ELECTRICAL INSTALLATION ENGINEER

NEWS LETTER

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EDITORIAL

Dear Members, Fellow Professionals and Friends,

Seasons Greetings To One And All!

Happy Engineers Day!!

50th Engineers day is celebrated on **15th September** to commemorate the **birthday of** the legendary engineer **Sir Mokshagundam Visvesvaraya** who was an eminent Indian engineer and statesman. Due to his outstanding contribution to the society, Government of India conferred **"Bharat Ratna"** on this legend in the year 1955. This year the Engineers' Day will be celebrated all over the country and the selected theme for this year is **"Role of Engineers in a Developing India"** to mark the occasion.

We have published in this issue separately a write up on the Theme of the Engineers' Day. Engineers have a paramount role to play in Developing India as it is Engineering that plays the key role in all the developments, growth and prosperity of our country. All wealth generating and productive activities revolve around Agriculture, Industries and Services Sector and all these activities can only be supported by Energy, its availability in adequate measure and uninterruptedly. The country is therefore concerned about 'Energy Security'. Major portion of the Energy requirements are Fuel and Electricity and these are met at present very largely by Coal and Petroleum. Security concerns come to the fore because we have large dependence on imports of both Coal and Petroleum. India has another dimension of concern regarding Energy, as we rank very poorly with regard to **"Efficient Use of Energy"** among various countries of the World.

Energy and its uses are Engineers job and we have a very large role to play in Energy and Energy Efficiency. Energy requires focus as we need lots of it and more and more of it due to developments and advancements. Efficient uses of Energy in every one of the applications and everywhere can go a long way in getting our country out of the Energy Security concerns and in the process contribute to reduction of '**Carbon Foot Prints'** and **'Global Warming Dangers'**.

India is a blessed Country with adequate Rains, Sun Light and Weather Conditions which has resulted in abundance of Renewable Energy Sources, be it Solar or Wind or Biomass Energy or Hydel Energy. Engineering and Engineers can play a very contributive role to harness all these sources of energy to get out of Coal and Oil (Fossils), as much as possible, to contribute to Energy Excellence. Energy Excellence just revolves around **'Use of Energy Efficiently'** and **'Use of More and more of Renewable Sources of Energy'.**

Another important area to be focused by Engineers is Solutions for **'Equitable Distribution of Waters' all over the Country'** which needs united efforts by all Engineering fraternity in the country to make the Government accord priority attention. The top Judiciary is pushing the Government in this regard, but things, probably, are not moving forward due to lack of large involvement by Engineering Fraternity.

The World observes **"Ozone layer Preservation Day"** on the **16th of September** and it is the Engineering and Technology Contribution that can help preserve our Earth.

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

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KNOW THY POWER NETWORK - 120

You may be looking for the continuation of my article on "Electrical Accidents"? Well, here it starts. The real issue begins with the way in which we look at "human lives" i.e. the method we adopt for the earthing / grounding of the electric power systems triggers all the problems.

The adoption of "Solid Earthing System" reflects speaks / more about our attitude. We value our equipment and continuity of supply more than our own lives. We may say that by taking careful steps, we can handle electricity safely but we cannot risk our costly equipment and continuity of supply to the vagaries of power system behaviour like "Over Voltages and Short Circuits". So we have no other alternative except to go for solid earthing or other methods of power system grounding. Thus we sacrifice the human beings instead of electrical equipment at the alter of "Electricity". So we have no other way except to begin this chapter with the issues related to power system grounding in its true nature.

Power system grounding consists of four methods. 1. Equipment earthing (EHV and HV substation earthing); 2. Safety earthing (Distribution systems LV side earthing); 3. Grounding for lightning and surge protection; 4. Grounding for electrictronic equipment and other HF Devices / Equipment.

Grounding or earthing means the way in which the outer enclosure or casings of the equipment and the neutrals of the three phase systems are connected to the mass of the earth. It plays an important role in the security of the system and equipment and the safety of the generating personal and the consumer (public). The normal grounding system performs two chief functions; it ties all equipment together with low impedance conductors and connects / bonds this system to the ground electrode system and earth mats, so that the potential of the entire system is kept at the same earth potential even under fault conditions. This step helps to avoid an unsafe difference in potential between any two pieces of exposed non-current carrying metal to earth and thus the safety of the operating personal is ensured. Secondly, it provides a safe low impedance return path for ground fault current to permit the protective gears to clear the fault quickly and thus minimise the damage. In comparison, in an ungrounded three power system, continuous supply can be maintained even with a ground fault on one phase i.e. continuity of supply is ensured even with a fault. But this is performed it - one condition Viz. Presence of very high voltages on the other two healthy phases. Further, before the removal of that fault, if a second

ground occurs in any of the remaining healthy phases, there will be phase to phase fault and hence supply interruption cannot be avoided.

In the light of the above, it can be stated that in a three phase EHV and HV systems, the earthing of the neutral affords protection to the system and its costly equipment i.e. it aids the fast isolation of fault on a phase or phases and also helps to effect appreciable reduction in the higher potentials / voltages experienced on the other two healthy phases.

As regards the LV system, the neutral point earthing chiefly helps to minimize the possible electrical shocks or electrocution of human beings / animals, if a contact is made accidently with any live conductor or any faulty equipment. In addition, it offers the flexibility of feeding consumers' loads in a balanced way. The unbalanced loads can also be met with little problems to the Distribution Transformer that feeds it. *Now it is well established that the earthing cannot be avoided. It is a necessary evil*. Now the choice left open to us is the selection of earthing system and how it is going to be installed at site and also how it is going to be maintained at site. So let us deal with these aspects.

The selection and the type of earthing to certain extent depends upon

- The quantum / magnitude of the earth fault current.
- Characteristics of the equipment used.
- Voltage of the system where it is proposed to the adopted.
- The kind of risks the end users willing to take and finally
- The protection systems to be used.

Solid earthing, Resistance earthing and Reactance earthing are among the methods commonly in use. Use of peterson coil finds a place in this scheme of things. If the earth fault current is found be high enough to cause damage to generators, transformer, and other equipment, resistance or reactance grounds are preferred. This kind of installing the current limiting devices may lead to higher voltages on healthy places when an earth fault occurs in any one / two of the phases. So if we device to limit higher currents, then we have to experience higher voltage. *It goes with the adage that in life if you want to gain anything you have to sacrifice something free lunch / treatment can never be expected*. Thus grounding is an important feature of all electrical installations especially that of substations. A careful selection design and installation of earthing system is always required.

Some more points relating to the earthing of substations. The main purpose of a grounding system is to limit the potential gradient within and immediate outside of an substation area. It should always be kept at low level, so as to safeguard the lives of the operating personnel. This requirement must be met under normal and abnormal operating conditions of the power system. This grounding system helps to provide

- A uniform electric potential in all the non-carrying parts of the substation structure and apparatus as well as ensuring the operators and attendants are always working at the same electric potential.
- Achieving a low uniform, potential gradient through out the grounding system. This will reduce the chances of large potential differences between reasonable stride and reach distances. Failure to do this could result in electric shocks or injuries to the attendants when that circuit or other abnormal occurrences take place.
- Grounding for lightning and surge protection. The resistance to earth of the complete grounding connection never touches 'Zero' values and large currents when pass through this resistance may lead to higher IR values (high potentials) between the grounded apparatus and earth and it generates greater hazards. When copper earth rods of adequate current carrying capacity and size are properly placed in earth and used in these installations, it may help to reduce the high potentials. These rods immersed in the soils of uniform resistivity, the greatest potential gradient exists in the region immediately adjacent to these rods. Operating personnel in the EHV and HV substations always feel the risk of being enveloped by their higher potentials. A low resistance earthing grid or mat may be necessary to keep these potentials at a minimum.

Let us have more details on "Earthing" in the forthcoming articles.

Let me sign off here.

(To be continued...)

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50th ENGINEERS' DAY 2017

Theme: *"Role of Engineers in a Developing India"*

September 15 is celebrated every year in the country **since 1967** as **"Engineers' Day"** to commemorate the **birthday** of the legendary engineer **Sir Mokshagundam Visvesvaraya**. Sir Visvesvaraya, an eminent Indian engineer and statesman was born in a remote village of Karnataka, the State that is incidentally now the Hi-tech State of the country. Due to his outstanding contribution to the society, Government of India conferred **"Bharat Ratna"** on this legend in the year 1955. He was also called the precursor of economic planning in India. His learned discourse on economic planning in India, Planned Economy for India and Reconstructing India, was the first available document on the planning effort of the country and it is still held as the parent source matter for economic planners. A theme of national importance is chosen every year by the National Council of the Institution and deliberated at its various State/Local Centres to educate the engineering fraternity in general and the society in particular. This year the **50th Engineers' Day will be celebrated** all over the country and the National Council of the Institution has selected the theme as **"Role of Engineers in a Developing India"** to mark the occasion.

India is still a developing country and its development largely depends upon the robust industrial infrastructure. In the Indian industry scenario, Engineering is by far the largest segment. The nature of engineering industries in India is grossly diversified starting of heavy engineering, light and medium engineering and rural or cottage engineering. India's engineering industry accounts for 27% of the total factories in the industrial sector and represents 63% of the overall foreign collaborations. It has emerged as the largest contributor to the country's total merchandise exports. Indian manufacturing/engineering industry employs over 4 million skilled and semi-skilled workers (direct and indirect). The Indian engineering industry has emerged as a dynamic sector in the country's industrial economy and has made the country self reliant in key areas.

Being the largest foreign exchange earner in the country, the engineering sector gets around 63% of share through foreign collaborations. According to data from the Engineering Export Promotion Council of India, engineering exports from India grew 11.33% year-on-year to reach USD 65.23 billion in FY 2016-17. The Engineering Services market has witnessed substantial growth in recent decades, and has evolved to encompass a broad range of new product development, value-engineering and engineering consulting functions. The Engineering Process Outsourcing (EPO) market is likely to grow by USD 40 billion within 2020. The total offshore engineering spend is likely to grow to USD 125-150 billion by 2020 and India, with its talent pool and experience in engineering services, is well suited to realize 25% of this opportunity.

India has a well-developed and diversified industrial machinery/capital base capable of manufacturing the entire range of industrial machinery. The industry has also managed to successfully develop advanced manufacturing technology over the years. Among the developing countries, India is a major exporter of heavy and light engineering goods, producing a wide range of items. The bulk of capital goods required for power projects, fertilizer, cement, steel and petrochemical plants and mining equipment are made in India. The country also makes construction machinery, equipment for irrigation projects, diesel engines, tractors, transport vehicles, cotton textile and sugar mill machinery.

The nature of Indian engineering exports is also changing with time. India is fast moving from exporting low-value goods to developing countries to exporting high-value goods to developed countries. With development in associated sectors such as automotive, industrial goods and infrastructure, coupled with a well-developed technical human resources pool, engineering exports are expected to grow high and high. Capital goods now account for 26% of total engineering exports. A key driver for increased engineering exports is the trend towards shifting of global manufacturing bases to low cost countries like India. This trend is expected to boost exports of engineering goods from India over the coming years. Among developing countries, India offers the best combination of low costs, availability and skills and capabilities of manpower for the engineering sector.

In terms of availability and skills, India produces over 500 PhDs, 200,000 engineers, 300,000 non-engineering postgraduates and 2,100,000 other graduates each year, thereby ensuring a steady supply of qualified technical manpower for the sector. These huge numbers of qualified engineers are the key factor in developing the country and *The Institution of Engineers (India) feels proud to be the largest body of engineers in the country with a dedicated service for the development of the nation since 1920.*

GRANT OF EXEMPTION OF CUSTOMS & EXCISE DUTY ON THE PROCUREMENT OF MATERIAL / COMPONENTS REQUIRED FOR SETTING UP OF "GRID CONNECTED ROOF-TOP" SOLAR PV POWER PLANTS

Government of India

Ministry of New & Renewable Energy

Office Memorandum

Subject: Grant of exemption of Customs & Excise Duty on the procurement of material/ components required for setting up of "Grid connected Roof-top" Solar PV Power plants - Guidelines reg.

1. The undersigned is directed to say that the solar Power Developers setting up grid connected Solar PV projects have been approaching this ministry for grant of duty benefits to end users for installation of solar system under the notifications issued by Ministry of Finance (Dept. of Revenue). They have been emphazing the need to extend the above exemption to all the solar power plants being set up under the Grid Connected projects so as to bring down the cost of Grid projects and thereby the cost of generation.
2. The matter of extending the duty benefits to the Roof-top Grid connected Solar PV Power Plants has been under the construction in this ministry for some time past. After examination of various issues involved, it has been decided to give Customs & Exercise Duty Exemption Certificates (CCDC/EDECs), with immediate effect, to all Roof-Top Solar PV Power Plants up to a minimum capacity of 100KW as a single project or bundled project. The grid connected projects are those projects where Copy of approval / copy of application for Net metering made by end user, Grid connection feasibility by Utility, Power Purchase Agreement with Utility/Discom is considered. In this of case of Grid Connected projects the beneficiary is entitled for customs and excise benefits.
3. In case of bundled projects, as special case, Erection Procurement Commissioning (EPC)/RESCO contractor shall apply on behalf of end users/beneficiaries in separate category 'Bundling" project in the MNRE website (http//164.100.194.45/CCMS) in form of Bill of Material for approving and issue of Customs & Excise Duty Exemption Certificate (CCDC / EDEC) and withdraw material for installation of Solar PV projects on their behalf. The EPC contractor shall consume the material towards installation of Solar PV Systems at beneficiaries' locations and commission and complete the details of material withdrawn towards project EPC shall be given further certificates once he completes 80% of capacity. The EPC contractor shall give undertaking to MNRE in the format attached wherein he assures that the Self – Declaration, Customs Affidavits and Exercise Affidavit for each beneficiary / end user shall be submitted to the MNRE against the commissioned project after installation of the projects.
4. In case, the beneficiary or organisation has received capital subsidy for setting up a Roof-Top Solar PV Power Plant, they will furnish copy of the approval letter sanctioning subsidy for each plant.
5. In case, the beneficiary or organisation who are not receiving any capital subsidy for setting up a Roof – top Solar PV Power Plant, EPC contractor shall provide Bank Guaranty of amount equivalent to exemption value.
6. The details of the procedure to be followed for approving Bundling category of cases is as follows:
   a. The Execution and Procurement Contractor (EPC Contractor) / RESCO operator who intends to bundle the proposals to cumulative capacity of minimum 100 KW shall register in MNRE system in bundling category.
   b. Users name and password shall be forwarded from the system to EPC Contractor.
   c. The total bill of material for execution of bundled Solar PV projects shall be submitted by the EPC along with the documents as mentioned in check list (through online process) (Annex I)
   d. The EPC Contractor/ RESCO operator shall give undertaking in the prescribed Performa (Annex III).
   e. The BOM shall be forwarded to Chartered Engineer for verification.
   f. Ministry shall scrutinize the application & subsequently approve the BOM.

g. The EPC contractor shall make partial withdrawal up to 50 % of sanctioned capacity from approved BOM.

h. The EPC shall install systems at locations mentioned.

i. EPC contractor shall enter the details of beneficiary of each SPV System installed in the MNRE Portal in the (Annex II) and submit along with self –declaration /Customs Declaration of each beneficiary on line with digital signature /Aadhar verification.

j. EPC shall enter details of systems of at least 80% of material procured and then apply for further release.

k. Generate certificate for subsequent partial withdrawal.

l. After completion of projects , Reconciliation report & completion report shall be submitted by EPC contractor within 3 months.

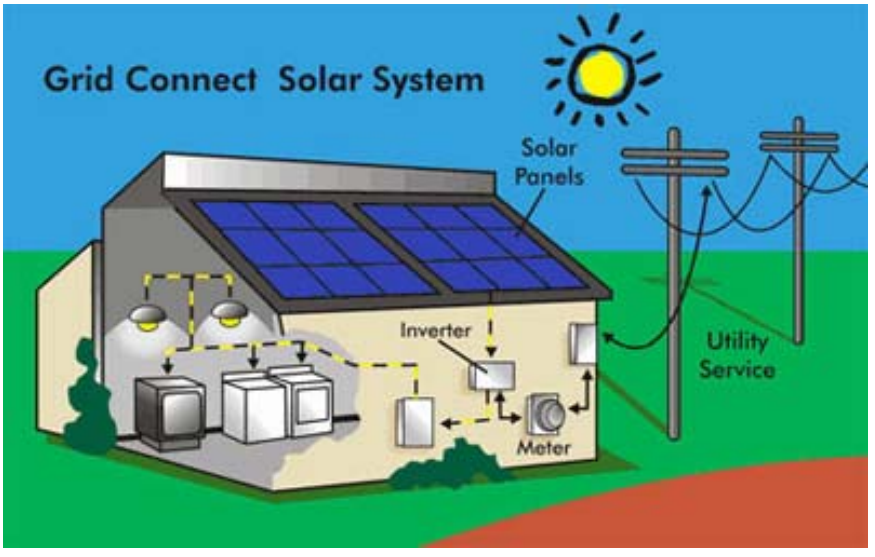
m. Further, no BOM for new projects shall be approved for EPC contractor if reconciliation report for old projects.

7. As regards the date of applicability, this simplified procedure shall be effective from the date of issue of this O.M.

8. This issues with the approval of the Competent Authority.

Signatory Authority,
(Anand Narvane)
Scientist E, 11 April 2017

GRID-CONNECTED ROOFTOP SOLAR PROJECT INAUGURATED IN ODISHA



According to reports, Chief Minister Naveen Patnaik today launched the grid-connected rooftop solar project through net-metering system.

"I hope establishing rooftop solar systems through net-metering will be well accepted by the people. I wish the initiative all success," Patnaik said. Patnaik also launched the web portal of the rooftop solar programme: www.rtsodisha.gov.in. Under the programme, consumers can install solar plants on their rooftops and consume the generated solar power during the day time. Excess power can be sold to the grid through service cables, said the secretary to science and technology department VirVikaramYadav.

The additional solar power generated could be exported through net-meter, a special type of meter which will be provided by the respective distribution companies. The difference between buying from the grid and selling to it will be billed to the consumer.Consumers can reduce their consumption of electricity by using solar power and simultaneously get a reduced bill on account of selling solar power to the grid, he said.

The investment on a rooftop solar system is about Rs 70,000 per kw. The state government will provide 30 percent subsidy to the consumers.

Officials said Odisha envisages renewable energy capacity addition of 2750 mega watt by 2022 and a major part of this capacity addition target has been assigned to solar power with a share of 2200 MW.

Roof top potential in Odisha has been estimated at 5000 MW. For the current year, a target of 8 MW has been fixed of which 4 MW has been exclusively assigned to Bhubaneswar, they said.

GOVERNMENT EASES ENVIRONMENTAL CLEARANCE RULES FOR SOLAR POWER PROJECTS, PARKS

In move that would bring relief to solar power developers, the Union environment ministry has said that provisions of the Environmental Impact Assessment (EIA) notification, 2006, which mandate environmental clearance for various projects, will not apply to solar PV (photovoltaic) power projects, solar thermal power projects and solar parks.

The ministry has, however, clarified that the disposal of PV cells will be covered under the provisions of Hazardous and Other Waste (Management and Trans-Boundary Movement) Rules, 2016. It also said that the development of solar parks will be covered under the Water (Prevention and Control of Pollution) Act, 1974 and Air (Prevention and Control of Pollution) Act, 1981.

The ministry's clarification came in an office order after it received several references seeking information on the applicability of the EIA notification 2006 to solar PV power projects, solar thermal power projects and solar parks.

The environment ministry noted that these solar projects would have to follow basic environmental safeguards. For example, they would have to ensure that the project area does not involve any agricultural land, wetlands and bio-diversity rich areas with a large habitation and ecologically sensitive areas.

It further said that if the project involves any displacement of habitation, a proper resettlement and rehabilitation plan should be in place. It said if the project area involves forest land, then forest clearance is needed and a site should conform to coastal regulation norms if it falls in such an area.

The ministry said the project proponent will need to take prior permission for the usage of water at the project site.

It also stipulated that the land made available for solar projects would not be diverted to any other purpose and no change of land use whatsoever would be permitted without proper clearances.

India has an ambitious target of producing 100,000 mega-watt (MW) of solar power by 2022 and as on 30 June, the total installed renewable power capacity across India was 58,303.35MW. Of this, 13,114.85MW is solar power.

The clarification from the ministry would comfort project developers as the environment clearance process is generally considered to be a time-consuming one.

Experts are, however cautious about government's push towards solar parks.

"Easing norms for solar projects like solar parks should be welcomed cautiously. One has to remember that lot of power is wasted in energy transmission. Need of the hour is to focus on solar rooftop which is a neglected area," said Rakesh Kamal, a consultant with The Climate Reality Project, an independent organisation working on climate change related issues.

Courtesy: Live Mint

Engineering is achieving function while avoiding failure. - Henry Petroski

INDIAN BUILDERS PLEDGE "GREEN" HOMES IN RACE TO MEET CLIMATE GOALS

India's top builders have pledged to make at least a fifth of their new housing developments sustainable by 2022, as the country looks to tap sectors other than renewable energy to meet its ambitious climate goals.

The campaign is led by the Sustainable Housing Leadership Consortium (SHLC) comprising builders Godrej Properties, Mahindra Lifespaces, ShapoorjiPallonji, Tata Housing and VBHC Value Homes. It is backed by the Ministry of Housing.

Builders will use mainly local and recycled material, and design homes that conserve water and electricity and make best use of natural light and wind patterns, while also pursuing more energy-efficient methods of construction.

"The construction industry has one of the biggest carbon footprints, so it's really important for us to take action to minimise the impact," said Jaimin Desai, head of design and sustainability at developer Mahindra Lifespaces.

"This initiative pushes us to incorporate sustainability right from the selection of the site to the design, the use of materials and in increasing awareness in the industry, as well as among our clients," he told the Thomson Reuters Foundation.

India is the world's third-biggest emitter of greenhouse gases that cause global warming. As a signatory to the 2015 Paris Agreement on climate change, India is committed to reducing its carbon emissions by a third by 2030.

It is doing so with tougher emission norms, more electric vehicles and giant solar power plants to replace energy generated by coal.

The real-estate sector is responsible for nearly a quarter of the country's carbon dioxide emissions. Those emissions come mainly from energy-intensive processes in making construction materials such as steel, cement and bricks.

As India's economy grows at a fast clip, demand for homes, offices, roads, airports and factories is also rising.

The demand for homes is particularly acute: in urban areas alone, there is a shortage of about 20 million homes.

Prime Minister Narendra Modi *has made affordable housing a priority, with incentives such as subsidised loans to meet a 2022 target of* **"Housing for All".** This has led to a boom in construction across the country.

The effort by SHLC - an initiative of the World Bank's International Finance Corporation under the eco-cities programme of the European Union - will add 110 million sqft of green housing by 2020.

GREEN HOMES THE NORM?

While "green" homes were built at a premium earlier and therefore had a niche appeal, newer technologies and greater demand have narrowed the cost differential between them and traditional housing to "almost nothing" now, Desai said.

Developers and buyers are also able to tap financing more easily for sustainable projects, as banks and investors look beyond renewable energy. The SHLC campaign is backed by HDFC Bank and PNB Housing Finance.

"India has huge funding requirements in ... sustainable housing, metro rail networks, urban waste management and infrastructure development, that can be met through green financing options," said SanjeevJha, India head of Global Capital Markets at Bank of America Merrill Lynch.

India, a relatively new player to green financing, has issued nearly $4.5 billion worth of green bonds so far, he said.

For homeowners, green homes will create savings of 198 million kWh per year in electricity consumption, and 108 billion litres in water savings, according to SHLC.

This will reduce India's carbon footprint by approximately 0.2 million metric tons of carbon dioxide, it estimates.

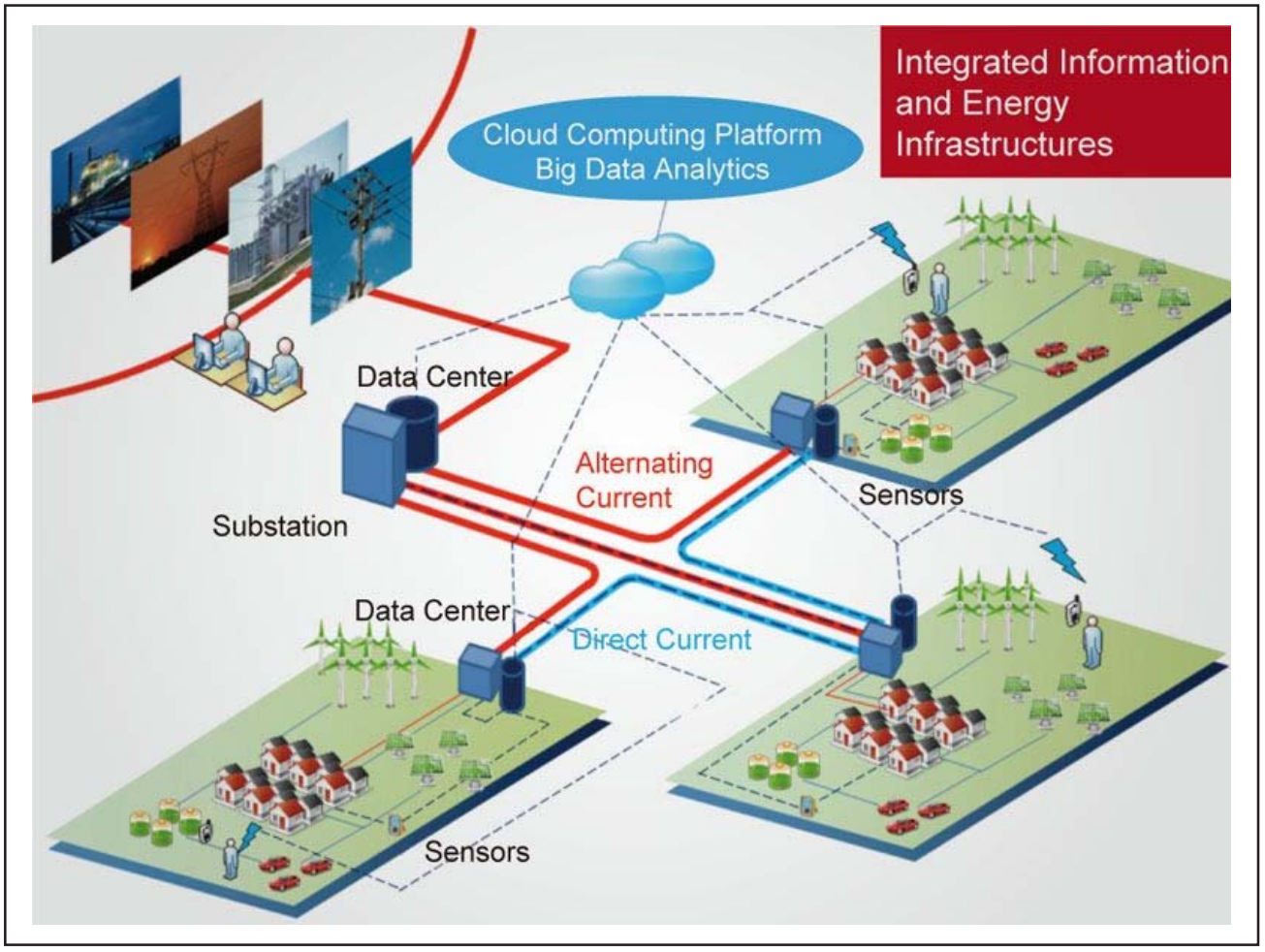
"Our long-term goal is to make green homes 100 percent of the industry portfolio," Desai said. "We see green homes becoming the default choice."

(Reporting by RinaChandran @rinachandran, Editing by Laurie Goering. Please credit the Thomson Reuters Foundation, he charitable arm of Thomson Reuters, that covers humanitarian news, women's rights, trafficking, property rights, climate change and resilience. Visit news.trust.org to see more stories.)

HOW TO BUILD THE ENERGY INTERNET IN 3 STEPS

What is the energy internet?

Imagine the following scenario made possible by the energy internet: You order your solar panels online after receiving a complete feasibility and economic analysis based on satellite images and related online tools. The delivery person installs the panels on your roof with pre-assembled, non-penetrating mounts. New standardized sockets (a USB-type interface for solar) allow you to simply plug the panels into the grid, just like plugging in a toaster, greatly simplifying permitting and interconnection procedures. Next, you call your utility to activate your system in the same way you currently activate new credit cards or a cable TV subscription. Congratulations, you are a now a power plant operator!

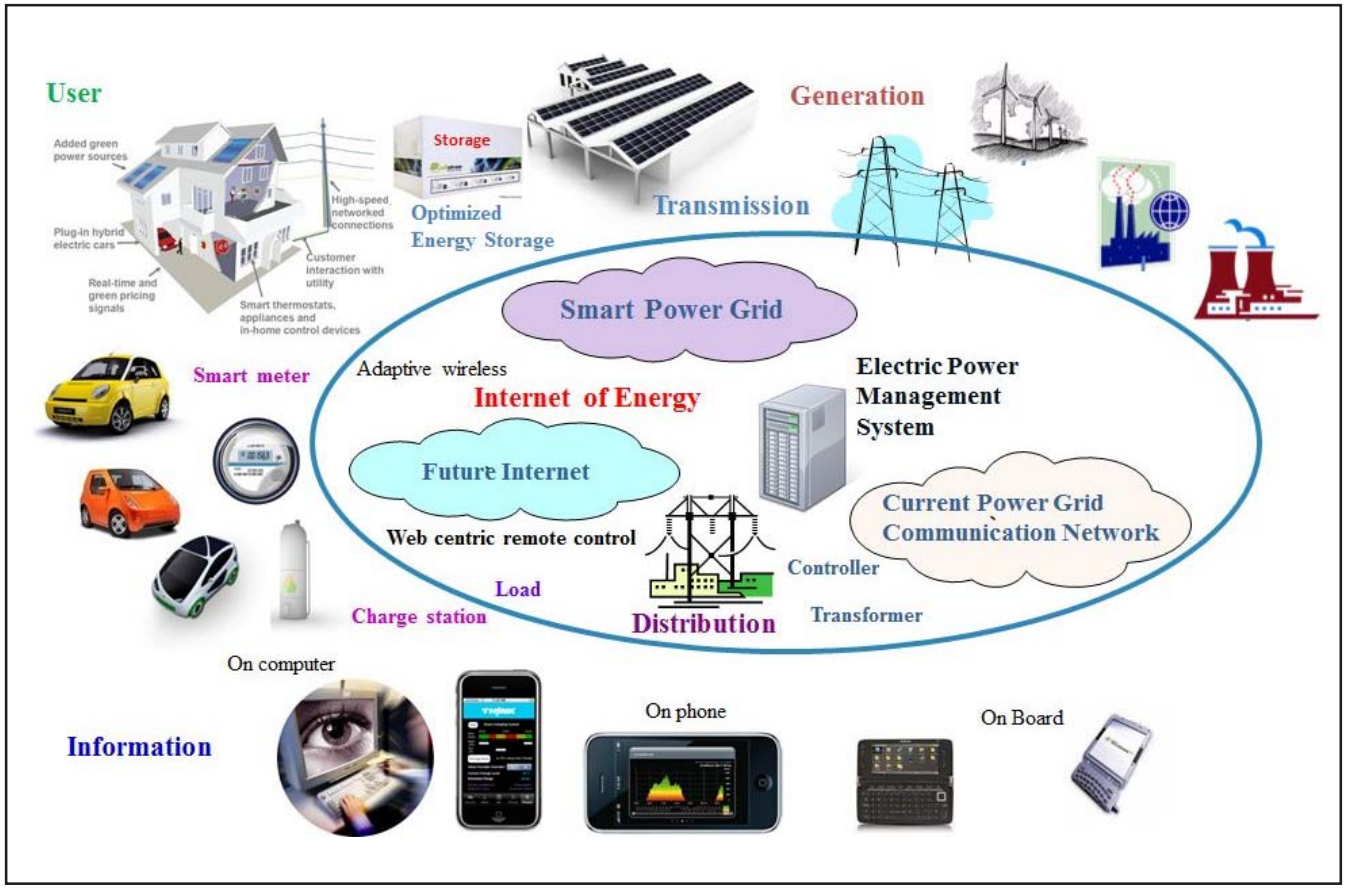


The utility automatically registers your panels within its generation assets database and starts to calculate your panels' output in its load forecasting, capacity planning, and grid balancing operations. It also updates your billing account to credit the value of your generation and register's your home's location in its solar generation forecasting system.

Since you are away from home during the day, your panels generate excess energy that you don't directly use. As an environmentally-conscious, sharing-economy consumer, you sell the excess generation to nearby homes or businesses at a competitive price via the online Renewable Energy Marketplace. At the same time your browse the marketplace for battery storage, solar panel maintenance services, and energy efficiency services to reduce your heating bill.

The utility provides settlement services for your energy sale, charges a transmission fee based on the distance between your home and your purchaser, and takes a small platform service fee. The utility enjoys new market-based revenue streams in place of regulatory-driven revenue and is motivated to deliver the cheapest energy regardless of its source.

Voila! The energy internet has transformed the electrical grid from a closed, proprietary, telecom-style network to an open platform that connects consumers, generators, and service providers.



How do we build the energy internet?

Here are the 3 steps:

1. Implement big data platforms to analyze the deluge of newly available smart meter data
2. Facilitate and accelerate deployment of renewable, distributed energy resources (DER)
3. Implement marketplaces for open buying and selling of energy and related services

In parallel we will need to drive regulatory reform and transform outdated utility business models.

Analyze smart meter data

One of the primary enablers for the Energy Internet is the growing deployment of smart meters. Bloomberg New Energy Finance predicts that 680 million smart meters will be deployed worldwide by 2017. Each one of these meters generates 3000x more data than the old 'dumb' meters that were read manually once a month. Without sophisticated big data processing and machine-learning prediction capabilities, this data offers limited value.

In-memory computing platforms that automatically process terabytes of data in seconds are now available. Innovative companies like C3 Energy and Space-Time Insight have developed applications specifically for utilities on top of their big data platforms. With this knowledge, grid operations can become proactive and predictive to reduce downtime and operating costs. Capacity planning and load prediction become more precise to reduce waste. Granular knowledge of customer usage patterns enables better rate design and drives energy efficiency efforts.

Deploy affordable DER

Distributed energy generation resources (DER) such as solar, demand response, and storage are already affordable. Besides generating clean energy at low cost, the same DERs can provide localized grid-support services such as reactive power and voltage control and reduce peak demand. According to Advanced Energy

Economy, 10% of the US electric grid is built to meet demand in just 1% of a year's hours. Efficient application of demand response could yield up to $4 per dollar invested. Utilities must transition from solely predicting load to actively shaping load to best match a broad portfolio of available resources.

From an operations point of view, utilities must absorb, manage, and optimize these various, intermittent resources that are 'hiding' behind the customer's meter. The challenge becomes especially acute with high levels of renewable penetration. Last year, the Hawaiian Electric Companies temporarily halted all solar interconnection and frequently curtailed solar output because midday over-generation was causing load balancing issues.

Implement renewable energy marketplaces

From a regulatory point of view, we must adjust incentive structures so that utilities are motivated to choose the cleanest, most economical energy resource for a given situation. Today, US utilities' rate of return is calculated based on capital expenditure on things like substations and transmission lines. Customer rates are then determined to generate the revenue needed to cover those expenses. Oftentimes investments in grid infrastructure can be deferred or cancelled through intelligent allocation of local DERs and demand reduction.

With the right regulations in place, utilities can seize new market-driven revenue sources outside of the traditional rate case and transform themselves into exciting growth companies. Utilities should be rewarded for greater operational efficiency rather than potentially wasteful capital expense. They should be incentivized to create an open, dynamic business environment that allows third-party service companies and innovative startups to offer consumers additional choices for sourcing energy in the cleanest, cheapest way possible.

Creating the 'Amazon Web Services'-like platform to support energy marketplaces and drive the Energy Internet represents a massive opportunity.

When will it happen?

It's happening now. Several states are already moving in the right direction. California already supplies 25% of its electricity from renewables and has a target of 50% by 2030. Colorado, Minnesota, and Massachusetts are leading the way on Community Solar. New York is already implementing pilot projects for its bold Reforming the Energy Vision (REV) initiative and is deploying new microgrids.

Stay tuned for the biggest disruption in the history of the electric grid.

Courtesy: Energy Central

IIT MADRAS TURBINE MAY GENERATE POWER FROM OCEAN WAVES

A team of 25 faculty members and students from the **ocean** engineering department in **Indian Institute of Technology Madras** have begun testing a prototype of a turbine they have developed which converts wave energy into electricity. The **'impulse'** turbine works with a unidirectional rotor powered by a generator. The system will be tested in oceans by the end of the year.

Associate professor AbdusSamad said the turbine prototype was selected from close to 30 different designs with different number of blades in the rotor. All the designs were tested through computer simulations and the design parameters of the turbine was optimized through numerical modelling. The power output for all the turbine designs was calculated before one simple commercially viable design was chosen to be developed into a prototype.

Unlike wind turbines that generate electricity from wind energy with three blades, the impulse turbine rotors will have more than 20 blades. "We have tested the turbine for a three-minute duration and the data is being analysed," he said. "We have chosen a simple design that has just one moving element so the system is more reliable and lasts longer."

Scientists said the turbine works on a **'oscillating water column theory'** where the system has a water column that acts like a piston moving up and down as the **waves** hit forcing air out and back into the chamber. This airflow is then converted into energy.

Wave energy has potential to produce 40 GW to supply to the Indian grids, approximately 13% of the total production capacity in India, the team said. Another advantage is that the energy density per square meter of wave energy is 5 and 10 times more than the wind and solar energy, respectively.

Samad said their challenge is to create a design with high efficiency in the midst of extreme weather conditions like tsunami. "There is so far no wave energy convertor that has been commercialized anywhere in the world. There are more than 1000 patents in the world including in Japan and Europe for wave energy convertors but only a few have been tested," he said.

Ocean wave energy is captured directly from surface waves or from pressure fluctuations below the surface.

Waves are caused by the wind blowing over the surface of the ocean. In many areas of the world, the wind blows with enough consistency and force to provide continuous waves along the shoreline. Wave power devices extract energy from the surface motion of ocean waves or from pressure fluctuations below the surface.

Ocean Wave Energy Resource

Wave power varies considerably in different parts of the world. Areas of the world with abundant wave power resource include the western coasts of Scotland, northern Canada, southern Africa, Australia, and the northwestern coast of the United States, particularly Alaska.

Whereas wind resource potential is typically given in gigawatts (GW), wave and tidal resource potential is typically given in **terawatt-hours/year (TWh/yr)**. The Electric Power Research Institute (EPRI) has completed a recent analysis of the U.S. wave energy resource potential. EPRI estimates the total wave energy resource along the outer continental shelf at 2,640 TWh/yr. That is an enormous potential, considering that just 1 TWh/yr of energy will supply around 93,850 average U.S. homes with power annually. While an abundance of wave energy is available, it cannot be fully harnessed everywhere for a variety of reasons, such as other competing uses of the ocean (i.e. shipping, commercial fishing, naval operations) or environmental concerns in sensitive areas. Therefore, **it is important to consider how much resource is *recoverable* in a given region. EPRI estimates that the total recoverable resource along the U.S. shelf edge is 1,170 TWh/yr, which is almost one third of the 4,000 TWh of electricity used in the United States each year.**

TESLA'S MUSK HANDS OVER FIRST MODEL 3 ELECTRIC CARS TO EARLY BUYERS

CEO estimates more than a half million reservations have been received for the model, which has a base price of $35,000 and can travel 350 km on a charge.

Tesla chief executive officer Elon Musk said on Friday the Model 3 had more than half a million advance reservations as he handed over the first 30 to employee buyers, setting the stage for the biggest test yet of the company's strategy to become a profitable, mass market electric car maker.

Eyeing Mass Market

Outside Tesla's Fremont, California factory, Mr. Musk showed off the $35,000 base vehicle with a range of 220 miles (350 km) on a charge that marks a departure from the company's earlier luxury electric cars.

Mr. Musk took to the stage driving a red Model 3, and said Tesla has produced 50 of the vehicles so far, including 20 for testing purposes.

Hours before the event, Mr. Musk acknowledged it would be "quite a challenge" to build the car during the early days of production.

"We're going to go through at least six months of manufacturing hell," Mr. Musk told journalists.

The over half a million reservations are up from about 373,000 disclosed in April 2016. Customers pay $1,000 refundable deposits for the car, which is eligible for tax credits. Any new buyers would likely not receive their car until the end of 2018, Mr. Musk said.

A longer-range version of the car is priced at $44,000 and will drive 310 miles (500 km) on a single charge. The cars feature a streamlined dashboard devoid of buttons or knobs, with a 15-inch touchstream display to the right of the driver.

Tesla faces major hurdles living up to the Model 3 hype. The 500,000 vehicles Tesla vows to produce next year are nearly six times its 2016 production.

Were Tesla to produce and sell 500,000 cars per year, the company would likely outsell the BMW, Mercedes, or Lexus brands in the United States.

Production delays and quality issues marred the launches of Tesla's Model S and Model X vehicles, and the company blamed production problems for a shortfall during the second quarter of this year.

Mr. Musk has said a simpler Model 3 design will greatly reduce potential assembly-line problems.

Tesla has burned through more than $2 billion in cash so far this year ahead of the launch. A troubled Model 3 launch could heighten the risks for the company, while a steady delivery of Model 3s could generate a stream of cash that would allow Tesla to avoid going again to the capital markets to fund its operations.

Tesla's share price has surged 54% since January in anticipation of the Model 3 launch, and Tesla's pricey valuation now exceeds that of traditional rivals like General Motors Co and Ford Motor Co.

Niche producer

Until now, Tesla has operated as a niche producer of luxury electric vehicles, with a charismatic, showman CEO who regularly interacts with fans on his Twitter account.

Now loss-making Tesla is trying to move into a different league, building vehicles in high volume for customers able to pay only a few thousand dollars more than the average price of a conventional car or truck sold in the United States.

The Model 3 is part of Mr. Musk's **broader plan to build a clean energy and transportation company that offers electric semi-trailer trucks, rooftop solar energy systems and large-scale battery storage systems.**

Courtesy: The Hindu, dt. 30.07.2017

HARYANA GOVT TO RUN ELECTRIC BUSES IN GURGAON

Haryana government will operate 75 to 100 electric buses, manufactured by JBM Solaris plant in Poland, in Gurgaon in the first phase.

The Haryana government will set up an environment-friendly transportation system in Gurgaon on the pattern of Poland, state minister Kavita Jain said on Tuesday.

The urban local bodies minister, who is leading a delegation on a visit to the plant of JBM Solaris Electric Vehicles Ltd in Poland's Ponzan, said "In the first phase, 75 to 100 electric buses would be operated".

As compared to ordinary buses, each electric bus would help save about 4.25 lakh litres diesel and reduce carbon emissions by 1,150 tonnes in 10 years of operation, she was quoted as saying in a Haryana government release.

This would help in improving the environment, she said, adding that the central and state governments were committed towards operating electric vehicles in the country.

In the first phase, electric vehicles would be operated in Gurgaon, which has excellent infrastructure and facilities in residential, commercial and public sectors, and is located in the national capital region, she said.

This would not only reduce traffic congestion, but also provide better public transport system to an average of 50,000 people every day. Gurgaon metropolitan development authority, Municipal Corporation, Gurgaon and Haryana State Industrial and Infrastructure Development Corporation (HSIIDC) would bear 50%, 40% and 10% of the cost of the project, respectively, she said.

JBM Group has already established plant for manufacturing of CNG buses in Ballabhgarh near Faridabad, which would soon begin manufacturing electric buses under the Make in India programme, she added.

JBM ELECTRIC BUS OVERVIEW

Exceptionally quiet, emission-free, distinguished by its modern design and guaranteeing low operation costs – discover the benefits of the JBM Solaris ECOLIFE 9mElectric, India's first 100% Electric bus. Crafted to 9 metres in length, ECOLIFE 9m Electric is a fully low-floor battery powered green vehicle with state of the art electric drive technology that ensures hassle free and comfortable commute for the passengers. ECOLIFE 9m Electric stands out distinctly by virtue of its attractive exterior and interior styling coupled with a series of innovative and cutting edge design solutions.

About JBM Auto Ltd.

JBM Auto Limited is the Bus division of JBM Group. The division specializes in the manufacturing of the high quality buses in India. These buses are built with leading cutting edge technology. JBM Buses take pride in providing the highest levels of comfort and safety with latest features. Moreover JBM Buses are committed to combining fuel efficiency with utility and performance using Green & Effective technology, thereby reducing the carbon footprint in the overall environment.

JBM Auto Ltd. has initiated the journey of becoming a technology oriented Bus Manufacturer in India with its state of the art product called CITYLIFE. The bus has been created to deliver convenience, safety, comfort and passenger delight by offering world-class travelling experience on Indian roads.

The product lineup of JBM Auto offers a cutting edge in its vehicles for the market. The brand has an in-house engineering and design centre, which has capability from Design to Deliver. JBM Auto brings to the table stringent quality standards, domain know-how, having proven track record in manufacturing of Automobile components in India. The division weaves in a seamless bond with the Group's offering due to the company's in-house base of varied auto components.

BHEL'S LARGEST-EVER RS.10,000 CRORE EXPORT ORDER FOR 1,320 MW SUPER THERMAL POWER PROJECT IN BANGLADESH

New Delhi, April 25: Bharat Heavy Electricals Limited (BHEL)'s largest ever export order, valued at Rs.10,000 Crore (US$1.5 billion), for setting up 1,320 MW (2x660 MW) Maitree Super Thermal Power Project in Bangladesh, has taken-off, following the issuance of the Notice To Proceed by the developer.

Significantly, won against stiff international competitive bidding, this is BHEL's largest power project order in the international market. The order has been secured from Bangladesh India Friendship Power Company (Pvt.) Limited (BIFPCL), a 50:50 JV company of NTPC, India and BPDB, Bangladesh. BHEL has arranged debt financing for the project from the EXIM Bank of India for which the loan agreement between EXIM Bank of India and BIFPCL has been signed in March, 2017.

BHEL's scope of work in the project includes design, engineering, manufacture, supply, construction, erection, testing & commissioning of 2x660 MW thermal sets with ultra-supercritical parameters on turnkey basis. The scope also includes setting up of a jetty and a river-water intake system. In order to meet stringent environmental norms, BHEL shall also install a state-of-the-art FGD plant and Dry bottom ash handling system.

This prestigious order is a testimony to BHEL's proven technological excellence and also to its capability in executing power projects of this magnitude and complexity on turnkey basis. The order will also provide a fillip to the company's focus on globalization as a driver of future growth.

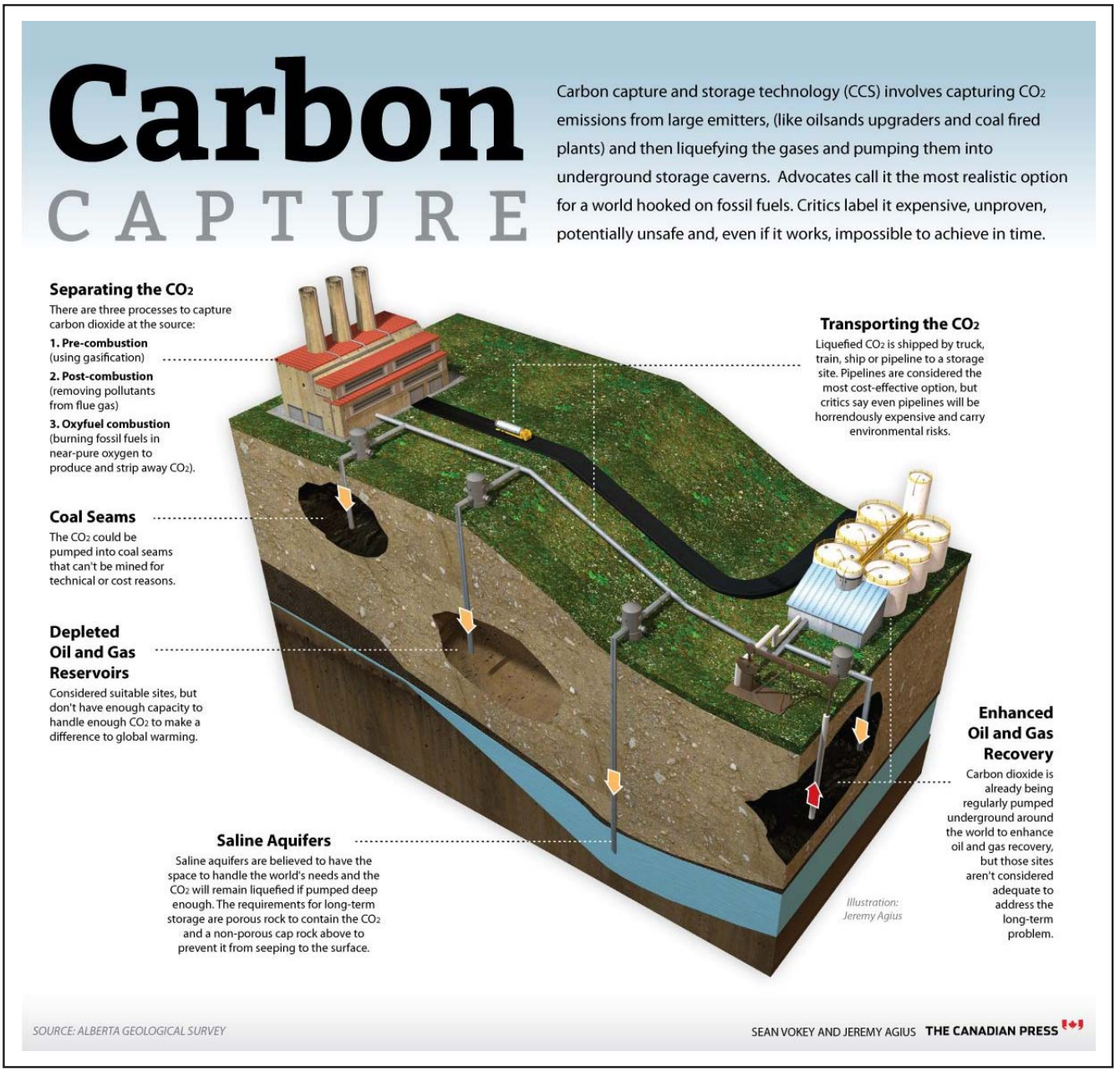
The key equipment for the project will be manufactured at BHEL's Trichy, Haridwar, Hyderabad, Ranipet, Bhopal, Bangalore and Jhansi plants, while the company's Power Sector construction division will be responsible for construction and installation activities at site.

BHEL has had a long association with Bangladesh's power sector – the company's first major project in the country was the 100 MW Baghabari Gas Turbine Power Project (GTPP) which was commissioned in 2001. Subsequently, BHEL has constructed 2x120 MW Siddhirganj GTPP, besides setting up 220 kV Baghabari & Ishurdi substations.

BHEL is India's largest manufacturer of power generation equipment with a formidable installed base of over 1,70,000 MW of power plant equipment globally. In the supercritical segment, BHEL has successfully demonstrated its leadership status and technological prowess in the manufacturing and execution of 660 MW, 700 MW and 800 MW sets. BHEL's customers also enjoy the advantage of assured and prompt After Sales Service.

CARBON CAPTURE'S NEW MATERIAL

A group of researchers from Kyoto University's Institute for Integrated Cell-Material Sciences, London's Imperial College and City University of Hong Kong have created a new 'mixed matrix membrane' filter they claim can make carbon capture and storage more affordable and more selective. Lead researcher, EasanSivaniah, speaks to Patrick Kingsland about the project.



Some 5,000 years ago when the people of ancient Mesopotamia discovered that smelting tin and copper could produce a material better than either alone, it was the start of a new historical era.

Metals too soft for any practical purpose could now be transformed into a material both malleable when hot and hard when cooled. Animal bones and chipped flint were quickly replaced by new tools and weapons, and the Bronze Age was born.

It's a discovery that EasanSivaniah, researcher at Kyoto University's Institute for Integrated Cell-Material Sciences (ICEMS) cannot help but mention when he discusses his work in the carbon capture and storage (CCS) field.

The carbon super filter

Using nano-sized additives – pioneered by Japanese scientist Susumu Kitagawa – and a polymer called PIM-1, Sivaniah's research team has developed new 'super filters' which he claims could make CCS more affordable and more selective than ever before.

"Like the Mesopotamians, we've taken two materials which by themselves are okay but together create a much more powerful combination," he says. These super filters differ from the ones commonly used in CCS to separate CO_2 from other gases produced during the combustion process. "You could just capture everything and stick it underground," Sivaniah explains, "but that would mean putting 80% nitrogen beneath the surface, which is pointless. What you want is a technology that can purify carbon dioxide by up to 100%."

In current CCS technology, "the filters are so slow", Sivaniah says, "which means you need to have a lot of them and a large area in order to deal with the amount of gas that is coming out of the power station. You are talking about millions of meters squared of filter area."

Instead of simply adding more filters, Sivaniah says the industry should use one that is much quicker. "Let's say you want to make a cup of coffee for yourself," he says, as an example. "If you have a coffee filter and you boil the hot water, you have a cup. But let's say you want to make a cup for ten people. Now you have a choice. You can either get ten filters that all work at the same speed. This will increase your cost by ten. Or you can get one filter which is ten times faster and makes ten cups of coffee in the same amount of time."

The new membrane Sivaniah and his team have created promises to drastically speed up the CCS process without compromising the filter's ability to separate materials. "With most filters, the faster something goes through a material the less good it is at separating stuff out," he explains. "What we've got is a fast material that can deal with a lot of gas at the same time, but that is still good enough to separate carbon dioxide from nitrogen."

Capturing carbon dioxide on the cheap

The key advantage of this, Siavana adds, is cost. "If you can make your filter ten times or a hundred times faster, that means you don't need a million meters squared. You need one hundred thousand meters squared, for example. This means you can cut the cost down by a factor of ten just by using a faster sheet of material."

As things stand, expense is a major factor turning people away from CCS, and from several aspects. "In the average-sized power station, which is roughly about 1,000MW, a single stripping unit is going to cost about $2bn," Siavana says. "If you times that by all the power stations in the world, what you end up with is a number that is something like half of the gross domestic product of the entire world."

This money, Siavana continues, is being used to glean a by-product that companies can't even sell. "You are talking about absorbing or cleaning up a material that nobody actually wants," he says. "It's not like you are cleaning the water of gold particles which you can sell on somewhere. There is a cost involved but you don't get a direct payback as a company.

Additionally, consumers don't want their energy bills to rise. "When you spend more on getting this carbon dioxide out you are increasing the price of electricity," he says, adding that, "Consumers obviously don't want to see the price of their electricity go up however much they want to see a reduction in CO_2."

Overcoming the 'Valley of Death'

Put together, these challenges have led many CCS projects into the dreaded 'Valley of Death' over the past two to three decades. "There was a recent article in ***Nature Energy*** which looked at the history of CCS," says Siavana. **"The conclusion was that there was a lot of enthusiasm for this stuff. People built their pilot facilities and spent a lot of money. But it never panned out. Everything would get so far but never be implemented to the next level."**

Everything we do is designed, whether we're producing a magazine, a website, or a bridge. Design is really the creative invention that designs everything. - HENRY PETROSKI

PRODUCING POWER WHERE THE RIVER MEETS THE SEA

A research team from Penn State College of Engineering has developed a new hybrid technology that could use salinity gradient to produce electricity from electrochemical reactions.

The idea of getting energy from salinity variant, where freshwater meets seawater, was first considered in the 1970s to be largely forgotten. But over the last few years interest has been resurrected and now a team from Penn State has developed a new hybrid technology to create power using the electrochemical charge created by the meeting of different salt concentrations.

The team at Penn State aims to harness this ch arge using a custom built technology made of two cells, one containing saltwater and one containing freshwater. Between the two is an anion-exchange membrane, and there is a nickel hexacyanoferrate electrode in each cell. As the saltwater passes through the cells it creates a charge that can be collected using graphite foil and discharged as electricity.

Researchers predict that the technology could meet up to 40% of the world's energy needs, if it can be successfully rolled out. But a host of challenges lie ahead before it can be produced on a large scale.

Uniting salinity gradient technologies

This hybrid combines elements of two older methods used in the field: capacitive mixing (CapMix) and reverse electrodialysis (RED). Both have proved inefficient for a number of reasons and this hybrid seeks to adopt the best elements from both.

"One approach is to use what's called reverse electrodialysis, in which potentials develop across ion exchange membranes," says Penn State assistant professor in environmental engineering Christopher Gorski. "So, as saltwater and freshwater are flying through an electrochemical cell this potential develops and then generates a voltage in the cell which can be used to discharge electricity."

"The other approach is often referred to as capacitive mixing, in which potentials develop at electrode surfaces," says Gorski. "An electrode develops a potential based on the amount of salt in the solution and when the two electrodes are exposed to different salt concentrations, they develop a voltage between the two electrodes of a potential difference. Then that can be discharged to generate electricity also." While this has proven to be a relatively successful technique, as with RED, it simply doesn't produce enough power to be viable.

However, Gorski and his team believe they may have found a way to yield a far greater amount of energy from salient differences by combining aspects of RED and CapMix. "In the cell we had electrodes that developed potentials based on the salt concentration, as well as the membrane that developed the potential across it," says Gorski. "By combining those two and reconfiguring the cell a little bit, we were able to generate far more electricity than either of those two technologies could do independently."

The potential to create more energy

In a recent test, 12.6W/m^2 of membrane power was generated. "In principle, the amount of power that we could generate was competitive with the best technologies that are out there [currently] that are mainly based on osmotic pressure," says Gorski.

The team claims that this technology could meet as much as 40% of the world's energy supply, a bold claim based on the study 'Membrane-Based Production of Salinity-Gradient Power' by Guy Z Ramon, Benjamin J Feinberg and Eric M V Hoek, published in the journal Energy & Environmental Science. The study examined points where river water meets seawater, taking into account both geographical and practical constraints, to estimate how much energy each location could generate.

"What goes into that are several assumptions that are probably somewhat impractical, like you'd have 100% efficiency," expands Gorski. "If you just look at solar energy, for example, and said that you would assume 100% efficiency, you'd easily provide all of the global demand for energy too, so there's that consideration."

While the previous study gives an indication of the technology's potential, there are further variables affecting the accuracy of the calculations. "There are other factors that need to be taken into account, like sea level rise,"

says Gorski. “As you have tides and high tide and low tide, that influences where freshwater and seawater mix and how much pumping energy you need to put into it, so that will probably also reduce that value.”

“I think in a very practical sense, where this technology would be used would be more where you have large cities on coasts, and you have a discharge of wastewater,” he says. “We did some back of the envelope calculations and in San Francisco they discharge about 20 billion gallons of wastewater per year to the San Francisco bay,” explains Gorski. “So, if you just mix that treated wastewater with the seawater, you’d generate about 20% of the electricity that San Francisco needs. So there you have a very controlled water stream that you’re mixing with, and that seems feasible to me.”

Along with wastewater plants, it’s hoped that the hybrid could be incorporated into the infrastructure at desalination plants. As water is desalinated, a salty substance is left over which is usually dumped straight back into the ocean which could instead be used with wastewater to generate power.

More time for testing

Tests of the hybrid technology were very promising but it’s still got a long way to go before it could be rolled out. “One of the main things is longevity,” says Gorski, explaining that “We did these experiments using pretty pure solutions and relatively short timescales. But if you wanted to implement this on a pilot-scale plant, you’d want to run it for years, ideally.”

The brief time period of testing the hybrid leaves a degree of uncertainty over its durability. Furthermore, the lab conditions raise concerns over the membrane’s ability to perform in real-life applications. “It’s not really clear how well the membranes hold up over time, or the electrodes hold up over time when they are exposed to all the random things that are in seawater and freshwater, like small particles, bacteria, strange metals that might get into the water,” says Gorski. “We don’t know how that will affect their performance over a time. So that’s something that we’re looking at now.”

As tests continue, the team is experimenting with various materials for the membrane to ensure the hybrid is as efficient as possible. “We used nickel and iron, but there’s other metals that you can put into it that will change its properties,” says Gorski, and it seems that there is a long way to go from here as, “lots of people have studied how those metals influence it and, sort of, the theory behind that, but haven’t explored their use for these sorts of materials, these purposes”.

SOLAR BLOCKS COULD REPLACE SOLAR PANELS ON BUILDINGS

New solar technologies are developed all of the time, but lately it seems that the focus has been less on making the perfect solar cell and more on making more adaptable solar tech that expands how we can use and harness solar energy.

Much of the excitement over **Tesla’s solar shingles** is due to the the technology’s ability to be built into the building; to be incorporated into the architecture so that the tiles can be both visually pleasing as well as a source of energy. A new technology from the **University of Exeter** would go beyond just the roof and allow energy-generating modules to make up the walls of the buildings too.

These glass building blocks called Solar Squared can be integrated into building walls in new construction or as part of renovations in existing buildings. The glass blocks would allow in daylight for ambient lighting as well as generate electricity.

Many companies have been developing transparent solar panels for use in buildings where the solar panels could replace windows or even make up entire facades of skyscrapers. Solar blocks could be used in a similar way, but they also feature optics that concentrate sunlight on the solar cells within, making them more efficient.

The other advantage of the solar blocks is that they are designed to have better thermal insulation than traditional glass blocks or transparent solar panels so they would help with the climate control of the building.

The blocks are currently in the prototype phase and the Exeter team is awaiting a patent on the technology, but they’ll soon move on to pilot tests of the technology.

Distributed energy sources will be as important to a clean energy future as large solar power plants and wind farms. Having many ways to incorporate solar power into our buildings, which consume 40 percent of the energy produced globally, will help architects and engineers to integrate renewable energy as we move forward.

HERE'S HOW UNESCO WORLD HERITAGE SITE MAHABALIPURAM BECAME COMPLETELY LITTER-FREE

A town in Tamil Nadu with a population of about 20,000 people has become environmentally sustainable and litter-free. Mahabalipuram, a UNESCO declared heritage site, just 55 km south of Chennai, has about 5,000 households.

Here almost 85 per cent of the waste is segregated at the source and diverted from reaching the landfills.

Hand in Hand (HiH), a Tamil Nadu-based NGO, convinced residents of this town the benefits of waste segregation. In India, about 150,000 tonnes of waste is generated every day. Of the total amount of municipal waste collected, an average of 94% makes its way to landfills, and only 5% is composted. The solid waste management wing of HiH aims to facilitate local bodies to manage India's burgeoning garbage menace.

On an average, six metric tonnes of waste is collected in Mahabalipuram or Mamallapuram, and thanks to a smooth system of waste collection and management installed, about 85% is diverted from the dump yard and processed. The biodegradable waste is converted to organic manure in a compost park, which was established for specifically this purpose.

It took years for the town to get here – two years to be precise. General Manager of HiH, V.Parisutham, said that it was a long process to convince everyone in the town, and everything including awareness campaigns was built from scratch.

Hand-in-Hand model

Under this system, every 800 households have one **"lady motivator, four green friends"** and a vehicle with educational display boards and an audioequipment. The motivator goes from door-to-door teaching people how to as well as the importance of segregating waste, while the **"green friends"** are responsible for collecting the waste and dumping it onto the vehicle. As the vehicle goes around collected waste, it also plays songs on the importance of waste segregation and spreads awareness on cleanliness.

Every household was given a green coloured bin for biodegradable waste, a black coloured bin for non-biodegradable waste and a white bag for recyclable waste.

HiH employed **"Lady Motivators"** keeping the cultural situation of the town in mind. Women are caretakers and so responsible for waste disposal in almost 80-90% of households in Mahabalipuram, said Parisutham, and they would feel more comfortable interacting and learning about waste from another woman. Also, women are known to be more patient, so they would talk to homemakers at length, added the GM.

Biogas plant

In order to make the town environmentally sustainable, HiH used the composted waste to developing a biogas plant. It collaborated with the Mamallapuram Town Panchayat and installed a 100 cu.m biogas plant with the capacity of handling about 500kg of food waste.

Food waste is converted to Methane, which is then used to generate electricity through a biogas generator. Currently, the electricity generated is used to light up 30 street lights on the East Coast Road.

Parisutham believes that every household in the country needs to begin segregating waste at the source in order to control its garbage menace. He says this model can be replicated in metropolitan cities such as Mumbai and New Delhi if the waste collection and management system is decentralised.

"Local authorities should divide city into zones of not more than 25,000 households. Every zone should have should have its own composting plan. This way only non-biodegradable waste will be taken to a centralised place for dumping," he said.

Biodegradable and recyclable waste makes up the major chunk of waste and only 15-20% is actually non-biodegradable. This way, authorities can also save up on transportation costs, which are huge, he added.

Mahabalipuram sure has a lesson for all in the country.

Hand in Hand

Skilled little fingers spinning the loom…weaving the fabled silk sarees of Kancheepuram. Once, amidst the infinite colours of silk yarns were stories of lost childhood. And with this picture began our story - helping children yarn their stories and gradually rewriting the narratives of many rural families and villages altogether.

Children traditionally constituted a cheap source of labour for the weaving industry in Kancheepuram and parents who did not have permanent jobs would send their children to master weavers. Bringing such children out of labour was our initial focus. In 1998, we started out our operations in a small way among the child labourers in the district of Kancheepuram, Tamil Nadu, through the efforts of two Swedish teachers and three locals.

Registering as a Charitable Trust in 2002, we initiated our first intervention, the Child Labour Elimination Programme which focused on enrolling child labourers in schools. Over a period of time, we broadened our interventions to address the multidimensional factors of poverty. Today, with more than a decade of work in the development sector, our integrated community development programme has Five Pillars devoted to poverty alleviation — Self-Help Groups and Microfinance, Child Labour Elimination Programme, Skills Development and Technology Centre, Health, and Environment.

From working in just one district in 2004, today we work in Tamil Nadu, Karnataka, Madhya Pradesh, Odisha, Maharashtra, Rajasthan and Puducherry. Our model has been replicated in Afghanistan, South Africa, Kenya, Brazil, Cambodia and Myanmar.

MUD BRICKS BEST FOR COOL, GREEN HOUSES, SAYS STUDY

Simple mud concrete bricks provide the most affordable and sustainable houses in the tropics, a Sri-Lankan study suggests.Comparisons of four different types of walling materials revealed that mud concrete bricks have the lowest environmental impact and keep houses cool. They are also the cheapest, and easiest to dispose of once a house is knocked down.

Researchers compared mud concrete bricks with red bricks (modern fired clay bricks), hollow cement blocks and Cabook, the Sri Lankan name for bricks made from laterite soil, which are common in the tropics.The goal of the study was to find out which types of walling material are the most suitable for constructing affordable houses in the tropics, where population density and poverty are generally high.

"Why spend more money and destroy the environment more?" asks Rangika Halwatura, a civil engineer at the University of Moratuwa in Sri Lanka, and one of the authors of the paper.

Mud concrete bricks are made from soil in the same way as traditional mud bricks, but contain gravel and sand to improve their strength. The researchers looked at the carbon footprint of all four walling materials, and found that mud concrete bricks were the most environmentally friendly to produce and dispose of.

To check on thermal conductivity the researchers built one-square-metre model houses of the different walling types. Here, they found that red brick kept a house coolest, but mud concrete bricks performed almost as well.

Mud concrete bricks were also found to be the cheapest, at less than US$1,000 in Sri Lanka for an average-sized house, whereas red bricks cost nearly US$3,500.

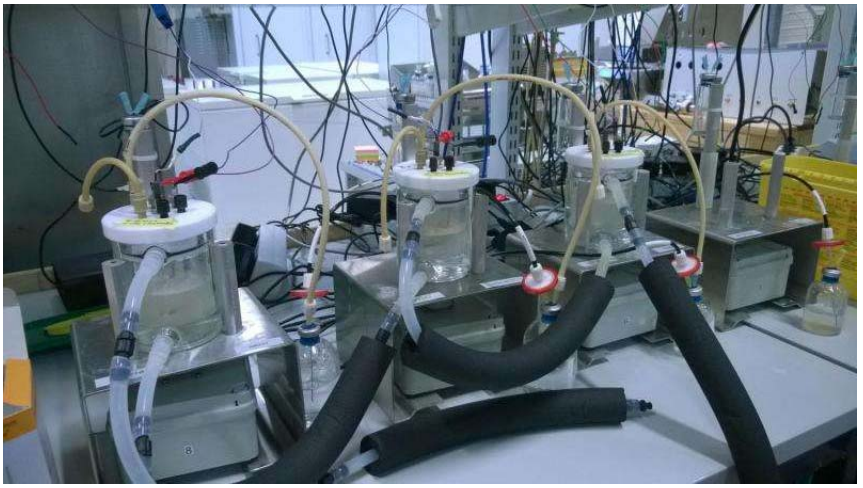
Mud concrete bricks are widely used in other tropical countries but novel in Sri Lanka. They are popular because they are easy to make and therefore cheap, says Hurryson Moshi, a civil engineer in Tanzania. However, Moshi points out that as people grow wealthier they prefer the red bricks and cement blocks, as these are associated with higher socio-economic status.

Moshi agrees with the study's findings but says that other considerations, such as aesthetics, and symbols of modernity or social status, influence people's choice of materials. Future studies should also take into account other sources of environmental damage such as deforestation (to produce timber to fire the bricks) or excavation of soil, he added.

In 2015, the government of Sri Lanka launched a programme to build 150,000 houses for the poor. This triggered the researchers' idea to compare the different types of brick.According to the United Nations, more than 850 million people around the world live in inadequate slum housing. According to Christophe Lalande, leader of the UN-Habitat's Housing Unit, poor neighbourhoods in developing countries are often the most affected by climate change and natural hazards such as storms and rising temperatures.

The sustainability of buildings and housing construction, being adapted to the local environment, is essential to save lives or prevent inadequate living conditions," he says.

PROTEIN PRODUCED WITH ELECTRICITY TO ALLEVIATE WORLD HUNGER



A batch of single-cell protein has been produced by using electricity and carbon dioxide in a joint study by the **Lappeenranta University of Technology (LUT) and VTT Technical Research Centre of Finland**. Protein produced in this way can be further developed for use as food and animal feed. The method releases food production from restrictions related to the environment. The protein can be produced anywhere renewable energy, such as solar energy, is available.

"In practice, all the raw materials are available from the air. In the future, the technology can be transported to, for instance, deserts and other areas facing famine. One possible alternative is a home reactor, a type of domestic appliance that the consumer can use to produce the needed protein," **explains Juha-PekkaPitkänen, Principal Scientist at VTT.**

Along with food, the researchers are developing the protein to be used as animal feed. The protein created with electricity can be used as a fodder replacement, thus releasing land areas for other purposes, such as forestry. It allows food to be produced where it is needed.

"Compared to traditional agriculture, the production method currently under development does not require a location with the conditions for agriculture, such as the right temperature, humidity or a certain soil type. This allows us to use a completely automatised process to produce the animal feed required in a shipping container facility built on the farm. The method requires no pest-control substances. Only the required amount of fertiliser-like nutrients is used in the closed process. This allows us to avoid any environmental impacts, such as runoffs into water systems or the formation of powerful greenhouse gases," **says Professor JeroAhola of LUT.**

Tenfold Energy Efficiency

According to estimates by the researchers, the process of creating food from electricity can be nearly 10 times as energy-efficient as common photosynthesis, which is used for cultivation of soy and other products. For the product to be competitive, the production process must become even more efficient. Currently, the production of one gram of protein takes around two weeks, using laboratory equipment that is about the size of a coffee cup.

The next step the researchers are aiming for is to begin pilot production. At the pilot stage, the material would be produced in quantities sufficient for development and testing of fodder and food products. This would also allow a commercialisation to be done.

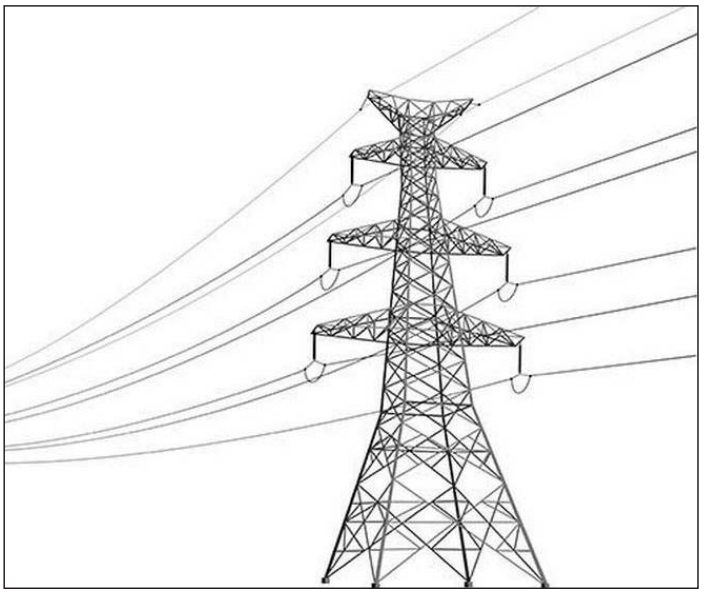
"We are currently focusing on developing the technology: reactor concepts, technology, improving efficiency and controlling the process. Control of the process involves adjustment and modelling of renewable energy so as to enable the microbes to grow as well as possible. The idea is to develop the concept into a mass product, with a price that drops as the technology becomes more common. The schedule for commercialisation depends on the economy," Ahola states.

50 percent protein

"In the long term, protein created with electricity is meant to be used in cooking and products as it is. The mixture is very nutritious, with more than 50 per cent protein and 25 percent carbohydrates. The rest is fats and nucleic acids. The consistency of the final product can be modified by changing the organisms used in the production," Pitkänen explains.

POWERING ASPIRATIONAL INDIA

Much more investment is needed to increase the use of low-carbon energy sources



How much electricity is needed by India? To answer this, one approach is to follow a top-down econometric model whereby one examines growth in the economy, looks at the relationship between **economic growth and energy requirements**, and incorporates influence of technological and policy changes exogenously. The alternative is a bottom-up approach, whereby one estimates demand based on equipment saturations, efficiencies and usage.

A simple method is to look around and draw conclusions. As per data for 2014 published by the International Energy Agency, average global per capita electricity consumption is 3030 kWh (kWh is colloquially known as a unit). The corresponding figure for India is about 805 units, and for developed countries of the OECD, it is 8,028. A majority of the OECD countries are in the temperate climate zone. Therefore, let us examine the scene around India: the corresponding figure for Singapore is 8,844, for Malaysia 4,646 and for Thailand 2,566. The projected global average per capita consumption by the middle of the century is 7,500 units. We can use this data to set a target which India can aim at.

Generation & projected need

An emphasis on energy conservation and improvement in energy efficiency of industry and household gadgets will help in reducing electricity consumption, but bringing it down to below 5,000 units per annum to enjoy a standard of living enjoyed by citizens of OECD countries seems difficult. Assuming India's population by the middle of century will be about 1.6 billion and transmission and distribution losses will come down to the lowest technically feasible value of about 7%, India must plan to generate about 8,600 Billion Units (BU) to provide 5,000 units per capita per annum to its citizens.

The cumulative average growth rate of electricity generation in India for the period 2006-07 to 2015-16 was close to 6%. In 2016-17 generation by utilities was 1,242 BU. Data for generation from non-utilities is not yet available, but one can assume it to be around the same as in 2015-16, i.e. 168 BU. The total generation was thus 1,410 BU. Assuming a population of 1.3 billion, it translates to a per capita generation of 1,100 units. Thus, electricity generation projected for 2050 is six times the total generation in 2016-17 and in terms of per capita generation, it is about 4.5 times. India has a long way to go.

The target of per capita availability of 5,000 units per annum is very modest because of several reasons. The percentage share of electricity in total energy consumption is increasing. As per estimates by the International Atomic Energy Agency, this share was 34.8% in 2015 for Middle East and South Asia, and is projected to increase to 52% in 2050. The Government of India has announced policy initiatives such as electricity and housing for all, accelerated infrastructure development, Make in India, electrification of transport, etc. which call for more electricity and on a reliable basis.

Many have opined that we should return to a frugal way of living and consume less electricity. Can one expect the young in India to do that when electricity consumption is continuously rising elsewhere in the world? Aspirational India has a desire to work and live in air-conditioned spaces, reduce the drudgery of home work by using electrical appliances, entertain itself by deploying the best theatre system, commute in comfort in non-polluting transport and so on. Once basic amenities are available, an ordinary Indian will become an aspirational Indian.

Human lives have become more productive because of electrical lighting and indoor climate control. Indoor heating for climate control increased productivity in countries in colder regions of the world and air-conditioning is doing that now in tropical countries, including India.

Using alternative sources

Given this backdrop, we must maximise the use of low-carbon energy sources, i.e. hydropower, variable renewable energy (VRE), and nuclear power. Last year hydroelectricity generation was 122 BU; exploiting the additional potential will take time.

A NITI Aayog report says India's solar and wind energy potential is greater than 750 GW and 302 GW respectively. Assuming a load factor of 20%, this could generate 1,840 BU. All these numbers are rough estimates, but make it clear that the total possible generation from hydropower and VRE can at best be about a quarter of the projected requirement of 8,600 BU.

Wherefrom will India get the rest of electricity? The share of electricity generated by nuclear power must be ramped up as soon as possible and large investments must be made in research and development in electricity storage technologies to derive full benefit from VRE sources. Until installed capacity based on low-carbon sources picks up, fossil fuels have to continue playing their role. Recent moves such as the Cabinet nod to the construction of 10 indigenous pressurised heavy water reactors, taking further steps for the construction of units 3-6 at Kudankulam, and completing all steps towards operationalisation of the nuclear cooperation agreement with Japan are all steps in the right direction.

R.B. Grover is Homi Bhabha Chair, Department of Atomic Energy and a Member of the Atomic Energy Commission

Courtesy: The Hindu, dt 31.08.2017

WHAT DOES YOUR SMART METER KNOW ABOUT YOU? – FUTURE CHALLENGES

An ordinary smart meter gives your local utility useful information about how much energy you are using—every hour, or even as often as every minute. This helps utility planners efficiently adjust electricity generation to meet demand or encourage reductions in demand when necessary.

But machine learning systems, looking at that data, can tell something else about your home besides its energy use—they can tell if you are home, or if you are not. That's what University of California at Berkeley researchers Ming Jin, RuoxiJia, and Costas Spanos found out. That information, Jin says, is also useful for utilities—they can call or show up to perform necessary maintenance when you are home, and not waste personnel time trying to reach you.

But they aren't the only ones who can access this information, given the data is transmitted wirelessly, and isn't necessarily encrypted at every stage of **its journey**.

"If you know a person is home, as an advertiser, you can make a phone call. If you know a person isn't home, that information could be used for home intrusion or other bad activities," Jin says.

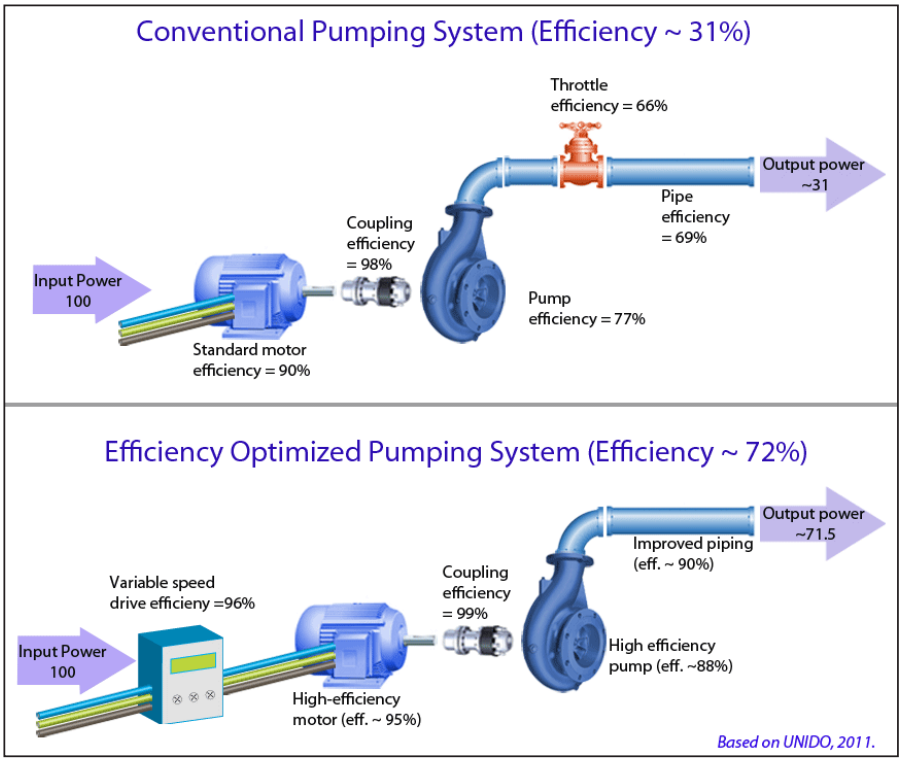
In a **recent paper**, Jin and his colleagues demonstrated that machine learning systems can be trained to detect occupancy without any initial information from a home owner. "You just need a smart meter that listens over time," he says, "as well as the basic assumption that different types of buildings have different occupancy patterns, for example, commercial buildings are typically occupied during the day and not the night and homes are the opposite." Using this assumption, the machine learning algorithms were able to tease out more detailed characteristics about power consumption when a home is occupied; they then are able to tell when someone is home or not, even when that person's patterns are outside the norm.

How to keep occupancy data private and still provide the information utilities need to manage their grids is the next area of research, Jin says. "Right now, meters are sending accurate information about energy consumption. To protect privacy, you could add some noise to that data. We are now looking to determine the optimal size of the added noise that would mask information about occupancy and still give the utility company an accurate enough reading for its needs."

ENERGY CONSERVATION THROUGH ENERGY EFFICIENCY – 30

EMDS: Integrated approach can only help save substantial Energy.

Let have a relook and do some analysis with regard to the same EMDS Example dealt earlier.



Let us look at some different situations and the impact on Efficiency:

a) **In the Conventional System, Motor alone is replaced with Higher Efficiency Motor:**

Overall Efficiency = 95x98x77x62*x69 = Nearly - 31% (Same as earlier).

*Note that that the throttling efficiency reduces to about 62% because the motor runs at higher RPM due to reduced Slip and the throttle has to handle higher volume and higher velocity of flow.

b) **In the Efficiency optimized System, the old Low Efficiency Motor is retained:**

Overall Efficiency = 96x90x99x88x90 = Nearly - 68% **- which is substantial increase from 32%**

It is therefore essential to plan and implement an Efficiency optimized System addressing all Equipments and components and Controls.

Implementation of Energy Efficient EMDS: Important points to ponder.

Energy efficiency potentials of electric motors and motors systems are not being realized, even when they are economically cost effective. Numerous barriers impede adoption and rapid market diffusion of efficient electric motor driven systems (EMDS) within major applications. Some non economic factors could be addressed through energy policy. Such barriers encompass trade issues and various economic aspects such as life cycle cost perspectives, traditional investment decisions and high transaction costs for investors. A further barrier is that electricity prices do not reflect full social costs, given externalities from electricity generation and distribution.

Many barriers limit the market uptake of cost effective EMDS solutions: lack of knowledge; short term thinking over investments and operation; excessively risk averse production practices; higher initial costs; confusion in standards and labels; lack of performance visibility within main production performance benchmarks; difficulty in recouping the cost of more efficient components; and trade issues. Some of these barriers are common to other energy using products and hence are subject to similar policy analysis and solutions, but some barriers are unique to motors.

Issues at the level of manufacturers and OEMs

Customer demand for low investment cost: Many manufacturers of plants and machinery or

OEMs rarely use premium efficiency motors or motor systems because purchasing customers ask for *low investment cost*, not *low life#ycle cost.* Manufacturers know that to remain competitive, they must avoid the extra cost of high efficiency solutions for motors or motor systems. As long as customers do not ask explicitly for high efficiency or least life cycle cost solutions, manufacturers and OEMs will tend to install and sell the least expensive versions of electric motors and motor systems, *i.e.* the less efficient solutions.

To remove these barriers: The concept of life cycle cost must be introduced at all levels of basic engineering training. Factory owners must establish clear rules for calculation of cost effectiveness for new and replacement production equipment.

Manufacturer tendency to discourage energy#fficient EDMS: In recent years, it has been observed that even when customers ask for high efficiency motors for production machinery or plants, manufacturers are hesitant. They ask for unrealistically high additional investment costs, try to significantly postpone delivery dates, or refuse to give the operating guarantees available for "normally" equipped machinery or plants. The reason could probably be that manufacturers and OEMs may want to sustain economies of scale in production or maintain price reductions from producers of motors or components of motor systems (*e.g.* ventilators, pumps or compressors).

To remove these barriers: Manufacturer and OEM trade associations could launch an information campaign and make recommendations to member companies about what each offer should include beyond investment cost and life cycle cost. Of course, life cycle cost must be calculated in the standard manner, taking into account the operating period and interest rate applied to capital costs. These data may depend on sectors traditions. Customers could also specify in their tenders the input data necessary to calculate life cycle cost of the investment and the different efficiency solutions.

A second simple option for OEMs is to introduce an efficiency label for certain types of mass produced machinery or plants, something similar to the **"Intel inside" label (*e.g.* "only Premium Efficiency motors inside").** This label could be initiated by trade associations at a national, regional or multinational level, starting with product classes that involve mass production. If the trade associations involved cannot implement rules for those labels, national governments or regional bodies (such as BEE) could initiate this through a directive. In order to highlight this issue to investors, for a limited period, government could provide subsidies to final investors to cover the difference in cost between standard and higher efficiency.

Inadequate assessment of actual use for EDMS: As key market players, OEMs tend to provide machines for safe and continuous operation even if they do not know the conditions under which the equipment will eventually be operated by their clients. This can lead to grossly oversized motors and other driven equipment with lower efficiency and higher investment costs at time of purchase. Because uninterruptible operation and low maintenance costs are key criteria for purchasers, OEMs are unlikely to change their attitude.

To remove these barriers: Factory owners and motor users should describe their intended application more completely. In cases of replacement and enlargement, it is usually possible to monitor existing processes and measure equipment to define critical dimensioning parameters.

Fear of EDMS failure that will disrupt production: An old fear is that overheating, burning and eventual stalling of electric motors will interrupt industrial processes and cause high production losses and damages. The old fears persist, although general purpose electric motors in industry today are more efficient and do not heat up as they once did (they never reach their allowed maximum temperature). Moreover, motors are protected with an elaborate scheme of cooling with defined over temperatures and performance, etc. Generally service factors of 1.1 to 1.2 are standard (*i.e.* a motor can be run safely at 110% to 120% of its rated output power).

To remove these barriers: Motor performance documentation should clearly state what ambient and over temperatures are allowed, and to what extent motors and systems can be safely operated in overload conditions.

Issues in planning and engineering

Limiting types of motors and components to minimize capital costs: The wholesale sector for electric motors and motor systems tends to minimise capital costs by reducing types and number of electric motors and motor system components to a minimum of frequently sold items. In most cases, they offer not premium efficiency

solutions, but standard efficiency options for the various types and power sizes. Less frequently demanded components or motors must be ordered from the manufacturer, which can take several days or even weeks. When an electric motor or motor system stops operating, the energy manger or product engineer is often forced to find a replacement component within hours, because production must continue in order to minimise total production cost. If the wholesale sector cannot immediately deliver the premium efficiency version, or a premium efficiency alternative, customers will find it unacceptable to wait for several days (or even weeks).

To remove these barriers: Most important is an information campaign targeting both users of electric motor systems and wholesalers. This should eventually be reinforced by a procurement program organized by national energy agencies or an association of learning efficiency networks, which have interest and insight into high energy efficiency solutions.

Outdated engineering skills: The skills of consulting engineers and engineers of OEMs who design, plan new plants or retrofit existing factories may be outdated and not reflect the most current energy efficiency solutions (*e.g.* over dimensioning rules learned in the past or during previous education, no use of electronic discounted cash flow investment planning or decision tools, no up to date knowledge of new technical solutions). There is also some contractual or emotional attachment to certain technical solutions and preferences (*e.g.* waste heat recovery from motor systems) instead of using more efficient technology (*e.g.* hydraulic control instead of pneumatic control) or turning to high efficiency solutions in the production process itself (*e.g.* substantial reduction of cooling demand by substituting a different production process).

To remove these barriers: Professional training of consulting engineers is quite important. They should make use of easily available investment calculation tools of high technical quality or seek professional calculations to determining profitability of the various investment options (*e.g.* by net present value or internal rate of return and not just by payback times).

Issues at the level of investors and energy managers

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

To remove this barrier: Training programs and tools for factory technical staff must be readily available. Staff with adequate qualifications must be selected and trained regularly.

Sales generally not to end#sers: Eighty percent of equipment sales from manufacturers go directly to wholesalers, distributors and OEMs, not to end users. This means that the line of purchase is broken. End users may have little knowledge about motors, and the buyers of motors are not necessarily interested in using premium efficiency motors in machine design. Complete machinery may cost 10 to 100 times as much as the motor, with purchasing decisions based on product performance, not energy cost.

To remove this barrier: OEMs must be trained to include life cycle costing in equipment performance specification. When evaluating different products, end users should be educated to ask for life cycle cost calculations for entire production machines.

Stocks of replacement motors: Industry tends to have replacement motors in store to avoid lengthy interruption of production when a motor fails. Usually for five new motors, a sixth is bought and stored. This practice has been common for decades, since times when motor failure due to overheating and mechanical bearing failure was more frequent. Most industries have a large inventory of old, never used motors. When a motor efficiency upgrading campaign starts industry faces sunk costs of unused and unusable old motors.

To remove this barrier: Energy efficiency campaigns for industry could probably include an incentive system for lowering the purchase price of premium motors and an additional incentive for the return and destruction of old motors.

Purchasing decisions typically based on lowest investment cost: Energy managers and purchasing departments of companies often make decisions on the basis of lowest investment without calculating life cycle cost of the investment. Those who make the purchase also often get a bonus if they negotiate additional reductions from manufacturers of the machinery or plants. This exerts pressure on manufacturers to reduce prices, and often leads to selection of inefficient motors and motor systems if the customer does not clearly

specify required efficiencies. In many cases, manufacturers of the machinery or plants already contracted and installed could not report on expected electricity demand (or pretended not to know). This decision making process from customers, along with the search for inexpensive equipment from both customers and manufacturers, leads to sub optimal energy efficient solutions in most investments by medium size industries.

To remove these barriers: Investment decisions on long lasting, energy using equipment should always be based on a profitability calculation, not just on the payback period, which is only a risk indicator. It is of major importance that investors' profitability calculations accompany offers made by producers or wholesalers, along with information on life cycle cost (particularly on electricity demand of machinery and plants). Energy managers and purchasers of investments should have professional training on these issues.

Limited knowledge of energy#fficiency options: Investors in machinery and production plants equipped with EDMS often lack the necessary knowledge about energy efficiency options. Therefore, they either stick to traditional technical solutions (standard electric motor systems) or look for new solutions, undertake market research and technical studies, and convince the board and their company's purchasing department of the advantages of new energy efficient solutions. It takes time to search for new technical solutions and to convince others in the decision making and purchasing process, and there are transaction costs. For more modest investments, such as electric motors and motor systems, these costs are relatively high; for smaller electric motors or motor systems, these transaction costs can exceed the entire investment (when installation costs are included).

To remove these barriers: To eliminate these high transaction costs, labelling and technical standards are important options (including banning inefficient systems from the market). Another option is to introduce internal company rules and standards for energy managers and purchasing departments responsible for investments in electric motors and motor systems.

Inadequate understanding of how to avoid energy losses: The users of machinery and production plants equipped with electric motors often lack knowledge on energy efficient operations through related controls or limitations of energy losses (*e.g.* controls of factory, plant

or machine automation, or of pressure or leakage of compressed air systems). They either underestimate the positive effect of careful maintenance on efficient energy use (*e.g.* maintenance of cooling units, heat exchangers, filters), or are simply unaware of it.

To remove these barriers: General management or energy managers could change daily routines and initiate thorough and regular maintenance operations. Professional training for machine and plant engineers and operators may be important and should be offered within and outside the companies. Factory automation can be used to monitor and benchmark efficiency in production processes. Governments could support these activities by funding training material and attendance of participants from small and medium size companies. Consulting engineers could play a positive role as lecturers in these training programs.

Conclusion:

EMDS has been dealt a little elaborately due to the author's exposure and observations and it is really important that focused EMDS audits and implementations with an integrated approach is carried out in larger measure to achieve substantial Efficiency improvements that are feasible. Similar elaborate approaches at the individual and National levels are important with regard to other Energy areas like Heat and Fuel. For example in Automobiles and Fuel usage, the overall Efficiencies will be decide not only by the Automobile Efficiency, but by all elements including Fuel Quality, Road conditions and Driving habits of the Driver as well.

Measurements and Bench marking of End Use Efficiency (Input to Final output -Work done) of every area of Energy use can only help Conservation. **It is an alarming fact that in India the End Use Efficiencies range from as low as 8/10% to around 25% at best. The National Target should be to take this up to nearer 40/50%.**

(To be continued)
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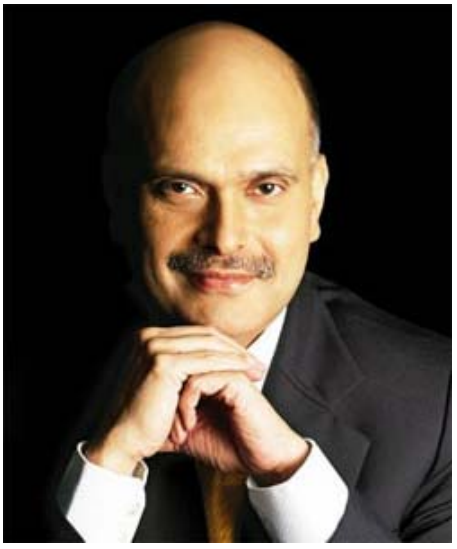


RAGHAV BAHL
Founder and Editor of Network 18

"Remember that your credibility and your honesty is all you will have as you go forward. That's your biggest wealth. You have got to be honest", Raghav Bahl.

Raghav Bahl is the founder and editor of Network 18, one of India's largest media businesses, which delivers television news and entertainment to Indian homes. He has over 25 years of experience in television and journalism.

Bahl did his Graduation in Economics from St. Stephens College, and then did his MBA from the University of Delhi. He attended a doctoral program at the Graduate School of Business, Columbia University, New York. He started his career in media in 1985 as a Correspondent and Anchor person for Doordarshan. He was the Anchor person and Production Consultant for India's first monthly video news magazine, Newstrack, produced by the India Today group. From 1991 to 1993 he was the Executive Director of Business India Television. He founded TV 18 (now Network 18 Group) in 1991 and has taken bold strides to emerge as one of India's leading media barons. Bahl has been instrumental in crafting successful Joint Ventures with media giants like CNBC-TV 18 and CNBC Awaaz. He successfully launched the Indian edition of Forbes magazine, and India's biggest distribution entities, Sun 18. Bahl has helped in the growth of the channel with other major joint ventures with Viacom, called Viacom 18 with houses MTV, VH1 and Nickelodeon channels in India and 'Colours', the country's leading Hindi general entertainment channel. Network 18 holds the Group's home shopping venture, Homeshop 18. Bahl's much acclaimed book "SUPERPOWER? The Amazing Race Between China's Hare and India's Tortoise" provides an inclusive and in-depth analysis about the race to the superpower status between India and China. Bahl was hailed as a Global Leader of tomorrow by the World Economic Forum. He was also selected by Ernst & Young as "**Entrepreneur of the Year (2007) for Business Transformation"**. *His empire spanning six news channels, 10 entertainment networks, a history channel, four media websites and two e-commerce sites generated revenues of Rs. 3,374 crore in financial year 2012.* **India Today High and Mighty power list 2013, Bahl has been ranked No.36.**

HUMOUR

The Good Thief...

Why didn't the man report his stolen credit card? The thief was spending less than his wife.

Credit Limit...

The Bride kissed her father and placed something in his hand.

Everyone in the room was wondering what was given to the father by the bride. The father could feel the suspense in the air and all eyes were on him to divulge the secret and say something.

So he announced: "Ladies and Gentlemen, today is the luckiest day of my life." Then he raised his hands with what his daughter gave him and said, "My daughter has finally returned my Credit Card to me!!!"

The whole audience burst into laughter. But one was in complete silence... The Groom!

Military Etiquette...

Officer: Soldier, do you have change for a dollar?
Soldier: Sure, buddy.
Officer: That's no way to address an officer! Now let's try it again. Do you have change for a dollar?
Soldier: No, SIR!

Turn Up Or Down The Air Conditioner...?

A customer was continually bothering the waiter in a restaurant, at first he'd asked that the air conditioning be turned up because he was too hot, then he asked it be turned down because he was too cold, and so on for about half an hour.

Surprisingly, the waiter was very patient, he walked back and forth and never once got angry. So finally, a second customer asked him why he didn't throw out the pest.

"Oh, that man I don't care." said the waiter with a smile. "We don't even have an air conditioner."

TOP 10 MAJOR DAMS OF INDIA - 3

5. Bisalpur Dam, Rajasthan

The greatest dam of Rajasthan-Bisalpur, located in Tonk District of Rajasthan. The dam is built across the Banas River between two mountains. The largest dam of Rajasthan-Bisalpur with a height of 39m is one of the honour of Rajasthan. Tonk dam attract vast **variety of birds** local as well as migratory.

Height: 130 ft.

Length: 1883 ft

Type: Gravity Dam

River: Banas River

Location: Rajasthan

6. Koyna Dam, Maharashtra

Koyna Dam is built across river koyana in Koyna Naga Maharashtra with a height of 103m. It is one of the largest dams in Maharashtra located at western ghats. The lake founded by the Koyna dam is called The **Shivaji Lake,** the area is surrounded with the natural beauty of Sahyadri **Mountains Ranges**.

Height: 339 ft.

Length: 2,648 ft

Type: Rubble-Concrete dam

River: Koyna River

Location: Maharashtra

Installed capacity: 1,920 MW

(To be continued...)

புரதச் சுரங்கம் - 2

உடலுக்கு உரம் தரும் முதன்மைப் பருப்பு - துவரம் பருப்பு

சாம்பார் இல்லாத இட்லியையோ, சோற்றையோ நினைத்துப் பார்க்க முடியுமா? சாம்பாரின் வரலாறு நீண்டது இல்லை என்றாலும் கூட, இன்றைக்கு நம் உணவில் சாம்பார் முக்கிய இடம் பிடித்துவிட்டது. தஞ்சை சரபோஜி வம்சத்தின் கொடையான சாம்பாருக்கு அடிப்படை பருப்பு, அதாவது துவரம் பருப்பு.

பொதுவாகவே பருப்பு என்று சொன்னால், அது மஞ்சள் நிறம் கொண்ட துவரம் பருப்புதான். துவரம் பருப்பை வேக வைத்து, தாளிப்புப் பொருட்களைச் சேர்த்து மசிப்பது தென்னிந்தியாவில் பொதுவாகப் பருப்பு என்றோ, பருப்பு மசியல் என்றோ அழைக்கப்படுகிறது. நாடு முழுவதுமே இந்தப் பருப்பு பரவலாகப் பயன்படுத்தப்படுகிறது.

தீபகற்ப இந்தியாவின் கிழக்குப் பகுதியில் தோன்றியதாகக் கருதப்படும் இத்தாவரம், ஆப்பிரிக்காவுக்கும் எடுத்துச் செல்லப்பட்டுள்ளது. வறட்சியைத் தாங்கி வளரக்கூடியது என்பதால் வறண்ட, புரதச் சத்து பற்றாக்குறை உள்ள பகுதிகளில் பயிரிட ஏற்ற பருப்பு வகை. துவரை மானாவாரியாகவே அதிகம் பயிரிடப்படுவதால், தண்ணீர் விரயமாவதில்லை. அத்துடன் மண்ணில் நைட்ரஜனை நிலைப்படுத்தி, மண்ணை வளப்படுத்தவும் துவரை உதவுகிறது.

உணவுப் பயிர் என்பதைத் தாண்டி, பல்வேறு வகைகளில் பயன்படுகிறது. விவசாயிகளுக்கு மூடாக்கு பயிராகவும், கால்நடைகளுக்கு ஏற்ற தீவனமாகவும் பயன்படுகிறது.

இந்தப் பருப்பு காய வைக்கப்பட்டு. பழுப்புப் பச்சை தோல் நீக்கப்பட்டு, இரண்டாக உடைக்கப்பட்டே பொதுவாகப் பயன்படுத்தப்படுகிறது. மஞ்சள் அரை உருளை வடிவத்தில் இருக்கும் இந்தப் பருப்பை எளிதாக வேக வைப்பதற்கு, கொஞ்சம் நேரம் ஊற வைத்தாக வேண்டும். வெந்நீரில் ஊற வைப்பது நல்லது. பருப்பு சுவை தூக்கலாக இருக்கும்.

எளிய செரிமானத்துக்கு... துவரம் பருப்பு வாயுத் தொல்லையை ஏற்படுத்தக்கூடும். அதைத் தவிர்க்கவே துவரம் பருப்பின் மேல் செம்மண்ணைப் பூசிக் காய வைத்து, பின் கழுவி எடுத்துப் பயன்படுத்துவது பாரம்பரிய வழக்கம். இப்படிச் செய்வதால் வாயுத் தொல்லை நீங்கும். இந்தப் பாரம்பரியப் பதப்படுத்தும் முறைக்குப் பின்னர்க் கிடைக்கும் துவரம் பருப்பின் சுவையும் மணமும் அருமையாக இருக்கும். ஊட்டச்சத்தும் இழக்கப்படாமல் இருக்கும்.

அதேபோலப் பருப்பை வேக வைக்கும்போது கொஞ்சம் விளக்கெண்ணெயைச் சேர்த்து வேக வைத்தால், துவரம் பருப்பு வேகும்போது நுரைக்காமல், பாத்திரத்தை விட்டு வெளியே வராமல் வெந்திருக்கும். நன்றாகச் செரிமானமும் அடையும். இது சேலம் மாவட்ட வழக்கு.

பயன்பாடு - இந்திய உணவில் அதிகம் பயன்படுத்தப்படும் பருப்பு வகை இது. சாம்பார், பருப்பு சோறு, அரிசி பருப்பு சாதம் தொடங்கிப் பல உணவுப் பண்டங்கள் இதை அடிப்படையாகக் கொண்டு செய்யப்படுகின்றன. மசிக்கப்பட்ட பருப்பாகத் தனியாகவும், சாலடில் சேர்க்கப்படும் பொருளாகவும் இருக்கிறது. ரசத்திலும் சில நேரம் சேர்க்கப்படுவது உண்டு. வடஇந்தியாவில், குறிப்பாக குஜராத்தில் சப்பாத்தியுடன் தரப்படும் தால் எனப்படும் பருப்பு மசியல், துவரம் பருப்பு மசியலே.

ஊட்டச்சத்து - இதில் புரதச் சத்து அதிகம் என்பதால், உடலுக்குச் சரிவிகித உணவைத் தருவதற்குப் பயன்படுகிறது. புரதச் சத்தைப்போலவே வைட்டமின் சி சத்து, அமினோ அமிலம், நார்ச்சத்து போன்றவை அதிகம். இதில் உள்ள கார்போஹைட்ரேட் சத்து (மாவுச் சத்து), ரத்தச் சர்க்கரை அளவை ஆரோக்கியமாகப் பராமரிக்கிறது, உடலுக்குத் தேவையான சக்தியையும் தருகிறது, **விஷயம் என்னவென்றால் கொலஸ்ட்ரால் கொஞ்சம் கூட இல்லை.**

தெரியுமா? துவரம் பருப்பு 3,500 ஆண்டுகளாகப் பயிரிடப்பட்டு வருகிறது. இப்போது உலகம் முழுவதும் சராசரியாக ஓர் ஆண்டில் 20 லட்சம் கிலோ பயிரிடப்படுகிறது. இதில் 82 சதவீதம் இந்தியாவில்தான் பயிராகிறது.

நவதானியங்களில் ஒன்று பழைய பெயர்கள்: தோரை, யவை, காச்சி, ஆடகி, ஆடகம்

தாவரவியல் பெயர்: Cajanus cajan

ஆங்கிலப் பெயர்: Toor Dal / Tuvar dal / Pigeon Pea

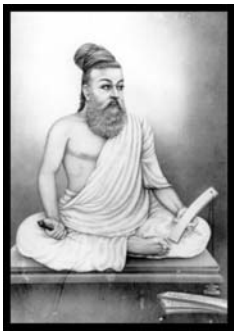
மருந்தாக... உடலுக்கு வலுவைக் கொடுக்கவும் உடல் எடையை அதிகரிக்கவும் கொடுக்கப்படும். **'பஞ்சமுட்டிக் கஞ்சி'**யில் துவரை முக்கியமான பொருளாகச் சேர்க்கப்படுகிறது. நோய்நிலை காரணமாக மெலிந்தவர்களுக்கும் சோர்வுற்றவர்களுக்கும் உடலை உரமாக்கும் துவரை முதன்மையான ஊட்டச்சத்து உணவு என்பதில் சந்தேகமில்லை.

துவரம் பருப்பு ரசம்: துவரம் பருப்பு ரசத்தை ஒரு மருந்தாகச் சித்த மருத்துவ நூலான 'தேரையர் குணவாகடம்' குறிப்பிட்டுள்ளது. மிளகு, பூண்டு சேர்த்துத் தயாரிக்கப்படும் துவரம் பருப்பு ரசம், செரிமானம் சார்ந்த கோளாறுகளை நீக்கப் பயன்படுகிறது.

பத்திய உணவு: பத்திய உணவாகத் துவரம் பருப்பு பயன்படுகிறது. பண்டைக் காலத்தில் உண்ணா நோன்பின் முடிவில் சாப்பிடும் உணவாக, துவரம் பருப்பை மக்கள் அதிகமாகப் பயன்படுத்தி இருக்கின்றனர். ***(To be continued...)***

Courtesy: ஆதி வள்ளியப்பன், தி இந்து, 09.07.2016

TIRUKKURAL AND MANAGEMENT IN A 'NUTSHELL' - 53



In an interesting deliberation about what are the Qualities that make a Leader, one of the Model presented is a "5 – C" Model of Leadership, which consists of the following:

a) Competency

b) Courage and Confidence (Paired into one)

c) Communication

d) Consistency and

e) Compass or Integrity

Tiruvalluvar, no doubt, deals with all these in a very comprehensive manner and in this part, let us review what he has to advise us about "**Compass".**

The Presenter of 5 – C Model of Leadership referred to 'Compass' on the Integrity Dimension. There is, in fact, one more important Dimension of 'Compass' meaning 'Comprehension'. Tiruvalluvar deals with both dimensions in enough measure and some of the Kurals dealing with both the dimensions are given below:

Aranizhukkathu Allavai Neekki Maranizhukka
Māānam Udaiyathu Arasu ***Kural 384***

அறன்இழுக்காது அல்லவை நீக்கி மறன்இழுக்கா
மானம் உடையது அரசு குறள் 384

"The Prince (Leader) shall not fall in virtue and shall abolish unrighteousness: He shall guard his Honor jealously and shall not sin against the laws of valor"

Azhivathoom Aavathoom Aagi Vazhipayakkum
Oothiyamum Soozhndu Seyal ***Kural 461***

அழிவதூஉம் ஆவதூஉம் ஆகி வழிபயக்கும்
ஊதியமும் சூழ்ந்து செயல். குறள் 461

"Take into consideration the output and the wastage and the profit that an undertaking will yield: and then put thy hand to it"

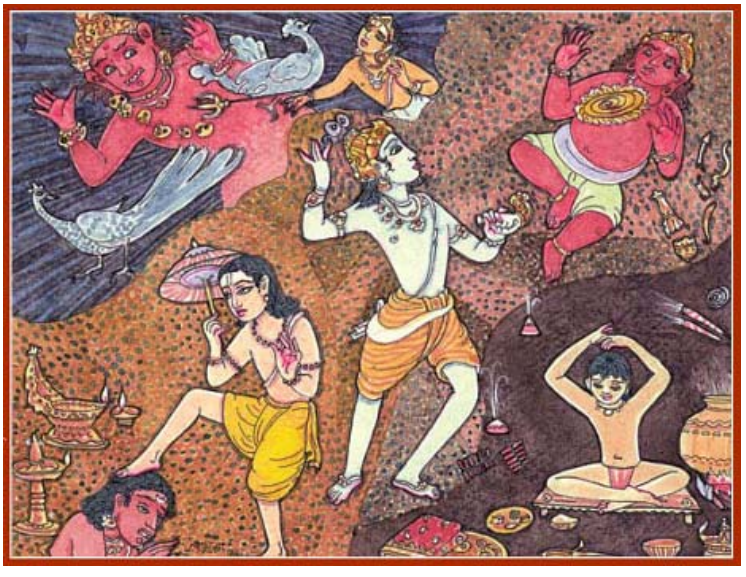
Thelivu Ilathanaith Thodangār Ilivuennum
Eethappādu Anju bavar ***Kural 464***

தெளிவு இலதனைத் தொடங்கார் இளிவுஎன்னும்
ஏதப்பாடு அஞ்சு பவர் குறள் 464

"Behold the men who fear to be ridiculed by others: they do not take up any enterprise without previous deliberation"

HOME FESTIVALS - 10

ஐப்பசி – Aippasi (October/November)



Skanda shasti is the first festival of this month, commemorating the victory of Lord Murugan over the demon Sura, of the higher, spiritual self over the lower nature. Dipavali is the major event of Aippasi, celebrated everywhere Hindus live and by Buddhists and Jains, too. In one story of its origins, Vamana, the dwarf avatar of Lord Vishnu, requests the amount of land from King Bali that he can cover in three steps. Granted the request, Vamana covers with his first step all of the Earth, with the second all of the sky, and then asks the king where to take the third step. The king offers his own head (lower left), and in commemoration of the king's humility, the day was established. In another story, Lord Vishnu (center) kills the demon Nagagasvaran with His discus. The various observances (lower right) of Dipavali include an oil bath, gifts of new clothes, fireworks (sufficiently indulged in Chennai to rattle dishes off the kitchen shelves), oil lamps for display and abundant pots of delicious food. The early morning bath is always considered to be in the Ganga itself, so one greeting of the day is, *"Did you have the Ganga bath?"* ***(To be continued)***

ACAR THE ELECTRIC ALL-ROUNDER

An electric car for Africa, custom-designed for the needs of the population there, that strengthens rural structures and helps drive the economy: Scientists at the Technical University of Munich (TUM) and partners have been working intensively towards this goal for four years. The aCar is designed for passenger and cargo transportation and is also interesting for the European automotive market.

Mobility is a part of our everyday lives: We transport large loads, commute to work, fly to a faraway country on vacation. However, access to a vehicle of any kind is hardly a given for many people in Africa. For farmers who live far from urban centers, this means that they have no direct access to medical care, education or to political processes. They are dependent on transport contractors who bring their products to the next city for sale in order to make a living. As a result many people are leaving rural areas in search of better living conditions in the city.

"With the aCar we have developed a mobility concept that can solve these problems," explains Prof. Markus Lienkamp, head of the TUM Chair of Automotive Technology. "The aCar is an off-road capable vehicle that is affordable for people there and is capable of transporting heavy loads. The modular structure also allows other uses for example for water treatment." Together with the "Bayern Innovativ" campaign, the TUM launched the project "aCar mobility - Rural mobility in developing countries" in 2013. The objective was to conceive a vehicle that precisely meets the requirements of the rural population in sub-Saharan countries. The project is supported by the Bavarian Research Foundation since 2015.

The concept: One vehicle, a variety of demands Four-wheel drive is a must for the roads of Africa, the majority of which are not paved. The team also decided on an electric power train. "An electric drive is not only greener, but is also the better solution in technical terms, since it is low-maintenance and can apply its full torque directly to accelerating from a stop," says Martin Šoltés, who shares leadership of the project with SaschaKoberstaedt at the Chair of Automotive Technology. The vehicle is primarily intended for transporting passengers and cargo, with a total load capacity of one ton. The battery offers a variety of other possible applications, either as an energy source or as a drive for high-consumption applications, for example as a winch. A number of various moduls have been designed for the cargo bed which can be used on a modular basis. Additional modules can turn the vehicle for example into a mobile physician's office or a water treatment station.

The 20 kWh battery capacity gives the vehicle an electric range of 80 kilometers. The battery can be loaded from an ordinary 220 volt household wall socket within 7 hours. Solar modules mounted on the roof of the aCar gather energy throughout the day. Optional solar collector sheets can be unrolled to significantly increase the amount of solar energy produced for self-contained battery charging.

First prototype: Technology testing and user studies the scientists produced the first prototype in May 2016 and conducted initial tests in Germany. However, to make sure the aCar also meets all the demands placed on it on location, they shipped the vehicle to Ghana, where they tested the technology and concept under local conditions in July 2017.The aCar has also undergone considerable further technical developments. The team was working among other things on optimizing weight, on electrical systems and software, acoustics and ergonomic seating and visibility. Model factory in Germany for the first vehicles To make sure the idea of the aCar becomes more than just an idea and actually makes it to series production, SaschaKoberstaedt and Martin Šoltés have founded the company "Evum Motors GmbH". The first vehicles are to be manufactured in a model factory in Europe. "We'll have to master all the technical procedures before the car can be made in Africa. Then we can train people from Africa who can in turn pass on their knowledge there."

Technical Data: Power output: 2 x 8 kilowatts; Electric drive range: 80 kilometers; EU vehicle classification: L7e; Voltage level: 48 volts; Battery capacity: 20 kWh; Top speed: 60 km/h; Tare weight: 800 kg; Load capacity: 1000 kg; Length: 3.7 m; Width: 1.5 m; Height: 2.1 m; Seating capacity: 2 Source and top image: Technical University of Munich

Read more at: http://www.energyharvestingjournal.com/articles/11581/acar-the-electric-all-rounder

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