully handle it as we do with LPG, Petrol and Diesel or any other inflammable material.

There are many issues connected with electrical accidents caused by **“Fallen Electrical Conductors”** i.e. this long standing problem has many dimensions or facts. Hence there is a big demand for us to have a detailed information on all these; such a measure will lead us to have effective remedial / corrective measures. Without adopting such an in depth study and analysis if we try to devise remedial measures on a **“Piece – Meal”** basis it will land us in a difficult terrain and we shall find it very difficult to come of it. i.e. no single measure can act as a **“panacea”** for the problem on hand. One among such tactical measures is the **“replacement of OH lines with UG cable system in cities”**. In this context, we have to note that **“bigger wounds or festering sores cannot be treated by “First Aids”**. So such palliative measures cannot avert electrical accidents in toto. That is, it will not bring the desired solutions anywhere on the horizon. So it is desirable to have a list of issues / topics connected with electrical accidents. This list is brought in below so that we can focus on them one by one. A list is given below for reference. It is only an illustration, not an exhaustive one

1. Human factors in Electrical Accidents
2. Gaps in the protective system. (The inadequacies or loopholes in the existing protective system for handling fallen LT and HT conductors. Unless the existing gaps are bridged, they will hamstring the system at an unexpected time.)
3. Selection and maintenance of electrical equipment and their unscheduled failure.
4. Threats posed by OH electrical lines. A general view which covers all related issues like the adequacy of stays and line supports.
5. Role of Pollution and Insulator failures in snapped conductors.
6. Role of bimetallic action in snapped LT conductors
7. Short comings of UG cable system; (e.g) the problems faced in pillar boxes and ring main gears which are a part of UG cables and also the **“Digging”** process adopted by agencies other than Electricity Board or other utilities. The common man expects that the Electricity Board will attend to all these in a satisfactory manner since all these lie beyond his reach.

Let me sign off here.



*(To be continued...)*

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# THE WORLD'S LONGEST POWER TRANSMISSION LINES

*High-voltage direct current (HVDC) has emerged as the preferred transmission technology for long-distance bulk power supply. Power-technology.com profiles the world's five longest operational power transmission lines.*

## **Rio Madeira transmission link, Brazil**

The Rio Madeira transmission link in Brazil, with an overhead length of 2,385km, is the world's longest power transmission line. The 600kV high-voltage direct current (HVDC) bipolar line was brought



into commercial operation in November 2013 and is capable of transmitting 7.1GW of power.

The Rio Madeira HVDC link exports electricity from the **Santo Antônio** and **Jirau hydropower** plants on the banks of the Madeira River in north-west Brazil to major load centres in south-eastern Brazil. It connects the Porto Velho Collector Substation in the state of Rondônia to the Araraquara-2 Substation in the state of São Paulo.

The HVDC transmission line was constructed in 24 months by Interligação Elétrica do Madeira (IE Madeira), a consortium comprised of three major Brazilian energy providers. ABB supplied power equipment for three HVDC stations. Alstom supplied two HVDC bi-pole converter stations and four HVDC converter transformers for the project.

## **Jinping-Sunan transmission line, China**

China's 2,090km-long Jinping-Sunan transmission link, an 800kV ultra high-voltage direct current (UHVDC) transmission line, is the world's second longest power transmission line. The 7.2GW transmission link is owned by State Grid Corporation of China (SGCC) and was put into operation in December 2012.

The line passes through eight Chinese provinces to transmit power generated from Guandi, Jinping and Sichuan hydroelectric plants located in Yalong River in central-western Sichuan province to the industrialised coastal area of Jiangsu province in eastern China. The AC voltage at both ends of the line is 525kV.

The transmission project was approved by the government in November 2008 and involved an investment of approximately CNY22bn (\$3.5bn). ABB designed and engineered the project in association with SGCC and local Chinese partners. ABB supplied the key components of the project, including the 800kV UHVDC transformers for both converter stations.

## **Xiangjiaba-Shanghai transmission line, China**

The Xiangjiaba-Shanghai transmission line, with an overhead length of 1,980km, is the world's third longest transmission line. The 800kV, 7.2GW line, owned by SGCC, is the world's first ever UHVDC transmission line and started commercial operation in July 2010.

The Xiangjiaba-Shanghai link transmits power from the Xiangjiaba hydropower plant located in south-west China to the country's major industrial and commercial hub, Shanghai. The link comprises a single overhead line and 28 high / ultra-high-voltage converter transformers. The AC voltage at both ends of the line is 525kV.

The UHVDC transmission project was approved by the government in April 2007 and was completed in 30 months. ABB, under a turnkey contract, provided the overall system design, in addition to supplying the key

components such as high- and ultra-high-voltage converter transformers, thyristor valves, DC and AC switchyard equipment, and the HVDC control system.

### **Inga-Kolwezi transmission line, Congo**

Congo's 1,700km-long Inga-Kolwezi transmission line, formerly known as the Inga-Shaba link, is the world's fourth longest transmission line. The 500kV transmission line, with a rated capacity of 560MW, is owned and operated by Democratic Republic of Congo's (DRC) national electricity utility, Société Nationale d'Electricité (Snel).

The Inga-Kolwezi HVDC link carries power from the **Inga Falls hydropower station** on the Congo River to the copper mining district of Katanga in south-eastern Congo. The line was brought into service in 1982 and was the longest transmission line in the world at that time. The AC voltage at both ends of the line is 220kV.

The key components for the project, including the converter stations, were supplied by ABB. The company was awarded a contract to refurbish the line with new thyristor valves, new high-voltage apparatus and a new control and protection system to enhance the efficiency and reliability of the line in 2009.

### **Talcher-kolar transmission link, India**

India's 1,450km-long Talcher-Kolar transmission link is the world's fifth longest transmission line. The 500kV HVDC transmission line, also known as the East-South transmission link, has a rated capacity of 2,500MW and is owned by Power Grid Corporation of India. It was the world's second longest transmission link at the time of commissioning in February 2003.

The Talcher-kolar HVDC transmission link transfers electricity from the Talcher power generation centre in the East Indian state of Orissa to Kolar near Bangalore in the South Indian state Karnataka. The bipolar transmission line had the capacity to transmit 2,000MW of power at the time of commissioning and was upgraded to 2,500MW in 2007. Siemens built the converter stations for the Talcher-kolar HVDC link.

Power Grid Corporation of India is also building India's first UHVDC transmission line, the 1,728km 800kV North-East Agra UHVDC link, capable of transmitting 8,000MW of power. The project is being delivered by ABB.

## **SMART STREET LIGHTING TO REACH 73 MILLION INSTALLED UNITS BY 2026**

The global installation of smart street lights is expected to go through tremendous growth over the next decade, according to a new report from Navigant Research, up from an install base of 6.3 million in 2017 to nearly 73 million in 2026.

Published this week by clean technology analyst company Navigant Research, the new report, *Smart Street Lighting for Smart Cities*, analyzes the evolution of smart street lighting technology and market trends across the globe, and provides a forecast for the future development and spread of the technology. The report concludes that LEDs are now the standard replacement for legacy street lighting in most cities around the world, and smart controls are beginning to become more widespread and, according to Navigant, "are increasingly installed alongside LED deployments."

Many cities around the globe are likely in and have been in a lengthy process of replacing existing street lighting with new, more efficient lighting — not just to meet energy efficiency standards, but because the economics makes sense. LEDs are obviously the most obvious option, but the new Navigant report explains that smart controls only currently account for 2% of the installed base of street lighting in 2017, and is "not being adequately exploited."

However, that is likely to change, according to the report, with the installed base of smart street lighting expected to grow from its current level of only 6.3 million worldwide, to an impressive 73 million by 2026.

"With LEDs established as the technology of choice for street lighting upgrades, the next frontier for smart street lighting networks involves rapidly increasing deployments of controls technology and a transition to being utilized as a broader platform for smart city innovations," said **Ryan Citron, research analyst at Navigant Research**. "Sensors and other technologies are being added to smart street lighting networks to offer a multitude

of new city services, including gunshot detection, air quality monitoring, electric vehicle (EV) charging, traffic management, and smart parking, among others.”

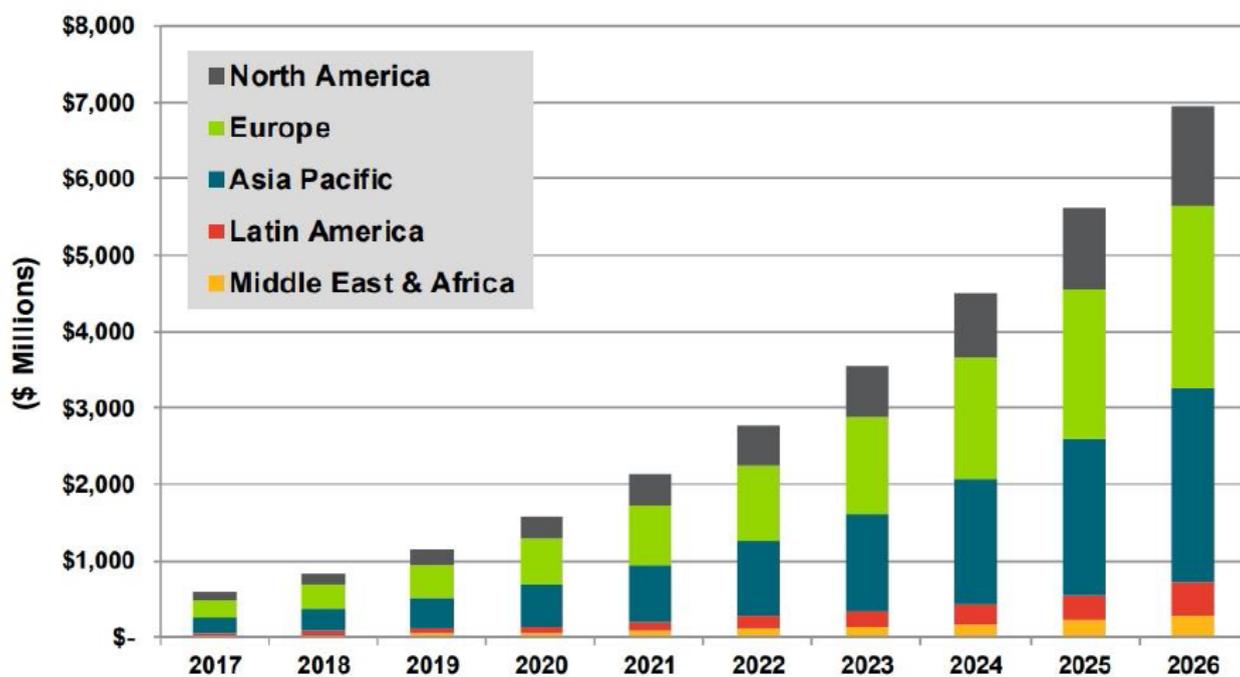
Obviously, there are many driving factors behind the current economy of smart street lighting. Widespread acceptance of LED lighting has been driven by significant cost declines and improvements in lighting quality — a surprisingly misunderstood development, with LEDs reaching a point where they can now provide the necessary yellow-lighting necessary for street lights. A year ago, **Cree highlighted** this need with the introduction of new RSW LED Street Luminaire lighting system, the first of a new generation of lighting which is not only energy efficiency but provided the warm color temperature most needed for street lighting.

“Cree is committed to providing better light experiences by continuing to unlock the true potential of LED technology,” said **Norbert Hiller, executive vice president of lighting at Cree**, at the time. “Cree’s RSW Series ensures residents will no longer have to live with the glare of street lights in their homes at night, saving municipalities time and energy while reducing resources allocated to managing residential complaints about harsh street lighting.”

The Navigant report explains that installing smart controls is cheapest when done in conjunction with new LED installations, which explains why the adoption of smart controls is still lagging behind, somewhat. But smart street lighting could be a vital tool for cities looking to adapt to future energy efficiency requirements. But there are unsurprisingly still several barriers. Navigant Research highlights these concerns: “Easing citizen concerns about surveillance and privacy intrusions, the legacy street light ownership model still present in some jurisdictions, departmental siloes, the complexity of multi-application projects, and the need to raise upfront capital are all challenges for the smart street lighting market.”

Looking forward, Navigant predicts that Europe will have the largest installed base of smart street lighting of any region, followed by Asia Pacific and North America. The share of smart street lighting is expected to grow from 2% of the installed base of all street lighting in 2017 up to just over 20% by 2026. Navigant also predicts that the global market for smart street lighting will be worth \$610 million in 2017, and grow to \$6.9 billion in 2026.

**Annual Smart Street Lighting Revenue by Region, World Markets: 2017-2026**



(Source: Navigant Research)

Courtesy: Clean Technica

# COULD AIR BE THE NEXT BIG BATTERY BREAKTHROUGH?

*The air all around us could provide an alternative to chemical batteries, helping store energy from unpredictable power sources such as wind and solar. A new project, RICAS 2020, aims to compress air in underground caverns until it heats under the pressure. Elsewhere, British company Gravitricity is proposing to compress air, by creating shafts through which weights can be lowered to create a similar rapid response power source. Could these pioneering technologies come to fruition? Patrick Kingsland reports.*

“If we are going to stop using nuclear, coal, gas and oil power plants and replace them with renewables then we will have a system that is very intermittent,” says Atle Harby, senior research scientist at the independent research organisation SINTEF.

For those working in the renewables sector it’s a familiar problem. While few doubt the clear benefits of wind and solar power, without energy storage and grid balancing technologies, it’s not clear how they could satisfy our electricity demands. As Harby says, “solar panels don’t work when there is no sun and wind turbines don’t rotate when there is no wind”.

As things stand, the most established form of energy storage is pumped hydroelectric, where water is pumped up a mountain and then released through turbines to create electricity. But the system still has its drawbacks, according to Harby.

“To have hydropower you need to have mountains, a height difference, and you need to have some water,” he says. “If you live in a dry country or in a flat, low-land country hydropower is not an option.”

## **Compressed air makes a comeback**

One of the most promising alternative systems currently being looked at is compressed air energy storage (CAES). This involves converting excess or off-peak power into compressed air, which is then stored in underground caverns and released through a gas turbine when needed. However, as Harby points out, CAES is not a new idea.

“There are two commercial power plants doing this that were built in the 1970s: one in the US and one in Germany,” he says. “They both use large salt caverns underground and have compressors to compress air. You store it until there is a lack of energy or high consumption. This happens when conventional plants cannot produce enough or the prices are very high so it is valuable to sell it.”

But there are various problems with these existing systems. Firstly, they are expensive. “I think they have gone bankrupt or been refinanced and are not been used, because it is just too costly compared to other options,” says Harby, “Sometimes you can gain money if you buy electricity when the prices are low and sell it back when the prices are higher. But you have to account for the efficiency losses.”

The main reason the plants are inefficient, Harby adds, is because they lack a way of storing the heat produced when air is compressed. “This is one of the big new challenges of the old systems,” he explains, “When you compress the air you also generate a lot of heat and if you cannot take care of that heat, if you just pump it down into the salt cavern, it will warm up the cavern, and then gradually the heat will decrease.”

## **Improving Efficiency**

RICAS 2020, a new project which involves SINTEF working alongside various EU scientists, is aiming to solve this problem. The team hopes to introduce a separate cavern filled with crushed rock that hot air will pass through on its way down into the underground cavern. The rock is heated by the hot air, which it then retains, while the cold air is stored in the main cavern.

“When the air subsequently returns through the crushed rock on its way to be used to generate electricity, the flow of air is reheated by the stones,” says Giovanni Perillo, project manager for SINTEF’s contribution to RICAS 2020. “Hot air is then expanded through the turbine generating electricity,” he adds.

Perillo believes this technology could improve the efficiency of compressed air storage systems by as much as 70%-80%. “The corresponding figures for most of the existing storage sites are no better than 45%-55%,”

which means that the produced energy is only half of what was initially used to compress the air into the cavern,” he says.

Other companies are also trying to improve compressed air energy storage systems. Canadian company Hydrostor, for example, recently designed a system that extracts heat from air and stores it in a purpose-built thermal management system. When energy is required, hydrostatic pressure forces the air to the surface, which then drives a turbine generating electricity.

British company Gravitricity is also proposing to compress air by creating shafts through which weights can be lowered. “We have a vertical shaft which has a weight moving up and down it,” says Charlie Blair, managing director of Gravitricity. “We can use that shaft as the pressure vessel for the compressed air energy storage.”

Among other benefits, Blair says this could create a rapid response power source. “CAES uses huge underground salt caverns to store that energy,” he says, adding, “What it does is store a lot of energy over a long period of time, but it doesn’t react fast enough. Our system – our gravity system – reacts very fast.”

### **The future of energy storage**

As well as CAES, other energy storage systems and technologies are currently being considered. Harby says, “There are people working on liquid air, for example. This involves cooling air down so it floats which requires less space. There are other ideas too. You can convert things to hydrogen or to chemicals, heat them and then use it back it again.”

For Harby, these new technologies and ideas are a welcome addition to an often neglected area. “We are not thinking enough about energy storage,” he says, “If we are actually going to replace all of these power plants it will require a total change in our energy system.”

<http://www.power-technology.com/features/featurecould-air-be-the-next-big-battery-breakthrough-5864457/>

## **ENGINEERS INVENT THE FIRST BIO-COMPATIBLE, ION CURRENT BATTERY**

**Engineers at the University of Maryland have invented an entirely new kind of battery. It is bio-compatible because it produces the same kind of ion-based electrical energy used by humans and other living things.**

In our bodies, flowing ions (sodium, potassium and other electrolytes) are the electrical signals that power the brain and control the rhythm of the heart, the movement of muscles, and much more.

In traditional batteries, the electrical energy, or current, flows in form of moving electrons. This current of electrons out of the battery is generated within the battery by moving positive ions from one end (electrode) of a battery to the other. The new UMD battery does the opposite. It moves electrons around in the device to deliver energy that is a flow of ions. This is the first time that an ionic current-generating battery has been invented.

**“My intention is for ionic systems to interface with human systems,”** said **Liangbing Hu, the head of the group** that developed that battery. Hu is a professor of materials science at the University of Maryland, College Park. He is also a member of the University of Maryland Energy Research Center and a principal investigator of the Nanostructures for Electrical Energy Storage Energy Frontier Research Center, sponsored by the Department of Energy, which funded the study.

“So I came up with the reverse design of a battery,” Hu said. “In a typical battery, electrons flow through wires to interface electronics, and ions flow through the battery separator. In our reverse design, a traditional battery is electronically shorted (that means electrons are flowing through the metal wires). Then ions have to flow through the outside ionic cables. In this case, the ions in the ionic cable — here, glass fibers — can interface with living systems.”

The work of Hu and his colleagues was published in the July 24 issue of *Nature communications*.

*“Potential applications might include the development of the next generation of devices to micro-manipulate neuronal activities and interactions that can prevent and/or treat such medical problems as Alzheimer’s disease and depression,”* said **group member Jianhua Zhang, PhD**, a staff scientist at the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK), part of the National Institutes of Health in Bethesda, Md.

“The battery could be used to develop medical devices for the disabled, or for more efficient drug and gene delivery tools in both research and clinical settings, as a way to more precisely treat cancers and other medical diseases, said Zhang, who performed biological experiments to test that the new battery successfully transmitted current to living cells..

“Looking far ahead on the scientific horizon, one hopes also that this invention may help to establish the possibility of direct machine and human communication,” he said.

### **Bio-compatible, bio-material batteries**

Because living cells work on ionic current and existing batteries provide an electronic current, scientists have previously tried to figure out how to create biocompatibility between these two by patching an electronic current into an ionic current. The problem with this approach is that electronic current needs to reach a certain voltage to jump the gap between electronic systems and ionic systems. However, in living systems ionic currents flow at a very low voltage. Thus, with an electronic-to-ionic patch the induced current would be too high to run, say, a brain or a muscle. This problem could be eliminated by using ionic current batteries, which could be run at any voltage.

The new UMD battery also has another unusual feature — it uses grass to store its energy. To make the battery, the team soaked blades of Kentucky bluegrass in lithium salt solution. The channels that once moved nutrients up and down the grass blade were ideal conduits to hold the solution.

The demonstration battery the research team created looks like two glass tubes with a blade of grass inside, each connected by a thin metal wire at the top. The wire is where the electrons flow through to move from one end of the battery to the other as the stored energy slowly discharges. At the other end of each glass tube is a metal tip through which the ionic current flows.

The researchers proved that the ionic current is flowing by touching the ends of the battery to either end of a lithium-soaked cotton string, with a dot of blue-dyed copper ions in the middle. Caught up in the ionic current, the copper moved along the string toward the negatively charged pole, just as the researchers predicted.

“The microchannels in the grass can hold the salt solution, making them a stable ionic conductor,” said Chengwei Wang, first author of the paper and a graduate student in the Materials Science and Engineering department at the University of Maryland in College Park.

However, the team plans to diversify the types of ionic current electron batteries they can produce. “We are developing multiple ionic conductors with cellulose, hydrogels and polymers,” said Wang.

This is not the first time UMD scientists have tested natural materials in new uses. Hu and his team previously have been studying cellulose and plant materials for electronic batteries, creating a battery and a super capacitor out of wood and a battery from a leaf. They also have created transparent wood as a potentially more energy-efficient replacement for glass windows.

### **Creative Work**

**Ping Liu, an associate professor in nanoengineering at the University of California, San Diego, who was not involved with the study, said:** *“The work is very creative and its main value is in delivering ionic flow to bio systems without posing other dangers to them. Eventually, the impact of the work really resides in whether smaller and more biocompatible junction materials can be found that then interface with cells and organisms more directly and efficiently.”*

*Courtesy: Science daily*

***Take Risks in Your Life If you Win, U Can Lead! If You Lose, You can Guide!***

***- SWAMI VIVEKANANDA***

## THE IMPORTANT LESSON FROM RECORD 560 MILES IN A TESLA MODEL S P100D

A new “hypermiling” record for production electric vehicles has been set by a pair from Belgium, using a Tesla Model S P100D. The duo in question, Steven Peeters and Joeri Cools, managed to squeeze 560 miles (901 kilometers) out of the Tesla Model S P100D in question, by traveling at an average of 24 miles per hour (39 km/h) for right around 24 hours.



Before we go further about the short-term news, there’s a very important lesson to be learned and shared (again) regarding this record and how it relates to the practicality of EV life today. There are many situations in which an **EV driver** today could find herself/himself in a low-range situation and without an EV charger nearby. It is not just a hypothetical — it must happen every day in locations around the world. Probably the #1 best thing a driver can do in such a situation is ... drive more slowly. In particular, ~24 mph is a pretty good sweet spot.

To emphasize: The *rated range* of a **Tesla Model S P100D** is 315 miles, or 507 kilometers (a bit less than the **335 mile rate range of the Model S 100D**). That’s pretty much considered to be an accurate estimate (more or less) of the car’s “real-world range.” But the point the Belgium duo emphasized is that you can boost that range from 315 miles (507 kilometers) to 560 miles (901 kilometers) simply by driving slower than normal (which can include getting off a highway to travel on slower residential streets instead).

To key takeaway, again, is for any people who find themselves in situations where they would be better off extending the range of their vehicle beyond what’s “expected” (and, to be frank, many of us have already or will land in such scenarios). The #1 thing to do at such a time (other than find a place to charge) is to simply slow down and switch over to slower roads (if possible). Anyway, with that public service announcement out of the way, back to the news:

The new record surpasses one set right around 21 months ago by a decent margin (10 miles, or 16 kilometers) — which isn’t too surprising considering that the Tesla Model S P100D hadn’t really been taken to its hypermiling limits since its launch until this record was set. Though, who knows, maybe someone with an excessive amount of time on their hands can best 560 miles.

To be clear, for those unfamiliar with what this is about, hypermiling records relate to seeing how far one can travel on a single charge of the battery packs of an electric vehicle — or on a single tank of gas/petrol, for that matter — when utilizing a driving style that limits energy use.

***All the powers in the universe are already ours. It is we who have put our hands before our eyes and cry that it is dark. - SWAMI VIVEKANANDA***

## TANGEDCO SET TO TAP 15,000 MW GREEN POWER IN TWO YEARS

Tamil Nadu discom could look forward to tapping renewable energy to its fullest potential of 15,000 MW (including 2,000 MW that is being installed) two years from now when a dedicated inter-state green power corridor becomes operational. Union power minister Piyush Goyal had recently said in the Lok Sabha that work on the Rs 11,369 crore corridor had started and it was expected to be ready by May 2019.

In the light of many states falling short of meeting their renewable power obligation targets, Tamil Nadu's surplus renewable power generation could be of high demand in the market. "The inter-state transmission network scheme is being implemented by the



Power Grid Corporation of India Limited (PGCIL). About 30% (Rs 3,410 crore) of the cost will be in the form of equity and 70% will be concessional loan (Rs 5,203 crore from German-based KfW and Rs 2,756 crore from Asian Development Bank)," said Goyal in a reply to Chidambaram MP M Chandrakasi.

As part of the green corridor, the PGCIL will be setting up 6 sub-stations with a total capacity of 18,000MVA. States like Tamil Nadu, Rajasthan, Karnataka, Maharashtra, Gujarat, Himachal Pradesh and Madhya Pradesh either have separate green corridors or are setting up such corridors to evacuate wind and solar power within those states.

"The intra-state green corridors are being set up within the states at a total cost of Rs 10,141 crore. In these states, sub-stations will be set up with a total capacity of 19,000MVA and the intra-state green corridors will be completed by March 2020," said the minister.

In Tamil Nadu, the green corridor starts from Tuticorin district and ends in Kancheepuram district. "Our green corridor from Kayathar to Ottiyamapakkam is almost complete. There are a few issues which are being solved and most probably, in a few months, the corridor will be fully operational," a senior Tangedco official said.

Former chief minister J Jayalalithaa, in 2016, sought a separate green corridor connecting Tamil Nadu and other states to sell wind, solar and nuclear power to energy-deficit states. Renewable purchase obligation refers to the obligation imposed by law on some entities to either buy electricity generated by specified green sources, or buy, in lieu of that, 'renewable energy certificates (RECs)' from the market.

As of now, several wind and solar companies are accusing state discoms of charging high tariff for using their transmission facilities. "*The charges for using transmission facilities are quite high. We are doubtful whether firms can sustain solar and wind projects at low tariffs,*" said Siemens Gamesa Renewable Power CMD Ramesh Kymal.

Indian Wind Turbine Manufacturers' Association wants the Centre to open access for all renewable power companies to sell power across the country. "*We want the Centre to waive the central transmission utility tariff on renewable power companies so that any renewable company will be able to sell power to any state discom without any additional cost,*" IWTMA secretary general D V Giri told TOI.

Courtesy: TOI

***Do not lower your goals to the level of your abilities. Instead, raise your abilities to the height of your goals. - SWAMI VIVEKANANDA***

## DRONES CHECK HT POWER LINES

Insulators inspected in over 100 HT towers in north Chennai for 'Corona effect'

The residents would well remember the black Saturday last year on April 30 when many areas in the city plunged into darkness the whole night.

Coming in the backdrop of the State recording the highest demand of 15,343 MW and consumption of 345 million units (MU) on April 29, the officials of Tamil Nadu Generation and Distribution Corporation (Tangedco) had to firefight throughout the night to restore power supply.

Later, Tangedco officials found out that the damage to insulators on high tension lines, which conveyed power to various sub-stations, including Taramani and Tondiarpet, was the reason.

The insulators of high tension (HT) lines normally get damaged by electrical flash called 'Corona effect', a senior official of Tangedco said. "The 'Corona effect' is a colloquial term for insulator breakdown which is caused due to industrial pollution where chemical compounds smudge the insulators. When these insulators are exposed to high temperatures combined with heavy load it leads to leakage of insulators causing electrical flash and power breakdown," he explained.

Normally, flashing or 'arc flash' happens on high voltage transmission power lines located on coastal belts because of various environmental factors, including fog, dew,

humidity and heavy wind, he noted. According to Tangedco officials, flashing of insulators are a regular phenomenon as city's power supply is dependent on the several thermal power stations including North Chennai Thermal Power Station (NCTPS), Vallur and Ennore, being located on the coastal areas. Similarly, the transmission lines in Thoothukudi also experienced 'Corona effect' last February.

This year, the officials of Tangedco do not want a repeat of last year and so have taken several preventive measures, including use of drones, night patrolling and regular checking of the health of insulators.

**Used for first time** - Drones were used for the first time to check the health of insulators in over 100 HT towers feeding the sub-stations in north Chennai. They were also used to check weakness in jumpers and any hot spots in feeder lines, an official said.

In addition to drones, maintenance staff carried out night patrolling to identify any flashing on feeder lines, as arcing could be seen clearly during nights. Similarly, a boat was hired and deployed in Pallikaranai marshland to inspect the feeder lines transmitting power to KITS Park near Sholinganallur. Every year, 200 to 300 insulators would be replaced with new ones on the HT lines as part of maintenance work by the end of March. Even this year, insulators on six transmission lines of 400 kilo volt (KV) and eight distribution lines of 230 KV were replaced, a Tangedco official in the city said.



*Courtesy: The Hindu*

# TEDA TENDERING 500 MW SOLAR PARK IN TAMIL NADU

The Tamil Nadu Energy Development Agency (TEDA) is on the lookout for a developer for a 500 MW solar park.

With August 11, 2017 set as the bid submission deadline, the Tamil Nadu Energy Development Agency (TEDA) has invited developers to submit bids for the establishment of a 500 MW solar park in one of India's leading solar states. Excluding Limited Liability Companies (LLC) and Limited Liability Partnerships (LLPs) from the bidding process, TEDA specified that the developer would also be responsible for operation and maintenance of the solar park for a period of 25 years.

Furthermore, TEDA pointed out that land acquisition and financial closure must be completed within six months after signing the agreement with the selected developer, whereas pooling substation, land development and other facilities should be completed within 15 months.

A deadline of 18 months has been set for the developer to establish internal transmission network, ensure grid connectivity, and commission the project.

In the official document, TEDA said that the bidders would be shortlisted based on the rate at which bidders offer developed land to the solar plant developers.

As **reported**, in March TEDA invited national and international companies and consortiums to express interest in developing Tamil Nadu's 500 MW solar park as part of the Scheme for Development of Solar Parks and Ultra Mega Solar Power Projects by the Ministry of New and Renewable Energy (MNRE).

Namely, earlier this year, the central government doubled its 2022 target for solar park capacity from **20 GW to 40 GW** as it pledged to develop 50 solar parks between 2019-2020 with its \$1.2 billion financial backing. Tamil Nadu's new solar park, which is to be developed on a contiguous piece of land around 1,000 hectares in size in the areas with solar irradiance ranging from 5 to 6 kWh/ m<sup>2</sup>/day throughout the year, is also expected to ensure compliance with the state's renewable purchase obligation.

## **ABOUT TEDA**

### **What is TEDA?**

**TEDA is Tamil Nadu Energy Development Agency.** It is an independent agency setup by Government of Tamil Nadu in the year 1984, as a registered society with a specific purpose – to create awareness and migrate the State from using fossil fuels to renewable energy.

### **Status of energy in India**

It is well known that India, as well as the rest of the world, is still powered predominantly by fossil fuels – coal, natural gas and oil. While this is of great concern throughout the world, in the case of India, it is an even bigger concern.

India uses about 500 million T of coal every year to produce electricity, about 3.6 trillion cubic feet of natural gas for power, chemicals and fertilizers and over 160 million T of oil for transport and industry.

The growth in the usage of the fossil fuel sources has been increasing tremendously. Such a huge growth has put tremendous strain on finances as a significant percentage of these fossil fuel has to be imported.

Pan India, renewables currently constitute only a small part of our energy mix. But renewable energy has started playing an increasingly important role and will be a vital part of our energy portfolio in future.



# VESTAS INTRODUCES RATING OF 4.2 MW AND THREE NEW TURBINE VARIANTS

The announcement introduces the fourth generation of the platform since its launch in 2010 and takes the platform's turbine portfolio to eight turbines, including the three new variants: V117-4.0/4.2 MW, V136-4.0/4.2 MW, and V150-4.0/4.2 MW. With its introduction, the V150-4.0/4.2 MW offers the largest rotor in its class and becomes the highest yielding onshore turbine in low wind.



The upgraded platform and its versatility is the result of Vestas' industry-leading investments in research and development and unparalleled scale and global reach,

enabling Vestas to develop turbines for wind sites all across the globe. By offering customisation beyond classic wind regime classification, the 4 MW platform sets new standards for onshore wind performance within regimes ranging from very strong wind and typhoon conditions to low wind.

Anders Vedel, Vestas Chief Technology Officer, said: *"With today's announcement, Vestas unfolds even more of the platform's potential, ensuring that we offer market-leading wind energy solutions. Building on state of art technology, the three new variants, 4.0 MW nominal rating and option of 4.2 MW Power Optimised Mode show Vestas' ability to efficiently drive down the Levelised Cost of Energy and hereby lead the industry through changing market conditions."*

Combining the industry's tallest tower of 166 meters with the evolutionary development of a thoroughly understood platform, the V150-4.0/4.2 MW offers 20+ percent more AEP in low wind\* while lowering the maximum sound level down to 104.9 dBA. The V136-4.0/4.2 MW raises the bar in medium wind conditions through increased AEP, while achieving leading sound power levels in its class with 103.9 dBA. Expanding Vestas' unparalleled global reach, the global introduction of the V117-4.0/4.2 MW expands the 4 MW platform into strong wind or typhoon type wind conditions.

Since the platform, now named 4 MW, was first introduced with the V112-3.0 MW turbine in 2010, Vestas has installed more than 4,000 turbines across 34 countries on six continents.

## **4 MW platform**

- Strengthening the existing platform with three additional variants: V117-4.0/4.2 MW, V136-4.0/4.2 MW, and V150-4.0/4.2 MW, the versatile 4 MW platform now has a portfolio of eight turbine models including V105-3.45 MW, V112-3.45 MW, V117-3.45 MW, V126-3.45 MW, V136-3.45 MW, V117-4.0 MW, V136-4.0 MW, and V150-4.0/4.2 MW. It is thus the same proven platform, but more powerful than ever.
- With more than 4,000 turbines installed across 34 countries on 6 continents, Vestas' 4 MW platform is one of the world's most applied and versatile turbine solutions.
- Launched in 2010, evolutionary upgrades to the 4 MW platform have resulted in up to 56 percent increase in annual energy production (AEP) depending on wind class.
- The 4 MW platform benefits from a high level of performance data and insights from diverse conditions: seven years of operational experience, from more than 4,000 turbine across the globe.

***The world is the great gymnasium where we come to make ourselves strong.  
You cannot believe in God until you believe in yourself.***

**- SWAMI VIVEKANANDA**

# WANT AN ENERGY-EFFICIENT DATA CENTER? BUILD IT UNDERWATER

**Microsoft wants to submerge data centers to keep them cool and to harvest energy from the sea**

When Sean James, who works on data-center technology for Microsoft, suggested that the company put server farms entirely underwater, his colleagues were a bit dubious. But for James, who had earlier served on board a submarine for the U.S. Navy, submerging whole data centers beneath the waves made perfect sense. This tactic, he argued, would not only limit the cost of cooling the machines—an **enormous expense** for many data-center operators—but it could also reduce construction costs, make it easier to power these facilities with renewable energy, and even improve their performance.

Together with Todd Rawlings, another Microsoft engineer, James circulated an internal white paper promoting the concept. It explained how building data centers underwater could help Microsoft and other cloud providers manage today's phenomenal growth in an environmentally sustainable way.

At many large companies, such outlandish ideas might have died a quiet death. But Microsoft researchers have a history of tackling challenges of vital importance to the company in innovative ways, even if the required work is far outside of Microsoft's core expertise. The key is to assemble engineering teams by uniting Microsoft employees with colleagues from partner companies.

The four of us formed the core of just such a team, one charged with testing James's far-out idea. So in August of 2014, we started to organize what soon came to be called Project Natick, dubbed that for no particular reason other than that our research group likes to name projects after **cities in Massachusetts**. And just 12 months later, we had a prototype serving up data from beneath the Pacific Ocean.

**Project Natick had no shortage** of hurdles to overcome. The first, of course, was keeping the inside of its big steel container dry. Another was figuring out the best way to use the surrounding seawater to cool the servers inside. And finally there was the matter of how to deal with the barnacles and other forms of sea life that would inevitably cover a submerged vessel—a phenomenon that should be familiar to anyone who has ever kept a boat in the water for an extended period. Clingy crustaceans and such would be a challenge because they could interfere with the transfer of heat from the servers to the surrounding water. These issues daunted us at first, but we solved them one by one, often drawing on time-tested solutions from the marine industry.

But why go to all this trouble? Sure, cooling computers with seawater would lower the air-conditioning bill and could improve operations in other ways, too, but submerging a data center comes with some obvious costs and inconveniences. Does trying to put thousands of computers beneath the sea really make sense? We think it does, for several reasons.

For one, it would offer a company like ours the ability to quickly target capacity where and when it is needed. Corporate planners would be freed from the burden of having to build these facilities long before they are actually required in anticipation of later demand. For an industry that spends billions of dollars a year constructing ever-increasing numbers of data centers, quick response time could provide enormous cost savings.

The reason underwater data centers could be built more quickly than land-based ones is easy enough to understand. Today, the construction of each such installation is unique. The equipment might be the same, but building codes, taxes, climate, workforce, electricity supply, and network connectivity are different everywhere. And those variables affect how long construction takes. We also observe their effects in the performance of our facilities, where otherwise identical equipment exhibits different levels of reliability depending on where it is located.

As we see it, a Natick site would be made up of a collection of "pods"—steel cylinders that would each contain possibly several thousand servers. Together they'd make up an underwater data center, which would be located within a few kilometers of the coast and placed between 50 and 200 meters below the surface. The pods could either float above the seabed at some intermediate depth, moored by cables to the ocean floor, or they could rest on the seabed itself.

Once we deploy a data-center pod, it would stay in place until it's time to retire the set of servers it contains. Or perhaps market conditions would change, and we'd decide to move it somewhere else. This is a true "lights

out” environment, meaning that the system’s managers would work remotely, with no one to fix things or change out parts for the operational life of the pod.

Now imagine applying **just-in-time manufacturing** to this concept. The pods could be constructed in a factory, provisioned with servers, and made ready to ship anywhere in the world. Unlike the case on land, the ocean provides a very uniform environment wherever you are. So no customization of the pods would be needed, and we could install them quickly anywhere that computing capacity was in short supply, incrementally increasing the size of an underwater installation to meet capacity requirements as they grew. Our goal for Natick is to be able to get data centers up and running, at coastal sites anywhere in the world, within 90 days from the decision to deploy.

**Most new data centers are** built in locations where electricity is inexpensive, the climate is reasonably cool, the land is cheap, and the facility doesn’t impose on the people living nearby. The problem with this approach is that it often puts data centers far from population centers, which limits how fast the servers can respond to requests.

For interactive experiences online, these delays can be problematic. We want Web pages to load quickly and video games such as *Minecraft* or *Halo* to be snappy and lag free. In years to come, there will be more and more interaction-rich applications, including those enabled by Microsoft’s **HoloLens** and other mixed reality/virtual reality technologies. So what you really want is for the servers to be close to the people they serve, something that rarely happens today.

It’s perhaps a surprising fact that **almost half** [PDF] the **world’s population** lives within 100 kilometers of the sea. So placing data centers just offshore near coastal cities would put them much closer to customers than is the norm today.

If that isn’t reason enough, consider the savings in cooling costs. Historically, such facilities have used mechanical cooling—think home air-conditioning on steroids. This equipment typically keeps temperatures between 18 and 27 °C, but the amount of electricity consumed for cooling is sometimes almost as much as that used by the computers themselves.

More recently, many data-center operators have moved to **free-air cooling**, which means that rather than chilling the air mechanically, they simply use outside air. This is far cheaper, with a cooling overhead of just 10 to 30 percent, but it means the computers are subject to outside air temperatures, which can get quite warm in some locations. It also often means putting the centers at high latitudes, far from population centers.

What’s more, these facilities can consume a lot of water. That’s because they often use evaporation to cool the air somewhat before blowing it over the servers. This can be a problem in areas subject to droughts, such as California, or where a growing population depletes the local aquifers, as is happening in many developing countries. Even if water is abundant, adding it in the air makes the electronic equipment more prone to corrosion. Our Natick architecture sidesteps all these problems. The interior of the data-center pod consists of standard computer racks with attached heat exchangers, which transfer the heat from the air to some liquid, likely ordinary water. That liquid is then pumped to heat exchangers on the outside of the pod, which in turn transfer the heat to the surrounding ocean. The cooled transfer liquid then returns to the internal heat exchangers to repeat the cycle.

Of course, the colder the surrounding ocean, the better this scheme will work. To get access to chilly seawater even during the summer or in the tropics, you need only put the pods sufficiently deep. For example, at 200 meters’ depth off the east coast of Florida, the water remains below 15 °C all year round.

Our tests with a prototype Natick pod, dubbed the “Leona Philpot” (named for an Xbox game character), began in August 2015. We submerged it at just 11 meters’ depth in the Pacific near **San Luis Obispo**, Calif., where the water ranged between 14 and 18°C.

Over the course of this 105-day experiment, we showed that we could keep the submerged computers at temperatures that were at least as cold as mechanical cooling can achieve and with even lower energy overhead than the free-air approach—just 3 percent. That energy-overhead value is lower than any production or experimental data center of which we are aware.

Because there was no need to provide an on-site staff with lights to see, air to breathe, parking spaces to fight over, or big red buttons to press in case of emergency, we made the atmosphere in the data-center pod oxygen free. (Our employees managed the prototype Natick pod from the comfort of their Microsoft offices.) We also

removed all water vapour and dust. That made for a very benign environment for the electronics, minimizing problems with heat dissipation and connector corrosion.

**Microsoft is committed to** protecting the environment. In satisfying its electricity needs, for example, the company uses renewable sources as much as possible. To the extent that it can't do that, **it purchases carbon offsets**. Consistent with that philosophy, we are looking to deploy our future underwater data centers near offshore sources of renewable energy—be it an **offshore wind farm** or some marine-based form of power generation that exploits the force of **tides, waves, or currents**.

These sources of energy are typically plentiful offshore, which means we should be able to match where people are with where we can place our energy-efficient underwater equipment and where we would have access to lots of green energy. Much as data centers today sometimes act as anchor tenants for new land-based renewable-energy farms, the same may hold true for marine energy farms in the future.

Another factor to consider is that conventionally generated electricity is not always easily available, particularly in the developing world. For example, 70 percent of the population of sub-Saharan Africa has **no access to an electric grid**. So if you want to build a data center to bring cloud services closer to such a population, you'd probably need to provide electricity for it, too.

Typically, electricity is carried long distances at 100,000 volts or higher, but ultimately servers use the same kinds of low voltages as your PC does. To drop the grid power to a voltage that the servers can consume generally requires three separate pieces of equipment. You also need backup generators and banks of batteries in case grid power fails.

Locating underwater data centers alongside offshore sources of power would allow engineers to simplify things. First, by generating power at voltages closer to what the servers require, we could eliminate some of the voltage conversions. Second, by powering the computers with a collection of independent wind or marine turbines, we could automatically build in redundancy. This would reduce both electrical losses and the capital cost (and complexity) associated with the usual data-center architecture, which is designed to protect against failure of the local power grid.

An added benefit of this approach is that the only real impact on the land is a fiber-optic cable or two for carrying data.

**The first question everyone** asks when we tell them about this idea is: How will you keep the electronics dry? The truth is that keeping things dry isn't hard. The marine industry has been keeping equipment dry in the ocean since long before computers even existed, often in far more challenging contexts than anything we have done or plan to do.

The second question—one we asked ourselves early on—is how to cool the computers most efficiently. We explored a range of exotic approaches, including the use of special dielectric liquids and phase-change materials as well as unusual heat-transfer media such as high-pressure helium gas and supercritical carbon dioxide. While such approaches have their benefits, they raise thorny problems as well.

While we continue to investigate the use of exotic materials for cooling, for the near term we see no real need. Natick's freshwater plumbing and radiator-like heat exchangers provide a very economical and efficient cooling mechanism, one that works just fine with standard servers.

A more pertinent issue, as we see it, is that an underwater data center will attract sea life, in effect forming an artificial reef. This process of colonization by marine organisms, called **biofouling**, starts with single-celled creatures, which are followed by somewhat larger organisms that feed on those cells, and so on up the food chain.

When we deployed our Natick prototype, crabs and fish began to gather around the vessel within 24 hours. We were delighted to have created a home for those creatures, so one of our main design considerations was how to maintain that habitat while not impeding the pod's ability to keep its computers cool.

In particular, we knew that biofouling on external heat exchangers would disrupt the flow of heat from those surfaces. So we explored the use of various antifouling materials and coatings—even active deterrents involving **sound** or **ultraviolet light**—in hopes of making it difficult for life to take hold. Although it's possible to physically clean the heat exchangers, relying on such interventions would be unwise, given our goal to keep operations as simple as possible.

Thankfully, the heat exchangers on our Natick pod remained clean during its first deployment, despite it being in a very challenging setting (shallow and close to shore, where ocean life is most abundant). But biofouling remains an area of active research, one that we continue to study with a focus on approaches that won't harm the marine environment.

**The biggest concern we had by far** during our test deployment was that equipment would break. After all, we couldn't send a tech to some server rack to swap out a bad hard drive or network card. Responses to hardware failures had to be made remotely or autonomously. Even in Microsoft's data centers today, we and others have been working to increase our ability to detect and address failures without human intervention. Those same techniques and expertise will be applied to Natick pods of the future.

How about security? Is your data safe from cyber or physical theft if it's underwater? Absolutely. A Natick site would provide the same encryption and other security guarantees of a land-based Microsoft data center. While no people would be physically present, sensors would give a Natick pod an excellent awareness of its surroundings, including the presence of any unexpected visitors.

You might wonder whether the heat from a submerged data center would be harmful to the local marine environment. Not likely. Any heat generated by a Natick pod would rapidly be mixed with cool water and carried away by the currents. The water just meters downstream of a Natick vessel would get a few thousandths of a degree warmer at most.

So the environmental impact would be very modest. That's important, because the future is bound to see a lot more data centers get built. If we have our way, though, people won't actually see many of them, because they'll be doing their jobs deep underwater.

This article appears in the March 2017 print issue as "Dunking the Data Center."

#### **About the Authors**

*Ben Cutler, Spencer Fowers, Jeffrey Kramer, and Eric Peterson all work at Microsoft Research in Redmond, Wash*

*Courtesy: IEEE Spectrum*

## **SOLAR PAINT OFFERS ENDLESS ENERGY FROM WATER VAPOUR**

Researchers have developed a solar paint that can absorb water vapour and split it to generate hydrogen — the cleanest source of energy.

The paint contains a newly developed compound that acts like silica gel, which is used in sachets to absorb moisture and keep food, medicines and electronics fresh and dry.

But unlike silica gel, the new material, synthetic molybdenum-sulphide, also acts as a semi-conductor and catalyses the splitting of water molecules into hydrogen and oxygen..

Lead researcher DrTorbenDaeneke, from RMIT University in Melbourne, Australia, said: "We found that mixing the compound with titanium oxide particles leads to a sunlight-absorbing paint that produces hydrogen fuel from solar energy and moist air.

"Titanium oxide is the white pigment that is already commonly used in wall paint, meaning that the simple addition of the new material can convert a brick wall into energy harvesting and fuel production real estate.

"Our new development has a big range of advantages," he said. "There's no need for clean or filtered water to feed the system. Any place that has water vapour in the air, even remote areas far from water, can produce fuel."

His colleague, Distinguished Professor KourosKalantar-zadeh, said hydrogen was the cleanest source of energy and could be used in fuel cells as well as conventional combustion engines as an alternative to fossil fuels.

"This system can also be used in very dry but hot climates near oceans. The sea water is evaporated by the hot sunlight and the vapour can then be absorbed to produce fuel.

# ABB'S MICROGRID TO POWER ARUBA AND SUPPORT TRANSITION TO RENEWABLE ENERGY

*ABB microgrid will integrate wind and solar energy to provide electricity to Caribbean island that was previously fully dependent on fossil fuels*

ABB will provide an advanced microgrid to WEB Aruba N.V., the main power utility serving the Dutch Caribbean island of Aruba. ABB's software, automation and control technologies will help WEB Aruba integrate solar and wind energy, forecast and plan better and optimize operations in real-time, while meeting Aruba's growing demand for electricity.

The island is 51 miles (32 km) long and 16 miles (10 km) across its widest point. It has a land area of 288 square miles (179 square km) and a population of about 103,000 inhabitants. A popular tourism destination, Aruba has a peak demand of 134 megawatts currently met by a mix of thermal, wind and solar photovoltaic generation. The utility has set a goal to generate half its annual average energy supplied from renewable energy sources and the other half from alternative fuels by 2020, supporting the government's vision to become completely fossil-fuel free.

ABB's microgrid solution allows for integration of a complex energy generation portfolio and maximizes the use of renewable energy, while optimizing operations in real-time. Using 24 hour forecasts of both renewable output and system load, the system will help plan operations and adjust dispatch in real-time to accommodate changes in renewable output, load or generation availability. This leads to a more automated grid.

At the heart of the solution is an advanced control system with dynamic load shedding capability. When major system transients occur, that the generation and storage are not able to accommodate, the system immediately calculates the minimum load shed required to stabilize frequency. It also ensures the distribution of load shed events so that no critical facilities are impacted.

"This innovative microgrid solution will support the island of WEB Aruba to integrate more renewables and maintain reliability and efficiency of power supplies to meet increasing demand for electricity", said Massimo Danieli, head of ABB's Grid Automation business, a part of the company's Power Grids division. "The embedded software, automation and control technologies will also facilitate 24 hour forecasts and enable a stronger, smarter and greener grid."

"We're eager to continue developing future projects together with ABB as they have enabled us in achieving our goals by introducing new renewables, new technologies and by adding value to our island's economy", explained Francis Ras, Division Manager Technical Affairs of WEB Aruba.

ABB is a pioneer in microgrid technology with around 40 installations all over the world, across a diverse range of applications serving remote communities, islands, utilities and industrial campuses.

## **About ABB**

ABB is a pioneering technology leader in electrification products, robotics and motion, industrial automation and power grids, serving customers in utilities, industry and transport & infrastructure globally. Continuing a more than 125-year history of innovation, ABB today is writing the future of industrial digitalization and driving the Energy and Fourth Industrial Revolutions. ABB operates in more than 100 countries with about 132,000 employees. For more information, visit [www.abb.com](http://www.abb.com)

*Source: ABB*



## ANOTHER STEP TOWARDS CLEAN ENERGY AS KINETIC STREET OPENS IN LONDON

*The kinetic energy produced by shoppers as they walk up and down Oxford Street is being captured to power light and sound on Bird Street, where Pavegen have installed their award winning V3 smart flooring . Could this be a model for the rest of London?*

An inauspicious alley off of Oxford Street, Bird Street has been fitted with the British company's V3 triangular vinyl tiles, which move as much as 10mm when stepped on, to produce energy, data and rewards via a mobile phone application. The vertical displacement causes generators which lie below the tiles to rotate, moving coils through magnets to create the electricity.



The power is being used on Bird Street to create bird sound during the day, and to power Pavegen's LED lights at night.

Opened on the 29<sup>th</sup> of June, Bird Street's upgrade has been funded by Transport for London's Future Streets incubator scheme.

"The 20 square metres of Pavegen on Bird Street is our newest smart flooring system, the award winning Pavegen V3 technology which won the 2017 South by Southwest smart cities interaction and innovation award," says Alex Johnson, head of communications at Pavegen. "This is the first time that our V3 technology, launched last year has been deployed in a permanent setting in London, so it's great that it's in the heart of Europe's busiest retail destination."

The generators that lie within the flooring hold low powered Bluetooth transmitters, which can connect to an app and allow you to see exactly how much power your footsteps are creating. The average footfall of an adult will create five watts of power. Whilst this is not a lot, Pavegen's custom LED matrix has drivers that are 90% efficient so very little energy is needed in the first place.

### **More to come?**

Whilst this is an interesting project, Pavegen are aware that the amounts of energy produced by this level of kinetic energy will never match up to more common sources of renewable power such as solar and wind. Instead the system is designed as a localised source of off grid, clean energy to work alongside renewables.

One of the key benefits of projects such as Bird Street is that it engages with people day to day, helping to keep sustainable energy at the forefront of their interest. The immediate visibility of the energy you produce through walking in either light or sound is a powerful tool to help engage the general population. As Johnson says, the project was designed "To show how Pavegen can bring to life the 'smart city' for communities and for retailers and brands."

Whilst Bird Street is just a small, quiet, alleyway, there are hopes to roll out the technology more broadly around Oxford Street. "We've got experience of delivering Pavegen in 200 locations around the world, both permanently and for experiential activations," says Johnson. The company currently have projects in Washington DC, Melbourne and Kazakhstan with hopes to continue to implement the technology in more locations.

In the UK, the project was designed as a pilot scheme to test its usage, and power generation before it is brought in around the West End with the eventual hope of being able to light large, busy streets like Oxford Street itself.

However, for Pavegen to be more broadly implemented it needs to be able to compete with more traditional paving stones economically. This is something the company is currently looking into, with the hope that it can get the cost down to at least in line with high end tiling.



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# ENERGY CONSERVATION THROUGH ENERGY EFFICIENCY – 29

**EMDS: Electric Motor Driven Systems** – We have been focusing on EMDS as it forms almost 50% consumption of all forms of Energy (Heat, Fuel, and Electricity) put together and an integrated approach is actually essential to achieve overall reduction in Energy Consumption.

Typically electric motors are a component in a motor system, responsible for converting electrical power into mechanical power. Consumption of a motor system corresponds to electricity consumption of its motors plus a small additional quantity to power system controls and the 100% Mechanical Energy produced in the shaft is put to use by the driven equipment and the components and the individual and collective efficiencies decide the overall Efficiency. Designing the total motor system (the entire application from supply grid to output product) is a complex task. To achieve cost effective installations and machines that operate safely and reliably, the engineering approach must set high targets for energy efficiency and apply an integrated design model. It is important to question production demands (capacity, speed, and environment) before selecting technical components.

## **Integrated machine design**

Motors are often part of a highly complex industrial production system. OEMs design machines for cement, plastics, metals, nutrition, textiles etc. that include heating and cooling as well as linear forces and rotational torque. Many machines have an array of different motors, some working continuously and others having auxiliary functions (such as only on/off or short periods).

Many OEMs tend to invest heavily in production performance; few invest in energy efficiency. To keep their machine price low they tend to use cheaper components, such as low efficiency motors and drives. This is changing for the better steadily and the total motor system concept is becoming the optimization routine of OEMs these days as more and customers are becoming conscious about Energy Consumption and running costs. One of the key cost determining elements is the often vaguely known maximum performance criteria. This may lead to over sizing of many components, including motors and packaged products as core motor systems.

Motor manufacturers often integrates the motor, gearbox and VFD with sensors together with a fan or pump wheel into one packaged product, as a core motor system. This approach has several advantages:

- Total **product costs** are lower because designs are matched and no transmissions are needed.
- Total **volume of product** is less because no space is lost for couplings and other connectors.
- **Machines** are optimized because components are matched and perfectly aligned.
- **Performance** is better because packaged machines run more smoothly with less wear.
- **Torque and speed control** can be adapted to required performance with standard programs and features.

Some manufacturers produce many or all of these components in house. Others work in alliance with component manufacturers and eventually sell integrated packages. Overall, this is a market development tendency, particularly in the range up to 30 kW.

## **Adequate sizing**

Typical inappropriately sized machines have efficiency disadvantages. With regard to electric motors, peak efficiency of high efficiency motors (depending on motor size) is at 50% to 100% load. Below 50%, the decrease in efficiency is severe. In older applications, the efficiency peak was closer to 100% and the decrease was already below 75% load. Past engineering practices were aware of critical temperature rises in full load and overload that could damage motor insulation.

Proper sizing is, of course, an issue not only with electric motors but with other system components, (*e.g.* in applications such as pump and fan systems, in which correct size pipe or duct work minimizes flow velocities and friction losses). The proper sizing of a motor system requires knowledge on all typical use stages of an entire machine. This is relatively easy for a closed loop water pumping system, but it can be difficult for a complex material handling process in which charges can vary within large boundaries.

In replacement cases, good engineering practice starts the sizing with the measurement of the typical load profiles of the machine, thus deriving a necessary peak load and starting torque condition. For new machines,

the design will depend on calculations based on the knowledge of the engineering handbook. In any case, a new high and premium efficiency motor can be sized with less safety margin because it runs cooler and can stand 10% to 20% overload (in Energy Efficiency Standards, this is called service factor) for a couple of hours repeatedly without hitting the allowed maximum temperature rise. Proper sizing offers several advantages: motors usually run more smoothly and for longer with less wear; they have fewer losses; and they cost less than oversized motors.

### **Efficient operation**

A well designed motor system also must be operated properly. Efficient operation means:

- no operation without use, no idle time (factory automation has to give on/off);
- no unnecessary fast starts and brakes (well defined production cycles and intervals)
- no unnecessary long overloads (defined starting conditions, soft start, VFD starting programme, clutch);
- regular mechanical checks (oil quality for wear, vibration for bad alignment) and maintenance (bearings, fan, dust, oil);
- regular electrical checks (electronic spikes, thermal image of motor) and maintenance (over heated windings, unbalanced phases).

Efficient operation should also include monitoring the motor system to ensure early detection of wear and failures.

### **Energy Audit of Motor Driven Systems and decisions costs and benefits:**

Electric motor driven systems have large untapped energy efficiency potential. Apart from appropriate, Selection, Sizing, Operation and Maintenance, periodical Auditing of the System can help extensively to achieve better efficiencies, performance and reliability. Auditing must include efficiency checks of individual components as well as cumulative efficiencies.

Efficiency gains will potentially come from matched components, including IE3 motors, VFDs and direct drive integration. The savings will come mainly from abandoning transmissions, low efficiency gears and throttles, dampers, bypasses etc. All variable load processes have to be studied to allow better partial load performance. It is important to carefully consider the use of VFD to avoid unnecessary investment and additional losses.

Pumps have traditionally been oversized. New engineering design tools allow for a much closer fit and better electronic controls in partial load conditions.

Fans have usually been made with lower engineering precision than pumps, because air leaks do not have the same consequences as fluid leaks. Air ventilation and blower systems today can be much more efficient through precise engineering and providing for the lowest necessary fan power and operation time for the necessary service.

Compressors are manufactured by specialist firms with large global volumes in all types and sizes. They have also now started to respond adequately to new ecological awareness and economic facts. This kind of response to the challenges and potential for new technology has led to benefits for the entire industry and the user Industries.

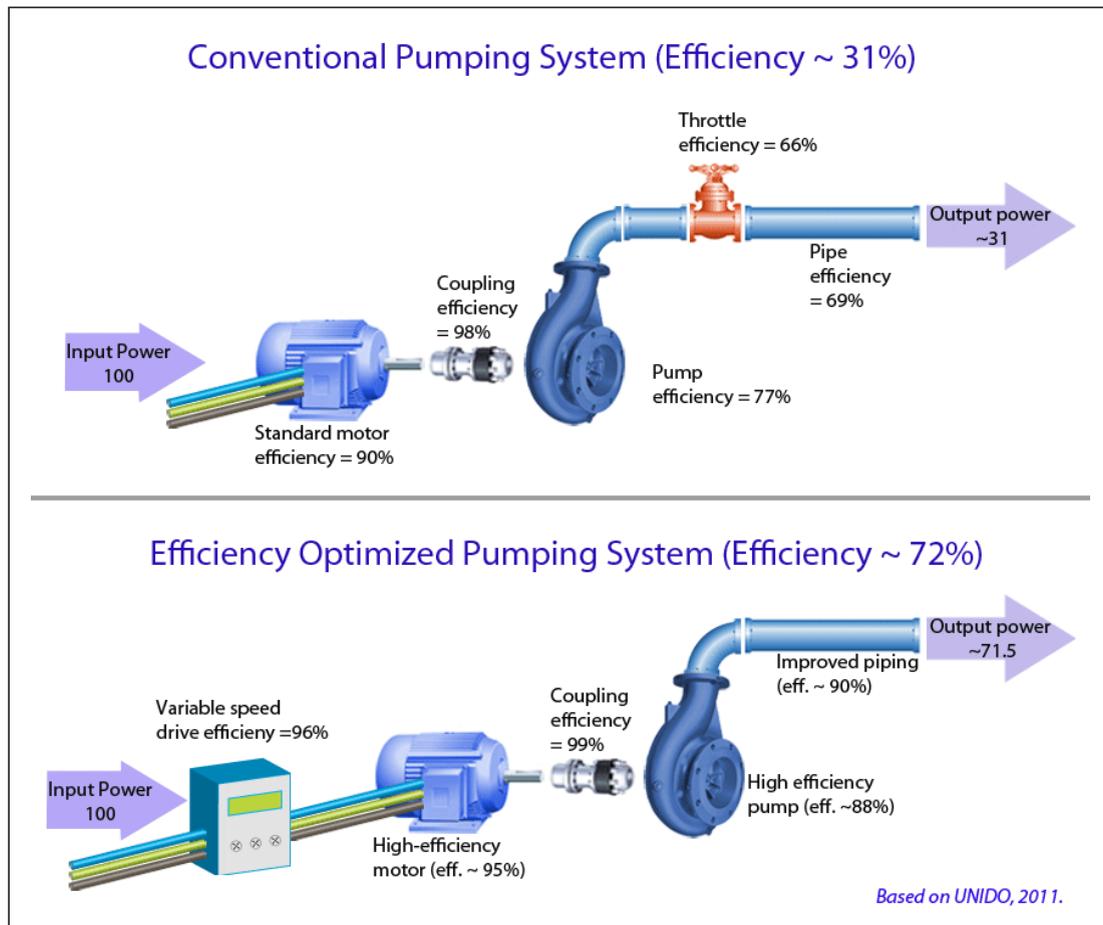
Overall, the average profitable energy efficiency potential for EMDS is estimated at 20% to 30% (the average case for improvement projects in existing total motor systems). In existing improvements on the level of the core motor system, only 10% to 20% profitable energy efficiency is feasible. In new designs, potential electricity savings with the optimal total motor system can be 30% to 80% on average, and a typical case of Pump System is illustrated below.

Motor systems are complex: mechanical and electric components must be matched carefully to the required task and the motor's torque and speed. Replacing a single component with a premium component does not generally lead to satisfying energy efficiency gains or short payback times. To study the entire system and optimize operation requires more time, qualified staff and advanced engineering know how.

Energy efficiency potentials of electric motors and motors systems are not being realized, even when they are economically cost effective. Numerous barriers impede adoption and rapid market diffusion of efficient electric motor driven systems (EMDS) within major applications.

Some non economic factors could be addressed through energy policy. Such barriers encompass international trade issues and various economic aspects such as life cycle cost perspectives, traditional investment decisions

and high transaction costs for investors. A further barrier is that electricity prices do not reflect full social costs, given externalities from electricity generation and distribution.



Many barriers limit the market uptake of cost effective EMDS solutions: lack of knowledge; short term thinking over investments and operation; excessively risk averse production practices; higher initial costs; confusion in standards and labels; lack of performance visibility within main production performance benchmarks; and difficulty in recouping the cost of more efficient components.

Some of these barriers are common to other energy using products and hence are subject to similar policy analysis and solutions, but some barriers are unique to motors. According to traditional market theory, investors will choose efficient motors or motor systems when they become more profitable (*e.g.* the concept of least life cycle cost or the lowest total cost of ownership). This theoretical concept is based on several assumptions, the most important being a well educated investor, who is fully informed on the markets relating to the investment, the seller's behavior and the quality of the various products. The investor may favour minimal cost of the system although the benefits may accrue to the system's user. Market theory usually ignores externalities such as environmental pollution, climate change or further indirect impacts such as corrosion, health and safety effects, or reduced productivity of economies.

### Energy Efficiency and Energy Conservation

Energy Consumption, Improving the efficiency of energy use and along with it an effective policy for reducing national CO<sub>2</sub> will lead to a reduction in national energy emissions. A more effective CO<sub>2</sub> policy is to concentrate on shifting to non-fossil fuels, like renewables, subsidized through a carbon tax. Ultimately what is needed is to limit energy consumption (or conservation) through energy efficiency.



(To be continued)  
 S. Mahadevan, B.E., F.I.E., M.B.A.,  
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## TOP 10 MAJOR DAMS OF INDIA - 2

### 3. Krishnarajasagar Dam, Karnataka

Krishnarajasagar dam built across **Kaveri River** near Mysore in Karnataka. It is one of the principal and largest dam built on the river Kaveri in Karnataka in, South India. The Kaveri is one of the major river in India and there is a Famous and beautiful Brindavan Gardens attached to the dam, its a part of the Krishna Raja Sagar Dam and is the most beautiful gardens in Mysore and one of best Garden in India.

**Height:** 125 feet

**Length:** 3.5km

**Type:** Masonry Dam

**River:** Kaveri River

**Location:** Karnataka

**Installed capacity:** 200 MW



### 4. Mettur Dam, Tamil Nadu

Mettur Dam built across Kaveri River at Salem district in Tamil Nadu with a height of 120 ft. It is one the largest and one of the oldest dam built in India. Mettur Dam has biggest and the most power generating capacity dam in Tamil Nadu. Mettur Dam is very beautiful place of tourist, the river is a wonderful site to explore the nature.

**Height:** 120 ft.

**Length:** 1700 meters

**Type:** Concrete Dam

**River:** Kaveri River

**Location:** Tamil Nadu

**Installed capacity:** 32 MW



*(To be continued...)*



**SARATH BABU – CEO**  
*Foodking Catering Services P. Ltd.*



**From selling Idlis in slum of Chennai to pepsu MTV youth icon 2008.**

Sarath Babu’s story is about determination, a mother’s hard work and enterprise and a family’s fight against the odds. Sarath accompanied his mother as she sold idlis on

the pavements of Chennai to supplement her meagre income. Despite the hardships, his mother encouraged him to get an education. With the help of his family and a loan of Rs. 30,000, Sarath managed to get into the prestigious BITS Pilani and followed that with an MBA from IIM Ahmedabad. ‘**Food King**’ was launched in 2006 to cater to the needs of students at his alma mater – IIM Ahmedabad and soon he expanded to his other training ground BITS Pilani.

*Serving 8,000 meals every day* **Food King today serves five universities across India.** Today he conducts his **food business in six locations**, with a **turnover of Rs. 9 crore**. Sarath has also recently launched a fast food restaurant and hopes to take the count to a 1000 by 2016 touching revenues of Rs. 50 crore.

In this particular sector, the challenges were availability of capital which applies to any other sector and then, the availability of quality manpower which was also one of the biggest challenges. The third challenge was since he was a first time entrepreneur and didn’t have any capital and or credit track record in the market. So nobody was willing to give credit.

His determination has made him not just a true leader in business but in public life as well. The dark horse in the 2009 general election, Sarath polled more than 15,000 votes in his debut attempt. Despite that drubbing he didn’t give up on his political aspiration. He stood as an independent candidate from Velachery in the recent Tamil Nadu elections but lost again. His manifesto was that he wanted to see a hunger free India in his life time. He would create at least 1,000 entrepreneurs in his constituency in the small and medium segment. He promised that in the next five years there would not be a single child from his constituency missing school.

So, far he has addressed almost 3.5 lakh students and slum children. His team consists of 1,500 volunteers and well-wishers, including 10 classmates from IIM- Ahmedabad.

**HEAR HERE:**

**\*NO\* \*PHONES\* \*IN\* \*THE\* \*KITCHEN\*  
\*PLEASE\***

Do you make or receive calls in your kitchen? My name is Dr. Ademola. Just 3 days ago my husband, who also is a doctor, shared the sad incidents of 6 people who were brought into the casualty department for treating burns which they sustained while making phone calls in the kitchen with the gas burner ON. Even microwave oven or induction stoves could be dangerous. Some cook with the phones pressed against ears! Please stop making or receiving calls in the kitchen. It is as dangerous as making or receiving calls in a petrol station. Please don’t forget to share with your loved ones. If the call is very urgent, then move away from the gas by 10-12 feet and then take the call.

**REMEMBER THAT YOUR SAFETY IS YOUR FAMILY’S SAFETY TOO.**



## தொழில் முன்னோடிகள்: லாரி எலிசன் (1944)

என் வாழ்க்கை ஒரு சுய தேடல், என் திறமைகளின் எல்லைகளை அறிந்து கொள்ளும் தேடல் - லாரி எலிசன்.

“நீ எங்கள் மகனில்லை”.

அம்மா லிலியன், அப்பா லூயி இருவரும் தன்னிடம் சொன்னதைக் கேட்டு அந்தப் பனிரெண்டு வயதுச் சிறுவன் திடுக்கிட்டான் கொஞ்ச நேரம் கதறி அழுதபின் கேட்டான். “என் அப்பா, அம்மா யார்?”.

அவர்கள் சொன்னார்கள். அமெரிக்காவின் நியூயார்க் நகரத்தில் வசித்த டிப்ளா ரென்ஸ் ஸ்பெல்மான் என்னும் யூதப் பெண், தன் பதினாறாம் வயதில் ஒரு இத்தாலிய விமான ஓட்டியோடு காதலில் விழுந்தார். கர்ப்பமானார். காதலர் காணாமல் போனார். அவன், அவர்கள் குழந்தை.

மகனை வளர்ப்பதில் டிப்ளா ரென்ஸுக்கு விருப்பம் இருக்கவில்லை. ஒன்பதாம் மாதத்தில் அவனுக்கு நிமோனியா நோய் வந்தது. தன் அதை லிலியனுக்கு மகனைத் தத்துக் கொடுத்துவிட்டு அம்மா காணாமல் போய்விட்டார். அவன் அப்பா பெயரையும் அவர்களிடம் சொல்லவில்லை.

லியனும், லூயியும் “பழமையானதும், மோசமானதுமான சேரி” என்று வர்ணிக்கப்படும் சிகாகோவின் தெற்குப் பகுதியில் வசித்தார்கள். வறுமையான வாழ்க்கை. 24x7 திருட்டுக்கள், கற்பழிப்புகள், கொலைகள் நடக்கும் குற்ற பூமி. பள்ளிக்கூடம் போனான். படிப்பு ஏறவில்லை. தண்டச் சோறு என்று அப்பா எப்போதும் திட்டுவார். தான் உதவாக்கரைதான் என்று அவனும் முடிவு கட்டிவிட்டான். ஒரே ஆறுதல், அம்மா காட்டிய அன்பும், தந்த அறிவுரைகளும் தான்.

பள்ளியில் கணிதத்திலும், அறிவியலிலும் நல்ல மதிப்பெண் வாங்குவான். மற்றபடி சுமார் மாணவன்தான். மேற்படிப்புக்காக இல்லினாய் பல்கலைக் கழகத்தில் சேர்ந்தான். இரண்டாம் வருடம் படிக்கும்போது வளர்ப்பு அம்மா மரணமடைந்தார். கையில் பணமில்லை, வளர்ப்பு அப்பாவின் உதவியில்லை. படிப்பைப் பாதியில் விட வேண்டிய கட்டாயம். சிறு இடைவெளிக்குப் பின் சிகாகோ பல்கலைக் கழகத்தில் சேர்ந்தான். அங்கேயும், வறுமையால், ஒரே செமஸ்ட்ரோடு படிப்பை விடவேண்டி வந்தது.

அப்போது 1970 காலகட்டம். கம்ப்யூட்டர்கள் பரவலாகப் பயன்படத் தொடங்கியிருந்தன. புரோகிராமிங் தெரிந்தவர்களுக்கு உடனே வேலை கிடைத்தது. கோர்ஸ் படிக்க நோ மணி. அவன் ஒரு வழி கண்டுபிடித்தான், எங்காவது புரோகிராமராகச் சேரவேண்டும். அங்கே தொழிலைக் கற்றுக்கொள்ள வெண்டும். அதற்கும் முன்னால், ஏதாவது வேலை வெண்டும். சிலிக்கான் பள்ளத்தாக்கு என அழைக்கப்படும் கலிபோர்னிய மாநிலத்தில்தான் பல கம்ப்யூட்டர் கம்பெனிகள் இருந்தன. சிகாகோவை விட்டு அங்கே போனான். சின்னச் சின்னக் கம்பெனிகளில் கிடைத்த வேலைகளில் சேர்ந்தான். வயிற்றுப்பாட்டை ஓட்டினான். ஆனால், அவன் இலக்கு புரோகிராமர் வேலையில்தான் இருந்தது. கேட்டாரைத் திருப்திப்படுத்தும் நாவன்மை அவனுக்கு உண்டு. இந்தத் திறமையால், அம்தால் கார்ப்பரேஷன் என்னும் நிறுவனத்தில் சேர்ந்தான். அவனுக்கு கற்பூர புத்தி. “நான் அதுவரை கம்ப்யூட்டர் பற்றியே படித்ததில்லை. ஒரு புத்தகத்தைப் படித்தேன். புரோகிராம் பண்ணத் தொடங்கிவிட்டேன்” என்கிறான் இந்தச் சுயம்பு லிங்கம்.

இந்த அனுபவம் அடுத்த அடி எடுத்துவைக்க வழி செய்தது. ஆம்பெக்ஸ் கார்ப்பரேஷனில் சேர்ந்தான். அவர்கள் சென்ட்ரல் இன்வெஸ்டிகேட்டிங் ஏஜென்சி (CIA – Central Investigating Agency) என்னும் அமெரிக்க உளவுத்துறையின் தகவல்களை நிர்வகிக்கும் பணியை அவுட்சோர்ஸிங் முறையில் செய்துகொண்டிருந்தார்கள்.

1970 – ஐ.பி.எம் கம்பெனியில் வேலை பார்த்த எட்கர் காட் என்னும் கம்ப்யூட்டர் மேதை, தகவல்களைச் சேமிக்கவும், நிர்வகிக்கவும், சுலபமானதும், அதிகச் செயல்திறன் கொண்டதுமான ரிலேஷனல் டேட்டாபேஸ் (Relational Database) என்னும் முறையைக் கண்டுபிடித்தார். பலரும் இதில் ஆர்வம் காட்டவில்லை. ஆனால், இந்தப் புதிய தொழில்நுட்பத்தில் ஒரு தங்கச் சுரங்கம் ஒளிந்திருக்கிறது என்று லாரியின் மனக்குறளி சொன்னது. தன் வருங்காலத்தையே இதனோடு இணைத்துக்கொள்ள முடிவெடுத்தார்.

லாரி எப்போதும் தடாலடி முடிவுகள் எடுப்பவர். இந்தத் தீர்மானமும் அப்படி எடுக்கப்பட்டதுதான் என்று சிலர் சொல்கிறார்கள். இல்லை. அவர் கம்ப்யூட்டர் யுகத்தின் வருங்காலத்தைச் சரியாகக் கணித்த



**தீர்க்கதரிசி என்று இன்னும் சிலர் சொல்கிறார்கள்.** கடும் போட்டிகள் நிறைந்த கம்ப்யூட்டர் தொழில்நுட்ப உலகில் லாரி இன்று வரை, 40 ஆண்டுகளாகத் தொடர்ந்து கண்டுவரும் வெற்றிகள் அவர் தீர்க்கதரிசிதான் என்பதை நிரூபிக்கின்றன.

1977 - ரிலேஷனல் டேட்டாபேஸ் தொழில்நுட்பத்தின் அடிப்படையில் சொந்த கம்பெனி தொடங்க முடிவெடுத்தார். 2,000 டாலர்கள் தேவை. அவர் மொத்தச் சேமிப்பே வெறும் 1,200 டாலர்கள், இரண்டு நண்பர்களைப் பங்காளிகளாகச் சேர்த்துக்கொண்டார். டெவலப்மெண்ட் லேபரட்டீஸ் என்னும் கம்பெனி பிறந்தது. முதல் வருடமே, லாரி தன் சா.ப்ட்வேரை அறிமுகம் செய்தார். அவர் இந்த சா.ப்ட்வேருக்கு வைத்த பெயர் **ஆரக்கிள்**. இதற்கு இரண்டு

**காரணங்கள்.**

1. ஆம்பெக்ஸ் கார்ப்பரேஷனில், சென்ட்ரல் இன்வெஸ்டிகேட்டிங் ஏஜென்சிக்கு லாரி செய்த புராஜெக்டின் பெயர் ஆரக்கிள்.
2. நம் ஊர்க் கோவில்களில் “சாமி வந்து” ஆடுபவர்களைப் பார்த்திருப்பீர்கள். பக்தர்களின் கேள்விகளுக்கு இவர்கள் அருள்வாக்காகப் பதில் சொல்லுவார்கள். இந்தச் சாமியாடிகளை ஆங்கிலத்தில் ஆரக்கிள் என்று சொல்வார்கள். இதேபோல் கஸ்டமர்களின் கேள்விகளுக்குப் பதில் சொல்லும் சா.ப்ட்வேர் என்பது இன்னொரு பெயர்க் காரணம்.

அப்போது கம்ப்யூட்டர் தயாரிப்பாளர்கள் பலவித சா.ப்ட்வேர்களை பயன்படுத்தினார்கள். ஒன்றின் சா.ப்ட்வேர் இன்னொன்றுக்கு ஒத்துப்போகாது. புது சா.ப்ட்வேர் கம்பெனிகளுக்கு இரண்டு பாதைகள் - முதல் வழி, தனிப்பட்ட கம்ப்யூட்டர் தயாரிப்பாளருக்காக சா.ப்ட்வேர் தயாரிக்கலாம். அவர்கள் பிசினஸ் நிச்சயம் கிடைக்கும். இரண்டாம் வழி, எல்லா கம்ப்யூட்டர்களுக்கும் பொருத்தமான சா.ப்ட்வேர் அறிமுகம் செய்யலாம். இந்த வழி கொஞ்சம் ரிஸ்க்கானது. எல்லோருமே வாங்கலாம், அதே சமயம், யாரும் வாங்காமலே போகலாம்.

இந்த முடிவு வருங்காலத்தையே பணயம் வைக்கும் ஆட்டம், லாரி ரிஸ்க் எடுத்தார். அவர் களத்தில் இறங்கிய ஆரக்கிள் எல்லோரும் பயன்படுத்துவது. பங்காளிகள் இருவரும் தொழில்நுட்பத்தைக் கவனித்துக் கொள்ள, லாரி மார்க்கெட்டிங் பொறுப்பில். அவர் வேகமும், விடாமுயற்சியும் இப்போது வெளிப்பட்டன. சில கஸ்டமர்களைக் குறி வைப்பார். திரும்பத் திரும்ப அவர்களைத் தொடர்புகொண்டு நச்சரிப்பார். ஆர்டர் கிடைக்கும்வரை அவர்களை விடமாட்டார். **தரமான சா.ப்ட்வேர், தீவிரமாகத் தூரத்தும் சேல்ஸ் படை. ஆரக்கிள் சா.ப்ட்வேர் அமோக வெற்றி கண்டது.**

1977 - இல் ரிலேஷனல் சா.ப்ட்வேர், 1982 - இல் ஆரக்கிள் கார்ப்பரேஷன் என்று இரண்டு பெயர் மாற்றங்கள். ஆனால், ராட்சச வளர்ச்சி தொடர்கிறது. புதிய தொழில்நுட்பங்களை அடையாளம் காண்பதில் அவர் கில்லாடி. கிளவுட் கம்ப்யூட்டிங் (Cloud Computing) என்னும் தகவல் சேமிப்பு முறையின் பயனை ஆரம்பத்திலேயே அவர் கணித்தார். இதேபோல், அவர் குறைந்த விலைக்கு வாங்கிய பீப்பிள் சாப்ட், சன் மைக்ரோசிஸ்டம்ஸ், நெட்கூட் (Net Suite) ஆகிய நிறுவனங்கள் ஆரக்கிளின் வளர்ச்சிக்கு மிகப் பெரிய பலங்கள்.

தன் பாதையில் லாரி சந்தித்த எதிரிகள் சாதாரணமானவர்களல்ல. ஐ.பி.எம், மைக்ரோசாப்ட் ஆகிய பிரம்மாண்டங்கள். லாரி அவர்களைக் கண்டு பயப்பட்டதே கிடையாது. அது மட்டுமில்லை. அவர்களைத் துச்சமாகப் பேசுவார். மைக்ரோசா.ப்டிங் பில் கேட்ஸ் சா.ப்ட்வேர் உலகின் கடவுளாக மதிக்கப்படுபவர். அவரைப் பற்றி லாரி என்ன சொன்னார் தெரியுமா? “தன்னை எடிசன் என மக்கள் மதிக்கவேண்டும் என்று பில் கேட்ஸ் நினைக்கிறார். பணக்காரர்கள் எல்லோரும் புத்திசாலிகளில்லை”. இப்படி விமர்சிக்கும் துணிச்சலும், தலைக்கனமும் லாரிக்கு மட்டுமே இருக்கமுடியும். ஆப்பிளின் ஸ்டீவ் ஜாப்ஸுக்கும் இதே குணங்கள்தாம். அதனால்தானோ என்னமோ, இருவரும் மிக நெருங்கிய நண்பர்கள். லாரியின் நான்காம் திருமணத்தின்போது போட்டோகிராபர் ஸ்டீவ் தான்!

**வறுமையில் பிறந்து வளர்ந்த லாரி இன்று உலகின் ஏழாவது பெரும் பணக்காரர். அவர் சொத்து 61 பில்லியன் டாலர்கள். (சுமார் 4 லட்சம் கோடி ரூபாய்). வருமானத்தில் ஒரு சதவீதத்தைச் சமூக சேவைகளுக்குச் செலவிடுகிறார்.** அதே சமயம். ஆடம்பரச் செலவுகளுக்கும் குறைவில்லை. ஹவாய் அருகே 2,000 கோடி ரூபாய்க்கு, 140 சதுர மைல்கள் பரப்பளவு கொண்ட ஒரு முழுத் தீவை விலைக்கு வாங்கியிருக்கிறார். இது தவிர, 23 மாளிகைகள், ஐப்பானில் தோட்டம், இரண்டு ஜெட் விமானங்கள், கணக்கில்லா கார்கள்..... தெரிந்தவை இவை. தெரியாதவை என்னென்னமோ? அனுபவி ராஜா அனுபவி. நீ உன் மூளையாலும், உழைப்பாலும் சம்பாதிச்ச பணம்!

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Courtesy: The Hindu, dt. 25.07.2017



நீயென்ன பெரிய பருப்பா? என்று உதிரியாகத் திரிபவர்கள், சிறுரவுகளைப் பார்த்துச் சினிமாவில் கேட்பதைப் பார்த்திருக்கலாம். மனிதர்கள் எப்படியோ தெரியாது, நிச்சயமாகச் சாப்பிடப்படும் 'பருப்பு', பார்க்கச் சிறிதாக இருந்தாலும் பெரிதுதான். காரணம் அதில் இருக்கும் அபரிமிதச் சத்து, அதிலும் தசைகளையும் உடலையும் ஊட்டி வளர்க்கும் புரதச் சத்து. பருப்பு வகைத் தாவரங்களின் காய்களையும் விதைகளையும் மனிதர்கள் ஆயிரக்கணக்கான ஆண்டுகளாகச் சாப்பிட்டு வருகிறார்கள்.

குழந்தைக்குச் செரிமானத் திறன் மேம்பட்டவுடன், முதலில் தரப்படுவது சோறும் மசிக்கப்பட்ட பருப்பும் சேர்ந்த பருப்புச்சோறுதான் (கொங்கு பகுதி அரிசி பருப்பு சாதம் கதை தனி). அதேபோலத் தமிழகத்தில் சாம்பார், கேரளத்தில் புட்டு மற்றும் ஆப்பத்துடன் வரும் கடலைக்கறி, வடஇந்தியாவில் சப்பாத்தியுடன் வரும் தால் எனப்படும் பருப்பு மசியல் எனப் பருப்பு இல்லாமல் இந்திய உணவைக் கற்பனை செய்தே பார்க்க முடியாது. பருப்பு வகைத் தாவரங்கள் நம் தினசரி உணவில் முக்கிய இடத்தைப் பிடித்திருக்கின்றன.

#### எளிமையின் உச்சம்

மாவுச் சத்து, புரதச் சத்து, (நல்ல) கொழுப்புச் சத்து, வைட்டமின், கனிமச்சத்து போன்றவை கலந்த சதவிகித உணவு ஆரோக்கியமான உடலுக்கு அடிப்படைத் தேவை. இதில் விலங்குப் புரதத்தைச் சாப்பிடாதவர்கள், தாவரப் புரதத்துக்குப் பருப்பு

வகைகளையே நம்பியிருக்கிறார்கள். தமிழகத்திலும் இந்தியாவிலும் புரதச் சத்துத் தேவையைப் பெருமளவு நிறைவு செய்வது பருப்பு வகைகள்தான். பருப்பு வகைகளின் சிறப்புகளைச் சுருக்கமாகச் சொல்லிவிட முடியாது என்றாலும், முக்கியமான சிறப்புகள்: இவற்றைச் சமைப்பது எளிது, அதேநேரம் உடலுக்குப் பெரிய தீங்கு செய்வதில்லை. வயலில் இவற்றை விளைவிப்பதும் மிகக் கஷ்டமானதோ அதிகப்படி தண்ணீர் உறிஞ்சுவதோ இல்லை.

#### எப்படி வருகிறது?

ஆங்கிலத்திலோ, லத்தீனிலோ லெக்யூம் (legume) என்று சொல்வது பருப்பு வகைத் தாவரங்களைக் குறிக்கிறது. Fabaceae அல்லது Leguminosae என்பது அவரை வகை தாவரக் குடும்பத்தின் தாவரவியல் பெயர். பருப்பு வகைத் தாவரங்கள் பல்வேறு வகைப்பட்டவை. பொதுவாக அவரை, துவரை, பயறு, மொச்சை, பட்டாணி வகைத் தாவரங்களின் விதை காய வைக்கப்பட்டு, மேல்தோல் நீக்கப்பட்ட பிறகு பருப்பு எனப்படுகிறது.

இந்தத் தாவரங்கள்தான் நம்மைச் சூழ்ந்திருக்கும் காற்றில் நிரம்பியிருக்கும் நைட்ரஜனை (78%) சேகரித்து, மண்ணில் நிலைநிறுத்துகின்றன. அவரை இனத் தாவரங்களின் வேர்க்கணுக்களில் ரைசோபியா பாக்டீரியா இருக்கிறது. இது, அந்தத் தாவரங்களுடன் ஒன்றி வாழ்ந்தபடி மண்ணில் நைட்ரஜனை நிலைப்படுத்துகிறது. இதனால் மண் வளம்மிக்கதாக மாறுகிறது. இதன் காரணமாகப் பயிற்சி சுழற்சி

முறையில் வயலின் வளத்தை மேம்படுத்துவதற்குக் காலங்காலமாக இந்தப் பயிர்களைப் பயிரிடுவதை உழவர்கள் வழக்கமாகக் கொண்டிருந்தனர். மண்ணில் நைட்ரஜனை நிலைப்படுத்தும் இந்தச் செயல்பாட்டால் இந்தத் தாவரங்களின் விதைகள் புரதச் சத்து நிரம்பியவையாக உள்ளன.

### எப்படியெல்லாம் சாப்பிடலாம்?

பருப்பு வகைத் தாவரங்களின் இலைகள் கூட்டிலைகள், சின்னச்சின்ன இரட்டை இலைகளாக, வரிசையாக இருக்கும். நீண்ட பச்சை நெற்று அல்லது உறையில் விதைகள் நிரம்பியதாக இவற்றின் காய் அமைந்திருக்கும். இந்தத் தாவரங்களின் விதைகள் காய வைக்கப்பட்டு மட்டுமல்லாமல், பச்சைக் காயாகவும் பயன்பாட்டில் உள்ளன. தாவர வளர்ச்சியின் பல்வேறு நிலைகளில், வகைகளில் அவரைக் குடும்பத் தாவரங்கள் சாப்பிடப்பட்டு வருகின்றன.

- அவரை, பீன்ஸ், தட்டைப்பயற்றங்காய் (காராமணி) வகைத் தாவரங்கள் பச்சை காயாகவே சாப்பிடப்படுகின்றன. அவற்றின் விதைகள் மட்டுமல்லாமல், முற்றாத மேலுறையும் உண்ணப்படுகிறது.
- அதேபோலக் காராமணி, பட்டாணி, மொச்சை போன்ற விதைகள் முதிர்ந்தவுடன் காய வைக்கப்படாமல் உண்ணப்படுகின்றன. இவற்றை சமைப்பது எளிது. அந்த நிலையில் வெளிப்புற உறை கடினப்பட்டிருப்பதால் சாப்பிடப்படுவதில்லை.
- அதற்குப் பிறகு நன்கு முதிர்ந்த காய்கள் வெளிப்புற உறையுடன் காய வைக்கப்படுகின்றன. பிறகு வெளிப்புற உறை அகற்றப்பட்டு, காய்ந்த முழு விதைகள் உண்ணப்படுகின்றன. இவற்றை நீண்ட நேரம் வேக வைக்க வேண்டும்.
- காய வைக்கப்பட்ட முழு விதைகளைத் தண்ணீரில் ஊற வைத்து, தண்ணீரை வடித்து முளைக்க விடப்படுகிறது. இப்படி முளைவிட்ட விதைகள் சத்து மிகுந்தவை. பொதுவாக ஓர் இரவு முழுக்க ஊற வைக்கப்பட்டு, தண்ணீரை வடித்துத் துணியில் கட்டியோ அல்லது பாத்திரத்திலோ வைக்கலாம். முளைகட்டிய பச்சைப் பயற்றை அப்படியே சாப்பிடலாம். முடியாதவற்றை எளிதாக வேக வைத்துவிடலாம்.
- காய வைக்கப்பட்ட பயற்றை அரைத்து மாவாகப் பயன்படுத்தலாம். இப்படிக்கிடைக்கும் கடலை மாவு பலகாரங்கள் செய்யப் பயன்படுத்தப்படுகிறது. சில மாவுகள் சூப்பில் சேர்க்கப்படுகின்றன.

இப்படிப் பச்சைக்காய், பச்சையான பயறு, முழு விதை முளைகட்டிய பயறு, பருப்பு, மாவு எனப் பல வகைகளிலும் பருப்பு வகைத் தாவரங்கள் சமையலில் பயன்படுத்தப்படுகின்றன. இந்த விதைகள் காய வைக்கப்பட்டு, இரண்டாக உடைக்கப்பட்டால் பருப்பு. இந்தப் பருப்பு வகைகள் நன்கு செரிமானம் ஆவதற்கும், வேக வைப்பதற்கும் தண்ணீரில் ஊற வைக்க வேண்டும். சீரகம், மிளகு போன்ற தாளிப்புப் பொருட்களும் சேர்க்கப்படுகின்றன.

### உலகம் கொண்டாடுகிறது

பருப்பு பயன்பாட்டைச் சார்ந்து நமக்கு வலுவான பின்னணி இருக்கும் அதேநேரம், 2016-ம் ஆண்டை 'சர்வதேசப் பருப்பு ஆண்டாக (International Pulses Year) ஐ.நா. சபை அறிவித்திருக்கிறது. ஊட்டச்சத்துமிக்க பயறு, பருப்பு, மொச்சை, பட்டாணி வகைகள் தரும் ஊட்டச்சத்தைப் பிரபலப்படுத்துவதே இந்த அறிவிப்பின் நோக்கம். அடுத்து வரும் வாரங்களில் நாம் அதிகம் உண்ணும் ஒவ்வொரு பருப்பு வகையிலும் பொதிந்திருக்கும் ஊட்டச்சத்து, நம் உடலுக்கு அது தரும் ஆரோக்கியப் பலன்கள், பயன்பாடுகளைப் பற்றி விரிவாகப் பார்ப்போம்.

### மருந்தாகும் பருப்பு

பண்டைய சித்த மருத்துவக் குறிப்புகளிலும், பருப்புகளைப் பற்றி நிறைய குறிப்பிடப்பட்டுள்ளது. 'பயற்றங்காயை கறியாக உண்ணில் நன்மை உண்டாகும்' எனத் தேரையர் குறிப்பிட்டுள்ளார். அகத்தியர் பாடல்களிலும் பருப்பு வகைகளைப் பற்றி குறிப்புகள் உள்ளன.

பருப்புகள் தரும் முக்கிய ஆரோக்கியப் பலன்கள்: மசித்த பருப்புடன் நெய் சேர்த்துச் சாப்பிடுவது, மெலிந்த உடலைத் தேற்றுவதற்கான சிறந்த உணவு. கர்ப்பக்காலத்தில் பனிக்குட நீர் அதிகரிப்பதற்குப் பருப்பில் உள்ள புரதம் அவசியம்.

பெரும்பாலான பயறு வகைகள் இனிப்புச் சுவையைக் கொண்டுள்ளன. இனிப்பு சுவை உடலுக்கு உடனடி ஆற்றலும் தசைகளுக்கு ஊட்டமும் தரக்கூடியது. குளிர்ச்சியுண்டாகும் செய்கையும் பயறு வகைகளுக்கு உண்டு. அதனால் குழந்தைகளுக்குப் பாலை மறக்கச் செய்வதற்கான நல்ல உணவாகப் பருப்பு வகைகள் பயன்படுத்தப்படுகின்றன.

புரதக்குறைவால் உண்டாகும் கால் வீக்கம் (Pedal Odema) வராமல் தடுக்க, பருப்பு வகைகளை அதிகம் உட்கொள்ள வேண்டும்.

தீப்புண்களுக்கு மருந்தாக சில பருப்பு வகைகள் பயன்படுகின்றன.

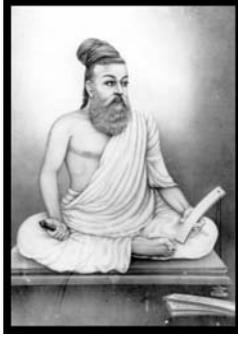
(To be continued...)

Courtesy: ஆதி வள்ளியப்பன், தி இந்து, 02.07.2016

மசித்த பருப்புடன் நெய் சேர்த்து சாப்பிடுவது,  
மெலிந்த உடலைத் தேற்றுவதற்கான சிறந்த உணவு.

## TIRUKKURAL AND MANAGEMENT IN A 'NUTSHELL' - 52

Recently, at a Conference of Business Leaders there were deliberations about what are the Qualities that make a Leader. One of the Top Business Leader in the meet presented a "5 - C" Model of Leadership, which are as follows:



- Competency
- Courage and Confidence (Paired into one)
- Communication
- Consistency**
- Compass or Integrity
- Tiruvalluvar, no doubt, deals with all these in a very comprehensive manner and in this part, let us review what he has to advise us about "Consistency".

**Consistency** is a very important dimension in Leadership and Behavior and it should be based on 'Values' and 'Excellence'. In Business and Marketing, it is stated that 'Long Standing Brands' of both Corporate and Offerings are created and built through

consistent Quality, Value, Performance and Relationships which can only be the result of consistent Leadership.

Tiruvalluvar deals with this Dimension of Leadership very aptly in a number of his verses, a few of which are dealt below.

*Anbunaan Oppuravu Kannottam Vaaymaiyodu  
Iynthusaalbu Ooindriya Thoon Kural 983*

அன்புநாண் ஒப்புரவு கண்ணோட்டம் வாய்மையொடு  
ஐந்துசால்பு ஊன்றிய தூண். குறள் 983

"Love to all, Sensitiveness to Shame, Complaisance, indigence to the fault of others and Truthfulness, these five are the pillars that support the edifice of a noble character"

*Ooozhi Peyarinum Thaampeyaraar Saandraanmaikku  
Aazhi Enappadu Vaar Kural 989*

ஊழி பெயரினும் தாம்பெயரார் சான்றாண்மைக்கு  
ஆழி எனப்படு வார். குறள் 989

"Beheld the men that would not swerve from the path of rectitude even if all else should change in a general convulsion; they will be called the very palladium of worth"

*Aatruvaar Aatral Panithal; Athusaandror  
Maatrarai Maatrum Padai Kural 985*

ஆற்றுவார் ஆற்றல் பணிதல் அதுசான்றோர்  
மாற்றாரை மாற்றும் படை. குறள் 985

"It is the Humility that is the strength of the strong; and that is also the armour of the man of Worth against his foes"

## HOME FESTIVALS - 9

புரட்டாசி - Purattasi (September/October)



Navaratri ("nine nights") is the principal festival this month (above left). The Goddess is worshipped in Her many forms, and on the ninth day, **Sarasvati** (center of the painting) is invoked to bless musical instruments, account books, agricultural instruments and home tools (upper left). On Vijaya Dasami, the day following Navratri, **Goddess Durga** is invoked as children are given their first instruction, worship their school books and honor their teacher (bottom left). A decorated display of dolls (lower right) is displayed through the nine days, then dismantled and stored on the tenth day. **Vijaya Dasami** is also the birthday of Lord Venkateshwara (upper right), presiding Deity of Tirupati temple in Andhra Pradesh, India's wealthiest temple.

(To be continued)

## THE SUPER 73 SCOUT SERIES

A year ago, **Lithium Cycles** started a campaign on Kickstarter to fund manufacture of their Super 73, an electric bicycle with fat tires and an attitude. They expected maybe 50 to 100 people to sign up for the \$2,000 bike that retails for \$3,000. To their surprise, they raised over half a million dollars, as the Super 73 quickly became the darling of clued-in, cool people everywhere. The bikes were all over Instagram and even made an appearance at the NY Fashion Week event.

The new Super 73 Scout is a scaled back version with fewer features but also a lower price. The introductory price is just \$995, which is pretty reasonable for an electric bicycle with a 500 watt motor, 40 miles of range, and a top speed of 20 miles per hour that looks for all the world like a small motorcycle. After one month, the price will go up to \$1,399, so early adopters can get the bike at nearly a 30% discount. It comes with a super bright headlight, taillights that glow when you brake, a small cargo rack, and a display on the handlebars to show speed, range, and other information.

Sean O’Kane writing for **The Verge** got to test drive one in New York City recently and says, “It was one of the more fun experiences I’ve had on an e-bike. That’s probably because it’s the least like an e-bike of the myriad other options — carving through NYC traffic on the Scout really makes you feel like you’re on a small motorcycle.”

The seat is comfortable and the riding style is more laid back than most bicycle riders are accustomed to. It’s more of a small motorcycle like the popular Honda Ruckus than a Tour de France machine. The riding position actually makes pedaling a bit of a chore, although the company is considering moving the seat back a skoosh to deal with that issue. The Super 73 Scout comes with smoothly functioning disc brakes on both wheels that have confidence-inspiring stopping power.

The Super 73 Scout offers a cross between the utility of a traditional bicycle and the status conscious world of personal urban transportation. The bike rack makes it possible to carry some stuff with you while you ride and the battery detaches so you can bring it inside to charge it up. That being said, it may be too bulky and heavy to fit easily into an elevator or lug up stairs. What is has going for it is a cool factor that easily surpasses most other similarly priced electric bicycle choices available today.



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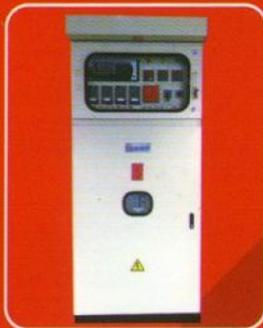


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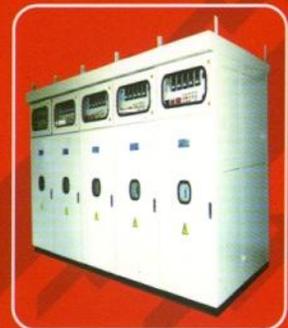
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