ELECTRICAL INSTALLATION ENGINEER

NEWS LETTER

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

The Annual General body meeting of our Association was held on 27/02/2021 at Hotel Green park, Vadapalani, Chennai. New office bearers for the year 2021-2023 were inducted through an election process. A total of 289 members participated in the voting process and elected Mr. Kannan as President, Mr. GM Vishnuram as Secretary and Mr. Kalyanavenkatraman as Treasurer.

We as members would like to thank our outgoing office bearers Mr. SD Poongundran, Mr. P Suyambu and Mr. Balamurugan for dedicating their time and energy to our association. We look forward to their guidance to the new team to take the association to greater heights.

We would like to extend our sincere gratitude to all the outgoing Vice Presidents, Joint Secretary and Executive members for their commitment and dedication towards the association.

As members of this association, we are proud to be a part of this team and are looking forward to work together for the betterment of the association.

EDITORIAL

Dear Members, Fellow Professionals and Friends,

Seasons Greetings To One And All!

The month of March signifies the financial year end for the Government and all businesses in India. Though there are concerns and comments about the Indian Economy that got affected badly due to the pandemic, we can feel relieved about the way our Governments at the State and at the Centre, ably assisted by people at large, institutions, corporates and social bodies, have bravely and squarely faced the situation. They took all kinds of steps to control the spread of the virus and provide food, relief and medical facilities to a great extent possible including testing and screening. There was a slowdown of the Economy even prior to the pandemic and the slide got accelerated during the year 2020. Due to the changing relationships between the countries, particularly with China, new opportunities are opening up for India and the Economy is slated to grow at 10% and more in the years to follow, which can trigger all round business opportunities. The goal of 5 Trillion $ Economy may take a little longer, but it should still be the immediate goal.

National Defense Day celebration falls on the **3rd of March** and it signifies lot of things to be proud of and lot of plans and developments to look forward to for opportunities and Self Reliance - "Athmanirbar". There was dangerous confrontation between the armies of India and China across the borders in recent months and the good news at present is that China withdrew its armies and India followed. There are some accounts reported from China that it decided to withdraw looking at the confidence and gaiety of the Indian forces on the other side. The comment goes that the "War" has ended without even a firing of a gunshot. We have seen the reports that the recent Air Show showcased the capabilities of HAL, Bangalore, which has also generated sizable exports. Vijayanta Tanks from Avadi, have demonstrated our Technology, Design and Manufacturing capabilities. In order to bring down the imports of defense equipments by increase of Indian manufacture, Defense Corridors Projects in Tamilnadu and Uttarpradesh are being pursued vigorously.

We celebrate **"Water Day"** also this month. Rains have been in plenty this year all over the country ensuring good harvests, though the rains have been in excess and untimely in some places resulting in loss of crops. The overall food production has not only resulted in food security but has also helped the GDP of the country. It is very heartening to see the activities in Tamilnadu to clean up tanks and lakes and the canals as well as creation of new tanks for increase of water storage and use. It is also interesting that, schemes to interlink Cauvery with some of the rivers within the State, is being pursued. Tamilnadu is also continuing to ask the Central Government to take up and implement linking of Godhavari River with Cauvery.

We have seen through the recent flash floods in Utharakhand due to melting of glaciers, that Energy and Environment and Global phenomenon need to be addressed more seriously and continuously by all countries of the World to save the Globe.

We thank all those members who have helped us by participating in the advertisement appearing for the issue February 2021 – E Power Engineering, Gravin Earthing & Lightning Protection System (P) Ltd., Mersen, Supreme Power Equipment (P) Ltd.

Editor

ELECTRICAL
INSTALLATION ENGINEER

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CONTENTS

WORLD WATER DAY

MARCH 22ND 2021 THEME: VALUING WATER

The Importance of Water

World Water Day, held on 22 March every year since 1993, focuses on the importance of freshwater.

World Water Day celebrates water and raises awareness of the 2.2 billion people living without access to safe water. It is about taking action to tackle the global water crisis. A core focus of World Water Day is to support the achievement of Sustainable Development Goal 6: water and sanitation for all by 2030.

Water and Climate Change

World Water Day 2020 is about water and climate change – and how the two are inextricably linked. The campaign shows how our use of water will help reduce floods, droughts, scarcity and pollution and will help fight climate change itself.

By adapting to the water effects of climate change, we will protect health and save lives. And, by using water more efficiently, we will reduce greenhouse gases.

Our key messages for this day are clear:

- We cannot afford to wait. Climate policy makers must put water at the heart of action plans.
- Water can help fight climate change. There are sustainable, affordable and scalable water and sanitation solutions.
- Everyone has a role to play. In our daily lives, there are surprisingly easy steps we can all take to address climate change.

History of the Day

The idea for this international day goes back to 1992, the year in which the United Nations Conference on Environment and Development in Rio de Janeiro took place. That same year, the United Nations General Assembly adopted a resolution by which 22 March of each year was declared World Day for Water, to be observed starting in 1993.

Later on, other celebrations and events were added. For instance, the International Year of Cooperation in the Water Sphere 2013, and the current International Decade for Action on Water for Sustainable Development, 2018-2028. These observances serve to reaffirm that water and sanitation measures are key to poverty reduction, economic growth, and environmental sustainability.

I call on all stakeholders to increase climate action and invest in robust adaptation measures for water sustainability. By limiting global heating to 1.5 degrees Celsius, the world will be in a much better position to manage and solve the water crisis that we all face.

SECRETARY-GENERAL'S MESSAGE

Did you know?

- Today, 1 in 3 people live without safe drinking water.
- By 2050, up to 5.7 billion people could be living in areas where water is scarce for at least one month a year.
- Climate-resilient water supply and sanitation could save the lives of more than 360,000 infants every year.
- If we limit global warming to 1.5°C above pre-industrial levels, we could cut climate-induced water stress by up to 50%.
- Extreme weather has caused more than 90% of major disasters over the last decade.
- By 2040, global energy demand is projected to increase by over 25% and water demand is expected to increase by more than 50%.

KNOW THY POWER NETWORK - 157

Safety Audit – Do it yourself 'DIY' methods

1. Need for Safety Audit / Safety Inspection

In our daily life, we face many life threatening threats / challenges emanating from various sources like Electricity, Moving Vehicles, Flying / Falling Heavy Objects, Harmful Chemicals, Industrial Hazards and Natural Disasters like Floods, Earth Quakes, Cyclones and Tsunami (Fig. 1). It is well-nigh impossible to take protective steps against all of them. Though the dangers from less frequent challenges like Tsunami cannot be belittle, we can take certain calculated risks / chances against them.

In this write up, Electricity Safety with a special focus on its components Viz. "Audit and Inspection" is mainly addressed. I am of the opinion that such safety studies should be started right from our dwelling places / working premises itself. Do it yourself (DIY) methods constitute a part of this measure and help to perform the audit.

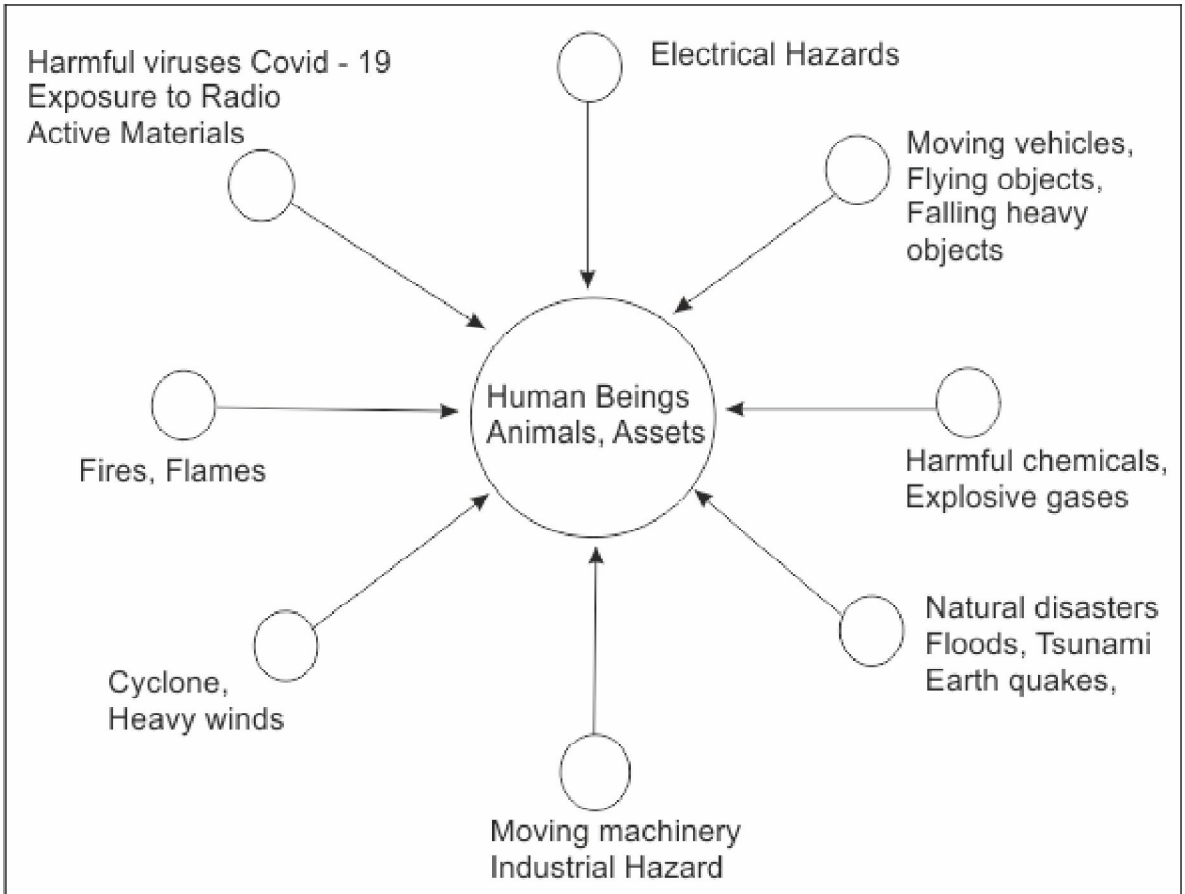

Fig 1. Threats faced by Human beings, Animals and Assets

It is well known that improper use of electricity, careless / over confident handling of electrical equipment / devices, failure to comply with the established safety rules and regulations are among the reasons assigned for electrical accidents. Electrical Safety forms one of our main responsibilities; in plants, both employer and employees should ensure safe working environment. Electrical Safety is not simply a matter of taking precautions while dealing with electricity. It is more than that; it starts from the stage of equipment design, its construction, testing, safe handling and movement, erection, operation, maintenance and finally compliance with all safety rules and regulations at worksite. All these aspects make Electrical Safety Audit / Safety Inspection as an issue of utmost importance.

Presently the creation of safety awareness among the end users is one of the important steps that warrant attention. Safety Audit and Safety Inspection at a place play significant roles in achieving this objective.

2. Safety Audit and Safety Inspection

"Audit" is a word normally associated with financial matters, especially that of financial accounting. Then you may wonder how it finds a place in "Safety Related Issues". This word is widely used not only in safety matters but also in environment and energy fields. In financial sector, to understand the risks and losses associated with the financial issues, "Audit" is the analytical procedure adopted. This not only helps to find out them but also provides avenues to the needed measures to mitigate them. Similar scenarios exist in Safety, Energy and Environmental fields also. Hence in order to understand the real nature of losses, risks and other issues encountered in these fields, similar analytical methods are required. So "Audit" procedure is generally followed in the said fields also.

The methodologies similar to the one followed in financial sector are adopted in Safety, Environment and Energy fields. Thus enters "Safety Audit" in our domain Safety inspection is the other analytical method. Though these two methods are different, their final goal remains the same. Once the readers understand the real meaning of the word "Audit", they can simply replace the word Safety Audit with alternatives like "Safety Assessment, Safety Survey and Safety Consultation at their discretion. Let us view what is common and not common between Safety Audit and Safety Inspection.

S.No.	Safety Audit	Safety Inspection
1	It is carried out once / twice in a year. It gives importance to on-site assessment and the effectiveness of safety practices followed in a place / premises	It focuses mainly on the monitoring function to locate and report the potential hazards / situations that could lead to accidents.
2	These are nothing but safety surveys that reveal potential areas / causes of accidents and offer opportunities to effect corrective actions. Such surveys are helpful in averting possible accidents	It facilitates all possible actions that would be taken in time to abate the hazards reported in the inspection reports.
3	These are effective ways of preventing accidents.	Its main function is to ascertain the **"On-site Condition"** from the safety point of view and to take immediate corrective measures.
4	It constitute one of the managerial/corporate activities/responsibilities	It is regularly conducted at a site with some periodicity.
5	These are "Report cards" on the success of safety in a plant or premises.	
6	It may be treated as a structured evaluation on the performance and compliance of safety rules and regulations at a place.	
7	Its goal is to ensure a safe and healthy work place/living place by eliminating unsafe practices and hazards.	
8	It identifies the strengths and weakness of a safety programme at a site.	

3. Electrical Hazards

Now it is time for us to learn the basic features of Electrical Hazards. With this back drop, we can go for the measures to ward off them.

(i) Hazards from electrical equipment that include

(a) Electric shocks and associated effects like internal organ damage due to the passage of electric current, burns on skin at the point of contact and injuries due to electric shock combined with "fall".

(b) Arc flash causing external burns.

(c) Temperature hazards due to the high temperatures involved in arcs.

(d) Exposure to live parts that lead to arcs, burns and shocks. (Direct contact)

(e) Exposure to parts that inadvertently become live (Indirect contact)

(f) Potential differences (pd) brought by electro static charges and electro magnetic induction.

(g) Potential differences between different points in the earth brought by certain operating conditions like discontinuity / loose connections, poor crimping in the earth connections.

(h) Direct contact with energized UPS, Capacitors, Storage Batteries, Invertor, Welding Equipment, energized broken wires or snapped conductors, broken plug points, damaged fuse units, displaced dangling, lightning down conductors during thunder storm days and heaters.

(i) Failure to isolate live parts or inadequate isolation of live parts.

(j) Poor maintenance and faulty equipment

(k) Protection provided is insufficient

(l) Lack of safety equipment and procedures.

4. Safety Audit – Methodology - Basics

A Safety Audit requires data on the following.

- The present electrical safety status at the location in point
- Its actual safety needs: What measures are provided?
- How it is met at present; what are the short falls or inadequacies?
- Whether compliance with established safety rules and regulation is met with or not; list of deviations noticed.
- What are the measures needed for correcting the deviations
- Undertaking the improvements in its safety status and how it can be achieved.
- Fault level at the site; I^2t capability of connecting cables, protective equipment like breakers, fuses etc.
- EMC and EMI compatibility of the equipment / devices at site.
- Possibilities of voltage stress related failure and the measures need to avert them
- Condition of the protective enclosures around the equipment.
- Status of system grounding and safety grounding
- Preventive measures adopted to ward off adverse thermal effects.

- Whether live parts are placed beyond Arm's reach? This includes
  - (i) Exposed conductive parts
  - (ii) Extraneous conductive part
  - (iii) Bare live part of any other system
- Possible fire hazards in the location in point
- Earthing and interlock systems
- Details of hazards (Other than electrical hazards) exist at the location in case. (Mechanical, Chemical and Fire Hazards)

The audit consists of two parts:

(i) Collecting the required data (as outlined above)

(ii) Evaluating the data thus collected

Further it should identify the strengths as well as the weakness of the existing safety methods / procedures followed. It should also explain or reveal methods required to achieve the compliances with the safety rules, regulations and guidelines currently in force. Finally it should clearly reveal / recommend various measures to improve the present conditions to the desired level.

Now let us move to Safety Audit programmes.

On site audits in industries require three main steps.

(i) In addition to site visits, interviews and detailed discussions are required to be held with facility people at site, since they play key roles in developing and implementing safety management systems.

(ii) Go through / review the available documentations relating to safe system records and critical tasks that generally cover hazard identification, emergency preparedness, control and monitoring and safety education and training.

(iii) Conduct / perform on site assessment of the facility and equipment. This assessment may include the verification of the implementation of safety practices. To cite an illustration; welders employed for welding works (Hot work) must have hot work permits. Verify at site whether this measure is followed or not. In a similar way, it is statutory to employ only experienced engineering degree holders in EHV sub-stations. The compliance of this statutory requirement is needed to be checked at site.

In the forthcoming articles we may see more details on Electrical Hazards identification, required protective measures, Emergency Preparedness and Check lists for on-site or field assessments of facility / equipment available for Electrical Safety.

Let me sign off here.

(To be continued)

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"The fact of the matter is our homes are on the frontlines when it comes to protecting and conserving our critical water resources – more than that, they are also key to protecting our health." – PHILIPPE COUSTEAU Jr.

AN INNOVATIVE DESIGN OF THREE PHASE 315 KVA, 11/0.433KV OIL IMMERSED DISTRIBUTION TRANSFORMER - 1

Abstract

A Three Phase Distribution Transformer is widely used in urban as well as rural area for power supply. It is also used in many industrial purposes to run many appliances. A three phase 315KVA, 11/0.433kV distribution transformer. Winding design and performance practice for power and distribution transformers has focused in the differences between rectangular core and coils and layer windings common in the production of distribution transformers

I. Introduction

A three phase 315kVA, 11/0.433kV Distribution transformers which has per phase voltage 250V. The high side 11000V having U-phase, V-phase, W-phase. While low voltage side 433V there is four terminal i.e., N-phase, U-phase, V-phase, W-phase. Each terminal along with Neutral caries 250V. The increasing demand of electricity oil immersed 3- phase Transformer in an economic way the cost optimization of the transformers design by reducing the mass of active part has become vital importance.

Transformer design technique, designer had to rely on their experience and judgment to design the required transformer. Several design procedure for low frequency transformers have been developed in past research. Mathematical design calculation using MS- excel in an attempt to eliminate time consuming calculations associated with reiterative design procedure.

The power scenario in India, as on March 31, 1988, the total installed capacity in India was 88,861MW. New power projects expected are over 2700MW. By 2010 AD, the expected requirement of power would be around 200,000 MW, which means there will be almost 100% more generation over the next 10/12 years.

With the addition of 100,000MW more power, we may expect enormous requirement of power and distribution transformers in India.

The transformer emits no-load and load losses. It is necessary to keep these losses at a minimum to reduce the line losses. The configuration of connection for distribution transformer in India is usually 'Delta' in primary and 'Star' in secondary with a vector group Dyn-11. The huge numbers of distribution transformers are required for electrification of any country. It is estimated that number of distribution transformer installed in electrical distribution Network is growing approximately 1.5% per annum. Around 15% of investment in transmission System goes towards transformer

Thermal design and operation considerations

Rectangular core and coil design are frequently used for distribution transformer design and offer advantages of reduction in direct labour and material when compared to circular core and coils with disc and helical winding usually wound with sheet conductors for the LV winding. The rectangular core design reduces the core window and result in a result in reduction of core losses compared to a circular winding design.

II. Mathematical Calculation for Transformer

Description of basic details:

V/T, volts per turn or E_t

C_d, current density in winding (A/mm^2)

CD, core diameter in mm

LL, Load loss or copper loss

NLL, No-load loss or core loss

A/L, axial Length of coil

R_1, Radial build of coil

g, Gap between LV/HV winding in mm.

E_t or V/T, Volt per turn.

A_g, cross-sectional area of core in centimeter

B_m, Flux density in tesla.

F, frequency = 50 Hz.

Stacking factor = 0.97

V/T	A CM	B_m T	NLL W	LL W	IR W
6.250	171.71	1.640	467	2532	2335

Impedance value Z% = 4.44

Density of copper, Cu = 8.9 g/cm^3

Density of core steel (iron) in 7.65g/cm^3

Resistivity of copper is 21*10^{-9} ohm-/mm^2

Grade of core is MOH 0.23

Rated Current AMP. Line Phase	LV	HV
	16.53----9.5	420.01
Resistance / PH At 75Ú C	LV	HV
	4.6014	0.002035

Core diameter, CD= 4.44 * f * B_m * A_g * 0.97 * 10^{-4}

(To be continued)

Courtesy: International Journal of Engineering Development and Research (www.ijedr.org)

WALK AWAY

*"**Walking**"* is the **Best Exercise**!!!

Walk Away from *arguments that leads you to nowhere but anger.*

Walk Away from *people who deliberately put you down.*

Walk Away from *any thought that reduces your worth.*

Walk Away from *failures and fears that stiffle your dreams.*

Walk Away from *people who do not care for you and who are opportunistic.*

The more you

Walk Away from *things that poison your soul*, **the happier your life will be.**

Give Yourself A Walk

Towards love, peace, kindness and goodness

May God help us daily to walk in the right direction

Keep walking for good health.....

EV CHARGING INFRASTRUCTURE CONTINUES TO GROW

According to a new report from the National Renewable Energy Laboratory (NREL), Golden, Colo., the first three months of 2020 saw public electric vehicle (EV) supply equipment grow 7.6%.

The report, "Electric Vehicle Charging Infrastructure Trends from the Alternative Fueling Station Locator: First Quarter 2020," provided a snapshot of the state of EV charging infrastructure, such as EV charging stations, in the United States, finding that DC fast chargers made up the largest piece of the pie, expanding by 10.6%.

DC fast chargers are 49.6% of the way toward meeting the projected 2030 charging demand for 15 million EVs, and level 2 EV supply equipment is 12% of the way there.

Private EV supply equipment, such as charging for transit fleets and employees, only grew 3.2% in the first quarter, bringing the total private EV supply equipment to almost 14,000.

The report added that, while all regions of the country saw substantial growth during the first quarter, a few stood out. For example:

- The Northeast (Maine, New Hampshire, Vermont, New York, Massachusetts, Rhode Island and Connecticut) saw an increase of 10% overall, which is the fastest growth in the nation.
- California's charging infrastructure grew 9%. However, California continues to lead the country in terms of the total available public EV supply equipment.

The states with the highest rate of charging stations per 100,000 people were Vermont (105.3), California (64.0), Washington, D.C. (63.3), Hawaii (47.7) and Colorado (40.9).

The report noted that, "With such rapid growth and change in EV charging infrastructure, the information presented in this paper aims to help readers understand how and where the infrastructure is developing, where there may be areas of opportunity, and whether development is keeping pace with the projections for demand for charging as the number of EVs on the road continues to grow".

Courtesy: By William Atkinson / Published In November 2020

"Water is the driving force of all nature." – LEONARDO DA VINCCI

GENERATORS WORK - 1

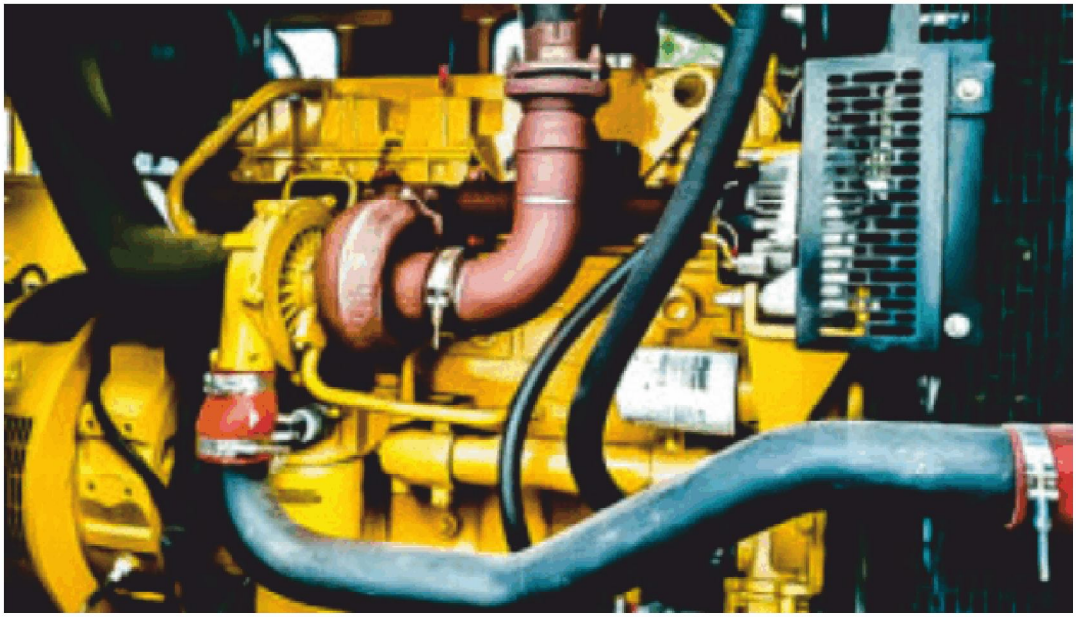

Fig. 1

Electrical generators are standalone machines that provide electricity when power from the local grid is unavailable. Generators are often used to supply backup power to facilities, businesses, or homes during power outages but they can also be used as a primary power source in areas where a local electrical grid is unavailable or difficult to access such as mining and farming operations or even new developments and construction. It's possible to buy a generator for just about any need. Some electrical generators are small, portable devices that are used for camping or hobbies to provide small amounts of power for just a few devices. Others are permanent installations that can power an entire house. Industrial generators are even more powerful, capable of maintaining full power to manufacturing facilities, hospitals, and office complexes.

There are diesel generators, natural gas generators, propane generators, and bi-fuel generators. Below, we'll take a look at how electrical generators work and what you need to know to install and maintain a generator.

How Do Generators Create Electricity?

Generators don't actually *create* electricity. Instead, they *convert* mechanical or chemical energy into electrical energy. They do this by capturing the power of motion and turning it into electrical energy by forcing electrons from the external source through an electrical circuit. A generator is essentially an electrical motor working in reverse.

Some electrical generators, such as those at Hoover Dam, for example, are huge and provide enormous amounts of energy by transferring the power created by water turning turbines into electricity. Residential and commercial generators, however, are much smaller and rely on more traditional fuel sources like diesel, gas, and propane to create mechanical power that can then be forced into a circuit and induce an electrical current.

Once an electrical current has been established, it is directed through copper wires to power external machines, devices, or entire electrical systems.

Modern generators can be attributed to Michael Faraday's *principle of electromagnetic induction.* Faraday discovered that when a conductor moves in a magnetic field, electrical charges could be created and directed to create a flow of current. At its most basic, an electrical generator is nothing more than an

electromagnet – moving wire near a magnet to direct the flow of electricity. It's similar to how a pump pushes water through a pipe.

What are the parts of an electrical generator?

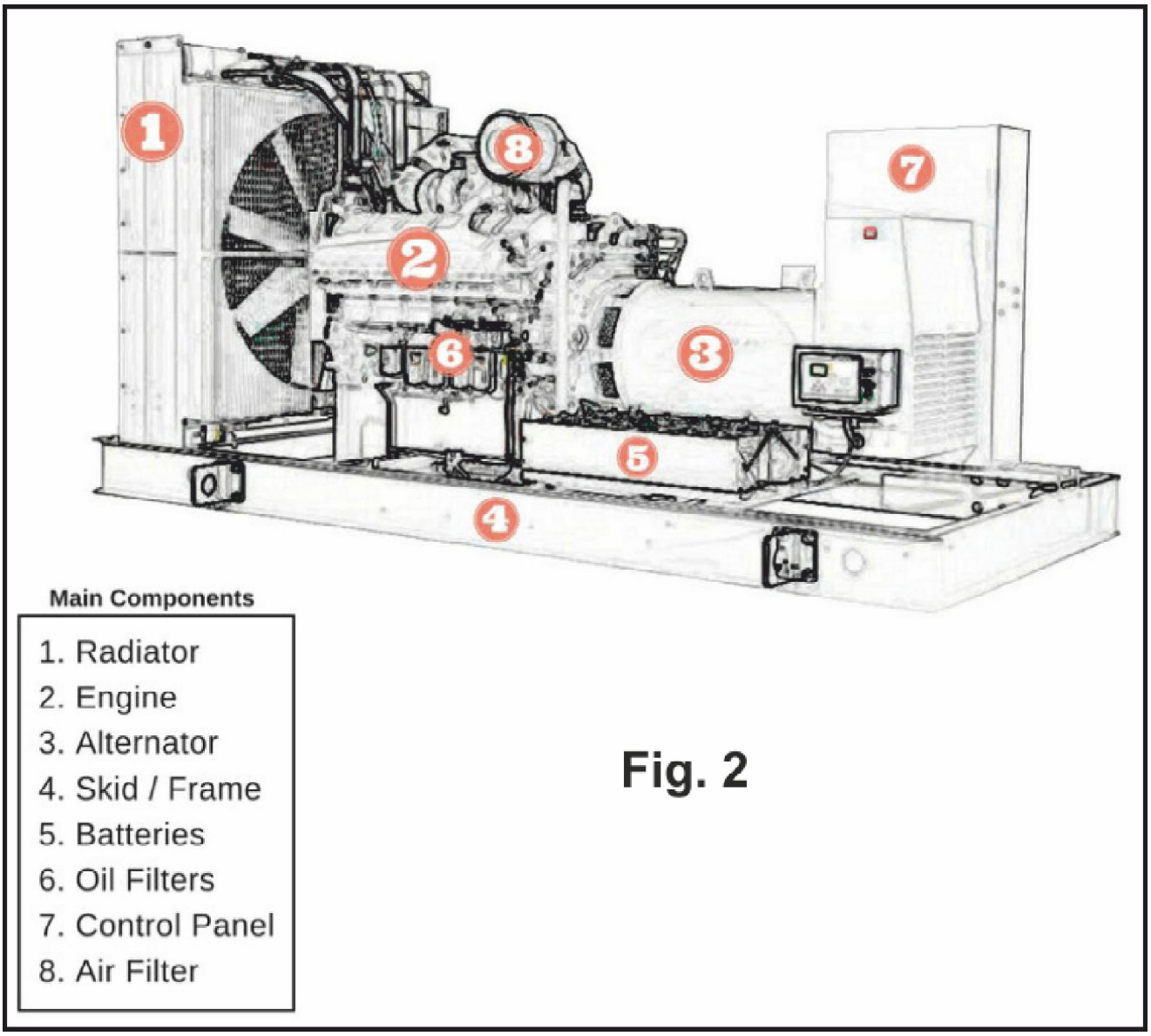

Fig. 2

There are nine parts to a generator and they all play a role in getting power to where it is needed most. The parts of a generator are:

1. **Engine.** The engine supplies energy to the generator. The power of the engine determines how much electricity a generator can provide.
2. **Alternator**. This is where the conversion from mechanical energy to electrical energy occurs. Also called a "genhead", the alternator contains both moving and stationary parts that work together to create the electromagnetic field and movement of electrons that generates electricity.
3. **Fuel System**. The fuel system makes it possible for the generator to produce the energy needed. The system includes a fuel tank, a fuel pump, a pipe connecting the tank to the engine, and a return pipe. A fuel filter removes debris before it gets to the engine and an injector forces the fuel into the combustion chamber.

4. **Voltage Regulator**. This component helps control the voltage of the electricity that is produced. It also helps convert the electricity from AC to DC, if needed.
5. **Cooling and Exhaust Systems**. Generators create a lot of heat. The cooling system ensures the machine doesn't overheat. The exhaust system direct and remove the fumes the form during operation.
6. **Lubrication System**. There are many small, moving parts inside a generator. It is essential to lubricate them adequately with engine oil to ensure smooth operation and protect them from excess wear. Lubricant levels should be checked regularly, as often as every 8 hours of operation.
7. **Battery Charger**. Batteries are used to start up the generator. The battery charger is a fully automatic component that ensures the battery is ready to go when needed by supplying it with a constant low-level of voltage.
8. **Control Panel**. The control panel controls every aspect of generator operation from start up and running speed to outputs. Modern units are even capable of sensing when power dips or goes out and can start or shut off the generator automatically.
9. **Main Assembly / Frame**. This is the body of the generator. It is the part that we see; the structure that holds it all in place.

What kind of fuel do electrical generators need?

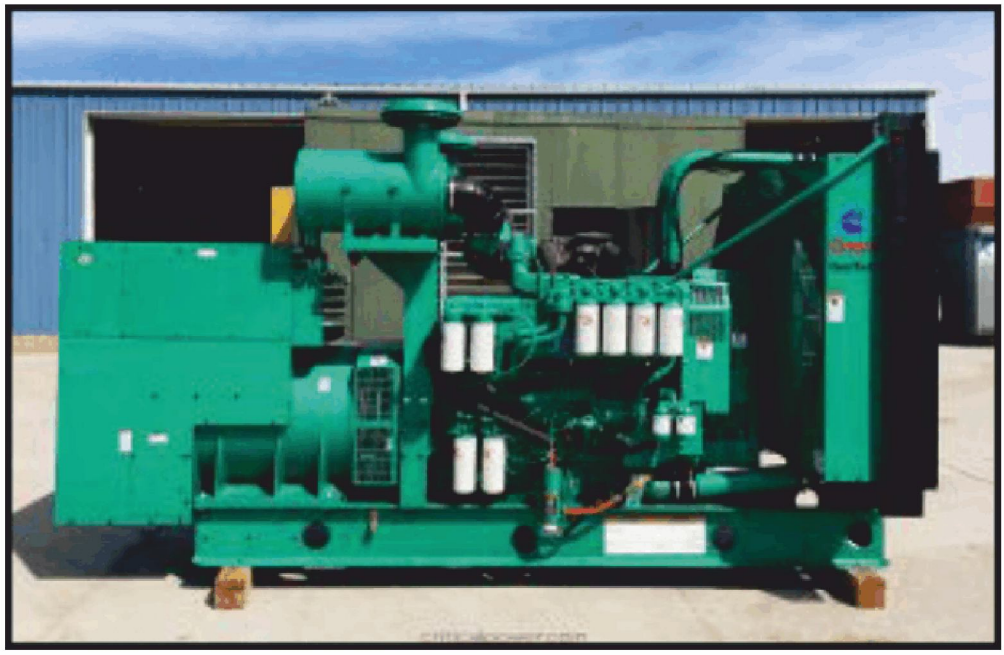

Fig. 3

Today's electrical generators are available in many different fueling options. Diesel generators are the most popular industrial generators on the market. Residential generators more commonly include: natural gas generators or propane generators, while the smaller portable generators typically run on gasoline, diesel fuel, or propane. Some generators are bi-fuel capable – running on both gasoline and diesel.

Generator Fuel Tanks

The fuel system ensures the generator has the necessary raw materials needed to provide electricity by initiating the internal combustion process. Without fuel, combustion can't take place and the generator can't convert the mechanical energy created into electrical energy. Generator fuel needs to be stored on-site so the generator can be put into operation immediately when necessary.

Fig. 4

Depending on the type of generator and its application, fuel tanks may be mounted to the generator frame or they may be external tanks located far from the actual generator. In general, the bigger the generator and the longer it needs to run, the bigger the fuel tank. Generator fuel is stored in tanks of various capacities, depending on the intended use of the generator and the amount of power required. Tanks may be located above ground, below ground, or sub base. Sub base tanks are intended for storing less than 1,000 gallons of fuel and are located above ground, but below the base of the generator set.

Above ground and below ground generator fuel storage tanks are a better choice for high capacity needs. Underground storage tanks are more expensive to install, but they tend to last longer since they are protected from the elements. There are pros and cons to both types of fuel storage tanks but you won't be alone in making a decision. Generator fuel tanks and generator fuel systems must meet several code requirements and approvals before they can be installed, whether the installation is for residential or commercial use.

The primary code governing generator fuel tanks in the United States is the *National Fire Protection Association Codes and Standards (NFPA)*, particularly sections NFPA 30 and NFPA 37. As such, all requests for a generator fuel tank must be submitted to the State Fire Marshall for approval.

To determine your minimum fuel tank capacity needs, you'll need to think about how you intend to use the generator. For short or infrequent power outages, a backup generator with a smaller storage tank may be acceptable; however you'll need to refill the tank more frequently than you'd have to refill larger tanks. Larger storage tanks may be required if you're planning to power a large commercial facility with a prime generator or if you are subject to long, frequent power outages.

Your generator supplier can help you determine the optimal fuel tank size to ensure you have enough fuel on hand when you need it. One more thing to keep in mind both when buying a generator and selecting a generator fuel storage tank is the cost and availability of the fuels to your location. It's a good idea to talk to local fuel suppliers before you buy a generator to get a better idea of the cost and logistics involved in obtaining generator fuel.

(To be continued)

Courtesy: Critical Power Products & Services

LIGHTING FUNDAMENTALS – 3

Incandescent A-Lamp

More efficient halogen lamps are available. These sources use an infrared coating on the quartz bulb or an advanced reflector design to redirect infrared light back to the filament. The filament then glows hotter and the efficiency of the source is increased.

Fluorescent Lamps

Fluorescent lamps are the most commonly used commercial light source in North America. In fact, fluorescent lamps illuminate 71% of the commercial space in the United States. Their popularity can be attributed to their relatively high efficacy, diffuse light distribution characteristics, and long operating life.

- Fluorescent lamp construction consists of a glass tube with the following features:
- filled with an argon or argon-krypton gas and a small amount of mercury
- coated on the inside with phosphors
- equipped with an electrode at both ends

Fluorescent lamps provide light by the following process:

- An *electric discharge (current)* is maintained between the electrodes through the mercury vapour and inert gas.
- This current excites the mercury atoms, causing them to emit nonvisible *ultraviolet (UV) radiation.*
- This UV radiation is converted into *visible light* by the phosphors lining the tube.

Discharge lamps (such as fluorescent) require a ballast to provide correct starting voltage and to regulate the operating current after the lamp has started.

Full-Size Fluorescent Lamps

Full-size fluorescent lamps are available in several shapes, including straight, U-shaped, and circular configurations. Lamp diameters range from 1" to 2.5". The most common lamp type is the four-foot (F40), 1.5" diameter (T12) straight fluorescent lamp. More efficient fluorescent lamps are now available in smaller diameters, including the T10 (1.25") and T8 (1").

Fluorescent lamps are available in colour temperatures ranging from warm (2700(K) “incandescent-like” colours to very cool (6500(K) “daylight” colours. “Cool white” (4100(K) is the most common fluorescent lamp colour. Neutral white (3500(K) is becoming popular for office and retail use.

Improvements in the phosphor coating of fluorescent lamps have improved colour rendering and made some fluorescent lamps acceptable in many applications previously dominated by incandescent lamps.

Performance Considerations

The performance of any luminaire system depends on how well its components work together. With fluorescent

Lamp-ballast systems, light output, input watts, and efficacy are sensitive to changes in the ambient temperature. When the ambient temperature around the lamp is significantly above or below 25°C (77°F), the performance of the system can change. Exhibit 6 shows this relationship for two common lamp-ballast systems: the F40T12 lamp with a magnetic ballast and the F32T8 lamp with an electronic ballast.

As you can see, the optimum operating temperature for the F32T8 lamp-ballast system is higher than for the F40T12 system. Thus, when the ambient temperature is greater than 25°C (77°F), the performance of the F32T8 system may be higher than the performance under ANSI conditions. Lamps with smaller diameters (such as T5 twin tube lamps) peak at even higher ambient temperatures.

Compact Fluorescent Lamps

Advances in phosphor coatings and reductions of tube diameters have facilitated the development of compact fluorescent lamps.

Manufactured since the early 1980s, they are a long-lasting, energy-efficient substitute for the incandescent lamp.

Various wattages, colour temperatures, and sizes are available. The wattages of the compact fluorescents range from 5 to 40 (replacing incandescent lamps ranging from 25 to 150 watts (and provide energy savings of 60 to 75 percent. While producing light similar in colour to incandescent sources, the life expectancy of a compact fluorescent is about 10 times that of a standard incandescent lamp. Note, however, that the use of compact fluorescent lamps is very limited in dimming applications.

The compact fluorescent lamp with an Edison screw-base offers an easy means to upgrade an incandescent luminaire. Screw-in compact fluorescents are available in two types:

- Integral Units. These consist of a compact fluorescent lamp and ballast in self-contained units. Some integral units also include a reflector and/or glass enclosure.
- Modular Units. The modular type of retrofit compact fluorescent lamp is similar to the integral units, except that the lamp is replaceable.

A **Specified Report** that compares the performance of various name-brand compact fluorescent lamps is now available from the National Lighting Product Information Program ("Screw-Base Compact Fluorescent Lamp Products," Specified Reports, Volume 1, Issue 6, April 1993).

High-Intensity Discharge Lamps

High-intensity discharge (HID) lamps are similar to fluorescents in that an arc is generated between two electrodes. The arc in a HID source is shorter, yet it generates much more light, heat, and pressure within the arc tube.

Originally developed for outdoor and industrial applications, HID lamps are also used in office, retail, and other indoor applications. Their colour rendering characteristics have been improved and lower wattages have recently become available as low as 18 watts.

There are several advantages to HID sources:

- relatively long life (5,000 to 24,000+ hrs)
- relatively high lumen output per watt
- relatively small in physical size

However, the following operating limitations must also be considered. First, HID lamps require time to warm up. It varies from lamp to lamp, but the average warm up time is 2 to 6 minutes. Second, HID lamps have a "restrike" time, meaning a momentary interruption of current or a voltage drop too low to maintain the arc will extinguish the lamp. At that point, the gases inside the lamp are too hot to ionize and time is needed for the gases to cool and pressure to drop before the arc will restrike. This process of restriking takes between 5 and 15 minutes, depending on which HID source is being used. Therefore, good applications of HID lamps are areas where lamps are not switched on and off intermittently.

(To be continued)

Courtesy: U.S. EPA Green Lights

"Plans to protect air and water, wilderness and wildlife are in fact plans to protect man."

– STEWART UDAL

WORLD ENGINEERING DAY FOR SUSTAINABLE DEVELOPMENT

March 4, 2021

Theme: Engineering for A Healthy Planet: Celebrating the UNESCO Engineering Report

World Engineering Day for Sustainable Development is celebrated on 4th March every year since 2020 as a UNESCO international day of celebration of engineers and engineering.

The 40th General Conference of UNESCO has adopted the resolution to proclaim 4th March of every year a World Engineering Day for Sustainable Development in November 2019 based on the proposal of the World Federation of Engineering Organizations (WFEO). This is an opportunity to celebrate the important contributions of engineers and engineering to sustainable development and modern life.

World Engineering Day for Sustainable Development, an international day with coordinated celebrations across the world, is an opportunity to increase the profile of engineering. The Day is also an opportunity to engage with government and industry to address the need for engineering capacity and the quality of engineers around the world and develop strategic frameworks and best practices for the implementation of engineering solutions for sustainable development.

The celebration of **World Engineering Day for Sustainable Development** is also about promoting engineering as a career and how it is an opportunity to change the world for better. There is a great deal to be done specially to achieve the UN Sustainable Development Goals in developing countries to ensure that everyone has access to clean water, sanitation, reliable energy, and other basic human needs. In all countries, there is also a great deal to be done – to deal with the impacts of climate change, environmental issues, our growing cities and the challenges of new technologies including artificial intelligence. There are many opportunities and the Day can be used to engage with young people and say "If you want to change the world for the better, become an engineer."

The theme for this year as decided by WFEO is "Engineering for A Healthy Planet: Celebrating the UNESCO Engineering Report".

In 2010, UNESCO in partnership with the World Federation of Engineering Organizations (WFEO), the International Council of Academies of Engineering and Technological Sciences (CAETS) and the International Federation of Consulting Engineers (FIDIC), produced the world's first comprehensive study on engineering. The UNESCO report, Engineering: Issues, Challenges and Opportunities for Development, highlights the importance of engineers to the socio-economic development of humankind. As stated in the publication, "Engineering drives social, economic and human development and underpins our knowledge societies and infrastructures. It is a major factor in innovation and indeed the rise and fall of civilizations".

Despite the importance of engineers to the improvement of global societies, there are a number of issues, most pertinent is the shortage of engineers, that need to be brought to the public's attention and that need to be addressed by international organizations, civil societies, industries, academic institutions and national governments.

The seven chapters of the UNESCO Engineering Report includes academic discussions by erudite engineering personalities on What is Engineering, Engineering and Human Development, Engineering: Emerging Issues and Challenges, An Overview of Engineering, Engineering around the World, Engineering for Development: Applications and Infrastructure, and Engineering Capacity: Education, Training and Mobility.

All Centres of IEI are requested to celebrate the World Engineering Day for Sustainable Development in a befitting manner and also request the engineering institutions, universities, and businesses within their jurisdiction to join the celebration.

3-PHASE DISTRIBUTION TRANSFORMERS 11 OR 433 KV/415-240V (OUTDOOR TYPE) - 4

18 CONSERVATOR:

(i) Transformers of rating 63 kVA and above with plain tank construction, the provision of conservator is mandatory. For corrugated tank and sealed type transformers with or without inert gas cushion, conservator is not required.

(ii) When a conservator is provided, oil gauge and the plain or dehydrating breathing device shall be fitted to the conservator which shall also be provided with a drain plug and a filling hole [32 mm (1¼")] normal size thread with cover. In addition, the cover of the main tank shall be provided with an air release plug.

(iii) The dehydrating agent shall be silica gel. The moisture absorption shall be indicated by a change in the colour of the silica gel crystals which should be easily visible from a distance. Volume of breather shall be suitable for 500g of silica gel conforming to IS 3401 for transformers up to 200 kVA and 1 kg for transformers above 200 kVA.

(iv) The capacity of a conservator tank shall be designed keeping in view the total quantity of oil and its contraction and expansion due to temperature variations. The total volume of conservator shall be such as to contain10% quantity of the oil. Normally 3% quantity the oil shall be contained in the conservator.

(v) The cover of main tank shall be provided with an air release plug to enable air trapped within to be released, unless the conservator is so located as to eliminate the possibility of air being trapped within the main tank.

(vi) The inside diameter of the pipe connecting the conservator to the main tank should be within 20 to 50 mm and it should be projected into the conservator so that its end is approximately 20 mm above the bottom of the conservator so as to create a sump for collection of impurities. The minimum oil level (corresponding to -5ÚC) should be above the sump level.

19 SURFACE PREPARATION AND PAINTING:

(i) GENERAL

19.1.1 All paints, when applied in a normal full coat, shall be free from runs, sags, wrinkles, patchiness, brush marks or other defects.

19.1.2 All primers shall be well marked into the surface, particularly in areas where painting is evident and the first priming coat shall be applied as soon as possible after cleaning. The paint shall be applied by airless spray according to manufacturer's recommendations. However, where ever airless spray is not possible, conventional spray be used with prior approval purchaser.

19.2 CLEANING AND SURFACE PREPARATION:

a) After all machining, forming and welding has been completed, all steel work surfaces shall be thoroughly cleaned of rust, scale, welding slag or spatter and other contamination prior to any painting.

b) Steel surfaces shall be prepared by shot blast cleaning (IS 9954) to grade Sq. 2.5 of ISO 8501-1 or chemical cleaning including phosphating of the appropriate quality (IS 3618).

c) Chipping, scraping and steel wire brushing using manual or power driven tools cannot remove firmly adherent mill-scale. These methods shall only be used where blast cleaning is impractical. Manufacturer to clearly explain such areas in his technical offer.

19.3 PROTECTIVE COATING:

19.3.1 As soon as all items have been cleaned and within four hours of the subsequent drying, they shall be given suitable anti-corrosion protection.

19.4 PAINT MATERIAL:

(i) Following are the types of paint which may be suitably used for the items to be painted at shop and supply of matching paint to site:

Heat resistant paint (Hot oil proof) for inside surface

(ii) For external surfaces one coat of thermo setting powder paint or one coat of epoxy primer followed by two coats of synthetic enamel/polyurethene base paint. These paints can be either air drying or stoving.

(iii) For highly polluted areas, chemical atmosphere or for places very near to the sea coast, paint as above with one coat of high build Micaceous iron oxide (MIO) as an intermediate coat may be used.

19.5 PAINTING PROCEDURE:

i) All prepared steel surfaces should be primed before visible re-rusting occurs or within 4 hours, whichever is sooner. Chemical treated steel surfaces shall be primed as soon as the surface is dry and while the surface is still warm.

ii) Where the quality of film is impaired by excess film thickness (wrinkling, mud cracking or general softness) the supplier shall remove the unsatisfactory paint coating and apply another coating. As a general rule, dry film thickness should not exceed the specified minimum dry film thickens by more than 25%.

19.6 DAMAGED PAINTWORK:

i) Any damage occurring to any part of a painting scheme shall be made good to the same standard of corrosion protection and appearance as that was originally applied.

ii) Any damaged paint work shall be made good as follows:

19.6.1 The damaged area, together with an area extending 25 mm around its boundary, shall be cleaned down to bare metal.

19.6.2 A priming coat shall be immediately applied, followed by a full paint finish equal to that originally applied and extending 50 mm around the perimeter of the original damage.

19.6.3 The repainted surface shall present a smooth surface. This shall be obtained by carefully chamfering the paint edges before and after priming.

19.7 DRY FILM THICKNESS:

19.7.1 To the maximum extent practicable the coats shall be applied as a continuous film of uniform thickness and free of pores. Overspray, skips, runs, sags and drips should be avoided. The different coats may or may not be of the same colour.

19.7.2 Each coat of paint shall be allowed to harden before the next is applied as per manufacturer's recommendation.

19.7.3 Particular attention must be paid to full film thickness at the edges.

19.7.4 The requirements for the dry film thickness (DFT) of paint and the materials to be used shall be as given below:

Sl. No.	Paint type	Area to be painted	No. of coats	Total dry film thickness (min.) (microns)
1	Thermo setting powder paint	inside outside	01 01	30 60
2	**Liquid paint** a) Epoxy (primer) b) P.U. Paint (Finish coat) c) Hot oil paint/ Varnish	 outside outside inside	 01 02 01	 30 25 each 35/10

19.8 TESTS FOR PAINTED SURFACE:

19.8.1 The painted surface shall be tested for paint thickness.

19.8.2 The painted surface shall pass the cross hatch adhesion test and impact test as acceptance tests and Salt spray test and Hardness test as type test as per the relevant ASTM standards.

Note: Supplier shall guarantee the painting performance requirement for a period of not less than 5 years.

(To be continued)

Courtesy: www.mstcecommerce.com>RenderFileViewVideo

ELECTRICAL Q & A PART – 1 (3)

31) What will happen when power factor is leading in distribution of power?

- If there is high power factor, i.e. if the power factor is close to one:
- Losses in form of heat will be reduced,
- Cable becomes less bulky and easy to carry, and very cheap to afford.
- It also reduces over heating of transformers.

32) What the main difference between UPS & inverter?

- Uninterrupted power supply is mainly use for short time. Means according to ups VA it gives backup. UPS is also two types: on line and offline. Online UPS having high volt and amp for long time backup with high dc voltage. But UPS start with 12v dc with 7 amps. but inverter is start with 12v, 24, dc to 36v dc and 120amp to 180amp battery with long time backup

33) Which type of A.C motor is used in the fan?

- It is Single Phase induction motor which mostly squirrel cage rotor and are capacitor start capacitor run.

34) What is the difference between synchronous generator and asynchronous generator?

- In simple, synchronous generator supplies' both active and reactive power but asynchronous generator (induction generator) supply's only active power and observe reactive power for magnetizing. This type of generators is used in windmills.

35) What is the Polarization index value?

- Its ratio between insulation resistance (IR) i.e meager value for 10min to insulation resistance for 1 min. It ranges from 5-7 for new motors & normally for motor to be in good condition it should be Greater than 2.5

36) What is Automatic Voltage regulator (AVR)?

- AVR is an abbreviation for Automatic Voltage Regulator.
- It is important part in Synchronous Generators; it controls the output voltage of the generator by controlling its excitation current. Thus it can control the output Reactive Power of the Generator.

37) Difference between a four point starter and three point starters?

- The shunt connection in four point starter is provided separately from the line where as in three point starter it is connected with line which is the drawback in three point starter

38) What happens if we connect a capacitor to a generator load?

- Connecting a capacitor across a generator always improves power factor, but it will help depends up on the engine capacity of the alternator, otherwise the alternator will be over loaded due to the extra watts consumed due to the improvement on pf.
- Don't connect a capacitor across an alternator while it is picking up or without any other load

39) Why the capacitors work on ac only?

- Generally capacitor gives infinite resistance to dc components (i.e., block the dc components). It allows the ac components to pass through.

40) Why the up to dia 70mm² live conductor, the earth cable must be same size but above dia 70mm² live conductor the earth conductor need to be only dia 70mm²?

- The current carrying capacity of a cable refers to it **carrying a *continuous* load.**
- An earth cable normally carries no load, and under fault conditions will carry a **significant *instantaneous* current but only for a short time** most Regulations define 0.1 to 5 sec before the fuse or breaker trips. Its size therefore is defined by different calculating parameters.
- The magnitude of earth fault current depends on:
- (a) the external earth loop impedance of the installation (i.e. beyond the supply terminals)
- (b) the impedance of the active conductor in fault
- (c) the impedance of the earth cable
- i.e. **Fault current = voltage / a + b + c**
- Now when the active conductor (b) is small, its impedance is much more than (a), so the earth (c) cable is sized to match. As the active conductor gets bigger, its impedance drops significantly below that of the external earth loop impedance (a); when It is quite large its impedance can be ignored. At this point there is no merit in increasing the earth cable size
- i.e**. Fault current = voltage / a + c**
- (c) is also very small so the fault current peaks out.
- The neutral conductor is a separate issue. It is defined as an active conductor and therefore must be sized for continuous full load. In a 3-phase system,
- If balanced, no neutral current flows. It used to be common practice to install reduced neutral supplies, and cables are available with say half-size neutrals (remember a neutral is always necessary to provide single phase voltages). However the increasing use of non-linear loads which produce harmonics has made this practice dangerous, so for example the current in some standard require full size neutrals. Indeed, in big UPS installations I install double neutrals and earths for this reason.

Courtesy: ***Jignesh.Parmar***

ELECTRICAL MAINTENANCE UNIT
(QUESTION & ANSWERS) - 6

86. What are the losses in DC generator?

There are two main losses.

a. Copper losses or electrical losses.

b. Stray losses or rotational losses or constant losses.

Copper losses includes following losses

a. Armature copper losses ($I_a^2 r_a$).

b. Field copper losses ($I_{se}^2 r_{se}$) or ($I_{sh}^2 r_{sh}$).

c. Losses in brush.

Stray losses are as follows

a. Magnetic losses (Iron loss or core loss).

b. Mechanical losses.

87. What is efficiency of generator?

Efficiency = Out put / input

= Out put / out put + losses

88. What is armature reaction?

Armature reaction is the effect of armature flux on the main field flux.

The effects of armature reaction are follows.

a. Armature reaction destroys (cross magnetizes) and weakens the main field flux produced by the main pole.

b. It causes to reduce the induced emf in the armature.

c. It causes to reduce the efficiency of machine.

d. It causes to produce sparking at the brushes due to the shifting of M.N.A (magnetic neutral axis).

e. At short-circuited loads or at very heavy loads, in case of self-excited generators de-magnetising of pole cores (wiping of residual magnetism) may takes place.

89. What are the remedies for armature reaction?

a. Brushes have to shift to new M.N.A position in the direction of rotation of armature.

b. To overcome the weakening of the field extra turns have to be added in armature.

c. Pole shoes have to modify at trailing pole tip side to increase the reluctance.

d. Pole shoes have to modify to increase the reluctance.

e. In big machines there is chance of load fluctuation, a compensating winding to be placed at the pole shoes and it is connected in series with the armature winding such that the current in that winding is opposite to the armature winding.

90. What is commutation?

Usually the width of the brush is equal to the two segments of the commutator. Whenever a brush contacts two or more commutator segments, the connected to those segments are short-circuited. After the period

of short-circuiting the current on those coils changes their current direction in it. The change that takes place in the coil after the period of short-circuiting of that coil is called commutation.

When that changes take place slowly, that commutation is known as smooth commutation and when that changes take place suddenly, that commutation is known as rough commutation.

If the commutation is not smooth, the spark may be more and that will damage the commutator surface, commutator segments and so the winding.

The remedies for rough commutation are resistance commutation method and emf commutation method.

91. What are the characteristics of DC generator?

There are three main characteristics of DC generator and they are,

No load saturation characteristics or OCC or magnetic characteristics (E0/If).

Internal or total characteristics (E/Ia).

External characteristics (V/I).

92. What is motor? How DC motor works?

A motor is a machine, which takes electrical energy and converts that electrical energy into mechanical energy.

DC motor works under the principle, that whenever a current carrying conductor placed in a magnetic field, a mechanical force will be acts upon that conductor and the conductor tends to rotate, if it is arranged freely to rotate.

The direction of the force or rotation can be determine by "Fleming's left hand rule"

93. What is torque?

Whenever a current carrying conductor placed in a magnetic field, a mechanical force will be acts upon that conductor and the conductor tends to rotate, if it is arranged freely to rotate. This rotation is due to the turning or twisting force acted on that conductor. This turning or twisting movement of a force about an axis is called torque 'T'.

T = force * radius Newton-meter.

Work done per revolution = force * distance covered in one revolution.

4" Work done per revolution = force * $2\pi r$.

Work done per second = force * $2\pi r$ N (r.p.s)

Work done per second = 2π N T (5"T = F * r)

So power developed in metric horsepower is equal to force $2\pi NT/735.5$ hp.

94. What are the classifications of DC motor?

a. DC series motor.

b. DC shunt motor.

c. DC compound motor.

There are two types of DC compound motor.

a. Differential compound motor.

b. Commulative compound motor.

95. What are the losses in DC motor?

The losses in DC motor are same as that of DC generator. They are copper losses, magnetic losses and mechanical losses.

96. What are the characteristics of DC motor?

The characteristics of DC motor shows the relation between armature current (I_a), speed (N) and torque (T).

a. Torque and armature current characteristics. It is also known as electrical characteristics.

b. Speed and armature current characteristics.

c. Speed and torque characteristics.

97. What is the necessity of DC motor starter?

$E_b = V – I_a r_a$.

4" $I_a = V – E_b / r_a$.

At the time of starting from the rest there is no any back emf (E_b) in the armature. So a large current flows through the armature based on V / r_a. This very large current blow out the fuses and before to that it will damage the commutator, commutator brushes and winding. To avoid this difficulties a proper resistance has to be introduce in series with the armature till the motor reaches its rated speed or till development of E_b in the armature to reduce the starting large current to safe value. This starting resistance is gradually cut out as the motor gains speed and the develops back emf (E_b) which regulates its speed and armature current. This can be achieved by the help of starter.

98. What are the types of DC motor starter?

a. DC two point starter for series motor.

b. DC three point starter for shunt motor.

c. DC four point starter for compound motor.

99. How speed control of DC motor can be achieved?

Induced emf in the armature E = P * Õ * Z * N / A * 60 volts.

Where Z and A are constant.

N "" Eb / Õ

N "" $V – I_a r_a$ / Õ.

We can consider that the $I_a r_a$ drop is very small and thereby in the place of $V – I_a r_a$

we can consider only V. If it so then N "" V/ Õ.

So speed may be varied by varying either applied voltage to the armature and by varying field flux or field strength per pole or total field flux.

100. What is cell?

Cell is one unit for converting chemical energy into electrical energy. A cell essentially requires two electrodes, electrolyte and container.

Courtesy: https://www.scribd.com/document/244623258/Question-and-Answers-Electrical-Maintenance-Unit

"We forget that the water cycle and the life cycle are one."
– JACQUES COUSTEAU

DRIVERLESS ELECTRIC VEHICLE TO BE POWERED WITH SOLAR ROOFTOP

An Australian startup is developing an innovative autonomous electric vehicle (EV) that will utilise a solar PV roof and lithium ion battery system.

On behalf of the Australian Government, the Australian Renewable Energy Agency (ARENA) has today announced $2 million in funding to Applied Electric Vehicles Pty Ltd (AEV) to complete the next stage of its EV commercialisation.

An early stage prototype of AEV's Modular Vehicle System (MVS), a driverless EV platform has already been showcased at world-leading future tech convention CES 19 in Las Vegas last year.

Now the Melbourne-based robotics business is taking their solar powered driverless EV to the next stage of development. As part of this project, AEV will complete a pre-production prototype demonstrating AEV technology and ready to progress to the final stages of design and testing.

AEV's vehicle will generate up to 60 per cent of its energy requirements from the sun, depending on the application. The use of a smaller battery pack will also mean the battery can also be charged by a common 240V wall socket, not requiring special charging infrastructure.

The $7.65 million project is being delivered in partnership with Japanese company Teijin Limited who is helping to develop the vehicle's lightweight materials and manufacturing methods.

AEV's MVS vehicles are designed for short trips at low speed. The versatile base platform could be used for a range of applications in delivery, agriculture, industrial applications, waste management as well as passenger transport. AEV's vehicles combine a lightweight design together with its solar roof and high efficiency driveline.

ARENA's funding will go towards solving energy related challenges such as selection of the most appropriate solar PV technology for the solar roof, and optimising the mass, energy efficiency, solar gain and safety of the vehicle.

ARENA CEO Darren Miller said this is a great example of Australian innovation utilising renewable energy options in vehicles.

"EVs are expected to play an important role in the coming decade in reducing the carbon footprint of transport. We hope to see AEV commercialise a homegrown driverless electric vehicle and be among the first to unlock the global driverless EV market.

"There is significant opportunity in the low speed vehicle market which is expected to gain considerable traction in cities, campuses and factories over the next decade that AEV could tap into," Mr Miller said.

"AEV's project could also unlock new applications for solar such as integrating it into curved surfaces and demonstrating that solar PV can directly power high-efficiency electric vehicles.

AEV's CEO, Julian Broadbent – previously Director of Global Advanced Portfolio Planning at General Motors in the United States – said he was excited to bring this technology to market.

"Our project with ARENA is focusing on passenger vehicles but the learnings will be applied to other vehicles, helping to reduce the charging infrastructure burden as EVs roll out globally.

"The Modular Vehicle System will offer companies access to transport that is cost effective, pedestrian friendly, gentle on the environment and very customisable to their business needs," he said.

"We appreciate ARENA's support for AEV, providing both funding and valuable expertise along the way. With ARENA's assistance, we'll be able to take our design to the next stage of development in utilising renewables for our autonomous electric vehicle and provide something potentially game changing in the low speed EV market."

Source: arena.gov.au

EXPERIENCE

A Giant Ship's engine broke down and no one could repair it, so they hired a Mechanical Engineerwith over 40 years of experience.

He inspected the engine very carefully, from top to bottom. After seeing everything, the engineer unloaded the bag and pulled out a small hammer.

He knocked something gently. Soon, the engine came to life again. The engine has been fixed!

7 days later the engineer mentioned that the total cost of repairing the giant ship was $20,000 to the ship owner.

"What?!" said the owner.

"You did almost nothing. Give us a detailed bill."

The answer is simple:

Tap with a hammer: $2

Know where to knock and how much to knock: $19,998

The importance of appreciating one's expertise and experience... because those are the results of struggles, experiments and even tears.

If I do a job in 30 minutes it's because I spent 20 years learning how to do that in 30 minutes. You owe me for the years, not the minutes.

OPERATION AND MAINTENANCE MANUAL FOR UNI-SOLAR POWERBOND EPVL - 1

Safety Warnings and Cautions

General

- Installation of ***UNI-SOLAR*** products must be in accordance with NFPA 70, Article 650, Solar Photovoltaic Systems, of the National Electric Code of the United States, or CSA 22.1 Safety Standard for Electrical Installations, Part 1 of the Canadian Electrical Code.
- Potentially lethal DC voltages can be generated whenever laminates are exposed to a light source, therefore, avoid contact with electrically active parts and be sure to isolate live circuits before attempting to make or break any connections.
- Do NOT proceed if any doubt arises about the correct or safe method of performing any of the procedures found in this document
- Always wear appropriate safety and protective equipment, such as:
  - Rubber soled shoes
  - Cut resistant and chemical resistant gloves
  - Safety glasses
  - Hard hat
- When working on electrical connections, remove all metallic jewelry, and use insulated tools
- Wear cut resistant gloves whenever handling laminates
- *UNI-SOLAR* laminates contain electrical components enclosed and protected within. Do NOT cut or trim or alter them in any way. Do NOT drive screws into any part of the photovoltaic laminate. Altering the laminate or improper installation could cause electric shock, may result in fire, and will void the product Limited Warranty. In extreme cases where additional fixation of the laminate to the substrate is required, consult your USO representative to learn about approved options

Work Site

- Follow all appropriate safety practices for the site
- Do NOT handle PV laminate assemblies in high wind conditions
- Do NOT perform maintenance on this product when laminates are wet or are in standing water
- Ensure that the work area is clear of trip hazards. Personal injury can result from tripping over power cords, tools, electrical conduit, natural gas lines, and/or installation materials

How Grid connected PV Systems Work

With today's technology, a photovoltaic (electric) system operates automatically and requires very little day-to-day supervision.

The solar array generates DC electricity whenever it is subjected to light. The inverter turns ON automatically whenever sufficient energy is produced to convert DC power from the solar array into grid quality AC power.

Similarly, when there is little or no DC energy coming from the solar modules (for example, at sunset), the inverter will go into a "sleep" mode until it detects that the solar array is again generating energy.

The inverter also continuously monitors the quality of the utility line and automatically switches itself OFF if it detects that utility power is outside acceptable limits. The inverter will reconnect itself when this irregular condition has been corrected.

Pre-Commissioning Tests

Prior to a full test by local electrical authorities, the installer should conduct a pre-test to verify that the system is correctly installed and suitable for connection .

- This pre-test should include the following three tasks:
- A visual audit of the installation
- Verification of electrical connections
- Verification of system performance once the system has been connected

Visual Audit

Performing a visual audit of the solar array at the completion of installation is important, as this will provide a good baseline for future operation and maintenance visits.

- Ensure that appropriate safety signs are in place at each access point to the installation
- Record the serial number of each laminate, it's location on the roof, and to which combiner box and inverter each laminate is connected
- Check that each laminate is bonded perfectly to the substrate. If any areas of the laminate are NOT perfectly bonded, mark the product with a permanent marker or crayon to flag an area to be repaired or monitored during subsequent maintenance
- Check the front surface of the laminate for any scratches or surface damage that may have occurred during installation. Contact your USO representative immediately for repair guidelines
- Clean any laminates which are particularly dirty before performing electrical checks. Excessive dirt, debris, or film on the laminates will limit performance and create false test results
- Verify that all laminates are located in areas that have minimal shading
- Verify that all laminates are located in areas which are not subject to water pooling
- Verify that the cables are appropriate for outdoor use, fit properly in a cable duct, and are NOT in standing water
- Inspect cables to verify that the connections are tight
- If the DC system is floating (not earthed or grounded), then fuses should be connected in both the positive and negative poles
- Verify that appropriate string fuses (max. 10A) are in place and that these are located in each pole of the string
- For systems that require grounding, verify that there is continuity between all metallic substrates and that the ground connection is correct

- Fill in the warranty registration form and attach a list of laminate serial numbers
- Ensure that the drainage system is unblocked

Electrical Connections Verification

The following tests should only be performed by qualified personnel who are familiar with working on high voltage solar power systems and understand local electrical code requirements.

The best weather conditions that will provide the most accurate system verification tests are cloudless days with strong sun conditions.

Before performing any of the following tests, ensure that:

- All DC isolation switches are open (OFF)
- All string fuses have been removed
- All test equipment, leads, and probes are rated for maximum system voltage
- The inverter is switched OFF

Tag each box with a warning sign to signify that work on the PV system is in progress, locking OFF switches, if possible.

Record the total number of Power*Bond* ePVL laminates connected to each array combiner box, and note how the system is configured.

- Verify that the number of laminates in series does NOT exceed the maximum system voltage as dictated by local codes (NEC/IEC) or the maximum input voltage of the inverter
- Measure and record the open circuit voltage of each series string, verifying that all strings that are feeding the inverter's mpp tracker have the same polarity and a similar open circuit voltage. It is easier to perform this test in the array combiner box or fuse box
- If the variation in string voltages is significant, or if the string delivers 0V, there is either a short or an open circuit within the string, requiring a check of each individual module
- Differences in string voltage can be due to a misconnection of the laminates. Check that the correct number of laminates is connected in series and that each laminate is providing correct voltage. To test for the latter, laminates need to be disconnected and the voltage checked directly across the module
- Verify that the polarity of each string is the same. A reversed string or module can result in damage
- to the product or protection circuits
  - Reversed polarity on an inverter can cause damage that is NOT covered by the USO product Limited Warranty

In addition to checking voltage across the series string, it is important to verify insulation resistance (R_{iso}) from both positive and negative poles of the string to ground. This can be accomplished with a megger meter.

- Close fuse switches in the DC disconnect switch combiner box
- Check open circuit voltage at the DC disconnect switch to ensure it is within proper limits, per the manufacturer's installation manual
- Close each switch after each test, except for the final switch before the inverter
- Follow the proper inverter startup procedure from the inverter manufacturer's installation manual

(*To be continued*)

Courtesy: Unisolar

"A river seems a magic thing. A magic, moving, living part of the very earth itself." – LAURA GILPIN

ENERGY INDEPENDENCE AND ENERGY SELF RELIANCE - 7

Sustainable Growth, Sustainable Energy and Renewable Energy

The following extracts from News Papers and Business Magazine bring out the policies plans and prospects of India about Energy Self Reliance.

Energy Sector And Atmanirbhar Bharat: Challenges And Prospects

Due to the impact of COVID 19, the economy has been slowing down and it becomes all the more difficult to install and scale up the supply chain of hardware and services sector of the energy sector.

December, 2020

Prime Minister had announced the mission of Atmanirbhar Bharat earlier this year with a stimulus of Rs 20,000 crore. The agenda is in line with the Make in India initiative, to make India a self-reliant / Atmanirbhar country.

One of the key mediums of securing self-sufficiency is through domestic industry based energy production plants, reduced dependency on imported hardware, technical services, and rapid expansion of local manufacturing capacity.

India has 3rd largest reserves of coal in the world with producing more than 600 million tonnes for power plants. Despite it, we are importing 200 million tonnes annually.

Government has liberalised the coal mining rules and regulations. This will open the sector and allow wider-participation by the private sector to mine and sell coal, thus emancipate this critical source of fuel from the monopoly of Coal India Limited. This move is expected to reduce reliance on imports and at the same time lower the prices for end customers.

Also, in India have a plethora of ministries and departments looking into the energy development of the country. These include the Ministry of Coal, Ministry of Power, Ministry of New and Renewable energy, and a separate Department for Atomic Energy. We have many regulators, namely, Directorate General of Hydrocarbons, and the Petroleum and Natural Gas Regulatory Board, State and Central Electricity Regulators. The wide distribution of work is not conducive for streamlining policies and achieving intelligible outputs. One can take a leaf out from the recent example from the Ministry of Jal Shakti and implement it in the energy sector. The ministry was formed by merging Ministry of Water Resources, River Development & Ganga Rejuvenation and Ministry of Drinking Water and Sanitation. This has streamlined the work to be in done to counter the situation of 54% of water-stressed states in India. The same merger can be contemplated in the energy sector, which will bring more cohesion in this sector.

On the renewable energy front, India needs to step up its hardware manufacturing base, particularly the solar panel or what we call as modules. Modules are imported from China. A small percentage of modules are procured from local manufacturers and that too at higher costs. This situation has a huge impact on the country because 60 per cent of its project cost is consumed in importing modules from China. By 2030 investment in this sector is estimated to be about 80 billion USD. Just the solar modules will be worth $50 billion.

Government has recently declared its intention to increase customs duty to 40 per cent to discourage import of modules, and thereby incentivising local production in India. While this is a positive step towards Atmanirbhar Bharat, it will take some time for showing tangible results for the India solar developers.

If India is to speed up energy self-reliance, a lot of investment in Research & Development is a must. Presently, we spend less than 2 per cent of our budgetary resource, as against Germany and USA which have increased their R&D expenditure to 7 per cent! These countries are leading Patents and IPR ownerships, conduct R&D in their Institutes, Universities plus they have developed state of art manufacturing industry support. Leading private industries in Europe and the USA have a mechanism in place to invest in R&D, to bring innovative technologies and retain a competitive edge in the global market.

To succeed in Make in India, we need a skilled and trained workforce. The lockdown has severely curtailed the workforce availability, their training, upskilling and deployment in industry. Pandemic has forced the country to adopt strict health and hygiene practices, that act as a barrier for sourcing workers from other states, relocate high-quality technical experts, bring in the labour force for construction and operations of the industry.

Due to the impact of COVID 19, the economy has been slowing down and it becomes all the more difficult to install and scale up the supply chain of hardware and services sector of the energy sector.

There is a flip side of Atmanirbhar Abhiyan as well. If more money is invested to manufacture, the initial brunt will have to be borne by the consumer until the industry becomes competitive and sustainable. The government will have to provide incentives and non-fiscal support in this first phase.

The government is taking many steps to promote the manufacture of energy-related hardware in the country. They have introduced a lower than previous tax regime for new manufacturing companies. Tax on Income of New Manufacturing Domestic Companies, 2019 passed on 20 September 2019 has inserted Section 115BAB offering a low tax rate of 15% (plus surcharge and cess) to newly built manufacturing companies. This is to align with international best practices and to prevent emigration of industries from India. Further, the government is contemplating to provide land bank for industrial clusters under Atmanirbhar Abhiyaan.

In the renewable energy space companies like Adani and TATA, have already expressed interest in setting up local manufacturing Li-Ion batteries in the country, under Atmanirbhar scheme of government of India. At present, we import all our batteries from China and Korea. These are required for Electric Vehicles and Energy storage systems for Indian electricity grids and large Industries that require a stable power supply.

The government of India has set-up the National Mission on Transformative Mobility and Battery Storage. The core objective of the Mission has been to obtain overarching cohesiveness in the policy framework for promoting e-mobility and battery storage in the country. This will bring changes in a niche sector of renewable energy.

Over and above the government initiatives, a lot can be done to overcome existing issues. For instance, India needs to come up with a strategic roadmap to harvest energy from green hydrogen. We can also take a leaf from the German model, which is the most energy-efficient country in the world. Germany is slowly moving towards renewable energy, with more than half of windmills of the European Union located in the country. India can produce 102GW of energy from wind alone! Also, one can look at the possibilities of a public-private partnership to diversify the energy sources.

With fluctuating oil prices and energy uncertainty. With the global economy recovering in the post-pandemic period, India must see this an opportunity to redefine the global supply chain and become a net energy exporter.

Policies for An Atmanirbhar Energy Sector

As India moves towards a new paradigm of 'AtmaNirbhar' Bharat, our energy security is a key component of this new resolve. The Prime Minister has already given pride of place to solar power, describing it as 'sure, pure and secure'. But there is a lot more to our energy policy that requires a converted effort from government and industry. With the government playing the role of enabler. We list down the 7 key areas.

Solar Policy

At this stage, it is quite clear that to encourage domestic manufacturing to take deep roots, and draw investments for growth, a certain amount of basic customs duty will be needed on imports.

With a target of 500 GW by 2030, we are potentially looking at a demand for 50 GW per annum. That raises the stakes to a level where hard decisions in the short term will need to be taken. Wafers, Cells & Modules production all need to be targeted, by using the tool of Viability Gap Funding (VGF).

To encourage manufacturing of Metallurgical Grade Silicon (MGSi), PolySilicon, Ingot/Crystal & Wafers, subsidised electricity, water and free pollution treatment will be needed.

The national Semiconductor policy needs to be revised by including Solar for the subsidy on the lines of Germany where 50% of CAPEX was provided by the Government. To promote the indigenous manufacturing of inverters heavy import duty must be imposed on the Chinese products.

Hydrogen Policy

Hydrogen Energy is fast emerging as the most viable option for thermal and nuclear energy. That explains the high focus and interest in developed economies in research and establishment of infrastructure for production of green hydrogen, or Hydrogen produced using renewable energy.

India must prepare a strategic energy plan for next 10 years to replace the import of petroleum products and use of Coal.

Strategic road map for Hydrogen & Fuel Cells to use Hydrogen for EV & Storage of electricity.

Prepare a white paper on Hydrogen Energy in line with Japanese Policy on Hydrogen (NEDO report, 2014).

Hydrogen production from Brown Coal mines & its transportation by Hydrogenation & Dehydrogenation in the intervening period.

To ensure focused research, an independent university for research and innovation in the field of Hydrogen for the commercialization of technologies to be developed for generation, storage, transportation and dispensing of hydrogen.

To setup demonstration parks to convince users that hydrogen is a safe energy source and non-hazardous.

To setup an independent department for hydrogen energy.

Policy On R&D And Innovation

We need institutes in line with Fraunhofer Institutes of Solar Energy (ISE) in Germany funded by industry, academia and government to innovate and commercialize technologies.

Currently, the projects allotted to universities/technical institutes do not meet industry needs as they are starved of sufficient resources. Easier access to funding and industrial participation must be made mandatory from R&D to innovation and commercialization.

Industrial R&D to be supported by government through launch of an industry managed advanced Energy Technology Centre in India to engage in precompetitive collaborative industrial R&D.

It's time for an independent entrepreneur ministry to support and ensure success of indigenously developed technologies.

Our apprenticeship policy need to be revised to ensure extended industrial engagements for students, some of which has been covered in the proposed National Education Policy too.

Policy On Manufacturing Of Capital Equipment

To attract entrepreneurs/industry in the manufacturing of capital equipment needs a strong hand holding by the Central and State governments by granting liberal subsidies and loans with the liberal terms and conditions. We have seen this done, selectively, with great results, as in case of telecom equipment like mobile handsets. Its time to make this the new normal.

A 3 years moratorium for re-payment of loan to the new units will help cover for the many unexpected delays and other challenges entrepreneurs face..

Like startups, a tax holiday to be introduced at least for 5 years.

Capital subsidy to the tune of 50% for establishing equipment manufacturing units in line with the M-SIPS as the infrastructure for this industry needs heavy investment.

BCD on imported equipment should be introduced to encourage the indigenous manufacturers on level playing field.

Import substitution by indigenously produced capital equipment should be treated as deemed export and all export related incentive should be allowed to be availed.

Policy On Ev Mobility Vis-A-Vis Hydrogen Energy

When it comes to mobility, lithium ion is definitely not the last word on the many options possible. We need to actively consider hydrogen for EV mobility to reduce the use of batteries which have limited life and disposal problems. Besides access to raw materials.

This will create opportunity for converting existing vehicles with hydrogen fuel cells kits thus generating the employment as well reskilling the mechanics who will go out of job due to introduction of Electrical Vehicles.

The manufacturing of fuel cells in India will open huge opportunities for technical jobs in automobile industry as well as for regeneration of electricity from stored hydrogen energy.

Special undergraduate/post-graduate courses to be introduced in technical institutions on Hydrogen Energy.

Policy On Bridging Of Research Achievements For Commercialisation

In order to utilize the investment in R&D in Academia, Laboratories and Industries to the maximum benefit of society an interactive organization/ institute should be created, with an aim to share results with industry.

This would be mandated to convert the developed technologies through R&D and innovation into production worthy technologies for industrialization.

It will ensure goal oriented basic research which forms the basis of innovation, bridge its outcomes with industry and nurture human resources for future innovations.

In any major R&D project, potential impact in terms of its industrialization & commercialization and its impact on society with respect to quality of life, should be addressed. Therefore, in such projects technical researcher, business management researchers and social scientist need to be involved from ab initio.

(To be continued)

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ANGELA MERKEL

Germany bid farewell to Angela Merkel with six minutes of warm applause, on the streets, balconies, windows, the whole country applauded for 6 minutes - spectacular example of leadership and defense of humanity, chapeaux!

The Germans elected her to lead them, and she led 80 million Germans for 18 years with competence, skill, dedication and sincerity. She did not utter nonsense .. She did not appear in the alleys of Berlin to be photographed. She was dubbed "The Lady of the World" and who was described as the equivalent of six million men.

During these eighteen years of her leadership of the authority in her country, no transgressions were recorded against her .. She did not assign any of her relatives to a government post .. She did not claim that she was the maker of glories .. She did not get millions in payment, nor did anyone cheer her performance, she did not receive charters and pledges, she did not fight those who preceded her and did not dissolve her.

Yesterday, Merkel left the party leadership position and handed it over to those after her, and Germany and its German people are in the best condition ever.

The reaction of the Germans was unprecedented in the history of the country ..The entire population went out to their balconies of their houses and clapped for her spontaneously for 6 continuous minutes. A standing ovation nationwide.

Germany stood as one body bidding farewell to their leader, a chemical physicist who was not tempted by the fashion or the lights and did not buy real estate, cars, yachts and private planes, knowing that she is from former East Germany ..

She left her post after leaving Germany at the top .. She left and her relatives did not claim advantage... Eighteen years and she never changed her wardrobe... God be upon this silent leader.

At a press conference, a female journalist asked Merkel: We notice that you're wearing the same suit, don't you have any other? She replied: "I am a government employee and not a model."

At another press conference, they asked her: Do you have housemaids who clean your house, prepare your meals and so on? Her answer was: "No, I do not have servants and I do not need them. My husband and I do this work at home every day."

Then another journalist asked: Who is washing the clothes, you or your husband? Her answer: "I arrange the clothes, and my husband is the one who operates the washing machine, and it is usually at night, because electricity is available and there is no pressure on it, and the most important thing is to take into the account the possible inconvenience for the neighbours, thankfully the wall separating our apartment from the neighbours is thick. She said to them, "I expected you to ask me about the successes and failures in our work in the government??"

Mrs. Merkel lives in a normal apartment like any other citizen .. She lived in this apartment before being elected Prime Minister of Germany. She did not leave it and does not own a villa, servants, swimming pools or gardens ..

Merkel, the now former Chancellor of Germany, the largest economy in Europe !!

ANCIENT STONE TOOLS FOUND IN TAMIL NADU PUSH BACK 'OUT OF AFRICA' EXODUS DATE

A recent discovery in Israel pointed to the possibility that modern humans migrated out of Africa 180,000 years ago. But stone tools unearthed in Attirampakkam have been found to be 385,000 years old.

It has been thought that the Indian Middle Palaeolithic culture developed 90,000-140,000 years ago and was closely tied to the dispersal of modern humans from Africa. But tools excavated from Attirampakkam, Tamil Nadu, have now pushed the antiquity of this culture by almost 50,000 years.

The tools bear marks of the Levallois technology that has its roots in Africa and predates the arrival of modern humans in India.

"These findings spark a new debate about the origins of the Indian Middle Palaeolithic culture," according to Shanti Pappu, the founder/secretary of the Sharma Centre for Heritage Education (SCHE), as told to *The Wire*.

The timeline of human history has been and is, constructed by piecing together evidence from genetic, anthropological and archaeological studies. Among the various types of artefacts, stone tools provide the more concrete evidence of the whereabouts of our ancestors as they journeyed through space and in time.

At the beginning of the Stone Age, early hominins used simple stone tools to gather food from trees and for hunting. As our species evolved and developed abstract thinking, our tool-making technology became more sophisticated. Gradually, modern humans in Africa found new ways of shaping rocks into useful instruments.

"There is a clear difference between the techniques used by hominins to fashion their tools and the knapping technology that evolved over time," Pappu, also the corresponding author of the new study, explained.

Complex design

Most early Stone Age tools were made by splintering rocks with either a hard stone or antler/wood hammers. The detached flakes would then be shaped into tools of different kinds, like scrapers or hand-axes.

In the Middle Palaeolithic period, a new technology called Levallois became common for forging instruments. "The technique involves the removal of small flakes or points from carefully prepared cores in a structured

manner," Pappu said. The geometric complexity of the process is thought to be a testimony to abstract thinking; some scientists even associate it with the *Homo sapiens*.

By examining stone tools from Attirampakkam, a village located about 65 km west-northwest of Chennai, Pappu and colleagues have shown how the Indian Middle Palaeolithic emerged from the preceding Acheulean culture around 385,000 years ago and then tracked its subsequent evolution until around 172,000 years ago.

"What's special about the new tools found at Attirampakkam is that they are complex in design and bear the markings of technologies used by Middle Palaeolithic cultures," Pappu said. "This implies that groups of humans consistent with this culture started dispersing from Africa (possibly) much earlier than what we believe."

But apart from being one of the oldest known sites for lithic records, artefacts recovered from Attirampakkam are also significant because of the site's location.

The Indian subcontinent (not just India) lies between East Africa, Dmanisi in Georgia and Sangiran in Southeast Asia. These regions contain paleoanthropological records – in the form of fossils or stone artefacts – dating back to 1.8 million years or earlier. Ergo, Attirampakkam must have been at a biological or technological crossroads as humans evolved and dispersed.

"That way, the palaeoanthropological record of this region is critical for linking the earliest evidence found in the regions of the Old World (East Africa, Georgia and Southeast Asia) while understanding hominin evolution and adaptations," Parth Chauhan, an assistant professor of humanities at the Indian Institute for Science Education and Research, Mohali, told *The Wire*. Chauhan was not involved in the study.

Luminescence dating

Excavation at Attirampakkam began in 1999. In the beginning, researchers from SCHE studied the artefacts recovered from the lowest rung of the excavation site, which corresponds to the Lower Palaeolithic or the Acheulean period. More recently, they analysed artefacts dug out from the layers on top. So by studying the site layer by layer, scientists have been able to reconstruct the history of human habitation, behaviour and culture in India.

"In the present study, one of our prime objectives was to examine the entire period of Middle Palaeolithic at Attirampakkam with a global perspective – specifically, its origins and evolution," Pappu said.

To this end, he and his team excavated more than 7,000 stone tools from the sediment layer and analysed them in the lab. They kept an eye out for the presence of telltale marks of tool-making technologies and, based on that, tried to attribute specific uses to these tools. They also examined cores and waste materials that arise from tool-making processes to discern their underlying techniques.

The age of the artefacts was calculated using luminescence dating, which relies on radiation-induced luminescence in natural minerals.

Exposure to radiation from natural radioactivity introduces minor electronic changes in the structure of minerals like quartz and feldspar. These changes can be uncovered by luminescence. Normally, such changes are reversed when minerals are exposed to sunlight. "So, before burial, the sediments have zero/near zero residual luminescence," Ashok Kumar Singhvi, a coauthor of the study, explained. "But once the minerals are buried, they start accumulating luminescence due to radiation exposure from its environment."

Because naturally occurring radioactive minerals decay at a very slow rate, the radiation exposure rate remains constant on a million-year time scale. Luminescence analysis of a mineral provides a measure of the "total radiation exposure" it would've received since burial – i.e the time when sediments were last exposed to the Sun. Analysing the concentration of natural radionuclides provides the annual rate of radiation exposure. The ratio of the total exposure to annual exposure provides the age.

Singhvi and his colleagues Haresh and Anil from the Physical Research Laboratory, Ahmedabad, conducted a luminescence analysis on sediments surrounding the artefacts. They assumed that the sediments corresponded to the periods when the tools were created. Thus they found that the tools are at least about 172,000 years

old – which means they were made 50,000 years before the first *Homo sapiens* are thought to have reached India, bringing with them their trademark technology.

"These results usher in a paradigm change in terms of how we perceive human evolution and what we know about human dispersal from Africa," Pappu said.

But the study remains silent on who made these tools.

"Were these technologies brought to Attirampakkam by modern humans or were they developed by other early human species – that can't be gauged from the data," Chauhan said. This last piece of the puzzle has multiple implications

A string of evidence from diverse locations has warped the timeline of human dispersal from Africa. Fossils found last year in Jebel Irhoud, Morocco, and a jawbone recovered from a site in Israel suggest that hominins dispersed early, about 180,000 years ago. In fact, according to a rough estimate, modern humans may have ventured out of Africa about 85,000 years *earlier than previously thought*.

But while conclusions based on data collected from the Moroccan and Israeli sites is held up by fossils, Pappu and her team are yet to recover fossils or DNA that could help them piece together the entire puzzle. Thus, they have been extremely cautious in their study and don't make any claims about who could have made these tools.

Fossil evidence

"Finding fossils is a matter of luck," Pappu said. Apart from a single hominin cranium, no fossils from this time-period have been found in India. Given that tools are an important part of human culture and behaviour, she added, "It would be silly to neglect them and focus only on fossils for delineating the history of human evolution."

But despite the absence of fossils, the scientists are confident that their Tamil Nadu study suggests a succession of population dispersals across South Asia, possibly marked by an interaction between modern humans and other archaic species.

"This is a nice example of using stone tool records to document changes in cultural behaviour," Mark Stoneking, a geneticist at the Max Planck Institute for Evolutionary Anthropology, Leipzig, told *The Wire*. "But in the absence of any fossils from the Middle Palaeolithic in India, the conclusions become speculative."

Even if the Middle Palaeolithic stone tool technology developed much earlier in India and is contemporaneous with similar developments in Africa and Europe, it does not prove that hominins in the Old World interacted with each other at this time."The tools could have been made by modern humans. They could have also been made by archaic humans," Stoneking speculated, "so we don't know if this was an indigenous development in India"; he admits that this "seems unlikely".

Chauhan, however, holds a slightly different view: "Chances are stronger that the reported Indian technology belongs to archaic hominins," he told *The Wire*.

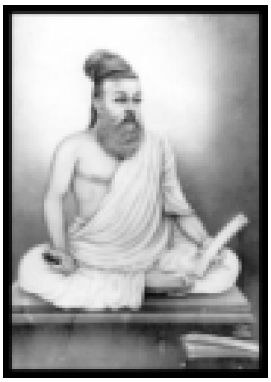
This possibility is supported by the fact that many early humans, including Neanderthals, developed similar technologies without interacting with the Homo sapiens, he said. "If they can, then archaic humans colonising India could have also developed similar technologies on their own."

But if we assume that the Early Middle Palaeolithic at Attirampakkam represents *Homo sapiens*, then there are greater implications.

The artefacts recovered from South India are older than the oldest known *Homo sapiens* fossils found in Africa (300,000 years ago). Even the oldest fossils outside Africa – recently reported from Israel – are far younger than those found at Attirampakkam.

According to Chauhan, "If the area at Attirampakkam was indeed inhabited by modern humans, it means that the oldest known *Homo sapiens* fossils have yet to be recovered, wherever their origins may be."

TENETS FROM TIRUKKURAL FOR GOOD GOVERNANCE AND GOOD LEADER



The very basics of Righteousness, Honour, Valour, Justice, Impartiality and Ruling to spread prosperity for all with inclusiveness are all important for Good Governance and Leadership. These are clearly brought out in the following Kurals of Tiruvalluvar.

Aranizhukka Thallavai Neekki Maranizhukka Maanam Udaiya Tharasu. ***Kural 384***

அறனிழுக்கா தல்லவை நீக்கி மறனிழுக்கா மானம் உடைய தரசு. ***குறள் 384***

"The Prince (Leader) shall not fall in virtue and shall abolish unrighteousness; he shall guard his honour jealously but shall not sin against the laws of valour"

Democracy is considered, in present times, as one of the best way of choosing the Government and the Governance. Elections and the people and the choice of Government every 4 or 5 years are all part of the democratic system which is sought and supported by more and more countries of the world. As people are involved and their choice is important, the leaders must believe and practice fair and powerful rule as the people definitely consider them as good to be given the mantle to rule. The following Kural deals about all these aspects.

Muraiseythu Kaappaatrum Mannavan Makkatku Iraiendru Vaikkap Padum ***Kural 388***

முறைசெய்து காப்பாற்றும் மன்னவன் மக்கட்கு இறையென்று வைக்கப் படும். ***குறள் 388***

"Behold the Prince (Leader) who administereth impartial justice and protecteth all his subjects; he will be looked upon as a good person among men"

HOME FESTIVALS - 4

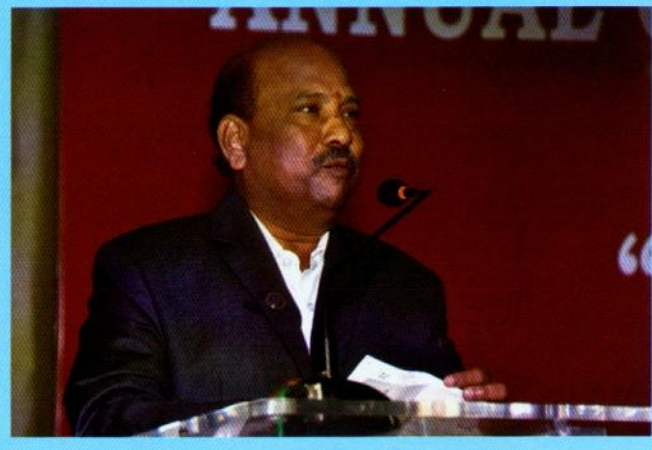
சித்திரை - Chitrai (April/May)

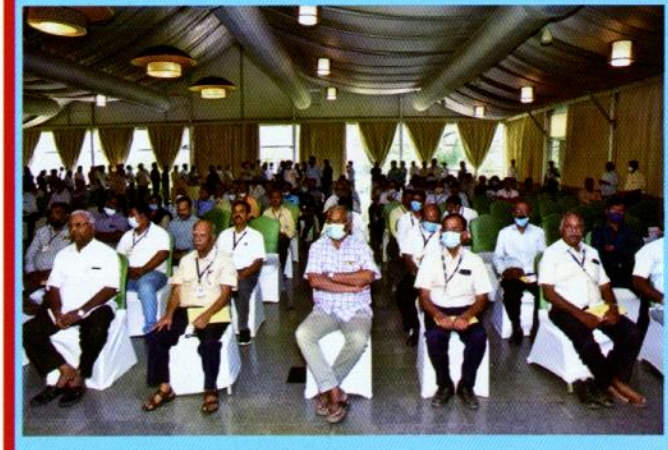
This month begins with the completion of Ram Navami, the nine days of celebration of Lord Rama's birth ages ago, which started in the previous month. At the upper left we see a decorated picture of Lord Rama's coronation. Next (Proceeding clock wise) comes a Vaisnava priest telling the stories of Lord Rama's birth and life; behind him are great parts of *paanagan,* a delicious drink of sugar and ginger, and a basket of *sundal*, spiced chickpeas, served to the storyteller's guests, who also receive palm fans, as this is the hot season. Tamil New Year often falls on April 14 (as does the New Year of several other communities). The lady at upper right is shown with the new clothes and jewellery which are part of the celebration, as well as bananas, mangoes and the ingredients for *vepon pu pachadi*, a combination of bitter neem blossoms, sugar and mango – a reminder to face the unpleasant in life with a sweet smile. At lower left is the marriage of Siva and Parvati, Meenakshi Kalyanam, with brother Vishnu pouring the sacred ganga water on the earth joined hands. At lower right is the dark form of Yama, Lord of Death, who figures in three stories associated with this month; that of Savitri, who won her husband back from Yama in a battle of wits; Nachiketas, the boy who extracted three boons from Him and Markandeya, who won eternal youth from Lord Yama through the worship of the Sivalinga. ***(To be continued)***

ANNUAL GENERAL BODY MEETING FOR THE YEAR 2021 HELD ON 27TH FEBRUARY 2021 - PHOTOS

Registration of Members

President Addressing the AGM



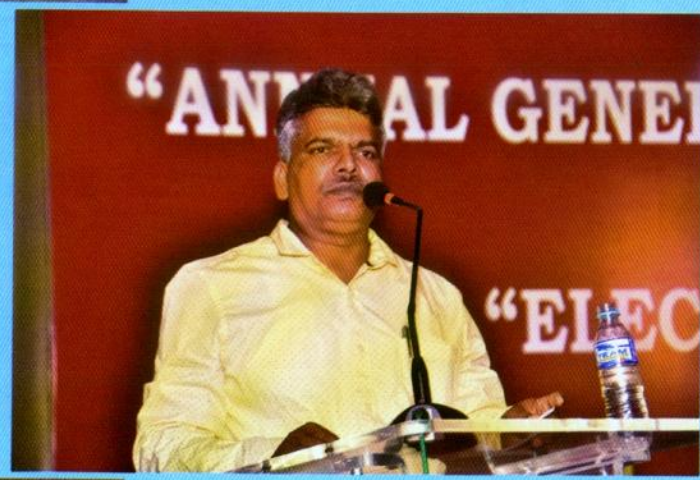


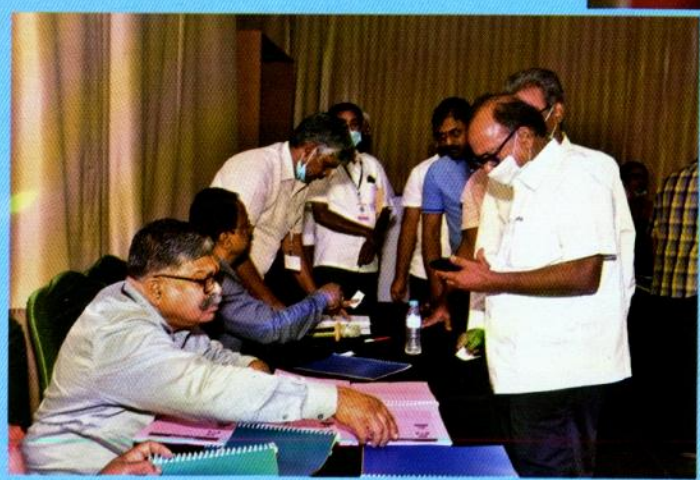
Members in AGM

Secretary Addressing the AGM

Members in AGM

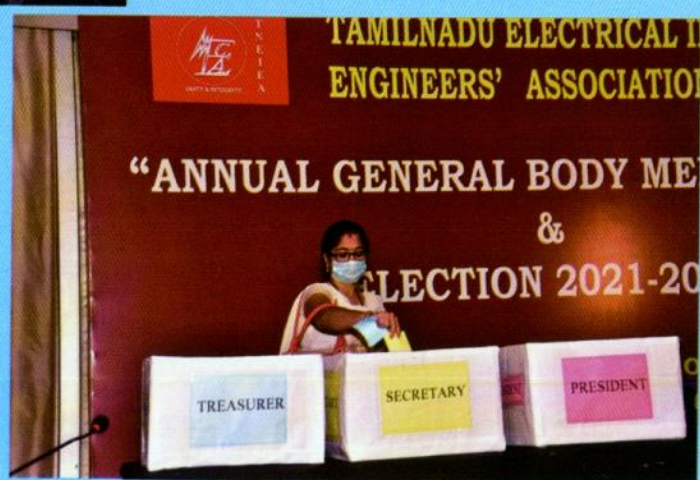
Treasurer Addressing the AGM





Members credentials Checked before voting

Voters Cast their Votes



Election Committee handing over the Winning Certificate to the Mr.Kannan as President

Election Committee handing over the winning Certificate to Mr. Vishnuram as Secretary

Election Committee handing over the winning Certificate to Mr. KalyanaVenkatraman as Treasurer

A new Beginning

New Team – Ready to Serve

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