



# 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!*

*Greetings For Happy Christmas!!*

*Advance Greetings For A Happy And Prosperous 2018!!!*

We are always proud about the Great Heritage of Art and Culture of our entire country in general and Tamilnadu in particular. What is spread all over the state over the centuries and more is now marked by a Great Art and Music Festival at Chennai during the month of December which is celebrated in a Grand Manner for over a century now, with participation of Artistes and 'Rasikas' from all over the Globe. **We can feel aptly proud that the city has been included in the UNESCO Creative Cities Network for its rich musical tradition.**

*It's a feature Chennai has always flaunted with pride. And now, it has got international recognition.*

December is marked by the Observance of **"Energy Conservation Day"** on 14<sup>th</sup> December and the **"Kisan Diwas"** or **Farmers Day** on the 23<sup>rd</sup> December. We are Happy and proud that a lot of progress, in both these areas, has been seen over the past 70 years and, more particularly in the last 25 years, to help us gallop to become one of the leading economies of the World. It may be more meaningful to celebrate the Energy Day as **"Energy Excellence Day"** rather than Energy Conservation Day, as our Energy Concerns have important dimensions of Energy Efficiency and Renewable Energy. Engineering and Technology play very vital role in these areas and Renewable Energy is considered of paramount importance the World over for eliminating the harms of **"Fossils"** as sources of Energy and to sustain the Energy needs of the present and the future. We are also seeing the important developments of **"RE100"**, meaning to focus to serve the entire energy needs through Renewable Energy.

**"Waste to Energy"** is the most important concept in Renewable Energy and conversion of wastes of all kinds generated from all activities including Industries and Agriculture and wastes from all living beings like cattle and people, into Energy, needs to be supported by Engineering and Technology. Even in Solar Energy, Waste to Energy is being addressed with encouragement of **"Roof Top Solar"**, of all kinds from Homes to Buildings to Industries, by the Government. There are huge potentials in India for Bio Energy as well, where waste to Energy is the most important concept and the technologies based on Bio Chemical and Thermo Chemical Engineering and Electrical Power Generation play very important roles. It is interesting that the Government is planning 100s of Waste to Energy plants all over the country to address the solid wastes generated by human habitations. There is sizable potential and the appropriate and **'Pollution Free'** technology is the key.

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

EDITOR



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## CHENNAI IS NOW PART OF UNESCO'S 'CREATIVE CITIES NETWORK'

**The world body recognises the city's rich musical tradition**

It's a feature Chennai has always flaunted with pride. And now, it has got international recognition. The city has been included in the UNESCO Creative Cities Network for its rich musical tradition.

On Wednesday, Prime Minister Narendra Modi tweeted, congratulating the city: **"Chennai's contribution to our rich culture is precious. This is a proud moment for India"**.

A total of 64 cities from 44 countries have joined the UNESCO Creative Cities Network, the organisation's website said.

"They join a network at the frontline of UNESCO's efforts to foster innovation and creativity as key drivers for a more sustainable and inclusive urban development," it stated.

Gastronomy, music, crafts and folk art, media arts, design, film and literature are the seven fields of creativity highlighted by the network, which now has a total of 180 cities in 72 countries.

Jaipur and Varanasi are the other Indian cities that feature on the list.

### **Chief Minister thanks PM**

**Tamil Nadu Chief Minister Edappadi K. Palaniswami, in a statement, said** *"the people of Chennai love their music and it is a part of their culture and tradition"*. **He thanked Mr. Modi** for *"congratulating the people of Chennai for this unique distinction"*.

**Carnatic vocalist Bombay Jayashri said,** *"This truly is a moment to remember each and every artiste of the varied forms who have laid the bricks to build this musical empire. A heaven for the classical music, popular music, music for dance and theatre and folk, we revel in the arts"*.

**Ghatam vidwan 'Vikku' Vinayakram said** *the city and its sabhas had played a very important role in bringing together Carnatic musicians from all over the country and abroad. "In the beginning, there were very few sabhas, but now, there are many. And even the very small ones help in propagating Carnatic music. The December music season is something very unique to this city and even for persons from other countries; it is a matter of pride to perform during it," he said.*

**Tamil Development Minister Ma Foi K. Pandiarajan said,** *"Chennai, as a cultural capital of India, is built on its music and dance culture. We are delighted that UNESCO has recognised it"*.



***True Love is the Medicine for all Diseases***

## MEMBERS DETAILS

S.No.	Company Name	District	Contact No.	License No.
61.	Johnsons Electrical Tradings	Chennai	044-24798280, 96001 64215	EA 3064
62.	Jothi Electricals	Chennai	044-42835672, 95662 22215	EA 2671
63.	Jupiter Electricals	Chennai	044-26712786, 98840 17708	EA 2171
64.	K.G.S. Electricals	Chennai	044-25651296, 94440 09940	EA 2743
65.	K.K. Singh Electricals	Chennai	044-22266663, 98842 96617	EA 1797
66.	K.R. Enterprises	Chennai	044-24897213, 98401 38908	EA 2153
67.	K.V. Electricals	Chennai	94440 09836, 97109 24925	EA 2566
68.	Karuna Electricals	Chennai	98403 81975	EA 1946
69.	Kavi Electricals	Chennai	044-26880660, 95661 59911	EA 2274
70.	Kevin Electricals Pvt. Ltd	Chennai	044-24912704, 98410 35365	EA 2032
71.	Kiruthika Electricals & Enterprises	Chennai	044-24927988, 97109 43801	ESA 380
72.	Kontakt Consortium India Pvt. Ltd	Chennai	044-26173011, 90878 40000	EA 2683
73.	KPV Powercon Engg. Services P Ltd	Chennai	044-22253768, 98400 85517	ESA 431
74.	Krishna Power and Control Pvt. Ltd.	Chennai	98400 91837, 98408 10724	EA 2730
75.	KSA Power Infra Pvt. Ltd	Chennai	044-42034399, 43114273	ESA 411

## HOME-SIZED BIOGAS UNIT TURNS ORGANIC WASTE INTO COOKING FUEL AND FERTILIZER, FOR UNDER \$900

A startup from Israel has developed a home-sized biogas unit that can take organic waste and convert it into enough gas for 2-4 hours of cooking, as well as 5 to 8 liters of organic liquid fertilizer, every single day.

The accurately-named HomeBiogas device could herald a new dawn for full-circle local waste recovery for both on- and off-grid homes, because it has the ability to take in up to 6 liters per day of any food waste (including both meat and dairy, which are often not recommended for home composting) or up to 15 liters per day of animal manure (including pet waste, which is also considered a no-no in home composting), and turn that into enough fuel to cook several meals per day, while also producing a rich organic fertilizer that can boost soil fertility and garden yields.

While many home biogas initiatives tend to be focused on the developing world, where animal and human waste can be converted into a clean-burning fuel for cooking or heating water, providing a renewable local energy source, this project is aimed at the suburban market, where it can function as a valuable component of a home's energy network, either as an adjunct to grid-based systems or as an off-grid accessory

According to HomeBiogas, 1 kilogram of food waste can produce an average of about 200 liters (7 cubic feet) of gas, which can fuel an hour's worth of cooking over a high flame, so with a full daily input of 6 liters of organic waste, the company's units can produce several hours of cooking gas each day, and can help homes eliminate one ton of organic waste each year, and avoid generating the equivalent of 6 tons of CO<sub>2</sub> annually.

These units, in addition to producing a usable fuel and fertilizer from materials that would otherwise go to waste, is being billed as an affordable and easy-to-assemble product that can easily fit into a backyard or greenhouse, measuring 123cm/165cm/100cm (48"x65"x39.4") and weighing in at less than 40 kg (88lb). The HomeBiogas units are also said to be simple to operate, and to require minimal annual maintenance, and although the biogas can be burned on a regular stove, at least one burner does need to be converted to use the fuel.

This time I would like to start my article with an adage. **“Knowing something is not doing anything** (simply it adds up your knowledge only); **doing alone is doing”**. So don't stop simply by knowing all about Electrical Accidents, safety rules and procedures; kindly practice or follow them in your day-to-day routines. In short, **“Doing is an acceptable approach, that always ensures our safer and happy life journey and just knowing”** will not do that.

### **Shock Currents through the Body – An Outline**

When a person touches a live conductor she / he experiences a sudden electric shock accompanied with the flow of electrical current through her / his body. The effects of such currents mainly depend upon several factors – (i) Magnitude of the current (ii) Duration of the hold exposure or contact and (iii) Frequency of the current, to some extent. In general, the tolerable limit for any human being is 10 mA and the corresponding duration is only a few milli seconds. If current / duration levels exceed these permissible levels, the ill-effects of electricity cannot be totally avoided.

When the body current exceeds one mA, unpleasant sensations start; higher currents in the order of 10-15 milli amps lead to ventricular fibrillation and make it difficult for the victims to breathe and release the energised object grasped by them. Still further currents will prove fatal. Greater the shock currents, greater will be the chances for the fatality or major burns / injuries to the person concerned. Such cases do not respond to resuscitation. In this context another important factor is the **“duration of the contact”**. If the duration of the fault is very short, even much higher currents will not cause any damage. i.e The person concerned can easily handle it. However such conditions cannot continue for a long period; precise tolerable levels can neither be predicted nor prescribed. Use of earth leakage circuit breakers (ELCB) in low voltage services connections with limited capacity (below 5KW) may be treated as one of the best approaches to protect human lives and property. In other services such devices can be used to indicate or signal the presence of the danger Viz earth faults / leaky circuits. As regards, large HT installations, high – speed relays or back-up protection can be relied upon to meet such earth faults. Another common practice of suppliers is the adoption of **“Auto Reclosure”** facilities in HT feeders.

In this context, it may be of interest to know the effects of **“repeated but closely- spaced electrical shocks”**. Presently there is no quantitative guide on this issue. Just to get a feel of such an event, it is to be informed that on comparing the effect of two closely spaced shocks of one 0.1 second duration each and one with a continuous shock of 0.2 second duration, it will be found that the latter will be more painful than the former i.e. the shock experienced with a single shock of 0.2 second duration will be more painful. An interesting point that needs to be noted at this moment is the **“heart action”** - it will generally return to its normal rhythm within five minutes of the stopping of the electrical current, provided the ventricular fibrillation did not accompany it or occur prior to its shock.

To move further, the electrical accident can be broadly classified into:

- Shock hazard
- Fire hazard

Invariably, these two categories of accidents are costly or fatal unless proper precautions are taken at the nick of the time. Adequate and effective earthing system is one of the better solutions; but it cannot a **“panacea”** for all the problems connected with earth faults. Leakage current of higher magnitudes can lead to corrosion through electrolysis process and a good earthing system may not be of any use under such condition. Likewise, continuous exposure to chemical fumes or smokes or improper angling of its installation may bring physical damages to the insulation of the electrical wiring system with the consequential electrical faults. Kindly note that many avenues are available for the electrical accidents to **“creep / sneak in”**; so follow the basic safety rules with impurity and adopt all necessary safe guards / safety measures. In this regard, the application of ELCB of 30 ms setting for shock hazard and 300 ms setting for fire hazard may constitute one of the best weapons in our armoury / arsenal.

***Use Earth leakage circuit breakers – protect Human Lives & Property***



Prior to our moving ahead and touch the core aspect of accident, Viz. Human factors in Electrical Accidents let us see what engineers engaged in the electrical contracting industry for over a number of years **“advocate”**

- (i) Though the electrical accidents cannot be totally eradicated, its numbers can be trimmed / brought down by finding ways to prevent them.
- (ii) All electrical works should be handled / carried out only by workers under skilled supervision.
- (iii) Electrical equipment / devices with BIS (Bureau of Indian Standards) mark alone should be employed.
- (iv) Arrangement may be made for the inspection and testing of electrical installations equipment / devices periodically atleast once in two years / one year
- (v) Publicity drives on the lines of **“Road Safety Campaign”** drawing attention to poor electrical installations, shoddy workmanship and misuse may be carried out by the government departments concerned regularly.
- (vi) Electricity suppliers should see that the consumers comply with statutory regulations and electrical safety rules without fail.
- (vii) There should be compulsory registration of contractors and operatives who engage in electrical works.
- (viii) The reduction of mains voltage to a safer level or adoption of all safety procedures while undertaking any electrical work brings better results.

No doubt, on adopting the above recommendations meticulously, the homes and other electrical installations can be made more safe and the accident rates can also be pulled down. This should be viewed in the context of people’s freedom to adopt their own measures, while handling electricity i.e. **“one cannot prevent people doing what they like in their own homes / electrical installations but can make better recommendations to them”**.

Normally the people who analyse the electrical accidents fail to view it from the point of view it deserved i.e from the angle of human psyche; the analyzers generally view it from the stand point of causative factors and contributors negligence like the failure to adopt safety precautions, carelessness, absent mindedness, curiosity but never look into the other crucial angle / dimensions of the problem that include poor workmanship, faulty / inadequate design / manufacture of the equipment / device, poor condition of the installations that invite the victims to accidents, physical conditions and mind status of the victims; chief among them are fatigue and loss of sleep. All these factors demonstrate the pressing demand to view the accidents from **“Human View Points”** rather than from other standard stand points. i.e make the accident more human by considering the consequences of human traits like limited rationality, over zealousness and lack of self control. A man’s; mind is a master controller of his behaviour. In the words of the great English poet Milton; “The mind in its own place and in itself can make a heaven of hell, a hell of heaven”. A disturbed mind is a big source of confusion. Invariably it leads to absent mindedness, an error of judgement, drowsiness, momentary mental, blankness and finally leads to costly lapses / errors.

One more point to be added-here people normally say that **“we are like this and we will always be like this”**. This attitude needs to be changed when we deal with electricity, which is a good servant but a bad master. They say nudge is the obverse of the shove. Creating awareness and persuading people to change their attitude and behaviour in the need of the hour. Here the **“nudge theory”** finds better application. In essence, there lies a big need to build a bridge between the technical and psychological aspects of the decision making processes of the affected persons. Let us discuss these issues in detail in the forthcoming issues of the journal. With this, I would like to sign off; eagerly looking forward to meet you again next month.

*(To be continued...)*



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**Follow Electrical Safety Rules - Be Happy**

## PEER RATING SOON FOR GREEN BUILDINGS IN INDIA

The US-based Green Building Council Inc (GBCI) will launch PEER, a system that evaluates power system performance in a building, in India by next year. The council is currently running the pilot here.

Gopalakrishnan P, Managing Director – APAC and West Asia markets, GBCI, told *BusinessLine* that Performance Excellence in Electricity Renewal (PEER), which assesses the quality and resilience of power and energy inside a building, could add great value to institutions like hospitals, stock exchanges, airports and sea ports, where power performance is critical. “We expect to launch PEER in the first quarter of fiscal 2018-19,” he added.

GBCI offers green building certification to buildings like Leadership in Energy and Environmental Design. The organisation works with private and public agencies in India and currently has 2,500 projects. According to Gopalakrishnan, demand for such certifications is on the rise from both private and public offices. Apart from increasing awareness, the interest is augmented by rising green businesses in the country, which is predicted to grow at the rate of 20-30 per cent annually for the next five years.

Though there are improvements, Gopalakrishnan feels they are limited to metros and tier-I cities. “A real change will happen only when the understanding percolates to small businesses and tier-2 and -3 cities,” he said.

To facilitate that, GBCI is organising first edition of international conference and expo Green Build India in Mumbai on November 2 and 3. “In addition, we are conducting events with the help of industry bodies in tier-2 and -3 towns,” Gopalakrishnan said.

**Performance Excellence in Electricity Renewal, also known as PEER, is the nation’s first rating system that measures and improves power system performance and electricity delivery systems. PEER helps energy professionals define, specify and assess power generation, transmission and distribution and provides a framework for continuous improvement.**

**Administered by Green Business Certification Inc. (GBCI), the premier organization independently recognizing excellence in green business industry performance and practice globally, PEER was modeled after the U.S. Green Building Council’s (USGBC) LEED (Leadership in Energy and Environmental Design) program for buildings.**

### **What is PEER?**

*PEER is the nation’s first comprehensive certification program and roadmap for sustainable power system performance. PEER is designed to measure performance and improve the regulation, design and operation of sustainable power. It drives market transformation by providing a framework for three-year minimum project grid improvements that benefit all stakeholders – from customers to businesses. PEER is the result of a collaborative effort between the USGBC and Bob Galvin, formerly of Motorola, to address urgently needed power industry reforms. The 2003 Northeast blackout underscored how crucial it is to have a reliable and resilient power system and how a lack of one can have a profound, negative impact on the economy. At the time, the power industry was in need of a major transformation that policy changes alone could not address.*

*Receiving PEER certification confirms improvement and sustainability for power systems. Projects are evaluated across four categories: reliability & resilience, energy efficiency & environment, operational effectiveness, and customer contribution. PEER helps identify waste and performance gaps and verifies outcomes.*

### **Why PEER?**

*PEER is designed to provide dependable, sustainable power for all, while lowering electricity costs, improving the long-term quality of life in communities. With outdated power systems, electricity is lost through conversion and waste, and these costs are passed onto consumers with poor power quality, costing U.S. facilities more than \$200 billion dollars per year. PEER quantifies the financial value of a sustainable electric system by effectively highlighting financial bottom-line benefits.*

*PEER standards incorporate distributed generation and on-site power generation, which results in less energy lost. It further supplements a reduction and optimization of the energy infrastructure including power lines, and plants.*



*As climate change increases frequency and intensity of severe weather, grid resilience is increasingly important. PEER-certified power systems offer better-built grids that outperform and outlast conventional grids.*

*PEER supports professionals spearheading sustainable energy delivery initiatives. PEER-certified grids lead to greater efficiencies in energy use, reduction in carbon emissions and minimize risks caused by, poor energy reliability and poor power quality.*

*PEER provides a valuable framework for projects that fall into three categories: city, campus or supply. PEER-certified projects can include universities, municipal utilities, industrial facilities and more.*

*GBCI is the only certification and credentialing body within the green business and sustainability industry to exclusively administer project certifications and professional credentials of LEED, EDGE, PEER, WELL, SITES, GRESB, Parksmart and Zero Waste.*

## **HYDROGEN FUEL CELL E-BIKE TAKES 2 MINUTES TO FILL AND HAS A 60+ MILE RANGE**

The first commercially available electrically assisted bike with a fuel cell (FC-Pedelec)

Pragma Industries has designed the first commercial-grade fuel cell Pedelec, *álpha*, integrating the OCS fuel cell technology. *álpha* has been developed as a response of today's energy demand and eco-mobility issues.

The fuel cell and hydrogen storage integrated inside Alpha2.0 delivers an unrivalled range of 100km on a single charge. Whereas battery-powered Pedelecs are adversely affected by low temperatures, Alpha2.0 provides constant range and performances in every weather conditions. Equipped with a best-in-class H<sub>2</sub> gauge, it accurately indicates the remaining energy to the user.

Compared to conventional electric bikes, *álpha* is refilled with hydrogen in only 2 minutes using the filling station, while standard e-bikes take more 3 to 4 hours to be fully charged.

- Electrical motor - Brose 36V
- Motor power - Electrical assistance up to 250 W
- Top speed - Electrical assistance up to 25 km/h
- Fuel cell technology - 150 W PEM fuel cell
- Bridging energy - 150 Wh Li-Ion batteries
- H<sub>2</sub> Storage - 2 L compressed H<sub>2</sub> gas cylinder

### **Who is it for?**

Captive fleet operators, your battery management nightmares are over!

*álpha* offers a complete electric solution while eliminating batteries logistics which can be highly time-consuming and costly.

### **Public services**

**Territorial staff mobility**

**Corporate staff mobility**

**Last mile delivery**

**Tourists rental**

**Bike sharing programs**



# FUEL CELLS POISED TO REPLACE INDIA'S DIESEL GENERATORS

Scientists at India's National Chemistry Laboratory have pinpointed a clean, cost-effective fuel cell that can replace the unreliable and pollutive diesel generators that power India's telecom towers.

Despite significant addition to power generation and transmission capacities in recent years, India still faces an energy deficit of 2.1% and about 20,000 villages are off-grid. Moreover, electricity supply to urban and rural India is still unreliable. As a result, diesel generators are widely used for decentralized power generation. These generators (Figure 1), although inexpensive, are inefficient and pose great environmental and health risks.

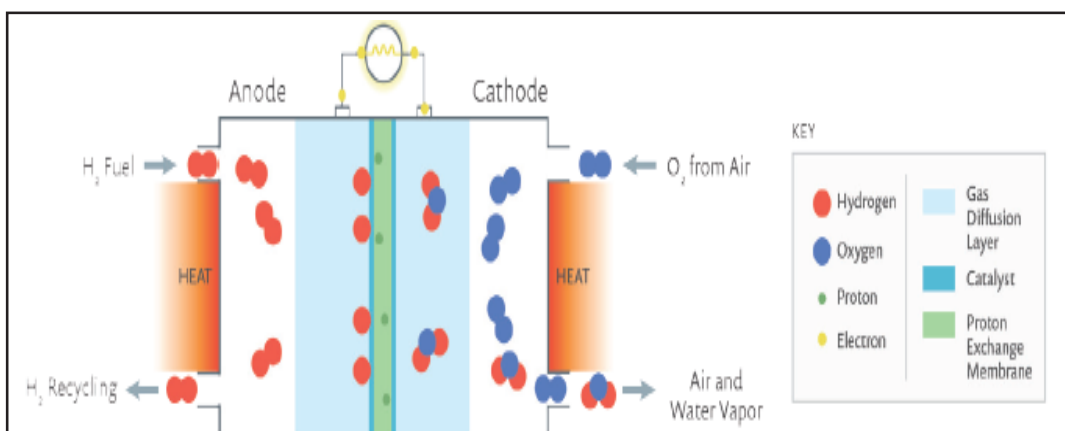
This is why the National Chemistry Laboratory (NCL) in India, along with two other labs in the Council of Scientific and Industrial Research (CSIR), the Central Electrochemical Research Institute (CECRI), and the National Physical Laboratory (NPL), are investigating cleaner, cost-effective, and more dependable technology for powering telecom towers and eventually buildings.

A promising answer to the cost and pollution conundrum can be found in proton exchange membrane fuel cells (PEM fuel cells or PEMFCs, shown in Figure 1, bottom), which are being phased into many applications as replacements for older power technology. Thanks to their small carbon footprints, low decibel levels, fuel compatibility, and excellent complementarity with other renewable energy options, they have potential for use in transportation, residential buildings and offices, and certain industrial sectors. PEM fuel cell systems have an overall efficiency exceeding 30% (compared to 22-25% for diesel generators), and when run on pure hydrogen, their only emission is water vapour.

## INSIDE A PEM FUEL CELL

PEM fuel cells contain a membrane electrode assembly (MEA) that comprises gas diffusion layers, electrodes, and polymer electrolyte membrane. Electrochemical reactions that generate power occur inside the MEA.

In a single PEM fuel cell, hydrogen streams to the anode side of the assembly, where it is split into protons and electrons by reactions in the presence of a catalyst. A network of carbon nanoparticles in the electrode conducts the electrons, providing current output to power a device before they reach the cathode on the other side. Meanwhile, protons travel through a proton



**Figure 2. Concept of a PEM fuel cell. Hydrogen enters the anode where it reacts on the catalyst's active sites to split into protons and electrons. Electrons are conducted through an external circuit over a load to the cathode, while the protons migrate to the cathode through the proton exchange membrane electrolyte. The PEM is made of a solid polymer that conducts protons but not electrons.**

exchange membrane and oxygen from air diffuses through a gas diffusion layer (GDL) in the MEA to reach the cathode (Figure 2).

The protons react with oxygen and electrons at the catalyst's active sites on the cathode to form water; the byproducts of the reactions are simply water and heat. Multiple such cells connected in series make a PEM fuel cell stack (Figure 3).

The power output and efficiency of the fuel cell

is determined by many factors, such as catalytic activity of the active layers at the anode and cathode, the ability of the electrodes to transport liquid water out of the gas diffusion electrodes, the conductivity and porosity of the carbon network, the transport of reactant gases to the catalyst, the proton conductivity of the PEM, and the electrical conductivity of the bipolar plates.

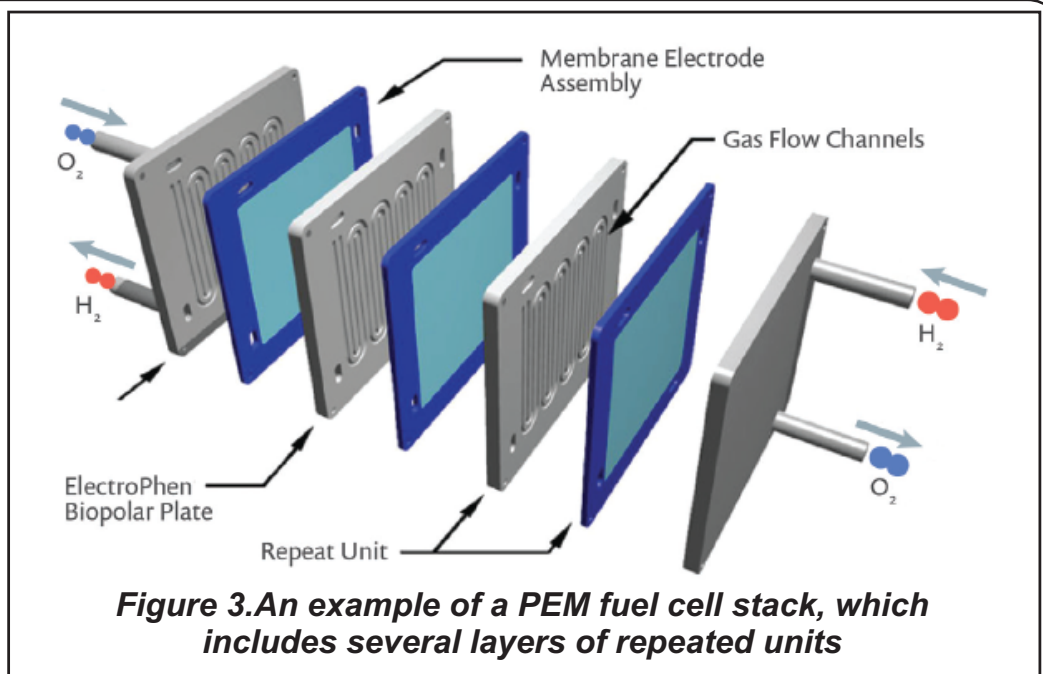
### CONFIGURING FOR MAXIMUM EFFICIENCY

The trick when choosing a PEM fuel cell for India's telecom towers is to find the best configuration for maximum efficiency, knowing that improving the design in one area might reduce the effectiveness of another. For example, increasing porosity in the GDL allows hydrogen and air to enter more freely and moisture to leave more freely, but might decrease electrical conductivity.

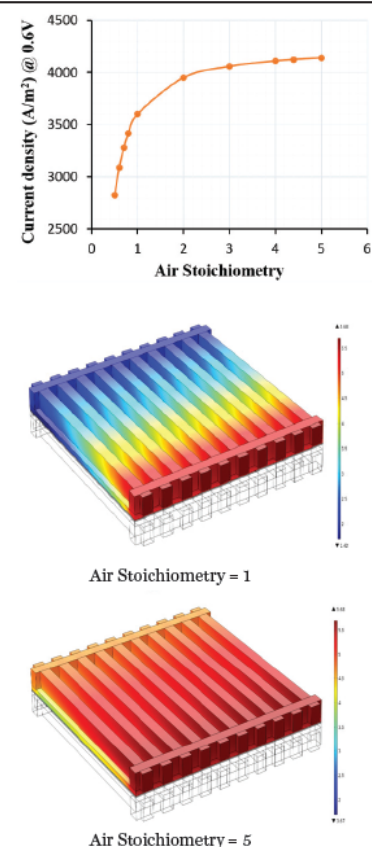
Dr. Ashish Lele, chief scientist on the project at NCL, leads a team that has simulated and analyzed different configurations to find the optimal combination of properties in the PEM fuel cells intended for India's telecom towers. "We wanted to understand the reactions at the carbon electrode and study how the transport of reacting gases and protons in the electrodes would modulate the overall reaction rate," he explains. "We were ultimately interested in understanding how various parameters, such as operating conditions, flow field geometry, and MEA structural parameters influence the overall PEM fuel cell performance."

Lele and his team modeled the convection of reactant gases in the flow field along with simultaneous reactions occurring at the catalyst layers and proton conduction through the PEM fuel cell. They relied on the functionality of the COMSOL Multiphysics® software for modeling chemical reactions and electrochemical impedance spectroscopy (EIS). EIS is used for characterizing electrochemical systems through measuring impedance and frequency response. The sidebar gives a brief overview of modeling EIS in the COMSOL® software.

"The nature of COMSOL allowed us to include mass balance, momentum balance, species balance, and charge balance together," he says. "We ran a



**Figure 3. An example of a PEM fuel cell stack, which includes several layers of repeated units**



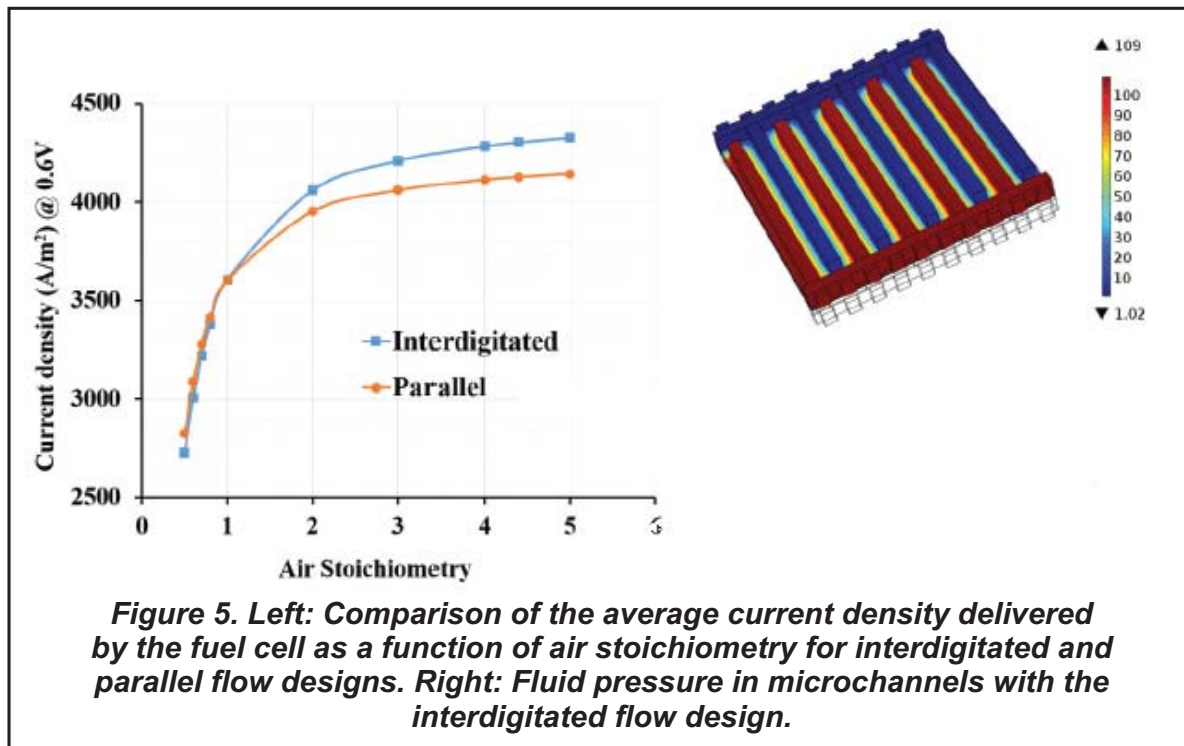
**Figure 4. Plots of the current density produced by the fuel cell for different air stoichiometries. An air-to-fuel ratio of 5 resulted in greater and more consistent current output.**



sensitivity analysis on different parameters — for instance, design parameters such as the flow field shape, operating parameters such as back pressure and

stoichiometry, and structural parameters such as the ionomer-carbon ratio — to determine their effect on the performance of the PEM fuel cell.” Thanks to the software, they were able to understand the effects of these variables on the overall power output of the PEM fuel cell.

The effect of stoichiometry — the ratio between the actual inflow of reactant gases and the amount required for producing a given amount of power — is shown in Figure 4 for a parallel flow field. Lele’s team studied different flow field types to determine the most effective shape and layout for the flow channels. “We were interested in analyzing the four known principle types of flow fields: parallel, serpentine, pin, and interdigitated,” he continues. “Using COMSOL, we found that the last of these [interdigitated] had certain advantages that could be exploited for high-temperature PEM fuel cells.”



Comparisons of the current density resulting from different flow shapes confirmed that the interdigitated flow type was preferable (Figure 5). More specifically, the faster reaction rate occurring with the interdigitated flow field is a consequence of pressure-driven convective mass transport in the GDL and electrode, which is absent in the other three flow types. Faster reaction rates occurring with the interdigitated type lead to better efficiency and more hydrogen and Oxygen being used up in the reactions. The pressure profile (Figure 5) clearly reveals the possibility of convection within the GDL due to a pressure drop between two consecutive channels.

### MOVING TOWARD GREENER FUEL

Analyzing the PEM fuel cell configuration in COMSOL allowed the team to choose the right flow pattern, carbon fiber layer, and gas input levels to maximize the power output. “COMSOL has helped us to look at the influence of all these variables on the final output,” Lele concludes. “Once you run the sensitivity analysis, you can figure out which variables are most important.”

As they move toward licensing and mass production of the PEM fuel cells for power generation, the researchers at NCL look forward to seeing India’s telecom towers run more cleanly and reliably. In the future, they expect these advancements to help the whole country move toward greener fuel for powering other structures, such as buildings and transportation networks.

***If all the economists were laid end to end, they would not reach a conclusion***

***- GEORGE BERNARD SHAW (1856-1950) Irish writer.***

## ELECTRIC JET IS PREPARING FOR TAKEOFF IN 2022

The aviation industry has made steady progress in cutting its fuel use and carbon emissions. Planes have become lighter, engines more efficient, and airlines are starting to use biofuel blends and to better manage their traffic flow in order to save money and reduce emissions.

Still, aviation produces **about 2 percent** of the world's carbon emissions. To reduce them further, **Zunum Aero** has a bold plan for a low-carbon flying future. **The Kirkland, Wash.-based startup plans to deliver its first hybrid electric plane in 2022.**

The company, which came out of stealth in 2017 and has backing from Boeing and JetBlue's venture capital arms, unveiled details of its aircraft in October. The 12-seater jet will have a range of 700 miles and maximum cruise speed of 340 miles per hour. It will generate 80 percent fewer emissions and produce 75 percent less noise.

Zunum's business model is based on short commuter flights between small, regional airports. With that strategy in place, they plan to cut costs and door-to-door travel time. Flying from Boston to Washington, D.C. would cost \$140 one way, the company predicts, and take around two and a half hours door-to-door, half as long as it takes now.

Zunum isn't the first company to make a big promise for electric flight. In September, European budget airline EasyJet **announced that it is developing a 180-seater electric plane for 2027** with Los Angeles-based Wright Electric. Slovenian manufacturer **Pipistrel** has been selling Alpha Electro, a commercial electric aircraft for pilot training, since 2015.

Bye Aerospace in Englewood, Colo. **has built a two-seater electric airplane** similar to the Alpha Electro for pilot training, and it's expected to cost less than a Cessna of that size. Both Boeing and Airbus have experimented with electric propulsion. NASA is also interested in **electric aviation** and is working on its **X-57 electric airplane.**

But while most of these companies are banking on huge advances in battery or fuel cell technologies, Zunum has chosen the hybrid route. Today's batteries are still too large and heavy for an all-electric aircraft with the size and range the company wants, says **Waleed Said**, ZunumAero's CTO of Power. The Alpha Electro, for instance, has a range of about 80 miles.

Zunum's airplane design has a **"series hybrid"** powertrain: propulsion is electric, with only an electric motor powering the drivetrain, but the engine extends the battery's range by generating power for the motor. Most hybrid electric cars, by contrast, use parallel hybrid or series-parallel hybrid powertrains.

The airplane will use a 1 megawatt battery. Said says the company is currently testing batteries used in hybrid trucks and ships, but is not wedded to a specific battery technology. "We're trying to be battery independent and are designing the airplane to accept the most efficient, safest, and lightest battery available in 2022," he says.

Zunum's engineers are now focused on making the aircraft super-efficient. That means including the obvious features such as lightweight parts, a composite airframe, and a sleek shape. But the engineers are also devising ways to use waste heat from the engine to heat the cabin or de-icing systems, and using the motor's wind-milling action to recharge the battery during periods of slow flight or on a descent (akin to regenerative braking in cars).

Zunum will begin flight tests by 2019. By 2030, the company plans to develop 50-seater airplanes with a 1,000 mile range.



**Photo-illustration: Zunum Aero**

# FLOATING WIND TURBINES ON THE HIGH SEAS COULD PRODUCE MASSIVE AMOUNTS OF POWER

The world's first offshore wind farm employing floating turbines is **taking shape 25 kilometers off the Scottish coast** and expected to begin operating by the end of this year. New research by atmospheric scientists at the Carnegie Institution for Science in Stanford, Calif. suggests that the ultimate destination for such floating wind farms could be hundreds of kilometers out in the open ocean. The simulations, published today in the *Proceedings of the National Academy of Sciences*, show that winds over the open ocean have far greater staying power than those over land.



Wind power generation is obviously contingent on how fast and how often winds blow. But only over the past decade have scientists and wind farm developers recognized that the winds measured prior to erecting turbines may not endure. For one thing, dense arrays of wind turbines act as a drag on the wind, depleting local or even regional wind resources.

It is now generally accepted that drag from wind turbines in the boundary layer (where the atmosphere interacts with Earth's surface) limits the kinetic energy that large land-based wind farms can extract to about 1.5 megawatts per square kilometer (MW/km<sup>2</sup>). "If your average turbine extracts 2-6 MW, you really need to space those turbines 2-3 kilometers apart because the atmosphere just doesn't give you more kinetic energy to extract," says Carnegie postdoctoral researcher **Anna Possner**.

What Possner and climate scientist **Ken Caldeira** reveal today is that the atmosphere is more generous out in the open ocean. There, they estimate, wind farms could be packed more tightly, because energy should flow down from above the boundary layer to quickly restore winds depleted by wind turbine rotors. In some regions, such as the North Atlantic, the simulations suggest that large wind farms can extract 6 MW/km<sup>2</sup> or more.

Possner and Caldeira credit this kinetic energy recharge to cyclonic weather systems that abound over the oceans in the mid-latitudes, forming as the seas release heat into the atmosphere. Such weather can wreak havoc when they reach hurricane scale and come ashore—as **Hurricane Maria has done to Puerto Rico and its power grid**.

But for open ocean wind farms, those cyclonic storms should be a boon, promoting the mixing of kinetic energy between the boundary layer and the more powerful trade winds sailing over it.

When wind farms suck the energy out of the boundary layer, explains Possner, they are quickly recharged from above. "Your wind speed can regenerate a lot quicker... because the kinetic energy is replenished faster from above. You have a far greater resource to tap into," she says.

In side-by-side simulations, the researchers packed wind turbines into large wind-rich regions in Kansas and over regions of equal size in the North Atlantic. For a massive wind farm stretching over 70,000 km<sup>2</sup> in



wind-rich Kansas, turbines could extract 0.3 to 0.4 terawatts (TW)—roughly the power consumption of the 4.4 million km<sup>2</sup> -wide European Union—for four months of the year.

The turbines packed into a 70,000-km<sup>2</sup> stretch of the North Atlantic, meanwhile, extracted that much power or more from September through June. Utilize 3 million km<sup>2</sup> of open ocean and they project the turbines would meet current annual global energy demand—18 terawatts. And summer-peaking solar farms could cover any gaps, notes Possner.

In other words, there is reason to be optimistic that wind power can provide a very large share of **future 100 percent renewable power systems**. That is, assuming floating wind technology can be made cost-effective. As Possner puts it: “This is really a big picture theoretical study. If we can utilize this is a wholly different question.”

The closest one can find to an answer is the 30-MW floating wind park [see photo above] that Norwegian oil and gas giant Statoil is expected to start up within a few weeks in Scotland’s Buchan Deep, offshore from Peterhead. Statoil’s quintet of turbines are held aloft in the 95-129-meters-deep waters by **the company’s Hywind spar buoys**, which employ technology adapted from offshore drilling platforms.

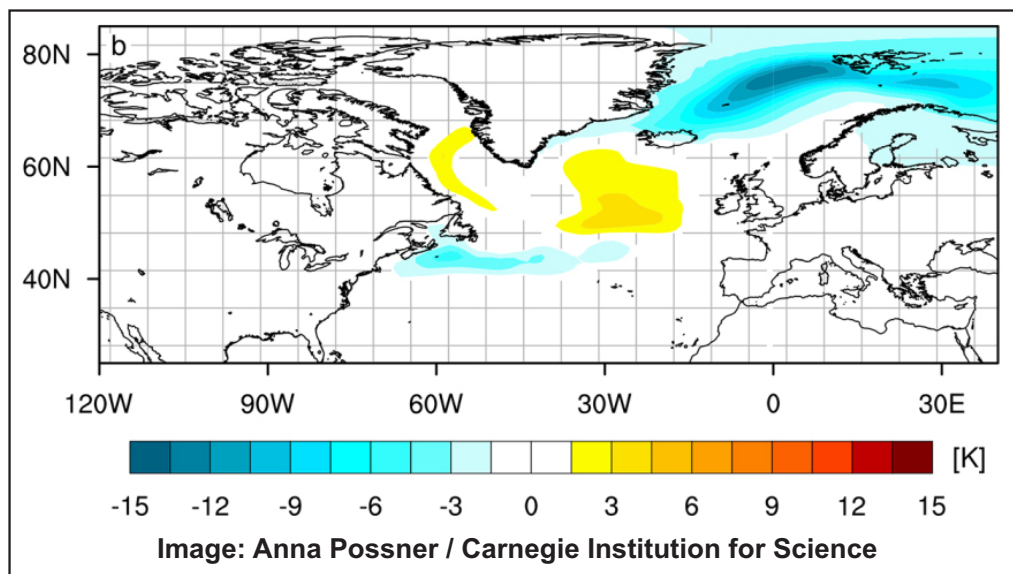
Statoil’s installation may be puny compared to the 15 gigawatts of offshore wind capacity installed on fixed foundations in relatively shallow water. But the energy giant claims that it is 60 to 70 percent cheaper than the technology used on its initial pilot in 2009 and says a further cost reduction of 40 to 50 percent is “**realistic for future projects**”.

And some commercial-scale applications for floating turbines are already under consideration, such as the **100-turbine array proposed for 24 kilometers out from California’s Morro Bay** in 2015.

Options to bring energy ashore from open ocean wind farms, meanwhile, could include onsite hydrogen generation, notes Barthelmie. That notion was first proposed in the 1960s by **University of Massachusetts wind power pioneer William Heronemus**, who envisioned flotillas of turbine-equipped ships or buoys that would produce electrolytic hydrogen from seawater for shipment to shore.

A massive North Atlantic wind farm generating nearly all of Europe’s power could also chill the Arctic

If open ocean wind farms prove feasible, another set of questions raised by today’s report will beg for answers. One is whether giant wind farms in the North Atlantic will weaken output from onshore wind farms in Europe. Another is what climatic surprises massive ocean arrays might deliver.



## EXCELLENT TIPS BY WARREN BUFFET

**On Earning:** “Never depend on single income. Make investment to create a second source”.

**On Spending:** “If you buy things you do not need, soon you will have to sell things you need”.

**On Savings:** “Do not save what is left after spending, but spend what is left after saving”.

**On Taking Risk:** “Never test the depth of river with both feet”.

**On Investment:** “Do not put all eggs in one basket.”

**On Experience:** “Honesty is very expensive gift. Do not expect it from cheap people”.

# SOLAR ENERGY'S DUCK CURVE

Intermittent renewable generating technologies (i.e. wind and solar) are causing havoc with electric grid operations because these technologies cannot be controlled by the operators of the electricity grid due to the fact that their generation depends on the wind blowing and the sun shining. Thus, the independent system operator in charge of running the grid must be ready to either drive down the generation of traditional technologies (i.e. natural gas and coal) when intermittent renewable generating capacity starts producing power or ramp up generation from more reliable technologies when intermittent renewable generating capacity shuts down. This means that the independent system operator needs an arsenal of flexible generating technologies to come to the rescue in order for electric consumers to receive electricity at the touch of a switch as they have been accustomed to.

Some countries, such as Germany, have built such a great deal of intermittent renewable generating capacity that their traditional generating technologies are not bringing in enough revenue to survive, which means either consumers will need to make adjustments regarding how they use electricity or government regulators will need to make adjustments regarding how electricity is priced to pay for the flexibility needed. Regardless, electric customers should expect changes in the future—either in price or in availability of electricity—or both—to deal with the increased advent of intermittent renewable generation.

IER has discussed this issue with respect to wind power whose construction largely preceded solar power due to its lower cost. But, now system operators are preparing for the advent of increased solar power and its potential havoc on the grid, including solar on residential rooftops and businesses.

## **Description of California's 'Duck Curve'**

The California Independent System Operator (ISO) has developed a 'duck curve' to describe how massive amounts of customer-sited photovoltaic systems could cause problems to the state's supply-demand balance on its electricity grid. It provides a scenario of a sunny day where distributed photovoltaic generation pulls down non-solar electricity demand to extremely low levels at midday when the sun is at its hottest and distributed photovoltaic generation is at a high. That is, the state's non-solar generating capacities must reduce their production to inefficient lows when the energy supply at the "belly" of the duck from solar distributed generation is at its highest. (See graph below.)

Later in the day when solar generation is declining and California residents are coming home from work and turning on their appliances, electricity demand ramps up dramatically, which requires flexible generation capacity to come on-line very quickly to meet it. The California ISO is worried that the "neck" of the duck curve could overwhelm the state's available generating capacity.

More specifically, the figure shows a net load curve for the March 31 for years 2012 through 2020. This curve shows the megawatts the system operator must follow on the y axis over the different hours of the day shown on the x axis. There are several distinct ramp periods. A ramp in the downward direction occurs after the sun comes up around 7:00 a.m. when on-line conventional generation is replaced by solar generation (producing the belly of the duck). As the sun sets starting around 4:00 p.m., and solar generation ends, the system operator must dispatch resources that can meet the most significant daily ramp (the arch of the duck's neck). Immediately following this steep 13,000 megawatt ramp up, as demand on the system decreases into the evening hours, the system operator must reduce or shut down generation to meet the downward ramp.

California has more than 170,000 distributed solar systems connected to the grid. Photovoltaic plants of 1 megawatt or larger are monitored and metered by the system operator; the smaller systems, which comprise nearly 90 percent of connected distributed generation capacity in California, are not. At the end of 2012, customer solar photovoltaic capacity totaled 1,785 megawatts. California has a project that is simulating the output every half hour from these photovoltaic systems so the system operator can manage its hour-by-hour power supply-demand balance.

## **Hawaii Is Already Confronting Its 'Duck Curve'**

California is not the only state that is facing the solar 'duck curve'. Hawaii's isolated and solar photovoltaic-rich grid is already seeing some days when non-solar demand drops below zero because of the amount of solar power being put onto the grid, which the state's utilities and regulators have called the "Nessie curve" after the Loch Ness monster.

The chart below represents typical circuits on Hawaii's island of Oahu, where incentives have resulted in a huge increase in distributed solar photovoltaic energy. Ten percent of the island's customers have rooftop photovoltaic panels, totaling 29,558 systems with a nameplate generating capacity of 221 megawatts. At mid-day, rooftop solar photovoltaic energy supply exceeds the energy demand on those circuits, then a steep upward curve results as the solar energy declines and late afternoon demand increases.

Hawaii has had to manage large penetrations of customer-owned generation, which is outside the control of

the electric utility company and puts a burden on its electric grid operators. To deal with the issue, the Hawaiian electric utility company, HECO, has adopted additional interconnection requirements for its systems including small-scale rooftop solar photovoltaic systems. The utility is planning to deploy smart meters, which would provide more data to help guide day-to-day grid management decisions and is investing in weather forecasting systems and distributed energy analysis and management technology. It is also installing grid-scale battery systems, incorporating demand response, and taking other steps to manage the solar challenge.

### Opposition and Solutions to the "Duck Curve"

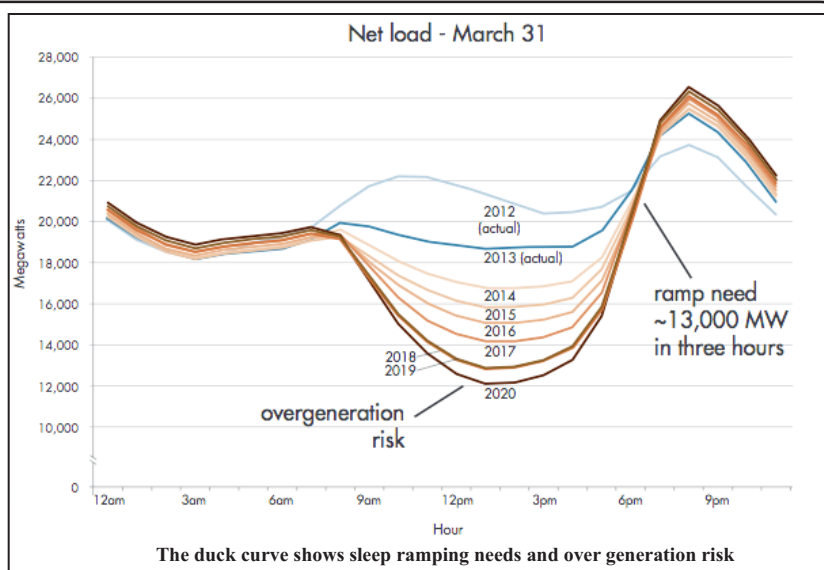
Opponents of seeing the duck curve as a problem indicate that it assumes a worst case situation. It assumes that consumers do not adjust to prices and incentives. It does not take into account time-of-use pricing that is being rolled out in California, the energy efficiency to come from new building codes and programs, or the potential for demand response to automatically adjust household or commercial building energy use to meet the needs of the grid.

But, system operators must look at worst case scenarios to ensure proper operation of the grid 24 hours a day- 7 days a week- to provide electric customers the reliability that they are accustomed to. Various strategies are being analyzed to deal with the situation, but they would require significant changes to the way utilities and consumers interact. For example, demand reduction and load control programs which are typically triggered only during the hottest peak summer days would need to be used during the late afternoon/early evening "ramp" times represented by the duck curve. Another strategy orients solar panels from south to west, where they would capture more late afternoon sunlight, but forego producing greater overall electric generation.

Since the federal investment tax credit is scheduled to drop from 30 percent to 10 percent at the end of 2016, a solar boom is expected in the next 2 years. With larger amounts of solar energy comes a larger problem of over generation. Some believe that curtailment of renewable generation may be necessary to manage the over generation issue. The worry is that if banks and investors think that system operators would curtail output severely, they may no longer want to take the risk of financing these projects.

### Conclusion

The advent of financial and mandated incentives for increased renewable energy has brought with it unexpected grid-related problems as intermittent renewable generation has increased to more measurable levels. California's mandate of 33 percent of retail electricity from renewable energy by 2020 and Hawaii's mandate of 40 percent of electricity generated from renewable sources by 2030 along with federal and state financial incentives have pushed the levels of these more expensive renewable sources where they are raising havoc with electric grid operations. The independent system operators are working on the issue so that consumers can still expect to have electricity on demand. But, it may mean changes to the way consumers use electricity or how much they pay for it to have the flexibility and reliability that they have historically enjoyed.





# THE INTERNET OF THINGS IN THE POWER SECTOR

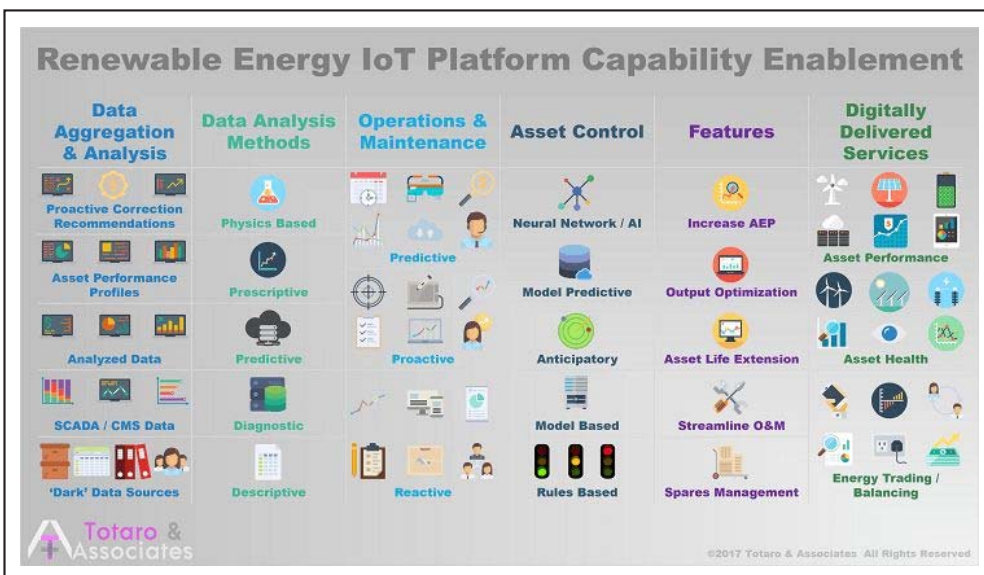
The Internet of Things (IoT) has the potential to significantly transform the industrial sector. The McKinsey Global Institute predicts that the total potential economic impact of IoT will be in the range of \$3.9 trillion to \$11.1 trillion per year in 2025.

On the top end, this would amount to 11% of the world economy. General Electric (GE) predicts that \$1.3 trillion of value can be captured in the electricity value chain from 2016 to 2025 globally by IoT.2

In its simplest form, IoT has three components: digitization of assets, collection of data about the assets and computational algorithms to control the system formed by the interconnected assets. Although there is a lot of hype around IoT, the power sector has been the beneficiary of two recognizable early consumer-oriented applications of IoT: smart meters and smart thermostats.

In its initial incarnation, smart meters were internet-connected devices to send electricity consumption data to the utility. In newer incarnations, a variety of add-on services have been created, for instance customer services like energy management portal, net metering, prepaid purchase of electricity, and data analytics based services for utilities like outage location, pilferage identification, management of distribution voltage to reduce losses, and others. After the installation of advanced metering infrastructure (AMI), the city of Burbank, California reported 1%–2% reduction in usage per customer, 87% reduction in field visits to customers, 15 minutes or less response time as opposed to hours or days to metering-related customer requests, and improvement to reliability of grid with drop in System.

Average Interruption Frequency Index (SAIFI) from 0.34 to 0.24, and System Average Interruption Duration Index (SAIDI) from 27.8 minutes to 9.5 minutes. Smart thermostats are internet-connected devices that measure temperature and/or humidity inside a home or office and send the data to the cloud. An automated algorithm or an authorized user on a smart phone can change the temperature setting of the thermostat. A variety of machine-learning applications have been developed to balance energy-saving and user-customized comfort. Nest, a leading manufacturer of smart thermostats has reported a drop in electricity bill of 10%–12% for heating and about 15% for cooling. For Extending this concept to large commercial buildings, according to a study conducted by Gartner, an integrated building management system that manages cooling, heating, and lighting can help reduce energy consumption by 50%.



In Asia, several pilots of smart meters, smart buildings, and smart cities are ongoing. Smart meters have the potential to significantly improve customer service and reduce cost through easier payments and better outage management; improve energy access by enabling new business models for providing electricity in off-grid applications. Smart thermostats and smart meters in conjunction with other IoT solutions have the potential to spur a variety of smart buildings and smart city applications.

### **The Internet of Things in the Power Sector**

More recently, IoT solutions are entering the domain of industrial operations. In the power sector, the most popular application in this category is condition monitoring and predictive maintenance of a wide variety of assets. The IoT-based approach transitions from traditional reactive and periodic maintenance strategies to proactive strategies. The applications are focused on the highest value assets in generation plants, and in the transmission and distribution grid. In this application of IoT, assets are continuously monitored with sensors, the collected data is sent to the cloud where a variety of machine learning and artificial intelligence algorithms are used to predict the health and impending failure of the assets, and determine the optimal time to perform maintenance.

In Asia, many grids are plagued with unreliable service. This is primarily because of aging equipment; poor maintenance; and in many cases, the struggle to upgrade power systems to keep up with very high annual demand growth rates. Investment in IoT for both existing and new equipment has the potential to significantly reduce unscheduled downtime by identifying problems before they occur, thereby improving reliability and reducing costs. According to the Asian Development Bank (ADB) publication Energy Outlook 2013, Asia and the Pacific will require a cumulative investment of about \$11.7 trillion in the energy sector to meet business as usual (BAU) energy demand from 2010 to 2035. Demand side investments (additional to BAU case) of \$ 7.3 trillion will be required to deploy advanced energy efficient technologies for transport, residential, commercial, and industrial sectors. Other applications of IoT are optimal use of generation assets to increase the efficiency of production.

In conventional power plants, IoT would be used to tune the operation of a power plant in real time and to balance production with life cycle cost of maintenance and life of equipment. As an example, GE has launched digital power plant systems for gas and coal plants. GE claims its digital technologies when applied to new coal and gas fired power plants can increase fuel efficiency by 3%, power output by 2%, and reduce unplanned downtime by 5%, operation and maintenance costs by 25%, and fuel consumption during starts by 20%.

In Asia, these strategies may be used to reduce cost of electricity production and emissions.

Another good example of IoT use for optimization of operations is in the wind power industry where

- i. Wake losses are reduced in a wind farm by adjusting pitch and yaw angles of individual turbines,
- ii. Turbines production is increased above rated value in a controlled manner as long as the stress and fatigue loading are within acceptable limit, and
- iii. Settings of individual turbines are optimized to local conditions to increase output. GE claims a 5% to 10% increase in annual energy production with these strategies.

A futuristic application of IoT is a holistic optimization of the entire power network with the goal of decentralization and defossilization of the power sector. IoT has the potential to achieve such a transformation in which

- i. Renewable energy is generated close to load centers;
- ii. Energy storage devices are used to store excess energy and deliver energy during periods of high demand;
- iii. Demand response is used to balance supply and demand
- iv. Flexible centralized fossil fuel-based power plants plan production based on real-time predictions of variable renewable generators; and
- v. Dispatch logic and controllers are used to manage the flow of power. Several of these transformations are being tested in a number of pilots in island grids in Asia with the goal of achieving close to 100% renewable energy in the power sector and IoT will be a key enabler.

There are several challenges to the adoption of IoT in Asia and the Pacific. The following list summarizes the challenges and the way forward:

- i. Financial constraints. A large amount of investment would be required to modernize the energy infrastructure in Asia and the Pacific to achieve the benefits of IoT. It should be noted that this investment is much less

than the larger infrastructure investment. IoT investment should be done alongside new infrastructure investments. For existing equipment, the balance sheet of many utilities may not be healthy for market based financing of IoT projects, therefore it may be impossible to structure results-based or outcome based vendor or commercial financing for the IoT projects. ADB has worked with and invested in state owned utilities since its founding. It is therefore in a unique position, using results-based lending, sovereign lending and other financial vehicles, to enable the IoT transformation, thereby assisting the utilities toward achieving higher reliability, efficiency, and customer satisfaction.

- ii. Policy impediments. The power subsidy policy in many countries in Asia and the Pacific disincentivizes market-based investment in energy infrastructure. In addition, there is political pressure to keep electricity rates low and employ large numbers of people. These are not conducive to increasing efficiency through IoT driven automation. ADB-funded development interventions such as technical assistance programmes and loans may be a vehicle for these countries to develop an IoT transformation road map that is based on best practices and lessons learned from similar initiatives (e.g., telecommunications, online banking, online retailing, and others).
- iii. Capacity limitations. Strong information and communication technology and analytics skills would be required to fully realize the benefits of IoT, and these skills may not be readily available in these countries. Furthermore, strong capability would be required to implement business transformation of the magnitude required by IoT projects to gain higher efficiencies and reliability, and overall lower cost. Given these requirements, an IoT road map should have capacity building and knowledge transfer as one of the focus areas so that skills development is an essential part of the transformation.

## INDIA BARS STATES FROM INDEPENDENTLY EXITING, MODIFYING SOLAR PROJECTS

**India has barred state authorities from unilaterally cancelling or modifying solar power purchase agreements (PPAs) after six state governments in last two months pushed developers to lower tariffs, threatening to derail projects worth \$7.5 billion.**

Narendra Modi's government aims to raise solar power generation capacity nearly 30 times to 100 gigawatts (GW) by 2022. The capacity has already more than tripled in three years to more than 12 GW.

The government said it will impose a minimum penalty of 50 percent of the tariff if the purchase agreement is arbitrarily scrapped by the state or the developer, an official notification said late last week. "New solar norms will ensure equitable distribution of risk and reward between states and power generators," said Ratul Puri, chairman of Hindustan Power projects that operates in five states, including top power consuming state Uttar Pradesh. "It should ensure that some of the challenges at state level do not take place in the future," Puri told Reuters.

Over the last four months, debt-laden power distribution companies in Gujarat, Andhra Pradesh, Uttar Pradesh, Tamil Nadu, Karnataka and Jharkhand were pushing developers to renegotiate signed or previously agreed upon PPAs, risking closure of 7 GW of solar projects, a report from ratings agency CRISIL noted.

The Indian Banks' Association (IBA) this month called for intervention from the energy ministry, saying a cancellation or revision of tariffs could cause bad loans to pile up in the power sector due to the financial stress on developers.

Indian states and developers had clashed in May after the solar tariff for the 500 MW Bhadla solar power park in the western state of Rajasthan slumped to a record low of 2.44 rupees a unit for 200 MW. However, the southern state of Andhra Pradesh, which accounts for the highest number of solar projects in the country, is not looking to sign new PPAs in the near term, the top official in the state government told Reuters.

"We are honouring all the signed solar PPAs at the tariff rate they were auctioned," Ajay Jain said, adding, there was over capacity in the state.





# TELANGANA TO LAUNCH ELECTRIC VEHICLE POLICY NEXT MONTH

The Telangana government will next month launch its policy for electric vehicles to provide incentives to manufacturers and private players setting up charging stations. **JayeshRanjan**, Principal Secretary, Industry, Commerce and Information Technology, said the policy will offer incentives for setting up charging stations and enable creation of infrastructure like allotment of lands.

The policy will also provide necessary regulatory framework for the sector. The government will amend certain laws so that the power can be drawn from power stations for charging facilities, he told reporters on the sidelines of an event where Mahindra Electric and Zoomcar announced launch of shared mobility in Hyderabad.

Zoomcar has deployed 20 Mahindra e20Plus on its platform for hire. Ranjan said the EV policy was almost ready and they were waiting for feedback from the Transport and Municipal Administration Departments on the proposals. "Once we get their feedback, the policy draft will be sent to Chief Secretary and later to the Chief Minister for approval," he said.

He said they already consulted industry and experts on the EV policy. The state government also hopes to attract EV manufacturers. The EV market is currently small but once it starts growing, Mahindra will ramp up the production at its facility in Zaheerabad in Telangana, he said. Ranjan said he feels that electric vehicles could also play a key role in ensuring last mile connectivity for commuters of Hyderabad Metro, which is set to be launched next week.

Hyderabad Metro Rail (HMR) has already tied-up with Uber and Ola to ensure last mile connectivity to and from metro stations. The commuters will have multiple options including electric cycles and pedal cycles from the stations to reach their destinations.



# ENERGY, ELECTRICAL ENERGY AND RENEWABLE ENERGY – 3

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

As illustrated earlier, the role and contribution of Electrical Energy is assuming more and more importance and the sources preferred more and more, World over, for Sustainable Electrical Energy, are Renewable Sources which are of **FIRM and INFIRM Nature**, and current researches and work revolve around '**Intelligent Grid Systems**' to make best use of all the sources and supplies and to best meet the end user demands.

In the Indian context at present, for stepping up the Renewable Energy portion of the 'Energy Basket, there are lot of Focus and activities pertaining to '**Solar**' and '**Wind**' Energy sources and both are of '**INFIRM**' nature. **Bio Energy** is another important source of Renewable Energy and is of '**FIRM**' in nature. India has a huge potential for Bio Energy and the Government is also planning a "**Bio Energy Mission**", similar to the Solar Mission that is currently on with all the Government support and incentives. Bio Energy can help provision of Energy in all the forms of Electricity, Fuel and Heat for utilization, but the most important of all is Electricity Generation with application of appropriate technologies about which we will see more in later parts. The important fact to note is that Electrical Energy from Biomass can be cost effective, Firm and sustainable.

## **Waste to Energy and Bio Energy**

Waste to Energy is the most powerful concept which helps in both directions of Waste Disposal (or reduction or conversion to more useful form) and Energy Generation. Bio Energy very largely and mostly revolve around this concept and utilization of all kinds of wastes from Agriculture, Plantations, Animals and Poultry, Agro Industrial and other industrial wastes for Energy Generation. Even in case of Solar Energy, it will be more sensible to adopt this concept through more and more of '**Roof Top Solar**' Plants instead of utilizing Lands for erecting Solar Farms. The lands chosen could be barren now, but could become cultivable when water is made available, like it happened even in Rajasthan Deserts with Indira Gandhi Canals. The interesting point is that when Solar Energy is put to use for Agriculture or Plantations, it can help provide 13 times more Energy in different forms.

## **Biomass & Bioenergy Sources**

All Materials Bio – Organic in Nature can be called Biomass – All Wastes to Energy will be the Core Idea Sources

<b>Plants Derived</b>	<b>Animal Derived</b>	<b>Others</b>
Agriculture – Field and Process Based – Straw, Husk.....	Cattle, Poultry other Animals – Dung, Litter..... - Gaseous,	Agro Industrial Wastes of all kinds from Sugar, Paddy, Sago, Foods..... Solids and Liquids
Plantations wastes of all kinds – Coconut, Palmyrah.....		Municipal Wastes – Liquids and Solids - Biofuel, Biogas ...
Aquamarine – Emerging, Floating and Submerged		

Let us see one example of abundant crop wastes which can be converted to Electricity at cheap cost with **adequate planning and appropriate technology, the Technology aspect being most important.**

We are all aware of the recent and serious Pollution Problems in Delhi and surrounding areas dislocating the daily life completely for a considerable period. The main reason attributed for the problem is the Crop Burning in the neighboring states of Haryana and Punjab and let us see the News Item in detail to understand the seriousness of the problem and the opportunity available for Electricity Generation.

## **Crop Burning: Punjab and Haryana's killer fields**

Polash Mukerjee

Wednesday 12 October 2016

Punjab produces about 19-20 million tonnes of paddy straw and about 85-90 per cent of this paddy straw is burnt in the field



**Paddy straw needs to be utilised as biomass pellet fuel that can be commercially sold as the main fuel for an industrial boiler.** (Credit: Vikas Choudhary)

Burning of agricultural biomass residue, or Crop Residue Burning (CRB) has been identified as a major health hazard. In addition to causing exposure to extremely high levels of Particulate Matter concentration to people in the immediate vicinity, **it is also a major regional source of pollution, contributing between 12 and 60 per cent of PM concentrations** as per various source apportionment studies. In addition, it causes loss of vital components such as nitrogen, phosphorus, sulphur and potassium from the topsoil layer, making the land less fertile and unviable for agriculture in the long run.

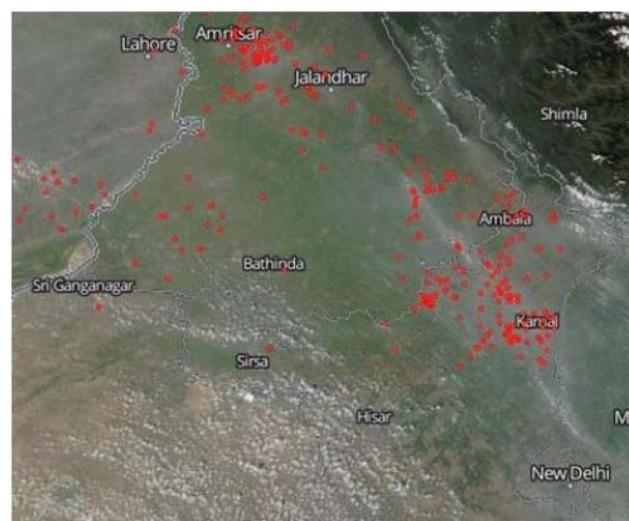
### Causes and Scale

The main causes of crop residue burning are two-fold. Firstly, there is a very short window of time between harvesting of paddy and cultivation of wheat, at the end of the Kharif season. Paddy, or rice, is a water-intensive crop. The high usage of water in its cultivation has resulted in the central and various state governments restricting the cultivation of paddy in the summer months. In order to prevent diversion of scarce water resources in the summer, paddy cultivation can legally begin only around mid-June, when the monsoons typically arrive over North India. This further delays the cut short to the root with a knife, the large units of harvesters leave 6-10 cm of paddy stalk on the field. The rise in incomes and the subsequent availability of mechanical implements in Punjab and Haryana lead to increased mechanisation of agriculture over the past 10-15 years.

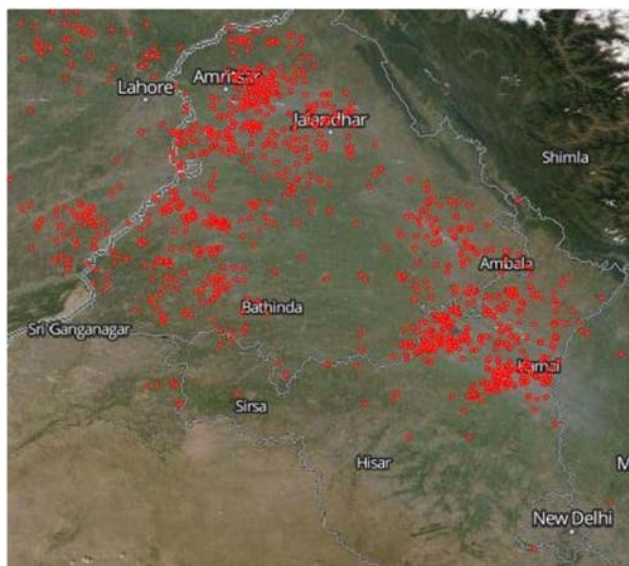
Traditionally, farm labour in these states was in the form of seasonal, migrant workers from the states of Uttar Pradesh and Bihar. Since 2005, the demand for these workers saw a reduction, and accordingly, the availability of assured income from farm labour has declined. The launch of an assured rural income scheme in the form of the NREGA further led to income opportunities in their home states. As a result, agricultural labour has become a scarce commodity in parts of Punjab and Haryana.

**The removal of the paddy stalk that remains on the field is a labour-intensive process.** With labour being unavailable and the time window for preparing the field for wheat cultivation being limited, the options that the farmer has are either investing in expensive and rarely used agricultural implements, or burning the residue right on the field. Of the two, the latter is both cheaper and requires less effort.

As per estimates, Punjab produces approximately 19-20 million tonnes of paddy straw and about 20 million tonnes of wheat straw. **About 85-90 per cent of this paddy straw is burnt in the field**, and increasingly,



NASA imagery depicting fires on agricultural lands in Punjab and Haryana on October 7, 2016



NASA image depicting fires on agricultural lands in Punjab and Haryana, on October 11, 2016



wheat straw is also being burnt during the Rabi harvesting season. In Haryana, the problem of paddy straw burning also exists, although the scale is smaller than in Punjab. Paddy straw production is estimated at 2 million tonnes.

The kharif harvesting season begins in October. These images depict the scale of fires in Punjab and Haryana, over the past few days. Each dot represents acres of farmland on fire, easily detectable by remote sensing technology. The fires began in the first week of October and have visibly intensified since October 10.

### Progress made so far

In terms of efforts being made to reduce crop residue burning, the following approaches have been used by various state and central administrations and regulatory bodies so far:

1. **Banning Crop Residue Burning:** Crop residue burning was notified as an offence under the Air Act of 1981, the Code of Criminal Procedure, 1973 and various appropriate Acts. In addition, a **penalty is being imposed on any offending farmer**. Village and block-level administrative officials are being used for enforcement.
2. **Detection and prevention:** A combination of remote sensing technology—use of satellite imagery—and a team comprising local officials—Sub-Divisional Magistrates, Tehsildars, Block Development Officers, *Patwaris* and village-level workers—is being used to detect occurrences of crop residue burning in real-time and to prevent them from taking place.
3. **Establishment of a marketplace for crop residue burning:** Efforts are being made to increase the avenues for the alternate usage of paddy straw and other crop residue. For instance, paddy straw has a considerable calorific value, making it suitable for use as a fuel in biomass-based power plants. Similarly, it can be utilised for the preparation of bio-fuels, organic fertilisers and in paper and cardboard making industries. The strategy, broadly, is to assign a real economic and commercial value to the agricultural residue and making burning it an economic loss to the farmer.
4. **Outreach and public awareness campaigns:** There are ongoing efforts to highlight the health effects of crop residue burning. It produces extremely high levels of toxic particulates, which affect the health of the people in the direct vicinity of the burning. In addition, efforts are also being made through *kissan* camps, trainings and workshops, apart from campaigns through various print media, televised shows and radio jingles, in informing farmers about the alternative usage of crop residue.
5. **Subsidy on agri-implements:** The state governments, in collaboration with the Centre, has rolled out schemes for providing subsidy on mechanical implements that help tillage of soil, so that the crop residue can be retained in the soil, adding to its fertility, or alternately, collection of crop residue for putting it to commercial usage. However, the high cost of these implements means that in spite of subsidies, only a small number of farmers have access to these implements at the moment.
6. **Crop Diversification:** There are various ongoing, long-term efforts at diversification of cropping techniques, such that crop residue burning can be effectively prevented. This is being attempted through cultivation of alternate crops (apart from rice/paddy and wheat) that produce less crop residue and have greater gap periods between cropping cycles.

### Measures required going forward

Stronger monitoring and enforcement mechanism through the use of remote sensing technology—use of real-time satellite imagery, along with village-level enforcement teams with the aim of zero incidence rate of crop residue burning, through prevention and penalisation.

**Establishment of a larger number of biomass-based power projects utilising greater amounts of paddy straw is needed.** Currently, operational and planned projects in Punjab cumulatively utilise just 0.94 million tonnes of paddy straw against estimated 19-20 million tonnes of



production. Punjab will have to expedite the construction of plants in progress and plan new one. Haryana has no operational biomass-based power projects presently. It will have to develop a policy programme around biomass-based power plants. The Central Electricity Regulatory Commission (CERC), under the Ministry of Power, has already notified favourable tariffs to biomass-based power plants, in order to incentivise establishment of higher numbers of such plants. In Punjab, this tariff has been determined at Rs 8.17 per unit, and is even higher than competing sources of renewable energy, such as solar energy or wind-based power projects.

**Effective and greater scope of subsidy provision**, so that agricultural implements can be made widely available. The extraction of paddy straw or any other crop residue from the field is an essential step for its utilisation in power plants, or in any other usage. Currently, this cannot be done manually, owing to supply-sided deficiency in the labour market. The alternative is a provision of subsidy of agri-implements, with the aim of reducing CRB. Punjab has a proposal to provide subsidy on 67,750 units of agricultural implements, and Haryana has notified a scheme in May to subsidise 1810 units of agricultural implements. This is not sufficient, considering the production of 19-20 million and 2 million tonnes of paddy straw, respectively. One way forward is to promote the co-ownership model. There are more than 1700 existing cooperative and privately-run Agricultural Machinery Service Centers (AMSC), which can be the focus of such subsidies. It is important that the farmer understands the value of the crop residue and wants to use these implements for extraction and packaging.

**Creation of a market for paddy straw**, along with a mechanism for commercial procurement of paddy straw for use in biomass-based power projects, as fuel in brick kilns and in production of ethanol. Establishment of bio-refineries for utilisation of paddy straw is another viable option. Punjab has projects in various stages of planning utilising 1.5 million tonnes of paddy straw. There's need to expedite operational status and plan more projects.

**Utilisation of paddy straw in the form of biomass pellet fuel**, which can be commercially sold as the main fuel for an industrial boiler, as a replacement for coal. Micro-pelletisation establishments need to be incentivised and local usage promoted. Alternate usage of paddy straw to produce paper, card boards, packing materials needs to be promoted, as an alternative to synthetic compounds.

### **Expert recommends**

According to Sunita Narain, director general of Centre for Science and Environment, "Farmers should be paid Rs 1,000 per acre under the Rashtriya Krishi Vikas Yojana so they can shun the practice of burning paddy straw. They should be given subsidies for buying Rotavator machines that help cut and mix agricultural stubble with soil. We need to understand why the farmers burn stubble and then deal with the basic problem."

### **A problem that recurs every year**

Each year, crop burning in the region is the start of the annual escalation of pollutant concentrations in the air, leading to massive winter pollution in the region. It is exacerbated by the massive usage of firecrackers in the region, around Diwali, at the end of October. Followed by this, the weather patterns change, making temperatures drop and reducing the dispersion effect of pollutants. Burning of biomass (leaves, and other organic waste) and garbage through thousands of small fires lit for warmth, along with massive MSW landfill site fires only add to making the air full of toxic pollutants and unfit for breathing.

**20 Million Tons of Crop wastes can help sustain about 2000 MW of Power Generation (24x7 and for 300 days), which can be planned as a number of decentralized plants , say 100 nos of 20 MW Plants. It is apt to repeat what is said earlier that "adequate planning and appropriate technology, the Technology aspect being most important."**



(To be continued)  
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***Men cannot not live by exchanging articles, but producing them. They live by work not trade  
- JOHN RUSKIN (1819-1900) English art critic.***



**SUDHIR HASIJA**  
Karbonn Mobiles



*"I understand the psyche of Indian population such as value for money and attraction towards innovation", Sudhir Hasija*

In an international study, our India has become top four wealth creators in the world. This is, to a great extent, due to Indian entrepreneurship and Indian entrepreneurs. Sudhir Hasija is the chairman of the Rs. 1200 crore homegrown

handset maker Karbonn Mobiles. His story will tell you how a person with few means can get into wholesaling and then into manufacturing.

57 years old Sudhir is the son of a government clerk. He felt his home in Meerut, Uttar Pradesh, after clearing his class 10 exams. He then moved to Hyderabad where he spent three years in a machine tools company and saved around Rs. 3,000. He used this money to set up a business selling TV accessories such as antennas and trolleys in Chennai. It was a difficult struggle. He would climb to the rooftops of buildings bare footed in the scorching heat to install antennas. He used to wash at railway stations and stay in low-cost lodges. However he persisted and managed to build a thriving business that he expanded across other southern cities. In 1996, when the pager and mobile phone revolution first started in Karnataka, Hasija bagged a contract to become the telecom hardware distributor for Alcatel-Lucent, soon he ended up as a distributor for Nokia, and then Samsung.

Then 4 years back when many Indian companies started to make their own handsets to tap the country's booming mobile handset market, Hasija too jumped in.

He gave up Samsung in 2009 to start his own mobile phone brand Karbonn. As he puts it, 'I thought of building my own home, rather than living in a rented house. I had enough experience to take the risk and my children had also grown up.' Today it has achieved a market share of 4.5%. He and other Indian handsets makers are "hungry" to go to Africa, Brazil and South East Asia.

**Well this is one of our India's believe it or not story from Meerut to all over the world selling over six lakh phones every month! Yes, around 75 lakh per year.**

## KINDNESS

A 10 – year- old boy entered a coffee shop and sat at a table. A waitress put a glass of water in front of him.

"Miss, how much is an ice cream sundae?" he asked.

**"50 Cents"** replied the waitress.

The little boy pulled his hand out of his pocket and studied the coins in it.

"Okay then, how much is a plain cup of ice cream?" he inquired.

By now, more people were waiting for a table and the waitress was growing impatient.

**"35 Cents"** she brusquely replied.

The little boy again counted his coins "I'll have the plain ice cream please," he said.

The waitress brought the ice cream, put the bill on the table, and walked away.

The boy finished the ice cream, paid the cashier and left.

Later, the waitress came back to clean that table and something caught her attention.

She stood there speechless as her eyes started tearing up.

There, placed neatly beside the empty cup were three 5-cent coins. **Her tip!**

The boy gave up his sundae to secure enough coin to give her a tip, **even though he has every reason not to.**

*You don't have to be rich to be generous to people. Be kind, whenever possible.*

**Throw kindness around like confetti!**

***If necessity is the mother of invention, scientifically developed production is the mother of scientific research. – ARTHUR EDWIN KENNELLY***



**சாகசப் பயணம் செய்ய விரும்பினால் செம்பரா மலைக்குதான் செல்லவேண்டும்.** கேரள மாநிலத்தில் வயநாடு மாவட்டத்தில் இருக்கிறது இந்த மலை. கடல் மட்டத்திலிருந்து 2,100 மீட்டர் உயரத்தில் உள்ள இந்தச் செம்பரா மலை, வயநாடு மாவட்டத்திலேயே மிக உயரமான மலை உச்சியாகக் கருதப்படுகிறது.



மலை உச்சியிலிருந்து பார்க்கும்போது பசுமை நிறைந்த வயநாடு மலைகளும் நீலகிரி மலைகளும் கண்களுக்கு விருந்தாக இருக்கின்றன! மலை அடிவாரத்தில் தேயிலைத் தோட்டங்களும் மலையின் வலப் பக்கத்தில் பசுமையான பள்ளத்தாக்கும் உள்ளன. கல்பேட்டா நகரத்திலிருந்து 8 கி.மீ தொலைவில் உள்ளது இந்தச் செம்பரா மலை. காடுகளுக்குள்ளும் மிகப் பெரிய பாறைகளைக் கடந்தும் செல்லவேண்டும்.

செம்பரா மலை உச்சியில் அடைவதற்கு 3 மணி நேரம் ஆகும். மலை ஏறுவதற்கு அருகில் உள்ள மேப்படி நகரில் உள்ள வனத்துறையிடம் அனுமதி பெற்று, நுழைவுச் சீட்டு வாங்க வேண்டும். காலை 7 மணி முதல் மதியம் 2 மணிவரை நுழைவுச் சீட்டு வழங்கப்படுகிறது. மலையேற்றத்துக்கு வழிகாட்டிகள் இருக்கின்றனர். அவர்களுடைய உதவி இல்லாமல் செம்பரா மலை ஏறுவது சற்றுச் சிரமமாக இருக்கும்.

மலை ஏறுவதை மூன்று பிரிவாகப் பிரிக்கலாம். நுழைவுச் சீட்டு வாங்கிய இடத்திலிருந்து சுமார் 2 கி.மீ. சமவெளியில் தேயிலைத் தோட்டங்கள் வழியே பயணிக்க வேண்டும். இது கொஞ்சம் எளிதான வழி. அடுத்து காய்ந்த இலைகள், கிளைகளுக்கிடையே சற்றுச் சாய்வாக உள்ள மலைப் பகுதியில் ஏற வேண்டும். வழக்குப் பாறைகளும் மாவு போன்ற மண்ணும் இருப்பதால் மிகவும் கவனமாக ஏற வேண்டும். கால்களை அழுத்தமாக நிலத்தில் பதித்தும். அருகில் இருக்கும் செடிகளின் கிளைகளைப் பிடித்துக் கொண்டும் செல்ல வேண்டும்.

அடுத்த கட்டத்தில் உயர்ந்த மரங்களுடன் கூடிய வனப்பிரதேசம். இங்கு மலை செங்குத்தாக இருப்பதால் ஏறுவது மிகவும் சிரமமாக இருக்கும். இங்கும் பாறைகள் வழக்கும் விதத்திலேயே உள்ளன. மேலே செல்லச் செல்ல பசுமை போர்வை போர்த்திய இடங்கள் கண்களைக் கவர்கின்றன. பெரிய பாறைகளைத் தாண்டிச் சென்றால் **‘இதய’** வடிவில் ஓர் அழகான ஏரி இருக்கிறது. இதை **‘இதயத் தடாகம்’** என்று அழைக்கிறார்கள். பச்சை மலைக்கு நடுவில் நீல வண்ண ஏரியைப் பார்ப்பதற்காகவே சுற்றுலாப் பயணிகள் குவிகின்றனர்.

ஏரிக்கு மேல் ஏறுவதற்கு வனத்துறை அனுமதிப்பதில்லை. வனவிலங்குகளின் அபாயம் இருப்பதால் முகாம் அமைத்து தங்குவதற்கும் அனுமதிப்பதில்லை. சுற்றிப் பார்த்து விட்டு, இரண்டரை மணி நேரத்தில் கீழே இறங்கிவிடலாம்.

கேரளா சுற்றுலாத்துறை சாலைகளோ, படிக்கட்டுகளோ அமைக்காமல் இயற்கையை அப்படியே பாதுகாக்கிறது. மலை ஏற்றம் சிரமமாக இருந்தாலும் சாகச அனுபவத்தைத் தருகிறது. இந்த மலையில் அபூர்வமான மரங்களும் விலங்குகளும் காணப்படுகின்றன.

இங்கு பிளாஸ்டிக் பொருட்களுக்குத் தடை விதிக்கப்பட்டிருக்கிறது. வனத்துறையும் சுற்றுலாத்துறையும் மிக நன்றாக மலையைப் பராமரிக்கின்றனர். செப்டம்பர் மாதத்திலிருந்து மார்ச் மாதம்வரை இங்கு மலை ஏறுவதற்கு தகுந்த காலம். மழைக் காலங்களில் ஏற முடியாது.

**மலை ஏறுவோம்! சாகசம் செய்வோம்!!**

தொடர்புக்கு: ஆம்பூர் மங்கையர்க்கரசி,  
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Courtesy: தி இந்து, தேதி: 22.11.2017

## கேரட்டிலும் பப்பாளியிலும் மட்டும்தான் வைட்டமின் “ஏ” உள்ளதா?

### கண்பார்வைக்கு அவசியத் தேவையான வைட்டமின்

கண்பார்வைக்கு அவசியமான வைட்டமின் எது என்று கேட்டால் குழந்தை கூட வைட்டமின் “ஏ” என்று சொல்லிவிடும். மங்கலான வெளிச்சத்தில் படிக்கவும் நம் கண்கள் திறன் பெற அவசியம் வைட்டமின் “ஏ” கண் உலர்ந்து நீரின்றி போவதும் அதனால் பல நாடுகளில் பல இலட்சக் கணக்கானோர் பார்வை இழப்பதும் வைட்டமின் “ஏ” பற்றாக்குறையால் மட்டுமே.

#### மற்ற பயன்கள்

இது கண்பார்வைக்கு மட்டுமின்றி மூப்படைவதைத் தடுக்கும் வைட்டமினாகவும் கருதப்படுகின்றது. நோய் எதிர்ப்பு சக்தி மற்றும் புற்று நோயைத் தடுக்கும் Canti – ageing ஆற்றல் கொண்டதாகவும் ஆய்வு முடிவுகள் கூறுகின்றன. இது தொடர்பான ஆய்வுக் கட்டுரைகளை இணையத்தில் நம்பகமான பல வலைத்தளங்களில் காணலாம். மேலும் பற்கள் மற்றும் எலும்புகளின் ஆரோக்கியத்துக்கும் இது அவசியம் தேவை.

**நமக்குப் புகட்டப்பட்ட மேலை நாட்டுத் தகவல்கள்**  
எந்த உணவில் வைட்டமின் “ஏ” உள்ளது என்று குழந்தைகளிடம் கேட்டால் கூட நமக்குக் கிடைக்கும் முதல் பதில் கேரட் என்பதே . அந்த அளவுக்கு நமக்கு மிகப் பழமையான சில விஷயங்கள் மனப்பாடம் ஆகும் அளவுக்கு பத்திரிக்கைகளாலும். மற்ற ஊடகங்களாலும் புகட்டப்படுகின்றன. பள்ளிக்கூட சார்ட்டுகளிலும் சுவர்களில் எழுதப்பட்ட ஒவியங்களிலும் கூட கேரட்டுகளும் ஆப்பிள்களும் முக்கிய இடம்பிடிக்கின்றன. மேலை நாடுகளில் முருங்கைக் கீரை இல்லை, மாம்பழம் இல்லை, கறிவேப்பிலை இல்லை, கொத்துமல்லி இல்லை, அகத்திக்கீரை இல்லை, தண்டுக்கீரை இல்லை, முளைக்கீரை இல்லை, பொன்னாங்கண்ணிக் கீரை இல்லை, வெற்றிலை இல்லை எனவே அவர்களுக்கு கேரட் மிகவும் முக்கியம். ஆனால். நமக்கு?

#### கட்டுரையின் நோக்கம்

கேரட்டில் வைட்டமின் “ஏ” இருக்கின்றது என்பதில் எந்த ஐயமும் வேண்டாம். கேரட் சாப்பிடுவது உடலுக்கு நன்மையைக் கொடுக்கும் என்பதிலும் எந்த சந்தேகமும் இல்லை. ஆனால், கேரட்டைவிடவும் அதிக வைட்டமின் “ஏ” வைக் கொண்டு, அதே நேரம் விலை மலிவாக, உள்ளூரிலேயே கிடைக்கும் பல கீரைகளை விட்டு விட்டு ஏன் கேரட்டுக்கு ஆலாய்ப் பறக்க வேண்டும் என்று உணர்த்தவே இக்கட்டுரை எழுதப்படுகின்றது. ஆச்சரியம் என்னவென்றால், கேரட்டில் மட்டுமே

வைட்டமின் “ஏ” கொட்டிக் கிடக்கின்றது என்று நினைத்து டாக்டர்கள் கூட அதைப் பரிந்துரைப்பதுதான்.

வ. எண்	வகையினர்	தேவைப்படும் பீட்டா கரோட்டின் (மைக்ரோ கிராம்கள்)
1.	குழந்தைகள் (1 வயது வரை)	1200
2.	சிறுவர்கள், சிறுமிகள் - 6 வயது வரை	1600
3.	மற்றவர்கள் (சாதாரண வேலை, கடின வேலை செய்பவர்கள், பெண்கள். கர்ப்பிணிகள் அனைவருக்கும்)	2400
4.	பால் கொடுக்கும் தாய்மார்கள்	3800

#### தற்போதைய நிலைமை

இதிலுள்ள அட்டவணையில் உள்ள தகவல்கள் இந்திய அரசின் ICMR நூல்களில் இருந்து தொகுக்கப்பட்டவை. இந்திய உணவுகளில் ஆய்வு செய்யப்பட்ட பின் இத்தகவல்கள் வெளியிடப்பட்டு குறைந்தது பத்து ஆண்டுகளுக்கு மேல் ஆகியிருக்கும். ஆயினும் மக்களோடு அன்றாடத் தொடர்பில் உள்ள நமது மருத்துவர்கள் பலரை இத்தகவல்கள் இன்னமும் சென்று சேரவில்லை என்பதே உண்மை.

#### தினமும் எவ்வளவு வைட்டமின் “ஏ” உடலுக்குத் தேவை?

வைட்டமின் “ஏ” வைப் பொருத்த வரை ரெட்டினால் என்ற வடிவிலும் β - பீட்டா கரோட்டின் என்ற வடிவிலும் நமக்கு உணவுப் பொருள்களில் கிடைக்கின்றது. உட்கொள்ளும்போது β – பீட்டா கரோட்டின் உடலுக்குத் தகுந்தவாறு வைட்டமின் “ஏ” வாக மாற்றம் பெறுகின்றது. கீரைகளில் கரோட்டின் வடிவ வைட்டமின் மட்டுமே கிடைக்கின்றது.

#### உடல் கிரகிக்கும் திறன்

பொதுவாக கீரைகள் மற்றும் காய்கறிகளில் (செல்லுலோஸ் உள்ளதால்) உள்ள சத்துக்களை நம்முடைய உடல் கிரகிப்பது குறைவாகும். ஆனால்,

அசைவ உணவுகளில் உள்ள சத்துக்களை நம் உடல் சுலபமாக கிரகித்துவிடும். இதனால் உணவில் அடங்கியுள்ள சத்துக்களின் படி கணக்கிட்டாலும் இந்த கிரகிப்புத் திறனையும் கணக்கிட்டு **தினமும் 2400 மைக்ரோ கிராம் அளவுக்கு பீட்டா கரோட்டின் தேவை என்று கூறுகின்றார்கள்.**

இது இந்தியர்களுக்கான பரிந்துரைக் கப்பட்ட அளவாகும். சிறுவர்கள் குறைவாக சாப்பிடலாம். இது அதிகபட்ச அளவு ஆகும். ரெட்டினால் வடிவில் இருந்தால் 600 மைக்ரோ கிராம் போதும்.

**ஒரு துண்டு மாம்பழம் அல்லது ஒரு கரண்டி கீரைப் பொரியல்**

இங்கு தரப்பட்டுள்ள அட்டவணையை பார்த்தால் தெரியும். 200 கிராம் கேரட்டை சாப்பிடும்போது கிடைக்கும் கரோட்டின். ஒரு துண்டு மாம்பழத்திலும், கைப்பிடி அளவு (சமைக்காத கீரையின் அளவில்) அகத்தி அல்லது முருங்கைக் கீரையிலும் கிடைத்துவிடும்.

**பத்து முட்டைகள்!**

அதே போல் “ஏ” வுக்காக முட்டையை சாப்பிட வேண்டும் என்றால் நாம் 600 கிராம் முட்டை சாப்பிட வேண்டும். ஒரு முட்டை 60 கிராம்கள் வரை இருக்கும். அப்படியென்றால் தினமும் பத்து முட்டைகள் சாப்பிடவேண்டும்!

**எந்தப் பழம் சாப்பிடலாம்?**

இந்த அட்டவணையில் இடம் பெற்றுள்ள இரண்டு முக்கியப் பழங்கள் ஆரஞ்சு மற்றும் மாம்பழம் மட்டுமே. ஒரு பெரிய துண்டு மாம்பழம் அல்லது இரண்டு முழு ஆரஞ்சுப் பழங்களை உட்கொண்டால் நம் தினசரித் தேவைக்கான β கரோட்டின் கிடைத்துவிடும். எவற்றில் வைட்டமின் “ஏ” (பீட்டா கரோட்டின்) இல்லவே இல்லை? வைட்டமின் “ஏ” அறவே இல்லாத உணவுப் பொருள்கள்: ஆப்பிள், மாதுளை, திராட்சை, தேங்காய், பலவகை மீன்கள், பீட்ரூட், மரவள்ளி. ஆயினும் விலங்குகளின் ஈரல் பகுதி வைட்டமின் “ஏ” சேமித்து வைக்கும் பகுதி என்பதால், அப்பகுதி வைட்டமின் “ஏ” செறிந்து காணப்படும் பகுதியாக விளங்குகின்றது.

**மகாராஜா**

கீரைகளில் எல்லாமே β பீட்டா – கரோட்டின் இருந்த போதிலும் **ராஜகீரை (செங்கீரை)** எனப்படும் *Amaranthus paniculatus* மிக அதிக அளவில் இச்சத்தினைக் கொண்டுள்ளது. ஆயினும் இக்கீரை கிடைக்கவில்லை என்று மெனக்கெட வேண்டாம். கறிவேப்பிலை, கொத்துமல்லி சட்னி சேர்ப்பதாலும் நாம் உணவில் இச்சத்தினைக் கூட்டிவிடலாம். கொஞ்சம் அதிகம் சாப்பிட வேண்டும் அவ்வளவே. இதை செங்கீரை என்றும் சில இடங்களில் குறிப்பிடுகின்றனர். கேரளாவில் இது அதிகம் பயிரிடப்படுகின்றது. உட்கொள்ளப்படுகின்றது.

**பரிந்துரை**

வாரத்துக்கு ஐந்து நாட்களாவது நாம் கீரைகளை உண்ண வேண்டும். கீரை செய்யாத நாட்களில் சிற்றுண்டிக்கு கறிவேப்பிலை அல்லது கொத்துமல்லி சட்னி செய்து கீரை இல்லாத குறையை சரிக்கட்டலாம். கோடையில் மாம்பழத்தைக் கண்டிப்பாக சேர்த்துக் கொள்ளவேண்டும். வேறு பழங்கள் என்றால் ஆரஞ்சும் நல்லதே.

கூடவே உங்கள் சர்க்கரை அளவைக் கருத்தில் கொள்ளுங்கள். கீரை உணவு என்றால் சர்க்கரை அதிகரிக்கும் என்ற பயமில்லை. சர்க்கரை அதிகரிக்கும் என்ற பயமில்லை. சர்க்கரை நோய் இல்லாதவர்கள் மாம்பழத்தைக் கவலையின்றி சாப்பிடலாம். வளரும் குழந்தைகள் மாம்பழத்தைக் கண்டிப்பாகச் சாப்பிட வேண்டும். நோய் உள்ளவர்களும் மருத்துவர் அனுமதித்தால் சிறிதளவு சாப்பிடலாம்.

**வைட்டமின் A செறிந்துள்ள உணவுகள்**

உணவு பொருள் (தினசரித் தேவை 2400 மைக்ரோ கிராம்கள்)	பீட்டா β கரோட்டின் (மைக்ரோ கிராம்) நூறு கிராம் உணவுப் பொருளில் உள்ள கரோட்டின் அளவு
ஆரஞ்சுப் பழம்	1104
புதினா	1620
கேரட்	1890
பொன்னாங்கண்ணி கீரை	1926
பருப்புக் கீரை	2292
வெந்தயக்கீரை	2340
மாம்பழம்	2743
முளைக் கீரை	3564
நூக்கல் கீரை	4146
அகத்தி	5400
தண்டுக்கீரை இலைகள்	5520
பசலைக் கீரை	5580
முள்ளங்கிக் கீரை	5742
வெற்றிலை	5760
முருங்கைக் கீரை	6780
கொத்துமல்லி	6918
கறிவேப்பிலை	7560
ராஜகீரை	14190

*Courtesy: Pesod, November 2017*

**கீரை வகைகளை உண்போம்! கண் நலம் காப்போம்!**



மாரடைப்புத் தடுக்கும் கர்ப்பிணிகளுக்கும் உதவும்  
கறுப்பு கொண்டைக்கடலை

கொண்டைக்கடலையில் இரண்டு வகைகள் உண்டு. ஒன்று வெள்ளை கொண்டைக்கடலை, மற்றொன்று நமக்கெல்லாம் நன்கு தெரிந்த கறுப்புக் கொண்டைக்கடலை. இது அளவில் சற்றுச் சிறியது. உறுதியானது. பொதுவாகச் சுண்டலாகவும் குழம்பில் சேர்க்கப்படும் சாப்பிடப்படும் இது, நாடு முழுவதும் முக்கிய இடம்பிடித்திருக்கிறது.



கறுப்புக் கொண்டைக்கடலை உள்நாட்டு வகையாகத் தற்போது கருதப்பட்டாலும், தென்கிழக்கு துருக்கியில் இருந்து வந்ததுதான். வெள்ளை கொண்டைக்கடலை இந்தியாவுக்கு வரும் முன்னரே, கறுப்பான கொண்டைக்கடலை நம் மண்ணைத் தொட்டுவிட்டது. இப்போது இந்தியா, பாகிஸ்தான், வங்கதேசத்தில் பெருமளவு விளைவிக் கப் படுகிறது. இந்தியாவில் அதிகமாகப் பயன்படுத்தப்படும் அதேநேரம், உலகம் முழுவதும் அறியப்பட்ட ஒன்று.

பழுப்பும் கறுப்பும் கலந்த நிறத்தில் சிறியதாக இருந்தாலும், புரதம் நிரம்பியது. அதன் எல்லா வளர்ச்சி நிலைகளிலும் உண்ணப்படுகிறது. கறுப்புக் கொண்டைக்கடலையின் காய் பச்சையாக இருக்கும்போதே வேக வைக்கப்பட்டுச் சாலடினும், வடஇந்தியச் சாட் நொறுவைகளிலும் சேர்க்கப்படுகிறது. முதிர்ந்த கறுப்புக் கொண்டைக்கடலையை ஊற வைத்த பின்னரே பயன்படுத்த வேண்டும்.

**பயன்பாடு**

சுண்டல் என்றாலே, பொதுவாகக் கறுப்புக் கொண்டைக்கடலை சுண்டல்தான். உறுதியாகவும் இனிப்பு சுவை இல்லாமலும் இருப்பதால் உப்பு சேர்த்தோ, வேக வைத்தோ, வறுக்கப்பட்டோ சாப்பிடப்படுகிறது. பொரிகடலை கடைகளில் விற்கப்படும் உப்புக்கடலை, மிகவும் பிரபலமான ஒரு நொறுவை. உடைச்ச கடலை எனப்படும் பொட்டுக்கடலையும் அதற்கு இணையாகப் பிரபலமானதுதான்.

புட்டு, ஆப்பத்துக்குச் சிறப்பு சுவை சேர்க்கும் கேரளக் கடலைக்கறி, கறுப்புக் கொண்டைக்கடலை குழம்புதான். இது முளை கட்டப்பட்டுச் சாலட்களில் சேர்க்கப்படுகிறது. கெட்டி

குழம்பு. சூப்புகளில் இடம்பிடிக்கிறது. தெற்காசியாவில் பல்வேறு சுவையான உணவு வகைகளில், கறுப்புக் கொண்டைக்கடலை பயன்படுத்தப்படுகிறது. இதை வறுத்துப் பொடி செய்து, நீர் சேர்த்துக் கொதிக்க வைத்துக் காப்பியைப் போலப் பயன்படுத்தலாம்.

**ஊட்டச்சத்து**

- கறுப்பு கொண்டைக்கடலையில் :.போலி அமிலத்துக்கு அடிப்படையான போலேட்டும் மக்னீசியமும் போதுமான அளவில் உள்ளன. இது மாரடைப்பு காரணியான ஹோமோசிஸ்டீனை கட்டுக்குள் வைத்து, அந்நோய் வராமல் பாதுகாக்கும் உன்னத உணவு.
- கர்ப்பிணிகளுக்கு அவசியத் தேவையான :.போலிக் அமிலம், ஆன்டிஆக்சிடண்ட் தன்மை கொண்ட சாப்போனின் போன்ற :.பைட்டோ வேதிப்பொருட்கள் அதிகமுள்ளன.
- வெள்ளைக் கொண்டைக் கடலையைவிட இதில் நார்ச்சத்து அதிகம், சர்க்கரையை வெளியிடும் பண்பு குறைவு.
- குளுகோஸ் பயன்பாட்டை மேம்படுத்தக்கூடியது என்பதால் நீரிழிவு நோயாளிகள் இதைத் தொடர்ச்சியாகச் சாப்பிடலாம்.
- இதன் சாறு இரும்புச்சத்து நிரம்பியது. இரும்புச் சத்து குறைபாடு, ரத்தசோகையைத் தடுக்க உதவுகிறது.
- இதில் இரும்புச் சத்து, சோடியம், செலெனியம், சிறிதளவு துத்தநாதம், மாங்கனீசு, தாமிரம் போன்ற கனிமச்சத்துகள் உள்ளன.
- அளவுடன் சாப்பிட்டால் செரிமானக் கோளாறு, வயிற்றுப்போக்கு, வாந்தி, வயிற்றுமந்தம் தீர்க்க உதவும்.
- வேக வைத்த கறுப்பு கொண்டைக்கடலை ஒரு கப் 269 கலோரி சக்தியைத் தரும். அதேநேரம் இதில் இருக்கும் 15 கிராம் புரதம், ஒரு நாளைக்குத் தேவையான 2000 கலோரி உணவில் 30 சதவீதத்தை

ஆரோக்கியமான வகையில் தரக்கூடியது.

#### மருந்தாக...

- முதிராத கொண்டைக்கடலையில் சிறிது நீர் விட்டு அருந்த, சீதக்கழிச்சல் உடனடியாகக் கட்டுப்படும்.
- சிறுநீர்ப்பெருக்கி செய்கை இருப்பதால், சிறுநீர் அடைப்பை சரி செய்யும் தன்மை, கறுப்புக் கொண்டைக்கடலை சுடுநீருக்கு உண்டு.
- இளம் கொண்டைக்கடலை விதைகளுக்குக் காமம் பெருக்கும் செய்கை உண்டு.
- கொண்டைக்கடலைச் செடியின் மீது ஒரு வெள்ளைத் துணியை இட்டு, அதன் மீது படியும் பனி நீரைப் பிழிந்து சேகரிப்பது 'கடலைப் புளிப்பு' என்று அழைக்கப்படுகிறது. செரியாமை, வாந்தி போன்ற நோய்களுக்கு இந்தப் புளிப்பு நீர் மருந்தாகப் பயன்படுகிறது.

#### தெரியுமா?

கறுப்புக் கொண்டைக்கடலை உற்பத்தியில் முதலிடத்தில் இருக்கும் நாடும் இந்தியா.

வேறு பெயர்: சூரம்

தாவரவியல் பெயர்: Cicer reticulatum

ஆங்கிலப் பெயர்: Kala Channa, Black Channa, Black Chickpea

முதன்மை புரதத் தேர்வு – கடலைப் பருப்பு  
கடலைப் பருப்பு

வரலாற்றின் ஆரம்பக் காலத்திலேயே பயிரிடப்பட்ட பருப்பு வகை இது. இந்திய உணவு வகைகளில் மிகவும் பிரபலம். குறிப்பாகப் பருப்பு வடை, அடை போன்ற மொறுமொறு உணவு வகைகள், லட்டு போன்ற இனிப்புகள் செய்யப் பயன்படும் கடலை மாவு போன்றவற்றுக்கு அடிப்படை கடலைப்பருப்புதான். சுவையைக் கூட்டுவதற்காகக் கூட்டுகளிலும் இது சேர்க்கப்படுவது உண்டு.

கடலைப் பருப்பும் கொண்டைக்கடலையும் முற்றிலும் வேறு வேறானவை அல்ல, நெருங்கிய உறவு கொண்டவை. கடலைப்பருப்பு விதைகள் தோலுடன்

கறுப்பாகவும், சிறியதாகவும், சொரசொரப்பாகவும் இருக்கும். இந்தியா, பாகிஸ்தான், வங்கதேசம், ஈரான், மெக்சிகோவில் அதிகம் பயிரிடப்படுகிறது.

இளம் கொண்டைக்கடலை நெற்றுகள் முற்றுவதற்கு முன்பாகவே பறிக்கப்பட்டு, மேல்தோல் உரிக்கப்பட்டு, விதை இரண்டாக உடைக்கப்பட்டால் அதுவே கடலைப் பருப்பு. மஞ்சள் நிறத்தில், கொண்டைக்கடலையைவிட சிறியதாகவும் சற்று இனிப்பாகவும் இருக்கும். இதைக் கொஞ்ச நேரம் ஊற வைத்து வேக வைக்க வேண்டும், உடனடியாக மசியாது. இந்தியாவில் சைவ உணவு சாப்பிடுபவர்களின் புரதத்துக்கான முதன்மைத் தேர்வு கடலைப்பருப்பு தான்.

பொட்டுக் கடலையோடு நெய்யும் ஏலக்காயும் சேர்த்துச் செய்யப்படும் உருண்டை, புரதச்சத்து நிறைந்த பிரபலமான தின்பண்டம். ஏலக்காய் சேர்வதால் வாயுத் தொந்தரவு உண்டாகாது. பருப்புப் பொடிகளிலும் பொட்டுக்கடலை சேர்க்கப்படுவது உண்டு. கடலை மாவு குளியல் பொடியாகப் பயன்படுகிறது.

#### ஊட்டச்சத்து

- கடலைப்பருப்பு புரதம் நிரம்பியது என்பதால், இறைச்சிக்கு மாற்றாகக் கருதப்படுகிறது.
- கடலைப்பருப்புத் தொடர்ந்து சாப்பிட்டுவந்தால், புரதச் சத்துக் குறைபாடு நீங்கும்.
- ரத்தநாளங்களில் கொலஸ்ட்ரால் அளவை குறைக்க உதவுகிறது.
- சர்க்கரையை மெதுவாக வெளியிடுவதால், நீரிழிவு நோயாளிகளுக்குச் சிறந்ததாகக் கருதப்படுகிறது.

#### தெரியுமா?

கடலைப்பருப்பு முடி உதிர்வதைக் குறைத்து, கூந்தலைப் பராமரிக்க உதவுகிறது.

ஆங்கிலப் பெயர்: Bengal Gram (Split) / Split Black Chickpea

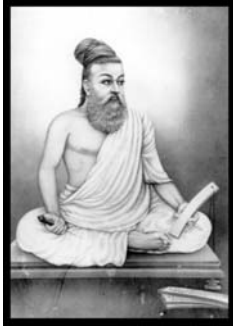
Courtesy: ஆதி வள்ளியப்பன்,  
தி இந்து, 30.07.2016

### அன்பு

- வேஷம் இல்லாத உண்மையான அன்புதான் எல்லா நோய்களுக்கும் மருந்து.
- அன்பு பொய்யானால் உலகில் அதைவிட கொடிய நோய் வேறு ஒன்றும் இல்லை.
- முரண்பாடுகளுக்கு முற்று புள்ளி வைக்கும் ஒரு மாபெரும் சக்தி அன்பு.
- மனத்தை புண்படுத்துவது அன்பு அன்று. மனத்தை உயிர்ப்பிப்பதே அன்பு.
- மனம் என்னும் பூட்டைத் திறக்கும் ஒரே சாவி அன்புதான், அன்பு இறைவன் கொடுத்த அருட்கொடை, அன்பு ஆன்மாவின் ஊட்டம்,

தெய்வீகத்தின் நுழைவு வாயில், இறைவனை காண்கிற கண்கள் அன்பு தான்.

- அன்பு விலை போவதும் இல்லை, அன்பு விலை பேசுவதும் இல்லை, அன்பு ஒரு மாபெரும் சக்தி.
- உண்மையான அன்பு அவமானப்பட்டாலும் அசிங்கப்படுத்த நினைக்காது...
- அன்பு நமக்குள் இருக்கும் அதிகாரத்தை காலி செய்கிறது, ஆணவத்தை காலி செய்கிறது, கோபத்தை காலி செய்கிறது, பொறாமையை காலி செய்கிறது.



Management and Leadership has a number of dimensions and one of the most important aspect or dimension is '**Human Resources Management**'. CMD or CEO or Managers at different levels are all leaders and have the important task of leading and managing human resources at their command to ensure successful operations. Being Neutral and impartial while dealing with them, to reward them or punish them, is considered very important and Tiruvalluvar deals with this dimension very aptly in many of Kurals. Justice and Fairness are valued high as brought out from some of the Kurals chosen below.

*Oornthukan Nodathu Iraipurinthu Yaarmaatum  
Thernthusei Vakthe Murai Kural 541*

ஓர்ந்துகண் ணோடாது இறைபுரிந்து யார்மாட்டும்  
தேர்ந்துசெய் வ.தே முறை குறள் 541

"Deliberate will and lean not to either side; be impartial and consult with the men of law; that is the way to administer Justice"

*"Velandru Venri tharuvathu Mannavan  
Kolathuuum Kodathu Enin Kural 546*

வேல்அன்று வென்றி தருவது மன்னவன்  
கோல்அதூஉம் கோடாது எனின் குறள் 546

"It is not the lance that bringeth victory unto the price; it is rather the scepter and that it is straight and leaneth not to either side"

*"Enpathaththaan Oora Muraiseyya Mannavan  
Thanpathaththaan Thaane Kedum Kural 548*

எண்பதத்தான் ஓரா முறைசெய்யா மன்னவன்  
தண்பதத்தான் தானே கெடும் குறள் 548

"Behold the prince who is not easy of access and who judgeth not causes with care; he will fall from his place and perish even when he hath no enemy"

## HOME FESTIVALS - 1

தை - Thai (Mid-January/Mid-February)



At left the Sun god, Surya, is being worshipped with the outdoor cooking of a large pot of rice from the recent harvest. The overflowing of the dish is called "**pongalo-pongalo**", and thus this festival is known as **Thai Pongal**. Other crops, like sugarcane, bananas and turmeric, are also offered. *Kolams* (hand-made rice flour patterns) are drawn in the form of the chariot, with the Sun and Moon in the centre. On this day cows and other animals are decorated and fed special foods, and their owners prostrate to them. Crows and other birds are offered food on leaves of turmeric. Sisters pray for the welfare of brothers, and elders bless the children. **Thai Pongal is celebrated by the poorest farmers and the wealthiest householders.**

**Economy is too late when you are at the bottom of your purse**

- Seneca (4 BC-65) Roman philosopher and playwright.



# TECHNICAL SEMINAR 05.08.2017 AT COURTALLAM



**Hotel Esakki High view Resort**



**Welcome Banner**



**Left to Right: Mr. J. John, Vice President, Tirunelveli, TNEIEA, Mr. MG. Ramesh Kumar – General Manager, M/s. Schneider Electrical India (Pvt) Ltd, Er. S. Gopalakrishnan, Secretary, TNEIEA; Er. S.D. Poongundran, President, TNEIEA; Er. M. Balamurugan, Treasurer, TNEIEA**



**Welcome Address by Mr. J. John, Vice President, Tirunelveli, TNEIEA**



**Speech by Er. S.D. Poongundran, President, TNEIEA**



**Brief Introduction about Schneider Electrical India (Pvt) Ltd by Mr. MG. Ramesh Kumar – General Manager**





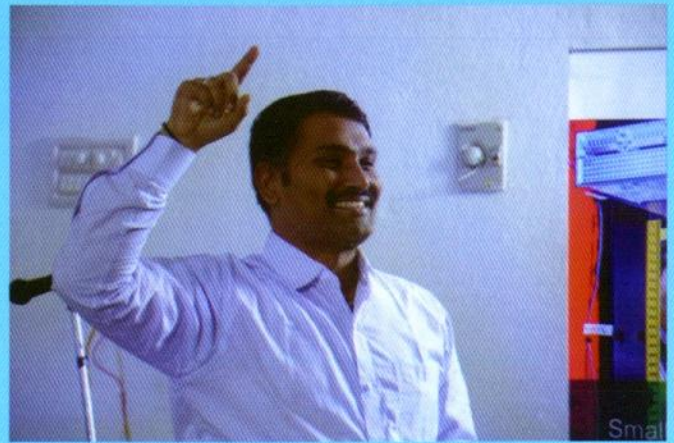
**Delegates at the Meeting**



**Brief Introduction about  
Schneider Electrical India (Pvt) Ltd by  
Mr. MG. Ramesh Kumar – General Manager**



**Presenting Technical Papers by  
Mr. R. Pradeep Kumar – General Manager,  
M/s. Schneider Electrical India (Pvt) Ltd**



**Presenting Technical Papers by  
Mr. R. Suresh Kumar - Manager,  
M/s. Schneider Electrical India (Pvt) Ltd**



**Presenting Technical Papers by  
Mr. I. John Harrison - Manager,  
M/s. Schneider Electrical India (Pvt) Ltd**



**Presenting Technical Papers by  
Mr. V. Parthasarathy – Senior Manager,  
M/s. Schneider Electrical India (Pvt) Ltd**





**Presenting Technical Papers by  
Mr. Sareesh Thiagarajan – Associate General  
Manager, M/s. Schneider Electrical India (Pvt) Ltd**



**Presenting Technical Papers by  
Mr. Suraj Subramaniam - Manager,  
M/s. Schneider Electrical India (Pvt) Ltd**



**Briefing about the "THAI JACKPOT" scheme by  
Mr. MG. Ramesh Kumar – General Manager,  
M/s. Schneider Electrical India (Pvt) Ltd**



**Mr. J. John, Vice President, Tirunelveli, TNEIEA  
honouring Mr. MG. Ramesh Kumar – General Manager,  
M/s. Schneider Electrical India (Pvt) Ltd**



**Left to Right Mr. G. Kannan, Vice President,  
Coimbatore, TNEIEA; Mr. J. John, Vice President,  
Tirunelveli, TNEIEA; Mr. MG. Ramesh Kumar –  
General Manager, M/s. Schneider Electrical India  
(Pvt) Ltd; Er. S.D. Poongundran, President, TNEIEA**



**Presenting Technical Papers by  
Mr. Durai, M/s. Elmer LED Lights**





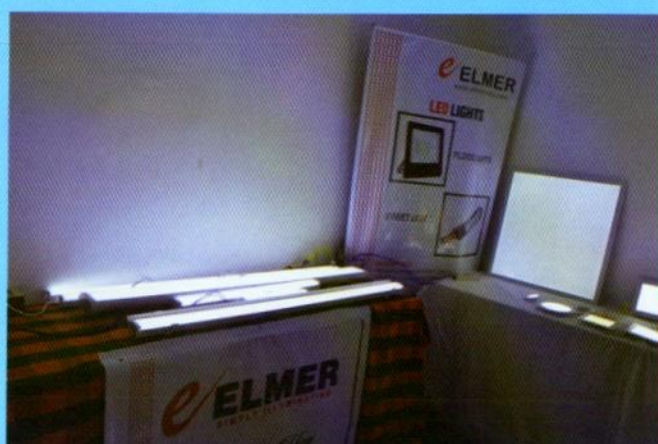
**Er. M. Balamurugan, Treasurer, TNEIEA honouring Mr. P. Duari, M/s. Elmer LED Lights**



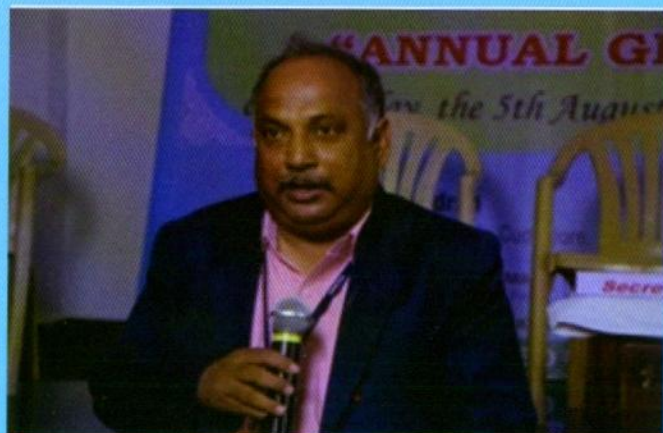
**Elmer LED Lights - Display**



**Elmer LED Lights - Display**



**Elmer LED Lights - Display**



**Vote of Thanks by Er. S. Gopalakrishnan, Secretary, TNEIEA**



**National Anthem by Members.**



# SPEL



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# SPEL

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