ELECTRICAL INSTALLATION ENGINEER

NEWS LETTER

TAMILNADU ELECTRICAL INSTALLATION ENGINEERS' ASSOCIATION 'A' GRADE (Regn. No. 211/1992)
Old No.82 / New No. 123, Lloyds Enclave, Avvai Shanmugam Road, Royapettah, Chennai - 600 014.
Phone : 2811 1300 Email : tnagrade@gmail.com Website : www.teiea.com

ISSUE NO. 132 | VOL : No. 12/2017 | MONTHLY ISSUE NO. 2 | PRIVATE CIRCULATION ONLY | FEBRUARY 2017

EVENTS

L&T Training Programme

Selection & Application of Drives	1st - 3rd March 2017
Best Maintenance Practices in LV Switchgear	6th - 10th March 2017
Industrial Protection with Numerical Relays	13th - 16th March 2017
Introduction to Industrial Electrical Systems	20th - 22nd March 2017
Electrical Safety	23rd March 2017
Selection, Protection & Maintenance of Transformer	27th - 28th March 2017
Introduction to Medium Voltage Switchgear	29th - 30th March 2017

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

POWERELEC INDIA
International Power, Electrical & Electronics Expo
9 - 11 March 2017 | B C E C , Mumbai - India

Events Profile: The International Tradeshow and Conference on Power Generation, Electricals and Industrial Electronics
Date: 9th – 11th MARCH 2017
Venue: BCEC MUMBAI
Website: http://www.powerelec.co.in/

ELECTRIC, POWER & RENEWABLE ENERGY MALAYSIA 2017
The Region's Flagship Event for Sustainable Power Generation, Energy Efficiency, Transmission and Renewable Technologies

Events Profile: EPRE 2017 is organised by Malaysia's leading exhibition organiser. All World Exhibitions members have been organising trade shows for over 30 years and currently organise over 150 trade exhibitions biennially. These include Asian Elenex (Hong Kong), Elenex Vietnam, Power Mongolia and Electric Power & Renewable Energy (Myanmar).
Date: 15th – 17th March 2017
Venue: Kuala Lumpur Convention Centre, Malaysia
Website: http://www.epremalaysia.com/

POWER-GEN India & Central Asia
Renewables | Fossil Fuels | Nuclear

Events Profile: POWER-GEN India & Central Asia 2017 will bring together industry experts from across the globe to exchange knowledge and share their expertise, as well as showcase the latest power generation technology developments that will ultimately shape and strengthen the Indian power sector
Date: 17 – 19, May 2017
Venue: Pragathi Maidan, NewDelhi
Website: http://www.power-genindia.com/index.html

EDITORIAL

Dear Members, Fellow Professionals and Friends,

Seasons Greetings to One and All!

India and the whole world seem to be passing through rough times, with terrorism showing its head in many parts of the world, with doubts about the policies and performance of the New Government at the US disturbed with growing opposition to it in the US as well in many 'friendly' countries, Global Energy and Environmental concerns and so on. On Indian part, strong measures like **'Demonetization'** to set the economy straight and efforts to bring about **'Uniformity'** in the country and more such, seemed to create serious problems all over, but as times are rolling by we are able to see calming down taking place periodically to ensure carrying on the affairs and marching towards betterment in all fronts all the time. We, as Indians, will easily attribute it to the 'Grace' of the Almighty and the World at large may attribute it to the **'Law of Nature'** and both we can understand, ultimately mean the same. Let us invoke for more of the 'Grace' for Peace, Welfare and Happiness!!!

Instead of the usual 'February End' Budget we have a First February Budget this time and we will write and comment about its impacts on our Profession and Business in our next issue.

The most important Event of February, for we professionals, is the **National Science Day** being celebrated on the 28th of February, as we know that it is the Science and Technology and Engineering in their order, have been the Key to all the progress of the World at large and India too. It is mind boggling if we just look at the role played by Science and Engineering in the last 150/ 170 years in the progress of the World Civilization, comforts and prosperity, ultimately resulting in a "Global Village" situation, bringing every one near to each other – efforts to making them **'Close to each other'** also, is continuously on by the UN and all countries of the World. There are also arguments, rightly so, that the misuse of advancements in Technology could result in great dangers to world and the humanity at large.

Looking at our own country's situation and Growth in the past 100 years only – it is our proud history that for a thousand years and more we were the leading light of the World, possessing the advanced Knowledge and abundance of all Wealth – we can feel with Pride that from a most underdeveloped, poverty ridden Country, which we had become due to invasions and colonization, we are one of the Fast Developing Economies of the World today, vying to become an **"Economic Super Power"** of the World. We can see and appreciate the positive role played by Science and Technology in all spheres of our Economy, be it Agriculture or Industries or Commerce or Societies at large. The **"Green"** and the **"White"** and the Industrial Revolutions as well the recent Automobiles and Communication and **"Space"** Revolutions are all examples of the contributions of Science and Technology. Let us pray for Good Senses to prevail in all the Powers of the World to make the World, a Peaceful and Enjoyable place.

Our Association conducted a Technical Seminar on Monday the 30th January 2017 at "HOTEL GREEN PARK", Vadapalani, Chennai - 600 026. Hundred plus (100(+)) Delegates participated in the Seminar.

We thank all those members who have helped us by participating in the advertisement appearing for the issue January 2017 – Safvolt Switchgears Pvt Ltd., Supreme Power Equipment Pvt. Ltd., Flir India Pvt. Ltd., Power Links, Wilson Power and Distribution Technologies Pvt. Ltd., Universal Earthing Systems Pvt. Ltd., Ashlok Safe Earthing Electrode Ltd., OBO Bettermann India Pvt. Ltd., Elmettlerr, Consul Neowatt Power Solutions Pvt. Ltd., SPS Transformers Pvt. Ltd., Galaxy Earthing Electrodes (P) Ltd., Pentagon Switchgear Pvt. Ltd., Dehn India Pvt. Ltd. Power Cable Corporation.

EDITOR

ELECTRICAL INSTALLATION ENGINEER

President :
S.D. POONGUNDRAN
Secretary :
S. GOPALAKRISHNAN
Treasurer :
M. BALAMURUGAN

Editor : G. VENKATESH
Advisor: S. MAHADEVAN
Printer : M. VENKATARAMAN

CONTENTS

MEMBERS DETAILS

S.No.	Company Name	District	Contact No.	License No.
196.	Sri Srinivaasaa Electricals	Coimbatore	0422–2511876, 94430 44315	EA 1681
197.	Sri Vignesh Electricals	Coimbatore	98941 37868, 81449 10303	EA 2562
198.	Volts Trans Engineers	Coimbatore	0422–2233955, 97894 59399	EA 2503
199.	Sri Lakshmi Electricals	Coimbatore	0422-2574193, 98430 57419	EA 1379
200.	DKD Engineers & Agencies	Coimbatore	0422-4392009, 98652 52528	EA 1819
201.	Nithyagomathi Power Controls	Coimbatore	0422-2406958, 93446 20998	EA 2383
202.	Power Electricals	Coimbatore	88832 44900, 98422 04900	EA 2586
203.	Surieya Electricals	Coimbatore	94437 35778	EA 1861
204.	Union Electricals	Coimbatore	94430 49625, 99945 82845	EA 1606
205.	Justin & company	Coimbatore	0422-2450339, 98942 58789	EA 1378
206.	Kiruthika Electric Co.	Coimbatore	98422 14655, 98424 14655	EA 1765
207.	Success Electriical Engineers	Coimbatore	99449 66004, 90920 99016	EA 2943
208.	Excelltech Wind India Pvt. Ltd.	Coimbatore	0422-2526283, 97500 99998	EA 2687
209.	E Green Electricals	Coimbatore	95002 50005, 75022 50005	EA 2933
210.	Beacon Electric System	Coimbatore	98424 54653, 94889 51717	EA 2140

KNOW THY POWER NETWORK - 113

Having completed the topic on Storage Batteries, I was wondering what to do next. Then it strikes me that why should not we select some topic related to Electrical Energy and its meshed network (grid), which will be of great use to the readers. So I opt to for **"Micro Grid"** as the subject theme of my next article. Hope you all will be pleased to receive it whole heartedly when it is delivered to you. Before proceeding to my new topic, I would like to make some wanderings on the **"Energy Highway"** and share some of my general thoughts on energy front that includes all kinds of electricity grids that ranges from "Super Grid to Micro Grid", which lies at its extreme end.

*Just as **"Cricket Game"** not all the issues of electrical energy starting from its "generation to final delivery at the consumer's premises and its storage may not find easy solutions. Many issues required to be studied and tackled. Some of them may be taken up frontally; some others cannot be directly dealt with. So we need to handle them carefully. Complex / complicated topics need to be met with a "Straight Bat"; attention demanding topics may be cut through the slips or swept through to fine leg. In some cases, we have to block the issues simply so they will die down slowly and gradually. For all these works, a shrewd methodology is required. To master this, we are in need of a good understanding of all the issues connected with the modern electricity system.*

Before proceeding further, let me define various categories of Electricity Grids.

i. **Super Grid** – It is an inter connected (meshed) network of large electrical power stations and EHV transmission lines / cables

ii. **Normal Grid** – It is nothing but the present day electricity grid which inter links many generating stations and transmission networks of 400 KV and 230 KV lines and cables. At times, depending upon the situations these grids are operated in an **"independent or islanded mode".**

iii. **Smart Grid** – It is formed when the physical infrastructure of the modern electricity grid is when enveloped by information and computer networks (ICT Networks). Then it is called Smart Grid. That is smart control of all its components is achieved: two way transacting smart meters find major a role in its functioning.

iv. **Micro Grid (Nano Grid / Autonomous Grid)** – It is an autonomous network that functions independently from other networks like grid connected facility. This network is constituted by Wind Electricity Generators, Solar Photo Voltaic Cells and Electricity Storage Systems. According to CIGRE, "Micro Grids are electricity distribution systems containing loads and distributed energy sources (such as distributed generators, storage devices and controllable loads) that can be operated in a controlled co-ordinated way-either while connected to the main power network or while islanded" - Micro grid generally handles the electricity flow both from conventional and renewable energy resources. This results in many operational issues like variation of power generation between them. Further electricity from wind is seasonal and solar power is available only in a particular period of time of the day. Thus this system requires to resolve many issues.

Today a confluence of many sophisticated softwares and electronics, higher communication band width combined with a significant fall in the prices of electricity generated by wind solar natural gas and reduction in the cost of storages the boundaries of energy frontiers are pushed / moved to greater distances. Having witnessed the presence of Super Grid, Normal Grid, Smart Grid and Micro Grids in the energy field, you may be of interest to know what would be its future. Without doubt, you may witness many surprises. One among them will be the role played by DC; certainly DC will replace AC in all areas starting from "long distance transmission to local distributed generations and micro grid applications. Nearly 135 years ago, there as a **"war of currents"** between Edison, Tesla and Westing House. AC won that battle then. Now it is the turn of DC to stand on the winner's pedestal. It is mainly due to the supports extended by the evolution of Power Electronics Technologies and the development of HVDC Breakers, Smart Meters, Larger Electrical Storage Systems and other supporting technologies.

In future, we can see that many new long distance transmission lines will be in the Ultra High Voltage DC (UHVDC) rating. Compared to HVAC systems, HVDC can carry five to eight times the amount of power that would normally more along a given HVAC transmission right-of-way. i.e. it has very high capacity of energy transfer. Further it helps to ward off the problems like under frequency pull out of grids and wide-scale cascading black outs. This step will be of much use to transport electricity from major wind and solar forms.

In order to provide reliable power supply, storage batteries are essentially required in all renewable energy systems since these sources generate electricity in pulses or intermittently. In this context, being an inherently DC energy supply, Solar photo voltaic cells and storage batteries need a compatible interface. DC power delivery system easily meets this requirement. It can also provide a reliable power conversion interface to the grid.

The enhanced role of DC in future power supply system is mainly due to the factors as listed below.

i. Most modern electrical loads and electronic devices are in need of LVDC supply for their operation. With minimum power loss, DC supply can meet this demand.

ii. Reliable Energy Storage methods are required to improve the capacity utilization of renewable energy supplies. When DC finds better applications, the energy storage integration is widely achieved.

iii. DC power is highly energy efficient than AC power.

To cite an example, today's DC motors and appliances have higher efficiencies and power-to-size characteristics. DC based LED lamps are also highly efficient.

iv. It is beneficial to form DC and Hybrid AC/DC Micro Grids.

Micro Grid applications effectively facilitate the tieing up of local power generation with the main power grid so as to serve defined end-use loads with minimum costs. It also helps improve reliability and energy security and grid resiliency.

v. DC finds wider applications in Computer Data Centres and Server forms.

vi. DC Batteries can be charged in lesser time from DC sources rather than from AC sources. This helps facilitate high electric vehicle growth and adaptation.

vii. Finally the distributed generation of DC power will help to achieve environmental carbon reduction. It also enhances its overall economic and environmental value proposition.

With this, let me sign off.

(To be continued…)

V. Sankaranarayanan, B.E., FIE,
Former Addl. Chief Engineer/TNEB
E-mail: vsn_4617@rediffmail.com
Mobile: 98402 07703

A WORKABLE ALTERNATIVE TO INTER LINKING OF RIVERS PROJECT OF INDIA

Details extracted from the Web for Information purpose.

The Concept:

The concept of linking rivers in India has been there for many years and is yet to move from the concept stage towards fruitful implementation. The idea originated when **Sir. C. P. Ramaswamy lyer**, an eminent educationist, had a far vision and suggested linking the rivers Ganges with Cauvery to solve our water problems. But this was only a suggestion and no concrete **proposal was put forth**.

Sri K. L. Rao, an eminent Engineer and former Central Minister gave the proposal to link Ganges and Cauvery by a long canal. This was a good proposal but had a major disadvantage. To bring water beyond Vindhya Mountains, heavy pumping had to be resorted to lift water. The Power requirement was so very heavy, being equivalent to the power generated in the entire country at that time. Hence this proposal was **dropped**."

Captain Dastur presented a project connecting all the major rivers in the country. This is also a good proposal having varied advantage of irrigation, power generation etc. However Capt. Dastur's proposal was found to be of a very big magnitude involving heavy cost. Besides it was not found technically viable. Hence the proposal was also **dropped**.

National Water Development Agency was formed under society act in 1982 and supported by Government of India. They are studying the Peninsular component in the South and Himalayan component in the North. The preliminary investigations on these two schemes are going on and the cost component for this project is about 5.6 lakhs Cr. (as estimated in 2002). But this project proposal also faces some problem.

First, the fear is whether, any State will ever agree that they have surplus water and even if they agree whether they will be willing to spare to the neighbouring state. Hence it may not be that easy to take water from surplus states to deficit States. Even if this problem is to be overcome by some means, there will always be interstate water problems as we already experience between many States. Besides, this scheme involves lifting up to 116 meters in some places involving huge power consumption and recurring expenditure.

Sri A.C. KAMARAJ, an eminent Engineer and expert in water management has evolved the formation of a system by the name GANGAI-KUMARI National Waterways, which overcomes many of the demerits noticed in the previous schemes. Since the National Waterway travels at even height, no pumping is required in the entire stretch and the flow of water is purely by differential water head. The water way will provide flood control in many states. This is an innovative proposal which works like a power grid.

Further the water transfer in the project is in either direction enabling water from Andhra to flow to Tamilnadu and Kerala. Similarly water will flow to Andhra from Kerala and Tamilnadu. As a result give and take policy is assured for all states in the project in the distribution of water. There will not be any interstate water problem and every state will get adequate water. In the National Waterways project we will be able to generate enormous power and that too cheap and pollution free hydroelectric power.

Since medium size ships and boats can ply in the National Waterways the present congestion on the National Highways will be greatly eased. Further the cost of transport will be very economical compared to that of road transport. In peninsular scheme water will mostly flow from one river to adjacent river, also experiencing that same monsoon. But in National Waterways water form one region will flow to the other region experiencing the different monsoon.

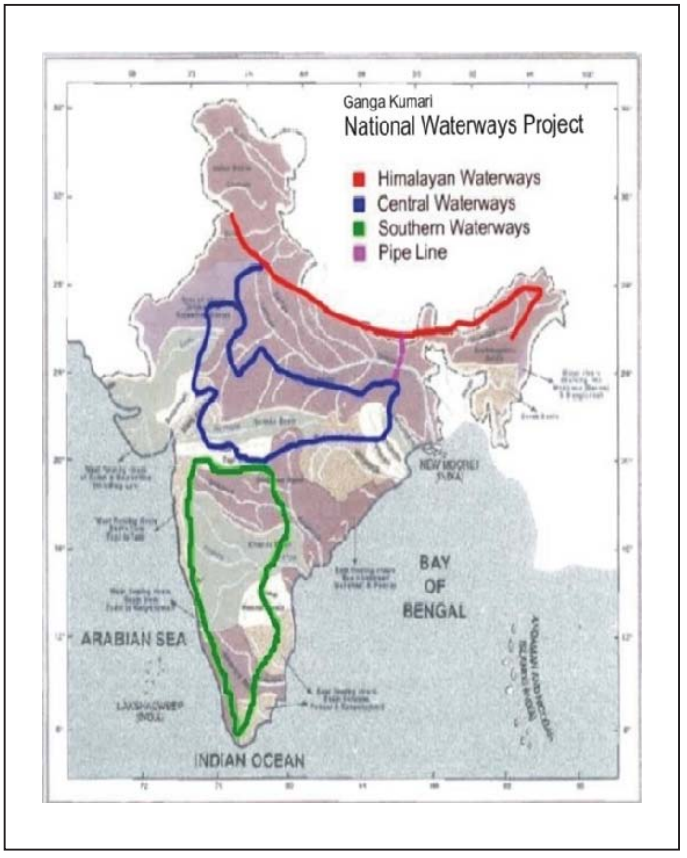
Our constitution provides for National Waterways just like National Highways. (Article - 246 - 7th Schedule list 1/24). Once the National Waterways is taken up as provided in the constitution, there is no necessity for nationalization of rivers.

Project Details in brief:

This project proposes to have National Waterways covering the entire nation just like National highways. The Himalayan Waterways lie almost along the entire country from west to east on the northern side. The Central

and Southern Waterways cover almost all the states in the centre and south upto Kanyakumari. The waterways provide very cheap and economical transporting system for various goods like food grains, fertilizers, cement, sugar and Minerals. Since the waterway runs at an even height of 500 metres and 250 metres above sea level, we will be able to generate enormous power by utilizing the level difference.

As we have National highways all over the country from Kashmir to Kanyakumari, we can have National Waterways all over the country from Kashmir to Kanyakumari. As we have power grid we can have water grid. Power can be tapped at any point of requirement from the power grid. Similarly water entering the National Waterways can be tapped at any point of requirement. After the completion of the project, there will be no dearth for water in most part of the country either for irrigation or for drinking.



The Himalayan Waterways Project

The Himalayan Waterways Project on the north consists of a wide canal travelling from West to East at the foot of Himalayan mountain and above the North of the Ganges River. The Waterway, starting from Jammu runs almost the entire length at the toe of Himalayan Mountain up to Bramhaputra and turns south passing through Arunachal Pradesh and Nagaland up to Haflong. The width of the waterway proposed is 150 m and depth of 10 m subject to variation. The waterways will be about 4500 Km long. The constant water levels in the waterway will be 10m.

There will also be a continuous balancing waterway on the upper side of this waterway, which will act as one long reservoir and check dam. The width of the dam is suitably designed to arrest the oncoming rush of water and also to avoid any silt entering the National Waterways. However the balancing waterway is designed to a width of 250 mts & depth of 30 metres. This waterway will provide flood control in all the northern states especially in U.P., Bihar and Assam. Since the waterway is at an even level, transfer of water is permitted in both ways. That is to say water will flow from Punjab to Assam and from Assam to Punjab

meeting the water requirement through out all the states. The flood in Ganges and Bramhaputra will be greatly controlled and drought areas will get water.

The Central Waterways Project

The Central Waterways starts in Uttar Pradesh on the Northern side of Vindhya Range and traverses on both sides of the range East and West. It passes through Bihar, West Bengal, and Circle in Maharashtra. The total length of the Central waterway will be about 5750 km. This will also have a balancing waterway of 200 mts width and 30 mts depth. Since the water from Maahandhi will flow to the area under Narmadha and vice versa, the flood and drought in the central region will be greatly minimized. We will be able to generate enormous electricity utilizing the level difference form the waterways to the sea.

The Southern Waterways project

The Southern Waterways starts from Maharashtra runs down in Andhra and Tamilnadu up to Kanyakumari. Then it travels in Kerala, Karnataka, and Goa and joins in Maharashtra forming a circle. The Southern Waterways is also a contour canal. The length of the Southern Waterways is 4625 km. Width - 100 metres (approx.) Depth - 10 Metres (approx.). This will also have a balancing waterway of 200 mts width and 30 mts depth. Since the waterways proposed is at an even level, flow of water is in both ways. Water form Andhra will flow to Tamilnadu, Kerala, Karnataka and Maharashtra and water from Maharashtra will flow to Karnataka, Kerala, Tamilnadu and Andhra.

The National Waterways scheme when taken up is sure to provide a lot of benefits in many fields. Income per year will be Rs. 1,04,000 Crores

Drinking Water: 700 million people will get uninterrupted drinking water supply.

Transport: We will get a very economical Inland waterway Transport (IWT) system. This will greatly reduce the fuel consumption and pollution. Hence waterways will bring down the diesel consumption greatly.

Agriculture: The projects will minimize the flood and drought to a very great extent. We will be able to bring in over 150 Million Acres under additional irrigation, to meet our food demand by 2050.

Power: We will be able to generate huge amount of hydroelectric power in the order of about 60000 MW, which can be utilized for the development of Industry for transport, for agriculture and domestic purposes and for many other purposes.

Income from power generation will be Rs. 60,000 Crores

Flood Control: The Gangetic Plain and the North Eastern States are affected by the flood during monsoon time. Our Neighbour Bangladesh is also affected terribly. All these flood related problems will be solved and the water is channelised for agriculture, transport and power generation.

Foreign Exchange Savings: Oil Import will be reduced nearly by Rs.1,00,000 crores due to water transport and hydro power generation.

Employment: 180 Million Opportunities are generated clearing all unemployment problems.

Testimonies about National Water Ways Development Technology - VIEWS of VIPs

"NWP is AN INNOVATIVE PROJECT and is alternative to ILR". HIS IS A VERY GOOD PROJECT. We get NAVIGATION, IRRIGATION, POWER, FLOOD CONTROL ETC.

- Dr. A.P.J. Abdul Kalam, Former President of India.

"Just as RAILWAYS and ROADWAYS, INLAND WATERWAYS is also a must for a country like INDIA. "This project is an Engineering MARVEL… It will be a JEWEL IN THE CROWN OF INDIAN ENGINEERING" **- Dr. S. Panchanathan, Former Chief Engineer, World Bank Expert**

"A team of enthusiastic and nationalist minded Engineers under the leadership of Mr. Kamaraj, an eminent engineer, has prepared AN AMBITIOUS BUT WORKABLE PROJECT which will link all the Rivers of the Country".

"Constitutionally, the scheme can be implemented straight away unlike any scheme for ILR for which the concurrence of all states will have to be obtained"

- Hon'ble Justice S. Natarajan, Former Judge, Supreme Court

"THERE IS NO BETTER PROPOSAL (THAN THIS) ON HAND"
- Shri. Venkateswara Rao, Hon'ble Minister – Andhra

"GOOD PROPOSAL, WIN – WIN SITUATION TO EVERY STATE"
- Dr. M.S. Swaminathan, Scientist

"BEST ALTERNATIVE" TO NWDA PROPOSAL IN CONTROLLING FLOODS AND DROUGHTS". "You have done wonderful work. There is nobody in the Country who is so committed and consistent like you." **- Shri. Suresh Prabhu, Chairman, Task Force – ILR**

"We will press the Planning Commission to approve this proposal"
- Shri. Shubash Chakravarty, Former Minister for Transport, West Bengal

"National Waterways Project is considered as an alternative and BETTER TO ALL OTHER PROPOSALS for the optimum use of water resources". "This is TECHNICALLY FEASIBLE AND ECONOMICALLY VIABLE" **- Er.K. Pandy, Former Chief Engineer, PWD**

"You have planned the Flood Control ingeniously"
- Dr. Kirit S. Parikh, Member, National Planning Commission

This is an "INNOVATION". "THIS PROJECT is equivalent to or its impact even EXCEEDS ALL THE PROJECTS TAKEN UP IN INDIA SINCE INDEPENDENCE"
- Er. K.V. Rupchand, Former Chief Engineer, TNEB

"This will be the EIGHTH WONDER". **- Er.A. Kesavan, Industrialist**

"THIS IS THE BEST PROPOSAL OF THE LOT RECEIVED and we have not so far come across such an expert team as yours"
- Dr. P.B.S. Sarma, Former Professor IIT and Member, Independent Group of Experts (IGE),ILR

"If at all Tamilnadu will get water, it will be only through NWP"
- Shri. Ponnaian, Former Finance Minister, Tamilnadu

"We feel strongly that when (your project) fully executed, the scope and nobleness of your plan will stand as good example to the rest of the World, and will hopefully inspire other visionaries and World Leaders to follow suit, and "boldly" plan for a future which is truly representative of a betterment of Mankind".
- Mr. Perry Morgen, U.S.A

"We have not heard such a proposal. ANYONE, who comes to know this Project and understands it WILL NEVER SAY NO TO THIS PROJECT. Any person or any Chief Minister for that purpose"
- Er. Prabhakaran, FIE, Hyderabad

"Engineer's innovative idea for linking rivers" **- Shri. T.S. Sreenivasa Raghavan, Times of India**

Tamilnadu Waterways Project is good for Tamilnadu. Let us take it up. Please pass order. (To The Chief Secretary, Tamilnadu) **- Madam J.Jayalalitha, Chief Minister, Tamil Nadu**

National Waterways Project (NWP) overrides many of the problems of the Inter-linking of rivers. The project is SELF - FINANCING **- Er. K.S. Rao, M.P., Chairman, Parliamentary Affairs Committee**

The scheme is not only very innovative but an engineering marvel and offers multiplicity of advantages which no other scheme for Inter Linking of Rivers can ever offer. **– Justice Natarajan**

This is a good project, we will take it up. **- Mr. L.K. Tripathy, Former Chief Secretary, Tamil Nadu**

"Expert proposes 'eco-friendly' method (NWP) to connect rivers" **- The Hindu New Delhi, 11th Aug 09**

"Waterways better than Inter-Linking". It gives additional advantages **- The Hindu, 29th Aug 10**

What Next

Wisdom should prevail for the Government to take this up seriously and implement fast.

Efficiency is doing better what is already being done. Effectiveness is deciding what to do better.
- PETER F. DRUCHER

NATIONAL ACCREDITATION BOARD FOR TESTING AND CALIBRATION LABORATORIES

NABL

National Accreditation Board for Testing and Calibration Laboratories

(An Autonomous Body under Department of Science & Technology, Govt. of India)

CERTIFICATE OF ACCREDITATION

SPECTRO ANALYTICAL LABS LIMITED

has been assessed and accredited in accordance with the standard

"General Requirements for Calibration Laboratories"

SAMPLE

in the discipline of

ELECTRICAL TESTING

Certificate Number

Issue Date

Valid Until

This certificate remains valid for the Scope of Accreditation as specified in the annexure subject to continued satisfactory compliance to the above standard & the additional requirements of NABL.

Signed for and on behalf of NABL

N. Venkateswaran, Program Manager

Anil Rana, Director

Prof. S. K. Joshi, Chairman

NABL is a registered society under the Societies Registration Act 1860. It operates as an autonomous body under the aegis of in the Department of Science and Technology (DST), Ministry of Science and Technology, Government of India. NABL has been established with the objective of providing Government, Industry Associations and Industry in general with a scheme of Conformity Assessment Body's accreditation which involves third-party assessment of the technical competence of testing including medical and calibration laboratories, proficiency testing providers and reference material producers.

The laboratory accreditation services to testing and calibration laboratories are provided in accordance with ISO/ IEC 17025: 2005 'General Requirements for the Competence of Testing and Calibration Laboratories' and ISO 15189: 2012 'Medical laboratories — Requirements for quality and competence'. The accreditation to Proficiency testing providers is based on ISO/IEC 17043: 2010 "Conformity assessment — General requirements for proficiency testing" and to reference material producers based on ISO Guide 34:2009 "General requirements for the competence of reference material producers".

NABL offers accreditation services in a non-discriminatory manner. NABL has established its accreditation system in accordance with ISO/ IEC 17011: 2004 "Conformity Assessment – General requirements for Accreditation bodies accrediting conformity assessment bodies". NABL accreditation system also takes note of the requirements of Mutual Recognition Arrangements (MRAs) of which NABL is a member.

In the current global scenario an essential pre -requisite of trade is that any product or service accepted formally in one economy must also be free to circulate in other economies without having to undergo extensive re-testing. WTO recognises that non acceptance of test results and measurement data is a Technical Barrier to Trade. Global sourcing of components calls for equivalence of measurement, which can be facilitated by a chain of accredited CABs. Accreditation is considered as the first essential step for facilitating mutual acceptance of test results and measurement data.

NABL went a step further in removing technical barriers to trade and achieved the status of signatory to Asia Pacific Laboratory Accreditation Cooperation (APLAC) Mutual Recognition Arrangement (MRA) and

International Laboratory Accreditation Cooperation (ILAC) Arrangement based on a peer evaluation by APLAC in 2000. This was a major step towards mutual acceptance of test results and measurement data across Indian borders. NABL went through the peer APLAC evaluation in 2004, 2008 & 2012 and reaffirmed its APLAC / ILAC signatory status with extension of scope for Medical Testing as per the new standard ISO 15189 in 2008. Today, the test results and measurement data produced by Indian accredited CABs are acceptable amongst economies which MRA partners represent.

NABL provides accreditation in all major fields of Science and Engineering such as Biological, Chemical, Electrical, Electronics, Mechanical, Fluid-Flow, Non-Destructive, Photometry, Radiological, Thermal & Forensics under testing facilities and Electro-Technical, Mechanical, Fluid Flow, Thermal, Optical & Radiological under Calibration facilities. NABL also provides accreditation for medical testing laboratories. In addition, NABL also offers accreditation for Proficiency testing providers & Reference Material producers. NABL is in the process of obtaining APLAC & ILAC MRA for these two programmes.

Why Accreditation?

Accreditation is the third party attestation related to a conformity assessment body conveying the formal demonstration of its competence to carry out specific conformity assessment task. Conformity Assessment Body (CAB) is a body which includes Testing including medical Laboratory, Calibration Laboratory, Proficiency Testing Provider, Certified Reference Material Producer.

The liberalization of trade and industry policies of the Government of India has created quality consciousness in domestic trade and provided greater thrust for export. As a consequence testing centres and laboratories have to demonstrably operate at an internationally acceptable level of competence.

Laboratory accreditation is a procedure by which an authoritative body gives formal recognition of technical competence for specific tests/ measurements, based on third party assessment and following international standards.

Similarly, Proficiency testing Provider accreditation gives formal recognition of competence for organizations that provide proficiency testing. Reference Material Producers Accreditation gives formal recognition of competence to carry out the production of reference materials based on third party assessment and following international standards.

Benefits of Accreditation

Formal recognition of competence of a laboratory by an Accreditation body in accordance with international criteria has many advantages:

Increased confidence in Testing/ Calibration Reports issued by the laboratory

Better control of laboratory operations and feedback to laboratories as to whether they have sound Quality Assurance System and are technically competent

Potential increase in business due to enhanced customer confidence and satisfaction.

Customers can search and identify the laboratories accredited by NABL for their specific requirements from the NABL Web-site or Directory of Accredited Laboratories

Users of accredited laboratories enjoy greater access for their products, in both domestic and international markets.

Savings in terms of time and money due to reduction or elimination of the need for re-testing of products.

Proficiency testing providers play an important role in the value chain for assurance of products and services. Being an accredited PTP gives the organisation credibility for their PT services. The benefits of proficiency testing are widely recognized. These include:

Comparison of a facility's performance with that of other participating (peer) facilities

Monitoring of a long-term facility performance

Improvement in the performance of tests/calibrations following investigation and identification of the cause(s) of unsatisfactory PT performance, and the introduction of corrective action to prevent re-occurrence Staff education, training and competence monitoring

Evaluation of methods, including the establishment of method precision and accuracy

Estimation of measurement uncertainty

Contribution to the facility's overall risk management system

Confidence building with interested parties, e.g. customers, accreditation bodies, regulators.

Formal recognition of competence of a RMP by an Accreditation body in accordance with international criteria has many advantages:

Accreditation is an effective marketing tool for RMPs.

Accreditation provides assurance that the accredited RMPs are competent to produce the RMs as listed in the scope of accreditation.

It provides confidence to RM users that the reference materials (RMs), and certified reference materials (CRMs) in particular, are produced according to technically valid and internationally recognized principles, and fitted for the intended uses.

These uses include the assessment of precision and trueness of measurement methods, quality control, assigning values to materials, calibration, and the establishment of conventional scales. This eliminates the needs of the users to evaluate the quality of the RMs themselves.

RMs are used globally. Many economies around the world have accreditation bodies offering accreditation to RMPs. These accreditation bodies have adopted ISO Guide 34 as the criteria for RMP accreditation. This has helped economies to adopt a uniform approach to determining RMP competence. This uniform approach allows accreditation bodies in different economies to establish arrangements among themselves, based on mutual evaluation and acceptance of each other's RMP accreditation systems.

Scope of Accreditation

Testing Laboratories	**Calibration Laboratories**	**Medical Laboratories**
Biological	Electro-Technical	Clinical Biochemistry
Chemical	Mechanical	Clinical Pathology
Electrical	Fluid Flow	Haematology & amp; Immunohaematology
Electronics	Thermal & Optical	Microbiology & amp; Serology
Fluid-Flow	Radiological	Histopathology
Mechanical		Cytopathology
Non-Destructive Testing		Genetics
Photometry		Nuclear Medicine (in-vitro tests only)
Radiological		
Thermal		
Forensic		
Proficiency Testing Providers		**Reference Material Producers**
Testing		Chemical Composition
Calibration		Biological & Clinical Properties
Medical		Physical Properties
Inspection		Engineering Properties
		Miscellaneous Properties

NABL Accreditation is currently given in the following fields and disciplines. The multi-disciplinary CABs shall have to apply in relevant discipline separately depending upon to which discipline the scope belongs. For more details on scope of accreditation please refer the relevant specific criteria.

Process of Accreditation

- The CAB is required to apply in the prescribed application form (NABL 151 for testing laboratories, NABL 152 for calibration laboratories, NABL 153 for medical laboratories, NABL 180 for PTP and NABL 190 for RMP), in three copies along with two copies of the quality manual of the CAB that should describe the management system in accordance with ISO/ IEC 17025: 2005 or ISO 15189: 2012 or ISO/IEC 17043:2010 or ISO Guide 34:2009 whichever is applicable. The application is to be accompanied with the prescribed application fee as detailed in NABL 100. CAB has to take special care in filling the scope of accreditation for which the CAB wishes to apply. In case, the CAB finds any clause (in part or full) not applicable to the CAB, it is expected to furnish the reasons.
- NABL Secretariat on receipt of application form, the quality manual and the fees issues an acknowledgement to the CAB indicating a unique ID number, which is used for correspondence with the CAB. After scrutiny of application for its completeness in all respects, NABL Secretariat may ask for additional information/ clarification(s), if necessary.
- In case there are no inadequacies in the quality manual or after satisfactory corrective action by the CAB, a pre -assessment visit of the CAB is organised by lead assessor appointed by NABL. The pre-assessment of the CAB is conducted to evaluate non-conformities (if any) in the implementation of the quality system, to assess the degree of preparedness of the CAB for the assessment, to determine the number of assessors required in various fields based on the scope of accreditation, number of key location to be visited etc. The lead assessor submits a pre-assessment report to NABL Secretariat with a copy to the CAB. The CAB takes corrective actions on the non-conformities raised on the documented management system and its implementation and submits a report to NABL Secretariat.
- After the CAB has taken satisfactory corrective actions, NABL finalizes the constitution of assessment team in consultation with the CAB. The team includes the lead assessor and technical assessor(s) / expert(s) in order to cover various fields/ disciplines/ groups within the scope of accreditation sought. NABL may also nominate an observer. The assessment team reviews the CAB's documented management system and verifies its compliance with the requirements of ISO/ IEC 17025: 2005 or ISO 15189: 2012 or ISO/IEC 17043:2010 or ISO Guide 34:2009 whichever is applicable and relevant specific criteria and other NABL policies. The CAB's technical competence to perform specific tasks is also evaluated. The non-conformities if identified are reported in the assessment report. It also provides a recommendation towards grant of accreditation or otherwise. The report prepared by the assessment team is sent to NABL Secretariat. However a copy of summary of assessment report and copies of non-conformities if any, are provided to the CAB at the end of the assessment visit.
- The assessment report is examined by NABL Secretariat and follow up action as required is initiated. CAB has to take necessary corrective action on non-conformities and submit a report to NABL Secretariat within 60 days. NABL monitors the progress of closing of non-conformities.
- After satisfactory corrective action by the CAB, the Accreditation Committee examines the assessment report, additional information received from the CAB and the consequent verification, if any. In case everything is in order, the Accreditation Committee makes appropriate recommendations regarding accreditation of the CAB to the Chairman, NABL.
- All decision taken by NABL are open to appeal by the CAB. The appeal is to be addressed to the Director, NABL.
- When the recommendation results in the grant of accreditation, NABL issues an accreditation certificate which has an unique number and NABL hologram, discipline, date of validity along with the scope of accreditation.
- For site laboratory, tests/ calibrations performed at site are clearly identified in the scope of accreditation while issuing the certificate.
- The applicant CAB must make all payments due to NABL, before the accreditation certificate(s) is/ are issued to them.
- The accredited CABs at all times shall conform to the requirements of ISO/ IEC 17025: 2005 or ISO 15189: 2012 or ISO/IEC 17043:2010 or ISO Guide 34:2009 whichever is applicable and relevant specific criteria and NABL Policies. The accredited CABs are required to comply at all times with the terms and conditions of NABL given in NABL 131 "Terms & Conditions for obtaining and maintaining NABL Accreditation".

- The NABL accreditation certificate is valid for a period of 2 years. NABL conducts annual Surveillance of the CAB at intervals of one year which is aimed at evaluating continued compliance to the requirements of ISO/ IEC 17025: 2005 or ISO 15189: 2012 or ISO/IEC 17043:2010 or ISO Guide 34:2009 whichever is applicable and relevant specific criteria and NABL Policies.
- The accredited CAB is subjected to re-assessment every 2 years. The CAB has to apply 6 months before the expiry of accreditation to allow NABL to organise assessment of the CAB, so that the continuity of the accreditation status is maintained.

International Recognition

NABL maintains linkages with the international bodies like ***International Laboratory Accreditation Co-operation (ILAC) and Asia Pacific Laboratory Accreditation Co-operation (APLAC).*** *NABL is a full member of* ***ILAC*** *and* ***APLAC*** *and regularly takes part in their meetings. More information on these international co operations can be obtained from their web-sites* ***www.ilac.org*** *and* ***www.aplac.org*** *respectively.*

NABL is signatory to ***ILAC*** *as well as* ***APLAC Mutual Recognition Arrangements (MRA)*** *for accreditation of Testing including Medical and Calibration laboratories, which is based on mutual evaluation and acceptance of other MRA Partner accreditation systems. Such international arrangements facilitate acceptance of test/ calibration results between countries which MRA partners represent.*

The information on ***ILAC*** *and* ***APLAC Mutual Recognition Arrangements (MRAs)*** *is available at NABL web-site. On request from the laboratories or their users, a copy of* ***ILAC/ APLAC MRA*** *is provided.*

In order to achieve the objective of the acceptance of test/ calibration data across the borders, NABL operates and is committed to update its accreditation system as per international norms. NABL operations conform to ***ISO/ IEC 17011: 2004.***

For more Information visit : http://www.nabl-india.org/

GUJARAT GOVT TO SIGN MOU FOR INDIA'S 1ST 500 MW OFFSHORE WIND PROJECT

In order to set up India's first offshore wind power project — having a total installed capacity of 500 MW — Gujarat government will be signing an MoU with a Rajasthan-based company during the upcoming Vibrant Gujarat Summit where over an estimated Rs 70,000 crore worth of deals are expected to be inked in the port sector alone. The wind power project is expected to take shape in the Gulf of Kutch near Jakhau for which Samiran Udaipur Windfarms Limited will be signing an MoU worth Rs 6,500 crore with the state government. This project will generate employment for about 500 people, state government sources told The Indian Express.

His comes almost two years after the Ministry of New and Renewable Energy (MNRE) had set up a joint-venture company towards undertaking the first demonstration offshore wind power project along the Gujarat coast. This company was meant to undertake detailed feasibility studies for offshore wind power project. Countries like UK, Denmark, Belgium, Germany, China and others already have 7.5 GW capacity of offshore wind power projects. Among the biggies of the port sector who will be inking MoUs during this Vibrant Summit is Adani Port and SEZ Ltd (APSEZ) which will be pledging investments worth Rs 30,000 crore development of Phase II and Phase-III of Mundra port in Kutch.

Similarly, Essar Group will be inking Rs 13,000 crore worth of MoUs for developing an LNG import terminal at Hazira, a 100 MTPA (million tonnes per annum) commercial port at Devbhoomi Dwarka with LNG import and regassification facilities.

The foreign players who will be inking MoUs in the port sector include, Netherlands-based Vopak Group which will be investing about Rs 1,500 crore for building a tank farm and a jetty at Dahej in South Gujarat. Similarly, UK-based KatOil Ltd along with a Gujarat-based firm will be investing Rs 2,800 crore for developing an all-weather green-field port and LNG terminal in Gujarat. This project will create an employment for 5,500 persons.

Apart from these projects, companies either operating or connected with the port sector like Cairn India Ltd, Tata Chemicals, HPCL-Shapoorji Energy Ltd, Swan Energy are expected to sign MoUs with the Gujarat government.

SEA ICE EXTENT TUMBLES AROUND BOTH POLES IN NOVEMBER

Water and air temperatures and shifts in wind patterns conspired to hold down sea ice extent, setting record lows for the month of November in both the Arctic and the Antarctic.

"It looks like a triple whammy – a warm ocean, a warm atmosphere, and a wind pattern all working against the ice in the Arctic," said Mark Serreze, director of the National Snow and Ice Data Center in Boulder, Colorado, in a statement.

The NSIDC tabulates satellite data on the extent of sea ice around the poles, adding to a 38-year satellite monitoring project. Usually, around this time of the year, dropping temperatures in the run-up to winter help Arctic ice freeze, a process that typically starts in September and peaks in March. Instead, at one point in mid-November, the extent of the sea ice had actually contracted by about 50,000 square kilometers (19,300 square miles).

In some places, air temperatures topped out at 10 degrees Celsius (18 degrees Fahrenheit) above the averages recorded in November from 1981 to 2010. Consequently, the extent of the sea ice dipped to 9.08 million square kilometers (3.51 million square miles), nearly 18 percent lower than the November average.

Warming of the sea around Svalbard, an Arctic archipelago, had apparently stopped the freezing of ice altogether, said NSIDC scientist Julienne Stroeve in the release. Sea-surface temperatures in the area were up to 4 degrees Celsius (7 degrees Fahrenheit) higher than normal.

"Typically sea ice begins to form in the fjords at the beginning of November, but this year there was no ice to be found," said Stroeve, who was in Svalbard last month.

Though the Arctic data is jarring, it follows a trend for the year: November was the seventh month of 2016 with record-low levels of sea ice.

What's striking is the parallel decline in sea ice extent at the opposite end of the globe, NSIDC scientists noted.The Arctic has typically been where the most interest lies, but this month, the Antarctic has flipped the script and it is southern sea ice that is surprising us," said Walt Meier, a NASA and NSIDC affiliate scientist, in the statement.

With 2- to 4-degree Celsius (4- to 7-degrees Fahrenheit) spikes in air temperatures for this time of year and shifting winds that have moved around parts of the Antarctic ice pack, sea ice around the continent dropped precipitously in early November, to an average of 14.54 million square kilometers (5.61 million square miles). That's 1.81 million square kilometers (699,000 square miles) below average, an area larger than Libya.

"The will is not free - it is a phenomenon bound by cause and effect - but there is something behind the will which is free."

- SWAMY VIVEKANANDA

CHINA HELPS PAKISTAN BUILD WORLD'S LARGEST SOLAR FARM

Some 400,000 solar panels, spread over 200 hectares of flat desert, glare defiantly at the sun at what is known as the Quaid-e-Azam Solar Power Park (QASP) in Punjab, named after Pakistan's founding father.

The 100 MW photovoltaic (PV) solar farm was built by Chinese company Xinjiang SunOasis in just three months, at a cost of around US$131 million and started selling electricity to the national grid in August.

This is the first energy project under the US $46 billion China-Pakistan Economic Corridor, a key part of China's 'new silk roads', linking the port at Gwadar in southern Pakistan with Kashgar in China's western region of Xinjiang.

The 100 MW plant is the pilot stage of a more ambitious plan to build the world's largest solar farm. Once completed in 2017, the site could have capacity of 5.2 million PV cells producing as much as 1,000 MW of electricity – equivalent to an average sized coal-fired power station and enough to power about 320,000 households. Construction of the next stage is already underway, led by Zonergy, another Chinese company. Eighteen months ago, the site was nothing more than wilderness. Now a mini city has emerged in the middle of the desert, with over 2,000 workers accompanied by heavy machinery, power transmission lines, blocks of buildings, water pipes and pylons.

Reducing emissions, providing livelihoods

The Cholistan desert is the ideal spot for solar power, said Muhammad Hassan Askari, operating manager of the solar park. The area gets 13 hours of sunlight every day while the huge expanse of flat desert is ideal for a large commercial project.The big advantage of solar power, he said, is that a large park can be completed

faster than thermal or hydropower projects, which take much longer and require a lot of maintenance.The solar park will also shrink Pakistan's carbon footprint, said Najam Ahmed Shah, the chief executive officer of QASP, displacing about 57,500 tonnes of coal burn and reducing emissions by 90,750 tonnes every year.

Pakistan aims to reduce its reliance on hydrocarbons, especially imported coal, oil and gas, to around 60 percent by 2025 from the present 87 per cent. The country has a target to produce 10 per cent of its total energy mix from renewables (excluding hydropower, which already constitutes 15 per cent of the total energy mix). The current generation from renewable energy is around 1-2 per cent.

While Pakistan contributes less than 1 per cent to global GHG output, the country's carbon emissions are growing by 3.9 per cent a year. By 2020 it will spew out 650 million tonnes of CO2e (carbon dioxide equivalent) if the current trend continues, said climatologist Qamar-uz-ZamanChaudhry, the UN secretary general's special advisor for Asia with the World Meteorological Organisation.

The solar park will also eventually generate 15,000 to 33,000 jobs for local people alone and attract investment to the region.

Unprecedented scale

Some experts worry the project is too ambitious. Former director general of WWF-Pakistan Ali Hassan Habib, who now runs a company providing rooftop solar solutions, welcomed the project but was uneasy about the government "jumping into untested scale". The plant will be almost double the size of the existing largest solar PV generating facilities worldwide, he said.

Environmental impact of clean energy

Because solar energy is still finding a foothold in the energy mix and technologies are evolving, not enough is known about the park's impact on the environment and natural resources.

Some negative impacts have already become apparent. For example, solar power consumes lots of water. PV panels may require little maintenance, according to QASP, but they need to be kept squeaky clean. An estimated one litre of water is used to clean each panel. Water consumed to clean the eventual 5.2 million panels built will be colossal for a country that is fast becoming water stressed. Currently, 30 people take 10 to 15 days to clean the entire 400,000 cells.

"This year we've been very lucky as there have been unprecedented rains and so panels were cleaned automatically," said Askari, who said they were looking for more efficient ways to clean panels. At the same time, increasing human activities will disturb the arid region's rich biodiversity and wildlife, such as the chinkara (Indian gazelle), caracal cat and houbara bustard.

The construction of new road network and supporting commercial activities associated with large solar PV projects do leave a substantial "footprint" on the land, agreed Habib. Shah justified the project, saying it was built on uninhabited wasteland. "An Initial Environmental Examination was carried out and we got a nod from the Environment Protection Department before embarking upon the project," he explained.

Habib suggested the government set up an environment and social fund to offset any negative impact.

Environmentalists are also concerned about the fate of the millions of PV panels which will wear out within 25 years. The panels will have to be recycled to extract the silicon used to make them, and then replaced.

Pakistan's energy crisis

Pakistan has been in the grip of severe energy shortages for many years with some rural areas left without power for up to 20 hours a day. There has been little local or foreign investment in the industrial sector because of the extensive power cuts, and a number of factories have had to close down.With an installed electricity generation capacity of 22,797 MW, the country's total production stands at just 14,000 MW. In recent years, demand has risen to 19,000 MW. While the 1,000 MW of solar energy will help ease energy constraints, Askari said government investment in several other hydropower and coal projects should also help alleviate power shortages. Prime Minister Nawaz Sharif promised power cuts would end by 2017-2018 at the inauguration ceremony of 100 MW solar project in May, earlier this year.

Efficiency is intelligent laziness - DAVID DUNHAN

WHY THE AUTOMOTIVE FUTURE WILL BE DOMINATED BY FUEL CELLS

Range, adaptability, and refueling time will put hydrogen fuel cells ahead of the competition

You'd have to be completely uninterested in cars or any other type of transportation to not recognize that automobiles are undergoing a major transition. They no longer run solely on internal-combustion engines and burn petroleum-based fuels. Nowadays, consumers routinely purchase vehicles that run in part or entirely on electricity.

There are different forces behind this colossal shift. For one, electrically powered vehicles reduce the emissions of pollutants that degrade local air quality and of carbon dioxide, which poses significant worry about altering the climate. Another reason to favour electrically powered vehicles involves national security. Ample supplies of petroleum are found only in select regions of the world. So countries that lack these natural resources will remain at a political and economic disadvantage if they continue to utilize vehicles that burn gasoline or diesel fuel. The final reason stems from the fact that exploitable sources of petroleum are slowly running out. Once society reaches the point where production cannot keep up with demand, prices will skyrocket. So it's no wonder, really, that the transition to electric vehicles is speeding up.

Electric vehicles can be divided into three groups. Most common today, of course, are hybrids, which combine batteries, electric motors, and internal-combustion engines. Although these vehicles have many virtues, in particular high efficiency, all but the plug-in hybrids ultimately draw all of their power from petroleum-based fuels.

The second group is battery electric vehicles, or BEVs, such as the Nissan LEAF and the Tesla Model S, which are now reasonably common. While the electricity they use to charge their batteries comes primarily from fossil fuels, BEVs are advantageous because they use that energy more efficiently than a car with an internal-combustion engine. The grid is also moving to more renewable power, further reducing the carbon signature associated with BEVs.

A third budding category consists of fuel-cell electric vehicles, or FCEVs, which are just emerging, but as I argue below, represent the electric vehicle that most people will ultimately select as their principal car. Forward-looking carmakers are now producing both BEVs and FCEVs, but not without considerable controversy and competitive posturing, which only makes the situation more confusing. So here I would like to clarify the relative benefits of the different technologies and relate how I see electric personal transportation evolving.

Hybrid and battery electric vehicles are common enough now that I needn't say much about their principles of operation. Fuel-cell electric vehicles are still a rarity, though, so let me describe more fully how they work. Rather than relying on combustion to drive pistons that then power an electric generator as in a hybrid car, a fuel-cell vehicle uses electrochemistry to generate electricity directly. This is done by taking compressed hydrogen gas stored on board and combining it with oxygen from the air. The product of the reaction is electricity to power the vehicle and water, which is discharged through the tailpipe along with the nitrogen that entered the fuel cell with the air. Because there is no combustion, high temperatures are avoided and oxides of nitrogen, a smog-inducing pollutant from conventional vehicles, are not produced. And because there is no carbon in the fuel to begin with, no hydrocarbons, carbon monoxide, or carbon dioxide are emitted from the tailpipe.

In addition, a fuel-cell electric vehicle has remarkably high efficiency, more than three times that of a today's average gasoline-powered automobile. Its range and fuelling time are comparable to those of conventional automobiles, its fuel can be produced in a variety of straight forward ways, and its drive train produces practically no vibration.

Of course, you need more than just to get the car—you also need a place to fuel it. In my state, the requisite hydrogen-fueling infrastructure is being developed by the California Energy Commission, which projects that there will be 27 hydrogen filling stations operating here by the end of 2016, more than 44 by the end of 2017, and 74 by 2020. The need for a hydrogen-fueling infrastructure elsewhere in the country is being addressed by H2USA, an initiative supported by the U.S. Department of Energy.

In Europe, there are currently a few dozen hydrogen-fueling stations in operation, and a programme called Hydrogen Mobility Europe is leading efforts to increase that number. As of mid-2016, there were 80 hydrogen

stations operating in Japan, where the government is keen to boost the number of such facilities considerably before the 2020 summer Olympics in Tokyo.

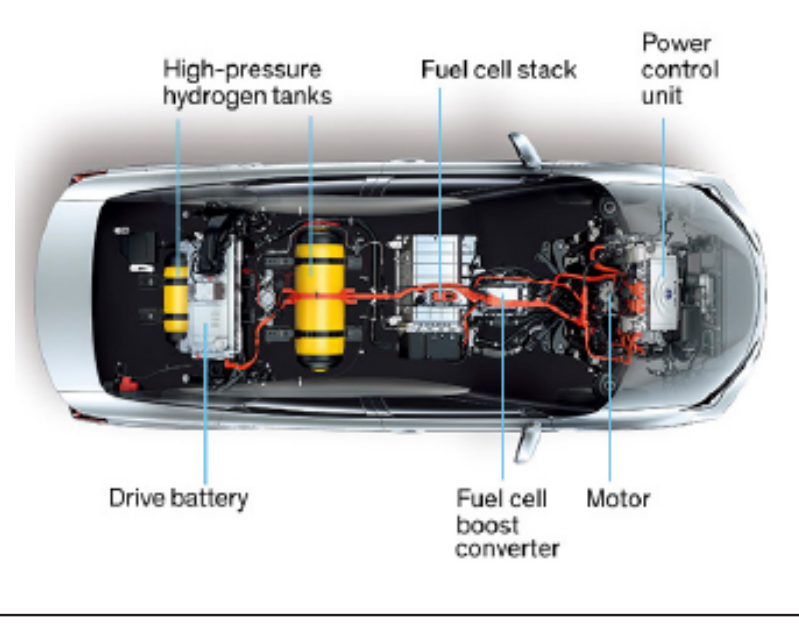
Hyundai, Toyota, and Honda's fuel-cell electric vehicles may be new to the streets, but much of the technology they carry is not at all new because these cars have a great deal in common with existing battery electric vehicles. Both FCEVs and BEVs have electric drive trains and battery packs. And both use regenerative braking, a key energy-saving attribute of electric vehicles. Where they fundamentally differ is in the source of electricity, the time required to recharge or refuel, the driving range, and the ability to scale up the size of the vehicle.

Consider first the source of electricity. BEVs are powered solely by electricity generated elsewhere and then stored in a battery pack, whereas FCEVs are powered by hydrogen, which is transformed to electricity by a fuel-cell engine on board the vehicle. Although the hydrogen fuel cell generates electric power, FCEVs also require a battery pack to supply surges of energy to the drive motor and to absorb electricity created by regenerative braking. In contrast to the battery size required for BEVs, the FCEV battery need only be of modest size, like those found in hybrid cars today.

The range of most BEVs falls somewhere between 65 and 320 kilometers (40 and 200 miles), depending on the model, the cooling and heating loads, the speed at which the vehicle is driven, and how much the headlights and other electric accessories are used. Affluent electric-car enthusiasts can purchase a Tesla Model S or Model X, which are reported to have ranges of nearly 480 km. That's approaching the range of FCEVs and conventional vehicles, which can typically travel from 480 to 640 km on one tank.

A BEV takes an hour to more than 4 hours to charge when a high-voltage source is available and more than 6 hours using a standard 120-volt household outlet. Cars equipped to accept DC "fast" charging take roughly 30 minutes. An FCEV fills up with a full charge of hydrogen in less than 5 minutes.

BEVs are well suited for light-duty vehicles and are emerging for use in delivery trucks and buses on routes of modest range. The problem with trying to power larger, longer-distance vehicles with batteries is that more battery mass must be added to do so. That in turn requires the vehicle to be outfitted with a bigger motor, a stronger suspension, and better brakes to maintain the same performance—all of which adds more weight, which means even bigger batteries are required. It's



a vicious circle, one that eventually becomes unsupportable when designing a large vehicle with the range to which drivers are accustomed. In contrast, fuel cells can be used to power virtually any size vehicle, from compacts cars to SUVs, to delivery trucks, to long-distance tractor-trailer rigs.

That difference in capability is well illustrated by what happened at Nikola Motor Co., which at one time had intended to produce a BEV tractor-trailer. After the realities of trying to engineer such a vehicle became apparent, the truck's designers switched to using a hydrogen fuel cell for power. And just this month, the company introduced its fuel-cell-powered tractor-trailer, called the Nikola One.

While fuel-cell cars are just now gaining a toehold in today's market, I believe that within the next quarter century, the majority of car buyers entering the showroom will select an FCEV as their primary means of transportation, and because of limitations in range and recharging speed, they will consider a BEV only as an option for their second car.

Hydrogen is no different in that regard from other fuels except for certain features that, in some ways, make hydrogen safer than the gasoline fuel with which we've grown so comfortable over the decades. In particular, hydrogen is lighter than air and rapidly dissipates upward and outward.

Photo: Honda Motor Co.

BEV charging, unlike hydrogen fueling, does not have the filling station as the natural home for deployment. The reason, clearly, is because charging takes so long. Charging stations are, however, being installed at major destination points such as shopping centers and office complexes. Home charging is also possible, but it's a challenge for the increasing numbers of drivers living in apartments and condominiums. And the long periods required to recharge a vehicle at a public charging station are problematic, often creating episodes of "charge rage," when one vehicle is denied access to a charging port because it's occupied by another vehicle that is either taking hours to charge or is fully charged but waiting for its driver to return from shopping or completing a day's work.

Keep On Truckin': Nikola Motor Co. recently released its fuel-cell-powered Nikola One, which is able to travel more than 1,200 kilometers on a single tank of hydrogen.

Inner Workings: Toyota's fuel-cell-powered Mirai has many of its key components located beneath or behind the passenger compartment, although the electric motor is situated up front, under the hood.

Clearing the Air: Honda's new Clarity fuel-cell powered car is soon to be joined by electric and plug-in hybrid versions of this model.

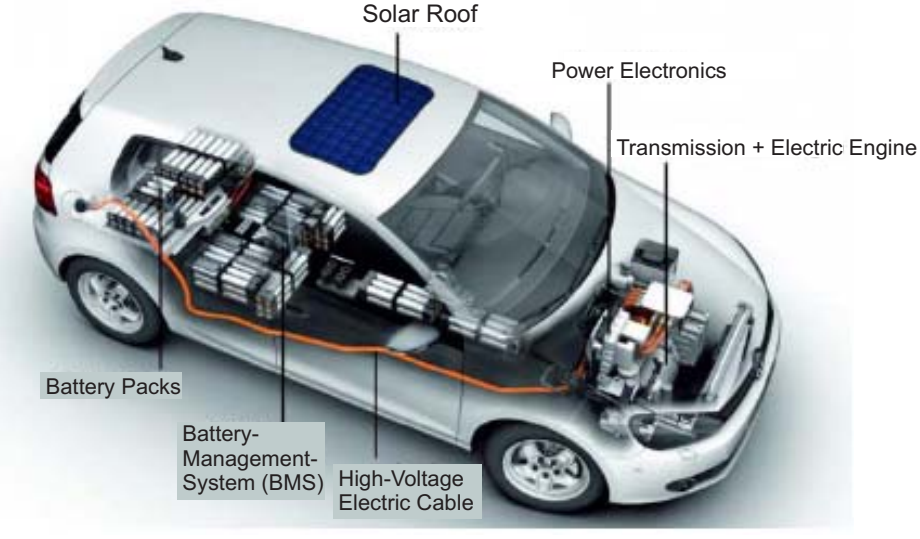
About the Author:- ***Scott Samuelsen, a professor emeritus of mechanical and aerospace engineering at the University of California, Irvine, is director of the National Fuel Cell Research Center, located at UC Irvine.***

WHY THE BOTTOM OF THE PYRAMID NEEDS ELECTRIC CARS... NOW

A recent article in the Harvard Business Review suggested that if someday millions of people want to buy electric vehicles instead of gas-powered ones, car manufacturers are prepared to adapt their production models to start churning out units immediately.

I wonder – are we at this point already?

Today we have more than a million electric vehicles plying the roads around the world. Nissan-Renault is currently leading global sales of electric vehicles, and other brands like Audi, BMW, General Motors, Ford, Mercedes Benz, and Volvo are also getting ready to enter the market.



Maybe we have reached a point of no return on electric vehicles. As of last week, over 500,000 plug-in vehicles have been sold in the US, according to the US Department of Energy, which is a major milestone. Naysayers have lost the battle, and will soon join the bandwagon and admit that electric vehicles are the only option going forward.

This shift has implications for developing Asia, where there are about over 20 million auto-rickshaws or tricycles, double that number of motorcycles and even more boats, cars and trucks. I earlier argued that it was in Asia where we need to start an electric car revolution at the bottom of the pyramid to trigger faster and wider market adoption for affordable electric cars, at the same time demand grows at the top of the pyramid for the more expensive Chevrolet Bolt or Nissan Leaf in the developed world.

Why wait 5-7 years for the technology to trickle down to bottom of the pyramid from the top, like the first generation mobile phones? With the right enablers and public sector support, developing countries can move forward even faster from this point of no return if we tag along the developing world into the same transformation.

For real transformation, though, we will need the inspiration and technology from forward-thinking governments in developing countries to create largely public-funded projects to enable new markets for electric vehicles to

grow. It not only makes business sense – poor people in developing countries disproportionately suffer pollution, unreliable power supply, and volatility in oil prices.

What developing countries need is a basic electric vehicle, not a fast-moving, high-end model. This car is essentially a set of batteries on a drive train without a fuel tank, heavy engine and radiators, and just a few moving parts. Experience shows that establishing a local electric car industry could be done with small investments and basic technology transfer.

I remember checking out the first electric 4-wheel vehicle back in 2009, and have seen many 3- and 2-wheel models since. Once the market of batteries, control systems and quality engines are set, the local industry will be able to develop innovative solutions to convert old gas-fuelled cars and boats to run on electric engines, an idea that is slowly taking shape in the developed world.

Let's take advantage of this point of no return, and help developing countries achieve energy independence, reduce air pollution, mitigate climate change impact, and meet the climate targets of the Paris Agreement.

We all need this transformation, as the growing market of car ownership will be in Asia. Let's not forget today, over 20 years after the introduction of mobile phone, it is the developing world that dominates. That's why we should start early to help the people at the bottom of the pyramid adopt electric cars faster.

Courtesy: Asian Dev Blog

SOHAIL HASNIE

Principal Energy Specialist, Central and West Asia Department, ADB

Sohail is a firm believer that the solution to climate change lies in new technology, and has applied new technology to many ADB projects as an energy specialist since 2001 in Afghanistan, Cambodia, PRC, India, Indonesia, Malaysia and Mongolia, among other Asian countries. With an academic background in engineering, business and entrepreneurship, before joining ADB he worked on wholesale electricity market design, pricing regulation, energy efficiency and demand management for the state power utility and independent regulator in Melbourne, Australia.

SOHAIL HASNIE

CHEAPER, LONGER-LASTING PEROVSKITE SOLAR CELLS COULD BE ON THE WAY

Perovskite solar cells are one of the most exciting green energy technologies to emerge in recent years, combining low cost with high energy conversion rates. Now, researchers at the Swiss Federal Institute of Technology in Lausanne (EPFL) have found a way to cut their cost even further by developing a charge-carrying material that is much cheaper, highly efficient, and could even help address the technology's current major weakness by significantly lengthening the lifespan of the panels.

Record efficiencies for solar cells tend to grab all the headlines, but it is other less flashy metrics – such as price per watt – that provide a much fairer assessment of whether a new technology can produce clean energy on the global scale. Perovskite solar cells excel in this area by combining low cost with efficiencies that have already surpassed the 20 percent mark, rivaling standard silicon-based panels while also being, according to a recent study, easier on the environment than any of the best-known alternatives in the solar arena.

But before perovskite cells can make it to mass production, one big issue still remains to be addressed: the outer shell of the panel, the function of which is to conduct electric charge, is made from organic compounds that will quickly wither away in real-life conditions, cutting the life of the cell to a few short months.

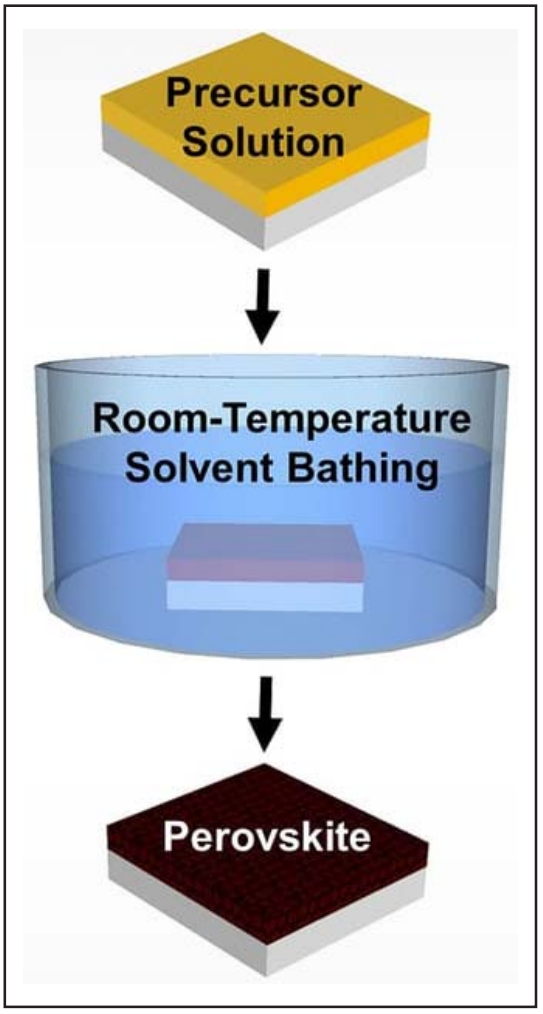
Researchers led by Mohammad Nazeeruddin at EPFL have now developed a new inorganic conductive material for perovskite cells that is cheaper, still allows for high energy conversion rates and, more importantly, offers plenty of wiggle room for experimentation, paving the way for longer-lasting, cost-effective perovskite panels.

The new material, dissymmetric Fluorene–Dithiophene (FDT), is said to cost less than one fifth to synthesize than previous compounds (US$60 versus $500 per gram) while still retaining a very competitive energy conversion rate of 20.2 percent.

"The previous material (Spiro) was rather difficult to synthesise and purify in large scale, preventing perovskite solar cells market penetration," Nazeeruddin told Gizmag. "It is also well knowa n in the literature that the stability of Spiro is limited. We are doing stability measurements of the new material: if the stability is established, the economic benefits would be enormous."

While no determination has yet been made on the stability of the compound used in the study, two considerations leave room for optimism. First, the inorganic nature of the compound is expected to make it more resistant to weather and biodegradation. And secondly, the FTD core material can be reportedly modified with ease, creating not one, but a family of compounds.

The hope is that this amount of wiggle room will be enough for researchers to engineer a material that is both cheap, long-lasting, and still allowing for efficiencies that are competitive with respect to the final price of the panel.



Existing techniques for making perovskite cells involve the application of heat. Precursor chemicals are dissolved into a solution and applied to a substrate, with heat then used to remove that solution, leaving perovskite crystals in a film across said substrate.

Techniques that rely on the application of heat have, in the past, allowed for the production of films measuring fractions of a centimeter in diameter. To do so, the solution has to be exposed to temperatures of between 100 and 150 ºC (212 to 302 ºF), and the process can lead to uneven crystal formation, which in turn creates small pinholes in the resulting film that lower efficiency. To tackle the issues with heat-based perovskite cell production, the researchers came up with a new method, known as solvent-solvent extraction (SSE).

Whereas heat-based methods take a minimum of one hour to complete, SSE takes just two minute.

The method involves dissolving the perovskite precursors in a solvent called NMP, then coating it onto a substrate – just the same as existing techniques. However, rather than applying heat to the substrate, it's instead bathed in a second solvent known as diethyl ether (DDE), which removes the NMP solvent from the mix. This allows crystals to form evenly over the substrate, creating an ultra-smooth film.

Whereas heat-based methods take a minimum of one hour to complete, SSE takes just two minutes, and can produce much thinner films without the appearance of pinholes – just 20 nanometers, compared to around 300 nanometers produced by existing techniques.

The cells can also be made larger than with existing methods – up to several centimeters square – and as no heating is involved, the crystals can be formed on almost any substrate, including heat-sensitive polymers.

The ability to make thinner cells may also have other benefits. Whereas thicker perovskite cells are opaque, SSE-produced cells are thin enough to be partially transparent and could therefore be used in windows, and the process could even be tweaked to produced coloured cells.

"These could potentially be used for decorative, building-integrated windows that can make power," says NitinPadture, professor of engineering and director of the Institute for Molecular and Nanoscale Innovation.

Efficiency tends to deal with things. Effectiveness tends to deal with people. We manage things, we lead people. - DAVID DUNHAM

SPS TRANSFORMERS P. LTD

36 YEARS

of rich experience in Transformer making

- Back-up experience of manufacturing over thousands of transformers scaled up to 100MVA
- Range starts from Distribution Transformers 100KVA / 11KV to Power Transformers 16000KVA / 132KV
- State of the Art Facilities
- Compact design with extremely low noise and virtually Maintenance-free
- Elegant look and superior performance

- On-time delivery
- Best in class Loss-management
- Competitive price

For Inquiry:
inquiry@spstransformers.com

Works :
Survey No.192, SNMV College Road,
Malumichampatty, Coimbatore – 641050.
☎- 0422-2610360

Head Office :
No.:1, Dr.B.N. Road, 1st Street, T-Nagar,
Chennai – 600017.
☎ - 044-43324022 / 43325022

www.spstransformers.com

DR. K. ANJI REDDY | *Dr. Reddy's Labs* | ENTREPRENEUR

DR. K. ANJI REDDY
Dr. Reddy's Labs

An excellent compliment from a son to his father, which is rarest of the rare! "While I would be thinking of the next day or the next month, Dr. Reddy would be talking about what would happen in 10 years", satish

Kallam Anji Reddy was the founder-chairman of Dr. Reddy's Labs, which he established in 1984.

His journey from a son of a turmeric farmer to employing 2000 scientists and developing world class drugs is remarkable. He was honoured with the badge of **"Hall of Fame"** in 2005, for his Entrepreneurship, Leadership, Thrust and Innovation. He got B.Sc. Tech in pharmacy from Bombay University and a PhD in Chemical Engineering from Pune in 1969.

Reddy started out as an employee of state-owned Indian Drugs and Pharmaceuticals Ltd. He quit the company, pooled all his resources and started DRL in 1984 with an initial capital outlay of Rs. 25 lakh. In 2011-12, DRL posted a turnover of Rs. 9,597 crore and a net profit of Rs. 1,426 crore.

The Government of India, honoured him with **Padma Shri** and **Padma Bhushan** for his contribution to the Indian Pharmaceutical industry. To a group of entrepreneurs he said, "Not luck alone has taken me there. If you have the DNA to go forward, you will. And yes, serendipity (the fortunate occurrence) does help at times". Corporate Social Responsibility (CSR) is not only a buzzword for him but he walks his talk in the form of **Dr. Reddy's Foundation of Human and Social Development** which acts as a catalyst of change to achieve sustainable development. His goal in philanthropy was to **provide drinking water to all Indian village by 2020**. Between 1985 and 1986, DRL came out with a drug, Methydopa. The company approached Merck with the samples for manufacturing the drug but the proposal was rejected. This is said to have turned around the fortunes of DRL. Dr. Reddy took it as a challenge and within three months, produced Methydopa equal to Merck's quality and acceptable to them. His peers and industry veterans remember him most for his passion for innovative research and ambition. He died on March 15, 2013 in Hyderabad's Apollo Hospital, where he was being treated for cancer.

HUMOUR

Following are some Joke like Quotes with Morals!

"Never slap a man who's chewing tobacco."

"There are two theories to arguing with a woman. Neither works."

"Never miss a good chance to shut up."

"If you find yourself in a hole, stop digging."

"The quickest way to double your money is to fold it and put it back into your pocket."

"Good judgment comes from experience, and a lot of that comes from bad judgment."

"If you're riding' ahead of the herd, take a look back every now and then to make sure it's still there."

"Lettin' the cat out of the bag is a whole lot easier than putting it back in."

After eating an entire bull, a mountain lion felt so good he started roaring. He kept it up until a hunter came along and shot him.

The moral: "When you're full of bull, keep your mouth shut."

Computer Service

A computer technician got a call from a user. The user told the tech that her computer was not working. She described the problem and the tech concluded that the computer needed to be brought in and serviced.

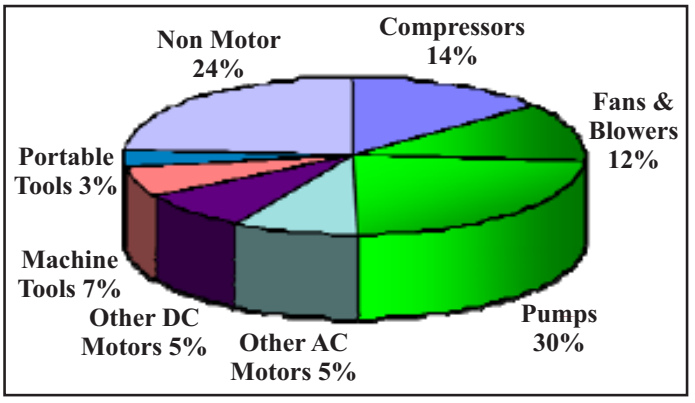
He told her to unplug the power cord and bring it to him and he would fix it. About fifteen minutes later she shows up at his door with the power cord in her hand.

ENERGY CONSERVATION THROUGH ENERGY EFFICIENCY – 23

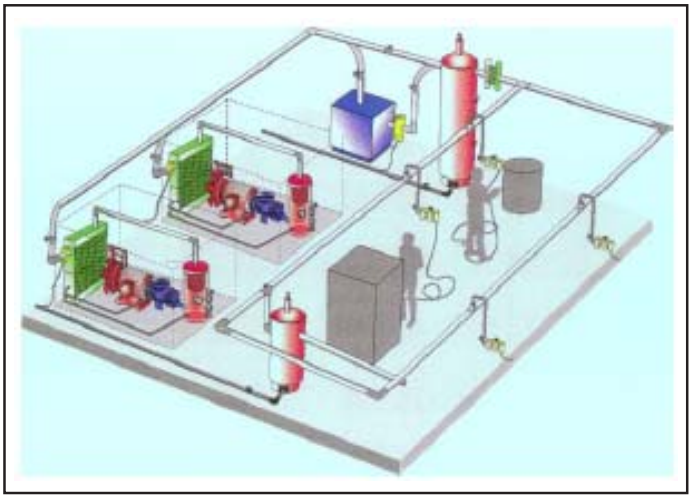
Compressed Air Systems and Energy Efficiency and Conservation:

As we analyzed earlier in the context of final uses of Electrical Energy and Motors Driven Systems, Compressors form another important area of consumption of Electrical Energy with sizable potentials for Energy Conservation.

As can be seen from a broad analysis of uses of Electrical Energy through various applications, Motor Driven Systems consume almost 76% of the total Electricity out of which 14% go through compressors, be it in Industries or large Air conditioning Installations or other applications and uses.

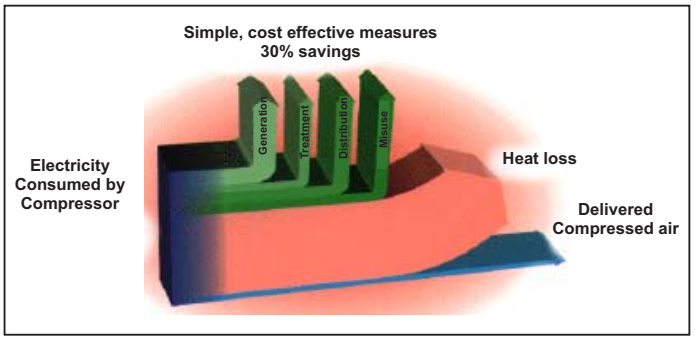


The use of compressed air systems span from simple Air conditioners, centralized systems, to large scale Automation Systems. The Diagram below shows a typical Compressor System installation in Industries and large applications.



As a 'Standard Engineering Statement' goes, Air is 'Free' but 'Compressed Air' costs lot of Energy due to its inherent Efficiency levels.

The diagram below gives the details and the breakup of the spend of Electrical Energy fed into the Compressor System. It can clearly be seen that 60 to 80% of the power of the prime mover is converted into an unusable form of energy (HEAT) and to a lesser extent, into friction, misuse and noise, and only about 10% is used to provide compressed air. The Diagram also indicates the scope for saving Energy to the extent of 30% and more through various means and measures.



APPROXIMATELY 10% GETS TO THE POINT OF USE!!

➢ Listed below are the various System Components in the system followed by the summary of energy saving potentials in some of these areas.

- Intake Air Filters: Prevent dust and atmospheric impurities from entering compressor. Dust causes sticking valves, scored cylinders, excessive wear etc.
- Inter-stage Coolers: Reduce the temperature of the air (gas) before it enters the next stage to reduce the work of compression and increase efficiency. They can be water-or air-cooled.
- After Coolers: Reduce the temperature of the discharge air, and thereby reduce the moisture carrying capacity of air.
- Air-dryers: Air dryers are used to remove moisture, as air for instrument and pneumatic equipment needs to be relatively free of any moisture. The moisture is removed by suing adsorbents or refrigerant dryers, or state of the art heatless dryers.
- Moisture Traps: Air traps are used for removal of moisture in the compressed air distribution lines. They resemble steam traps wherein the air is trapped and moisture is removed.

- Receivers: Depending on the system requirements, one or more air receivers are generally provided to reduce output pulsations and pressure variations.

Effect of Intake Air temperature on Power Consumption:

Inlet Temperature (˚C)	Relative Air Delivery (%)	Power Saved (%)
10.0	102.0	+ 1.4
15.5	100.0	Nil
21.1	98.1	– 1.3
26.6	96.3	– 2.5
32.2	94.1	– 4.0
37.7	92.8	– 5.0
43.3	91.2	– 5.8

Every 4^0C rise in inlet air temperature results in a higher energy consumption by 1 % to achieve equivalent output. Hence, cool air intake leads to a more efficient compression.

Effect of Pressure Drop across Air Inlet Filter on Power Consumption

Pressure Drop Across air filter (mmWC)	Increase in Power Consumption (%)
0	0
200	1.6
400	3.2
600	4.7
800	7.0

For every 25 mbar pressure lost at the inlet due to choked filters, the compressor performance is reduced by about 2 percent.

Power Reduction through Pressure Reduction

Pressure Reduction		Power Reduction (%)		
From (bar)	To (bar)	Single-stage Water-cooled	Two-stage Water-cooled	Two-stage Air-cooled
6.8	6.1	4	4	2.6
6.8	5.5	9	11	6.5

A reduction in the delivery pressure of a compressor would reduce the power consumption.

Energy Wastage due to Smaller Pipe Diameter

Pipe Nominal Bore (mm)	Pressure drop (bar) per 100 meters	Equivalent power losses (kW)
40	1.80	9.5
50	0.65	3.4
65	0.22	1.2
80	0.04	0.2
100	0.02	0.1

Typical acceptable pressure drop in industrial practice is 0.3 bar in mains header at the farthest point and 0.5 bar in distribution system

Cost of Air Leakage

Orifice Size mm	KW Wasted	* Energy Waste (Rs/Year)
0.8	0.2	8000
1.6	0.8	32000
3.1	3.0	120000
6.4	12.0	480000

*** based on Rs. 5 / kWh ; 8000 operating hours; air at 7.0 bar**

10 Steps to Savings

The most expensive component in the total cost of compressed air is energy. In fact, over the lifespan of a typical compressor, energy typically costs several times more than the purchase price of the compressor. The bottom line, maximizing energy efficiency saves you money.

The first step to reduce compressed air energy costs is to measure and monitor your compressed air system's energy consumption, flow rates and operating air pressure. Small adjustments can reduce your operating pressure and energy costs while improving flow rates and output. Here are 10 steps you can take to optimize your compressed air system and save energy costs.

1. **Turn It Off.**

   There are 168 hours in a week, but most compressed air systems only run at or near full capacity between 60-100 hours. Depending on your shift pattern, turning your compressors off during the evenings and weekends could reduce your energy bills up to 20 percent.

2. **Fix Existing Leaks.**

   A quarter-inch air leak at 100 psi will cost you more than $2,500 a year. Pipe systems older than five years can have leaks of up to 25 percent. Because it takes energy to generate compressed air, any air that leaks is money wasted. Approximately 80 percent of air leaks are not audible, so to minimize these problems, third-party help in detecting these leaks may be a necessity.

3. **Prevent New Leaks.**

   As Benjamin Franklin said, "An ounce of prevention is worth a pound of cure." So, be proactive and look inside your piping system. A clean, dry pipe indicates good quality air and no corrosion issues. Dust in the pipe is caused by particles in the compressed air. If compressed air is not filtered, or if the filter is clogged, pressure drops will occur and the risk of end product contamination will increase. Sludge in the pipe is bad news and must be fixed immediately. Dust and sludge in a compressed air piping system will cause corrosion very quickly and will greatly increase the number of leaks. Dried and filtered compressed air keeps piping clean.

4. **Reduce Pressure. Run at required pressures, not beyond.**

   Each two psig reduction cuts energy consumption one percent. Check the system pressure and resist the urge to turn up the pressure to compensate for leaks or drops in pressure due to piping problems or clogged filters. A central supply side controller can greatly reduce the operational pressure band and orchestrate air production much more efficiently and effectively.

5. **Check Drains. Are your condensate drains stuck open?**

   Condensate drains on timers should be adjusted periodically to ensure they open as intended or aren't stuck open. Better yet, replace timer drains with zero-loss drains to stop wasting compressed air.

6. **Review Piping Infrastructure. Many systems aren't optimized.**

   A piping system design should optimize transfer of compressed air at the desired flow and pressure to the point of use. Increasing the size of a pipe from two to three inches can reduce pressure drop up to 50 percent. Shortening the distance air has to travel can further reduce pressure drops by about 20-40 percent.

The more flow through a pipe the greater the pressure drop will be. Pressure drop in a pipe increases with the square of the increase in flow, which means if the flow is doubled; the pressure drop will increase four times. Air distribution piping should be large enough in diameter to minimize pressure drop.

7. **Change Filters Systematically. Not every once in a while.**

   Inspect and replace filters systematically to ensure the quality of your air and prevent pressure drops. Go beyond the air compressor and compressor room. There are several air-line and point-of-use filters within the facility. Those are just as important to maintain as the air compressor and air compressor room filters.

8. **Recover Heat. Compressing air generates heat - reuse it!**

   Its simple physics that compressing air gives off heat, and as much as 90 percent of that heat can be recovered for use in your operation. For example, you can produce hot water for washrooms or direct warm air into a workspace, warehouse, loading dock, or entryway. The savings can really add up.

9. **Emphasize Proper Maintenance. Ignoring maintenance costs more.**

   As with most industrial machinery, a compressor runs more efficiently when properly maintained. Proper compressor maintenance cuts energy costs around one percent and helps prevent breakdowns that result in downtime and lost production. Protect your reputation and profits with proper maintenance.

10. **Identify and Eliminate Inappropriate Uses of Compressed Air.**

    Inappropriate uses of compressed air include any application that can be done more effectively or more efficiently by a method other than compressed air. For example, high pressure air often is used for cooling or applications where much lower air pressure is required.

Use of Variable Speed Drives in Compressed Air Systems for Energy Saving:

This is one of the valuable practices which is becoming quite common now a days, with good scope for Energy Saving.

Traditionally Compressed Air Systems, depending on the rate and quantum of Air Usage by the System, have Loading and Unloading Cycles of the Motors and Compressors due to fixed speed of Motors. The introduction of Variable Speed Drives in the Compressed Air Systems helps to match the Compressed Air Requirements with the Compressed Air supplies by the System. The Diagram below shows the actual operation cycles without and with the introduction of Variable Speed Drives. The elimination of the Loading – Unloading cycle is achieved through speed control of Motors and the Energy Input to the Motors greatly reduces due to speed reduction of Motors.

The elimination of Loading and Unloading Cycles and replacing it with regulation of Air Volumes through Speed Controls enable Energy Savings.

Typical saving in the electrical bill with VFD depending on loading

Unload %	Energy Saving %
10	11
15	13
20	16
25	18
30	21
35	23
40	26

(To be continued)

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

BIG, BEAUTIFUL AND SUSTAINABLE – 10 OF THE WORLD'S MOST ENERGY EFFICIENT OFFICES - 7

THE EDGE, AMSTERDAM (NETHERLANDS)

Located in Amsterdam, The Edge is considered to be the most sustainable building in the world - it's been awarded the highest score ever recorded under BREEAM's new construction certification scheme. Created by OVG Real Estate, it was the first building to utilise Philips Ethernet powered LED lights which enables employees to use a smart phone application to regulate the climate and lighting over their individual workspaces. The building is energy neutral and uses solar panels on its roof and every other surface that is not a window on its south façade as its source of power.

(To be continued...)

THE WORLDS TOP 10 MOST INNOVATIVE COMPANIES IN ENERGY - 7

OKEANOS TECHNOLOGIES

OKEANOS TECHNOLOGIES

desalination at the speed of light

For discovering a more-efficient way to remove salt from water. As pure water becomes more and more scarce in a warming world, desalination technology has become increasingly important. But water desalination is extremely energy intensive, with desal plants often using an electricity-sucking reverse-osmosis process that forces salty water at very high pressure through fine mesh filters. Okeanos employs a radical new technology, using a kind of electronic chip that taps microscopic electrical fields to take the salt out of the water. Though a fairly early-stage company, Okeanos has made a huge splash in the scientific community and promises to offer radical new methods for desalination.

(To be continued...)

முத்து போன்றது, நாற்றத்தையும் விரட்டும்

சங்க இலக்கியத்தில் மட்டும் 90 பாடல்களில் சுட்டப்பட்டுள்ள புன்னையின் மாற்றுப் பெயர்களாகப் புன்னாகம், நாகம், வழை, சுரபுன்னை ஆகியவற்றைத் திவாகர, பிங்கல, உரிச்சொல், சூடாமணி, நாமதீப நிகண்டுகள் குறிப்பிடுகின்றன. இவற்றில் புன்னாகம் மட்டுமே புன்னையின் நிச்சயமான மாற்றுப் பெயராக இருப்பதற்கு இலக்கியச் சான்றுகள் உள்ளன. புன்னாகம் என்றால் புன்னையின் விசேஷம் என்று அகராதி காட்டும் பொருள் மட்டுமில்லாமல், அதுவே சரியான மாற்று பெயர் என்று நச்சினார்க்கினியரும், தமிழறிஞர் மீனாட்சிசுந்தரம் பிள்ளையும் வாதிடுகின்றனர். **"புன்னாகச் சோலை புனல் தெங்கு சூழமாந்தை நன்னாகம் நின்றலரும் நன்னாடன்"** என்ற முத்தொள்ளாயிர வரிகள் புன்னாகத்தை நெய்தல் நிலத்துப் புனல் தெங்குடன் (தாழை) இணைத்துக் கூறியிருப்பதால், புன்னாகம் என்பது புன்னையைக் குறிக்கும் சொல்லாகக் கொள்ள வேண்டும்.

இனிய நறுமணம்

ஞாழல், தாழை போன்ற இதர நெய்தல் நிலத் தாவரங்களுடன் ஏப்ரல் முதல் ஆகஸ்ட் மாதம் வரை புன்னை பூக்கும். புன்னை மலரின் மொட்டு உருண்டையானது, வெண்மை நிறமானது, முத்தோடு ஒப்பிடப்படுவது. குறிப்பாக நன்கு கழுவிச் சுத்தம் செய்யப்படாத முத்து போன்றது, மொட்டு வெண்மையான பல்லி முட்டையோடும் (பொரிப்புறப் பல்லி சினையீன்ற புன்னை "ஐந்தினை ஐம்பது 43 "....பல்லி செறீத்த சினை போலும் நீளீரும் புன்னை பொரிப்பூ" (பழமொழி 317), ஊர்க்குருவியின் முட்டையோடும் ஒப்பிடப்பட்டுள்ளது (அகநானூறு 231:6).

புன்னை பூக்கள் நல்ல மணம் கொண்டவை (கடிமலர்). இவை மஞ்சரியில் கொத்தாக உண்டாக்கப்படுகின்றன. மலரின் மணம், கடுமையான கருவாட்டு நாற்றத்தைக்கூடப் போக்கும் தன்மையுடையது. இந்த மணம் பூவின் தாதுவிலிருந்து பெரும்பாலும் தோன்றுகிறது என்று அறியப்படுகிறது.

புன்னை மலர் சூடத்தக்கது: நெய்தல் நிலத்து ஆண்களும் பெண்களும் இதைச் சூடினர். சூடியது போக எஞ்சிய மலர்களே, காயாயின. பூவின் தாது (மகரந்தம்) பொன்னிறமானது. பூவின் மணத்துக்கு இதுவே பெருமளவு காரணமாகத் திகழ்கிறது.

அற்புத எண்ணெய்

சதைப் பற்றுள்ள, உருண்டையான காயும் கனியும் பொதுவாகக் கோலிக்குண்டு அளவுக்கு இருக்கும். ஆண்டின் பெரும்பாலான மாதங்களில் காய்கள் மரத்தில் காணப்படும் என்றாலும் ஜூன் முதல் செப்டம்பர் வரை மிக அதிக அளவில் காணப்படும். புன்னைக் கொட்டையை மணலில் புதைத்துவிட்டுத் தேடும் விளையாட்டு நெய்தல் திணை மக்களிடையே பரவலாக இருந்தது (நற்றிணை:172) இன்றும்கூட, நாகை, புதுக்கோட்டை கடற்கரையில் சிறுவர்கள் இந்த விளையாட்டை விளையாடுவதை நான் கண்டிருக்கிறேன்.

பூவும் காயும் மருத்துவப் பண்புகள் நிறைந்தவை. நன்கு அரைக்கப்பட்ட பூ சொறி, சிரங்கு, புண்களை நீக்கப் பயன்படுத்தப்படுகிறது. பூவின் சாறு நரம்புக் கோளாறுகளுக்கும் வலிப்புகளுக்கும் கொடுக்கப்படுகிறது. புன்னைக்காய் நிறைய எண்ணெய்ச் சத்து கொண்டது (நெய்கனி). இந்த எண்ணெய் விளக்கு எரிக்கவும் தீப்பந்தங்களை ஏற்றவும் பண்டைய தமிழகத்தில் பயன்படுத்தப்பட்டது.

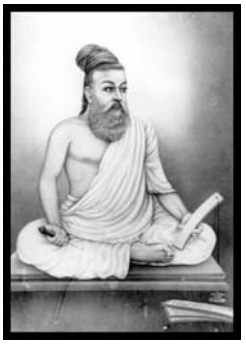
புன்னை எண்ணெய் அடர் பச்சை நிறமுடையது. நாற்றம் அடிக்கக் கூடியது. டோம்பா (Domba), டிலோ (Dilo) அல்லது லாரல் (Laurel) எண்ணெய் என்றழைக்கப்படும் புன்னை எண்ணெய் ஒரு சிறந்த வலி நிவாரணி. வாய்வு நீக்கி, புண்கள், கொப்புளங்கள் போன்றவற்றைக் குணப்படுத்தக் கூடியது.

பாலியல் நோய்களுக்கும் பூச்சாறு நல்ல மருந்தாகும். குறிப்பாக ஆண், பெண் இனப்பெருக்க உறுப்புகளில் உள்ள புண்களிலும் வீங்கிய கண்களிலும் போடப்பட்டால் வீக்கம் நீங்கும். குஷ்ட நோய் உள்ளவர்களுக்குப் புன்னை எண்ணெய் தசை வழியாகச் செலுத்தப்பட்டால் குஷ்ட நோய் வலி நீங்கும். புன்னை எண்ணெய்க்கு அதிக உள்நாட்டு பயன்பாடு மட்டுமின்றி ஏற்றுமதி வாய்ப்புகள் இருந்தாலும் இதற்கான பெரிய முயற்சிகள் எதுவும் இதுவரை எடுக்கப்படவில்லை.

கட்டுரையாளர், ஓய்வு பெற்ற தாவரவியல் பேராசிரியர் – கு.வி. கிருஷ்ணமூர்த்தி
தொடர்புக்கு: kvkbdu@yahoo.co.in

Courtesy: தி இந்து, 18.06.2016

TIRUKKURAL AND MANAGEMENT IN A 'NUTSHELL' - 46



Business is Marketing and Marketing is a very challenging function today as a result of Liberalization, Privatization and Globalization. Marketing is considered a 'Warfare' today, with competitors as our opponents in the war field of "Minds of Customers". There are lots of theories and Books written on Marketing Strategies based on 'War Strategies' of different times and countries. Marketing Strategies are derived out of "Offensive Warfare", "Defensive Warfare", "Flanking Warfare", "Gourilla Warfare" and so on.

We are able to see that we can draw wonderful and useful lessons from Tirukkural as well to understand the "Marketing Warfare" strategies. The following examples of Kurals will illustrate the lessons provided by the "Kurals"

1) Kural 861 - In the war field of Market Place, the enemies are our competitors and they could be large or small in terms of Size, Resources etc. In the Kural below, the moral provided is that if the competitor is 'Large', adopt flanking or defensive strategies and if the competitors is 'Small', adopt offensive strategy.

Valiyaarkku Maaruetral Ombuga; Omba
Meliaarmael Mega Pagai Kural 861

வலியார்க்கு மாறுஏற்றல் ஓம்புக; ஓம்பா
மெலியார்மேல் மேக பகை குறள் 861

"If the enemy is more powerful, adopt strategy other than direct confrontation; if the enemy is weak attack him with force"

2) Kural – 864 – If you are a Sizable player in the Market place with sizable share of the Market, you should take care to defend your market with suitable tactics, measures to keep the image of your Brand or operations high, ensure to attend to complaints and avoid arrogance in dealing with clients, as otherwise, your Market Share would easily be grabbed by competition.

Vazhinokkaan Vaayppana Seyyaan Pazhinokkan
Panbuilan Patrarkku Inithu Kural 865

வழிநோக்கான் வாய்ப்பன செய்யான் பழிநோக்கான்
பண்புஇலன் பற்றார்க்கு இனிது குறள் 865

"One who does not know tactics, does not do deeds to uphold honour, does not care for grievances and is not well behaved; he will be a sweet conquer to the opposition"

HOME FESTIVALS - 3

பங்குனி - Panguni (March/April)

This month brings the popular nine-day festival of Ram Navami, celebrating the birthday of Lord Rama, an incarnation of Lord Vishnu. When the full moon rises, Vishnu in the form of Satyanarayana is worshipped before a decorated kumbha pot with a branch of mango leaves placed in its mouth and a coconut on top. Rice is spread on banana leaves and the sacred vessel is completed with a tray of fruits, flowers an betel leaves and nuts. This month is also known for Sita's marriage to Rama. King Janaka, Dasaratha and priests surround the sacred fire, as Sita garlands Rama in Janaka's royal palace.

(To be continued)

ZEV'S LONG-RANGE, TILTING ELECTRIC THREE-WHEELERS LOOK THE GOODS

West Virginian company ZEV has been quietly building high quality electric scooters for more than a decade now, including the fastest and longest range electric scoots in the world. Now, ZEV's ready to release a long range, tilting 3-wheeler based on the same platform.

A small company running out of Morgantown, West Virginia, has been quietly making high quality **electric maxi-scooters** for more than 10 years now that frankly put the rest of the industry to shame.

ZEV's LRC-15 remains the e-scoot distance and speed champion, banging out an impressive 185 miles (298 km) at a constant 55 miles per hour (88 km/h) on a 12.4 kilowatt-hour battery – or about a solid 50 percent more than the **Zero S or SR** gets out of a slightly larger battery at the same constant speed. Aerodynamics are most definitely a thing.

Like all ZEV's bikes, the LRC-T uses a hub motor in the rear wheel, that's oil cooled and lubricated to eliminate overheating and rust, and extend motor life. In order to help deal with that extra unsprung weight, the swingarms are extra-long to improve the suspension's effectiveness. As an electric, it's simple enough to incorporate a reverse gear, so there's one of those, which will help move this 516-pound (234 kg) maxi around.

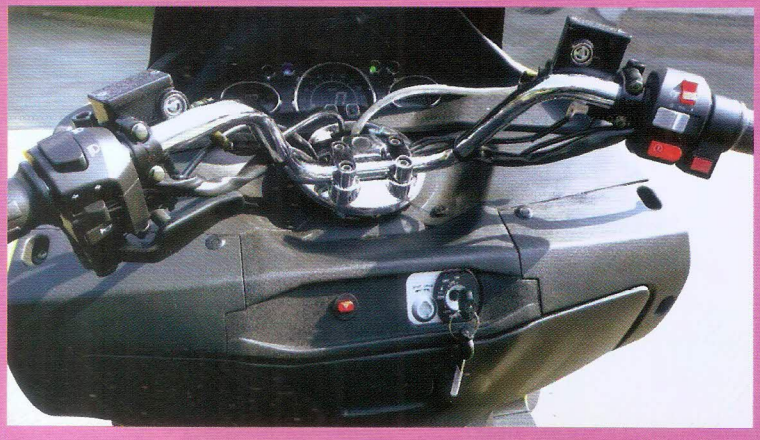
The company wanted to make this a super accessible bike for riders of all sizes, so it has an extremely low seat, as well as plenty of leg room for the taller among us. Thinking of disabled riders, there are no foot controls. Everything's on the bars, including a thumb control to lock the tilt, which lets you stop the bike without putting your feet down. Mind you, there's no automatic unlock for this system, you've got to release it yourself once you're moving.

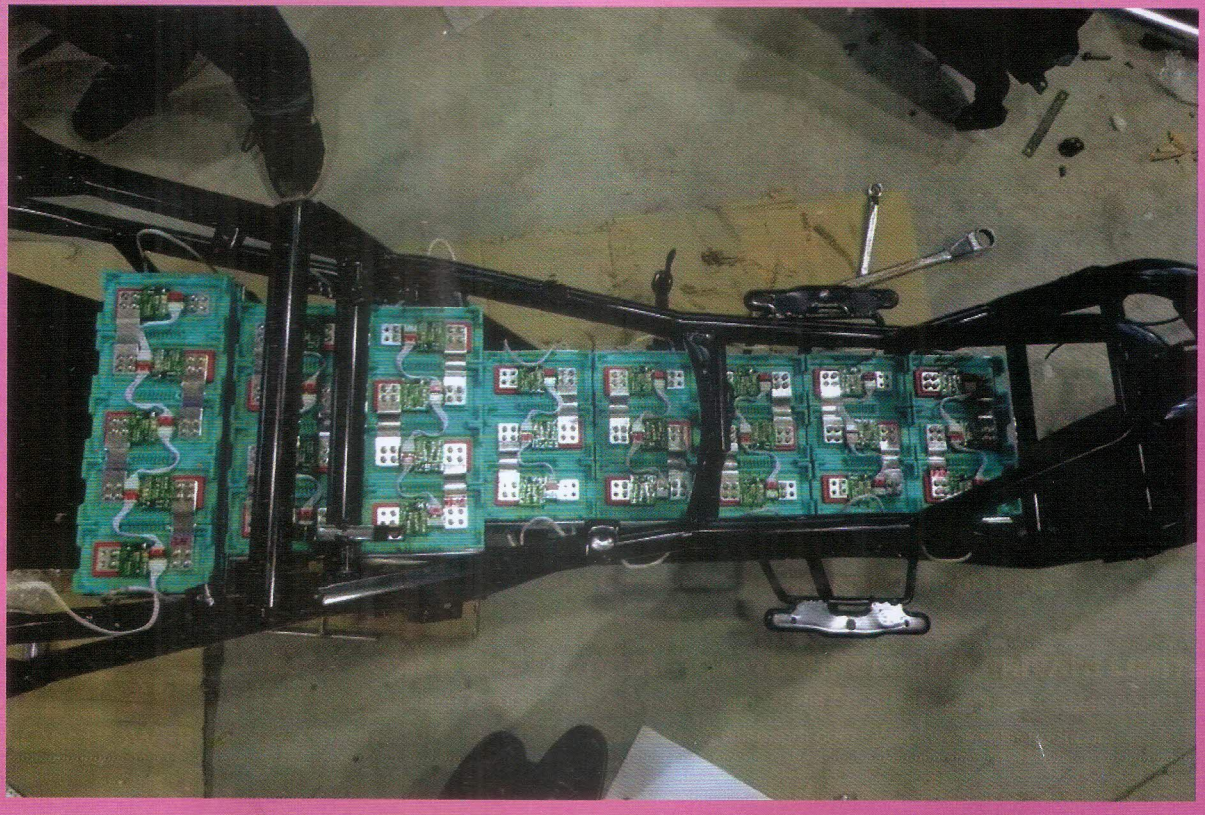
With no motor in the chassis, there's plenty of luggage space under the seat, and a center stand as well as a side stand for extra practicality. Should a battery cell fail, each can be removed individually – they're not wrapped up in a sealed unit like most of the competition. So you won't be riding these things underwater like you might with a Zero bike.

At US$13,990, it's not cheap, but there's a shorter range option available: the LRC-T6, for just under US$10K, with about 60 percent the battery and range. That'll do the vast majority of riders for the daily commute. Both are wildly cheaper than the BMW C-Evolution's estimated price of well over US$20,000.

These look like quality, well-built machines from a small company that puts its resources into engineering rather than marketing. They deserve to do well.

ZEV'S LONG-RANGE, TILTING ELECTRIC THREE-WHEELERS LOOK THE GOODS





Printed and Published by 'Tamilnadu Electrical Installation Engineers' Association
"A" Grade, Chennai -14. Editor : G. Venkatesh Advisor : S. Mahadevan