# ELECTRICAL INSTALLATION ENGINEER

## NEWS LETTER

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# EDITORIAL

Dear Members, Fellow Professionals and Friends,

## *Seasons Greetings To One And All!*

## *Happy Tamil New Year "Plava" And Best Wishes For Happy Times Ahead In All Economic And Social Activities!!*

The Month of April marks the commencement of New Financial year as well as the commencement of Tamil New Year PLAVA as per our tradition. Let us Hope and Pray for all Good for this year as well as for the future. Unfortunately the CORONA is on the rise in Tamilnadu as well as the whole of India and let us all resolve to extend our fullest cooperation in all the efforts to contain the Pandemic. The Vaccination Programme of India is indeed a Boon to secure the lives of people and we must extend our full cooperation with full faith to make it successful.

Tamilnadu and Pondicherry complete their Assembly Elections on the 6th of April, and the Assembly Elections are still on in the States of Assam and West Bengal. A question was raised in one of the discussions pertaining to India and Democracy, whether India is "Fit" for Democracy. The interesting point that came out in the discussion is that India is the fittest country for democracy as the 'Rule by the people' and the Rule of "Dharma" and Law are part of our long tradition spread over thousands of years, as it is proven by the centuries old "UTHIRAMERUR INSCRIPTIONS". It is very valuable to remember that the makers of our Constitution, to follow our Independence, just translated the wishes of the people at the time of Independence into the Constitution. Unlike many of the advanced countries with democracy, our constitution provided for voting rights for all citizens of India without any kind of discrimination, from the day of beginning of our Democracy. - 26th January 1950. The world looks at us today with wonder as to how we manage to conduct our Elections, in our large and diverse country, controlled by an independent Election Commission, as prescribed in our constitution. It is apt to remember the history of our freedom struggle and the makers of our constitution at this time and as a matter of coincidence, the day of Jalianwala Bagh massacre as well as Dr Ambedkar's remembrance day fall respectively on the 13th and the 14th of April.

India is a land of great heritage being one of the oldest civilizations of the World. With lots and lots of heritage sites all over the country, there is fantastic scope for stepping up our efforts to make India a valuable Tourist Destination of the World, helping our economy too in the process. The Government of India has been focusing on this for quite a few years now with moderate success which should go up. It was indeed a marvelous sight, seeing the Prime Ministers of India and the President of China walking and chatting around the Cave Temples of Mahabalipuram during October, 2019.

***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.***

**Editor**

*In a true democracy of India, the unit is the village.*

— ***MAHATMA GANDHI***

ELECTRICAL INSTALLATION ENGINEER

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# DR. B.R. AMBEDKAR, THE FATHER OF INDIAN CONSTITUTION

***"The third thing we must do is not be content with mere political democracy. We must note that our political democracy can not last unless there lies at the base of it social democracy. What does social democracy mean? It means a way of life which recognizes liberty, equality and fraternity as the principles of life." – Dr. B.R. AMBEDKAR***

**B.R. Ambedkar and Drafting of the Constitution**

On 29th August, 1947 passing one resolution the Constituent Assembly appointed a 'Drafting Committee" with the seven members including Dr. Ambedkar for preparing a draft of the Constitution of the independent India. It is said when drafting of the Constitution of India was embarked upon, Pandit Nehru and Sardar Vallabhbhai Patel thought of inviting and consulting Sir Guor Jennings, as internationally known constitutional expert of those times. When approached for advice in the matter Gandhiji is reported to have told them why they should be looking for foreign experts when they had the right within India an outstanding legal and constitutional expert in Dr. Ambedkar, who ought to be entrusted with the role which they badly need as he so richly and rightly deserved. The Law Minister Dr. Ambedkar was appointed the Chairman of the Drafting Committee. The seven members, including the Chairman of the 'Drafting Committee' were as follows:

1) Dr. B.R. Ambedkar, Chairman
2) N. Goipalswami
3) Alladi Krishnaswami Ayyar
4) K.M. Munshi
5) Saijio Mola Saadulla
6) N. Madhava Rao and
7) D.P. Khaitan

Dr. Ambedkar was honoured step by step. At the first step he was honoured as the member of the Constituent Assembly. At the second step he was honoured as the first 'Law Minister' of the independent India and at the third step he was honoured as the chairman of the 'Drafting Committee'. Because of his bright characteristics, as his deep and vast study, tremendous knowledge, amazing command of an English language, expertness in explaining the subject and ideal patriotism, he had got these pleasant honours.

He advocated for a government which was a responsible government formed by the representatives of the people. Dr. Ambedkar did not want to impose a Constitution on the Indians, but he submitted that the opinion of the people about the manner in which they desired to be governed must be accepted.

"The best government rests on the people, and not on the few on persons and not on property, on the free development of public opinion and not on authority.

In the constituent Assembly Dr. Ambedkar played a very significant role with a lofty responsibility of drafting the Constitution. He examined the functioning of a democratic government on the basis of stability and responsibility.

However, the Draft Constitution he recommended that the parliamentary of executive must have more responsibility to stability. As regards the character of the Constitution, it was Federal in form and Unitary in Spirit". It established a dual polity with the Union at the Centre and the States at the periphery, each endowed with sovereign powers to be exercised in the field assigned to them respectively by the Constitution.

**Concept Of Federalism**

His concept of federalism meant that the State was a federation in normalcy, but unitary in emergency.

**Centre Was Made Strong**

In the Draft Constitution Dr. Ambedkar offered more powers to the Centre and made it strong. Some members of the constituent assembly criticised him on the ground that since Dr. Ambedkar postulated – the rights and values of each individual and the development of each province and each–village, it was contradictory of his part to make the Centre strong.

Justifying the provisions for a strong Central authority Dr. Ambedkar said that he made the centre strong not only to 'save minorities from the misrule of majority' but also "for it is only the centre which can work for a common end and for the general interests of the country as a whole."

**Equality Of Opportunity**

In the Draft Constitution the "Fundamental Rights", prescribed were justifiable in the Court of Law. Of all the rights, Dr. Amebedkar observed "Equality of Opportunity" as the most important one. Regarding the constitutional remedies, he characterize Article 32 as the very soul of the Constitution and the very heart of it.

To him, fundamental rights would mean establishment of equality and liberty in order to reform our social system, which is so full of inequalities discriminations, and other which conflict with our fundamental rights.

**Directive Principles Of State Policy**

The Directive Principles of State Policy contained the positive obligations of the state towards its citizens. The Directives were meant to ensure social and economic democracy which was secured by the provisions of fundamental rights in a written Constitution.

Dr. Ambedkar said: "What are called Directive Principles is simply another name for Instruments of instructions to the legislature and the executive…as to how they should exercise their power."

**Constitution: A Dynamic Document**

The Constitution is a dynamic document it should grow with the growth of the nation and should suit the changing needs and circumstance. So Dr. Ambedkar urged the necessity of amendment.

"The Draft Constitution has eliminated the elaborate and difficult procedures such as a decision by a convention or a referendum. The power of amendment lies with the legislatures, Central and Provincial …"

Dr. Ambedkar was doubtful on the Constitutional mortality of the legislatures. So he wanted to incorporate the froms of administration in the Constitution.

**Concept Of Sovereignty And Suzerainty**

Dr. Ambedkar's concept of sovereignty and suzerainty and of the Indian States, i.e., integration of the native Indian Princely States which gave the shape to the rap of India as if is today, has indeed been prophetic. So also were his explicitly and outspoken views on what he called the biggest blunder of Partition of India.

Dr. Ambedkar forewarned his countrymen of the Consequences of partition. His questioning of the rationale of the tow nation theory which gave birth to Pakistan was born of deep interest in and compassion for his compatriots esp., the Scheduled castes settled for centuries within the territorial jurisdiction of the new notion of Pakistan.

**National Integration**

In the Draft Constitution Dr. Ambedkar prescribed single citizenship, a single judiciary and uniformity in fundamental Laws to integrate Indian society which was not only divided into caste and class, but also into regions, religions, languages, traditions and cultures. Therefore, a strong Centre was indispensable to maintain territorial integrity and administrative discipline.

However, in the Draft Constitution he suggested the acceptance of Hindi in the 'nagiri' script as the National Language of India. When it was finally decided that India should be divided into India and Pakistan, Dr. Ambedkar at that time demanded the division of Punjab and Bengal, and the territories to be added to India.

A pragmatist to the core, Ambedkar believed that in the absence of economic and social justice political independence would not bring about their social solidarity or national integration. He advocated the abolition of privileges on the basis of caste or status and vigorously fought for the liberty and dignity of the individual. At the same time, he was equally force-full in his advocacy of the unity of the nation. Ambedkar sought to achieve there objectives through the constitution of India by incorporating in it the following principles.

(1) Making the Indian constitution workable, flexible enough and strong enough to hold the country together both in peace and war time.

(2) Providing special safeguards to the minorities and certain classes who are socially and educationally backward.

(3) Incorporating the principle of one man, one value, and one man, one vote. Thus, the constitution of India accepted one individual and net on village as a unit.

(4) Incorporating exceptions and qualifications to the FRs while advocating, preventive detention and energy way powers of the President of India.

(5) Abolishing untochability and forced labour to achieve the ideal of "one man, one value, and one man, one vote', and placing all people equal before the law; securing equal protection of laws for every citizens as also freedom of profession and equality of opportunity.

(6) Incorporating the right to constitutional remedies for making the right real.

**Conclusion**

The contribution of Dr. Ambedkar in Indian Democracy is not to be forgotten. As a chairman of the Constitutional Committee he gave a shape to our country of a complete Sovereign, Democratic and Republic based on adult franchise. Baba Saheb Ambedkar's name will be written in golden letters in the history of India as a creator of social justice. This fact is doubtless. He was not only the man of age and builder of the Constitution but also the creator of social justice and betterment of the downtrodden. He was one of the few sons in the History of India that he can be said to the gift of Indian freedom movement. If Mahatma Gandhi gave direction and lesson of morality then Baba Saheb gave shape to social aspect without exploitation. In true sense of the word, he gave democratic and anti caste aim. He spent his whole life for the betterment of the poor, exploited, untouchables and troubled classes. Thus, Dr. Ambedkar's contribution to the Indian Constitution is undoubtedly of the highest order. Indeed he deserved to be called the "father or the Chief Architect" of the Indian Constitution.

***In politics we will be recognizing the principle of one man one vote and one vote one value.***

***– Dr AMBEDKAR***

# KNOW THY POWER NETWORK - 158

To start with, let us revisit the topics on hand Viz "Electrical Safety, Safety Audit and Safety Inspection".

## 1. Electrical Safety

It is nothing but the measures or efforts needed to avoid electrocution in a location either due to accidental contact or due to prevailing faulty conditions. Its chief objectives are (i) to avoid / eliminate the conditions that generate electric shocks, equipment damage / failure and (ii) to ensure a safe and reliable working environment.

## 2. Electrical Safety Audit

It can be defined as a methodical, independent way to assess / find potential dangers in a location, plant and to prescribe the required solutions. It is a much needed device or tool for identifying the ageing / deteriorating equipment parameters and electrical insulation, locating the areas of dangers and accident prone sites; risks and potential mishaps in a building / facility / plant. It gives the true essence of the electrical safety at any premises that includes plants, of buildings. It chiefly consists of (i) on-site inspections and its evaluations. This step helps to avert / limit the damages at the faulty location, prevent explosions and fires. (ii) finding out whether safety norms, rules and practices in force are strictly complied with or not (iii) recommending suitable corrective measures for improvement and guaranting the electrical safety of a place. In plants, this step ensures safer work practices and maintenances; helps to train the employees and employers with updated data in safety practices, also facilities the verification of exiting work procedures and safety measures followed by the employees and employers as well.

## 3. Electrical Safety Inspection

It is an on-site inspection or survey to get the first hand information on the safety condition of a place and it is a part of the Electrical Safety Audit.

## 4. Areas of Attention - Basic Needful Information

Before proceeding to arrange for the required phases of the audit programme, it is better to enrich ourselves with certain basic technical information, in addition to the points already provided in the previous (last) article

### (a) Copper Vs Aluminium

While selecting cables, electrical wires in our premises, we should not go by or lay stress on cost alone; consideration should be given to long term service life, continuity of supply and the adverse impacts wrought by aluminium with regard to safety and fire.

Three main factors are involved, when aluminium is used as an electrical conductor. Its joining with the noble metals like copper leads to,

(i) **Electrolytic Corrosion:** It occurs when aluminium and copper (dis-similar metals) are joined together in a corrosive, moist working atmosphere

(ii) **Formation of High Resistance Aluminium Oxide Films:** (It exists in the form of white powder and lead to poor electrical contact)

(iii) **Differential Thermal Expansion:** (The softness, creep and high thermal co-efficient of expansion of aluminium leads to differential expansion at the joints. Heat cycling amplifies this problem).

All the three factors mentioned above, invariably lead to poor contact surface, formation of corrosive gases and finally erosion of contact surface itself with the consequential reduced or limited service life of the joints. When it is difficult to avoid such joints, bimetallic clamps or jointing materials should be invariably employed. Selection of aluminium cables is based on this. This is in addition the cost factor involved.

**(b) To establish, the proper operation of RCB (ELCB)**

During earth faults in a premise; the earth and neutral should be linked at one location only. (just at the entry of incoming phases and neutral at the S.C. premises). It also depends on the current and time settings selected for RCBs. Formation of multiple earth loops should be strictly averted / avoided since it leads to mal-operation / non-operation of RCBS.

**(c) Fault Level and Magnitude of Short Circuit Current at the location on hand**

On this basis, the adequacy of protective coordination needs examination i.e. the coordination between the upstream and downstream protective devices like HRC Fuses, Rewirable Fuses, Circuit Breakers and Protective Relays. Similarly calculation of earthing factor, insulation level of the sub-station in point in case of HT services; calculation / measurement of touch, step and transfer potential levels, are also to be calculated / measured comparison of $I^2t$ characteristics of protective devices (like fuses and circuit breakers) with that of the protected equipment like Transformers, Motors, Cables with respect to the fault level (short circuit power).

It is important factors that require attention. Inadequate attention given to this factor will lead to major problems with consequential losses, fires and equipment failures. Under no circumstances the $I^2t$ withstand of the protective devices like fuses and breakers should be higher than that of the protected equipment. This condition throws light to the fact that the protective equipment, instead of protecting the costly equipment, simply permits the fault currents to reach and cause damages the protected equipment. In other words its "let through current" is more than the withstand capability of the protected equipment. So greater attention is needed in the selection of $I^2t$ characteristics (S.C. withstand) of HRC fuses, breakers, rewirable fuses, cables and other protected equipment.

**(d) Provision of Maximum Demand Ammeter in Neutral Circuit**

This step will help to find out the quantum of neutral current flows and the corresponding unbalance in the circuit. Higher neutral currents indicate greater unbalance in the circuit with the consequential, prevalence of safety problems like heating and fires.

**(e) Perceptual Safety Survey**

As already outlined, it is preferable to conduct Perceptual Safety survey in the plant. It is nothing but informal discussions with the selected officials and staff of the plant concerned in respect of electrical safety problems faced / witnessed in their plant. It is carried out prior to the initiation of audit in the plant. In a way such informal discussions will facilitate better on- site inspections. The people selected / for such discussions play key roles in the safety management system of the plant in point.

**(f) HT Service Connection Vs LT Service Connection - Need For Differential Treatment**

HT and LT service connections are mainly differentiated based on their characteristic features with respect to,

- Voltage withstand
- Fault currents withstand
- Need for continuity of supply
- Safety of operating personnel
- Adequacy of earthing

Not with standing their common objective to maintain complete safety. In the case of HT installations, voltage plays an important role where as in case of LTSC. Currents assume a significant role. In the case of HT services, the potential rises noticed during earth faults need special attention. This helps to establish the earthing factor of the site and also its percentage insulation level. So during Safety Audit, entirely different treatments are required to be given. i.e. the entirely different approaches are needed during the Safety Audits.

The other points / factors that need consideration in this context are briefly enumerated as follows and it is preferable / desirable to keep them in mind while performing audits.

- Provision of smoke free, fire proof cables in the premises.
- Earthing in the plant should be given special attention. All devices, equipment should be connected to common earth but; no metal enclosure should be left unearthed. This includes the enclosing metallic fences also. Similarly all switches handles should be earthed. The condition of earth pits, week growth in the switch yard and the usage of 4" blue granite jelly are to be checked regularly. Instances of step potential, touch potential and transfer potential are required to be monitored
- When UG cable is connected to OH conductors, LA should be used at the connecting point
- If inverters are employed, the condition of their battery, its maintenance requires attention; further this circuit should be disconnected while going for any maintenance work.
- Copper wires with proper colour codes are to be given preference for giving connections.
- If capacitors are employed they need to be discharged before attending any works related to them.
- Details of previous accidents / electrical fires in the plant.
- To ensure safety against various threats that accompanied with the incoming electrical supply, the electrical protection panel (LT panel) employed at the metering point should be in line with the one described in Fig 1. of the article titled "Embracing Electrical Safety" that has appeared under the caption "Know thy power network – 156" in the Electrical Installation Engineers Newsletter "Feb 2021".
- Details of static electricity hazards, if any experienced in the plant operation.
- Data on the instances of electrical mischances and close misses if any experiences in the plant
- Details of electrical systems and the techniques followed while issuing work permits (Line clear permits, Interlocks etc.)
- Methods adopted / followed in the plant to convey the importance / awareness of electrical safety in the plant
- Data on the nature of pollution, if any present in the work site; presence of corrosive gases / corrosive environment, use of insulators / insulation that aligns with the pollution present in the work site is to be ensured. In the same way, the chances of moisture ingress are needed to be looked into
- Proper ventilation / enclosures, cooling air circulation for the motors, transformers and other equipment are to be ensured.

Kindly stay tuned for my next article.

*(To be continued)*

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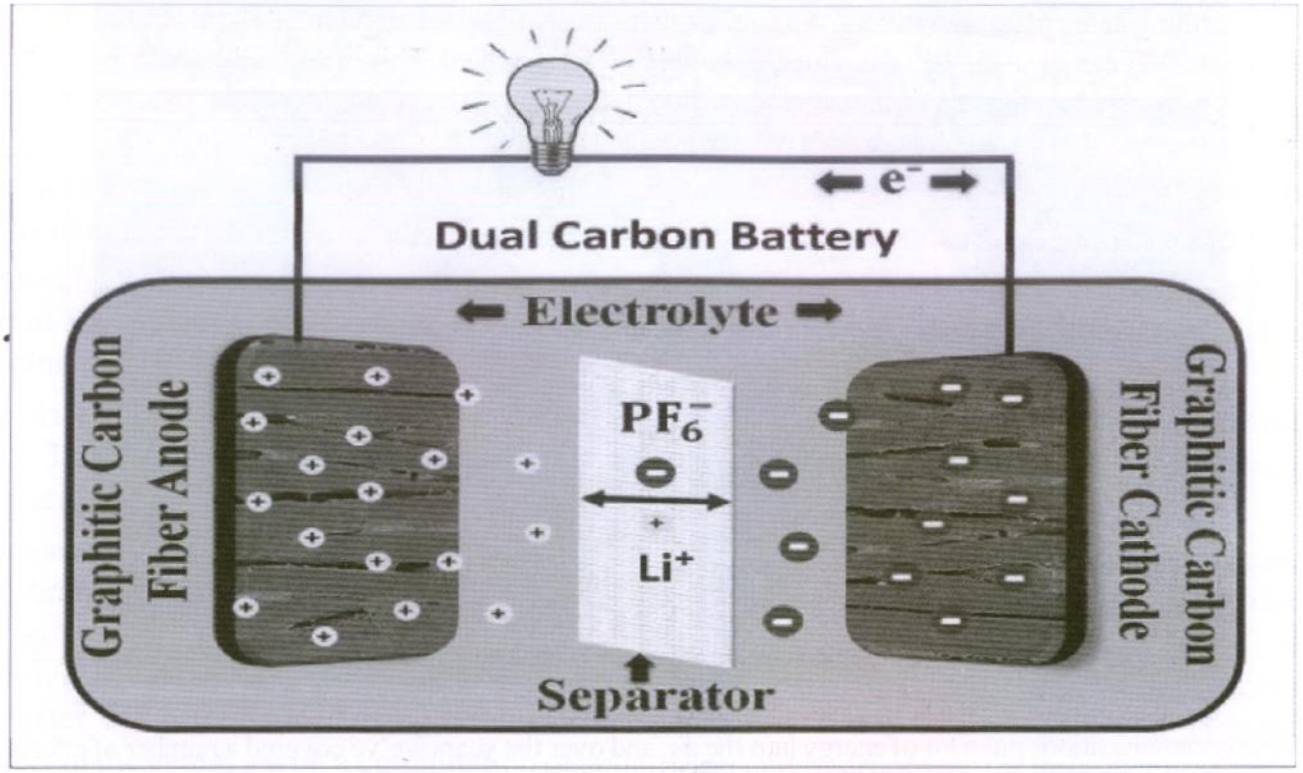
# AN ALTERNATIVE FOR CONVENTIONAL LITHIUM-ION BATTERIES DEVELOPED BY IIT HYDERABAD RESEARCHERS

Electrochemical Energy Storage (EES) Lab at IIT Hyderabad, under the supervision of Dr. Surendra Kumar Martha (Associate Professor, Department of Chemistry) has developed a 5V Dual Carbon Battery utilizing self-standing carbon fiber mats as both electrodes (cathode and anode). This new model sets aside the requirement of toxic, costly, and heavy transitional metals.




Energy economy based on renewable sources has been put forward as a way out to shrug off the dependence on fossil fuel. Rechargeable Lithium-ion batteries (LIBs) are projected to meet future electric mobility, electric aviation, and stationary grid energy storage targets within 2030. However, LIBs need toxic and costly metals like cobalt, nickel, manganese, etc., for functioning. Geologically unsymmetrical distribution of Lithium and cobalt along with geopolitics and unethical child labour centered on mining, causes havoc fluctuationsin raw material cost. It affects the market price stability of large LIB packs used in electric vehicles. In the dual-carbon battery, both the electrodes consist of carbonaceous materials, and the ions from the electrolyte intercalate and de-intercalate into the electrode matrix.

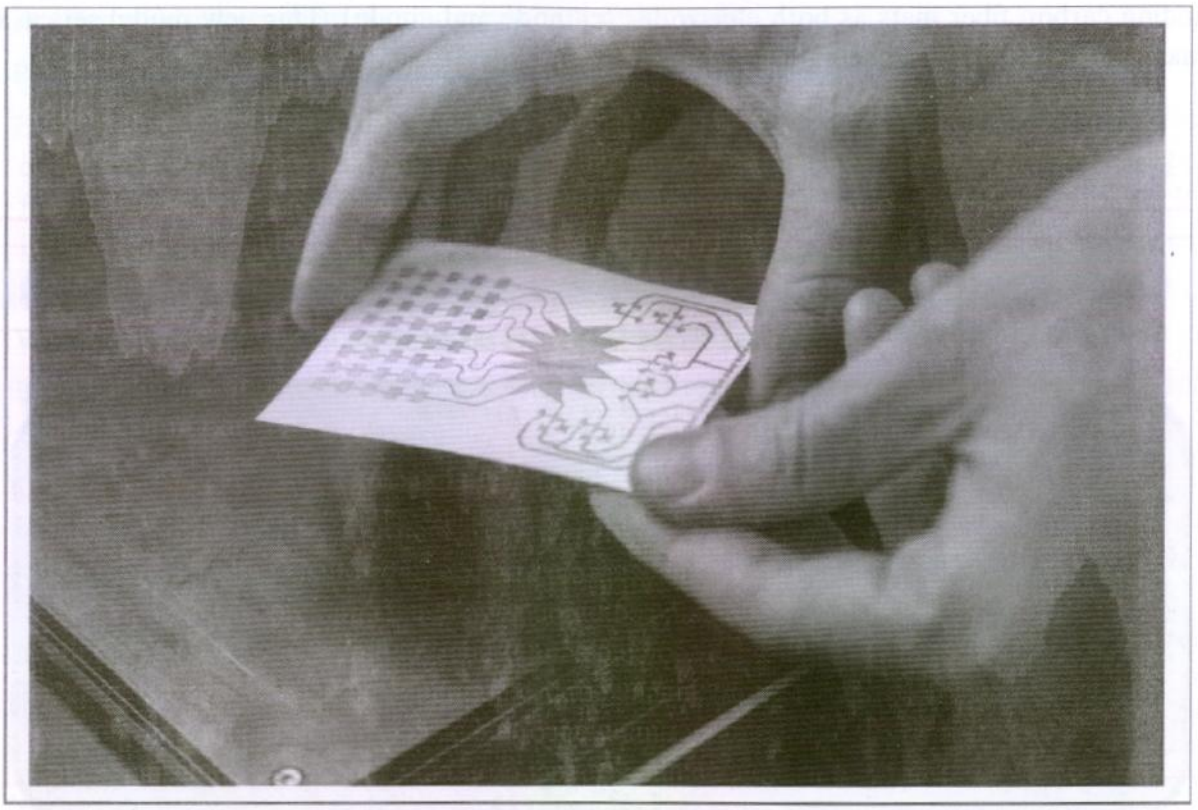
The novel dual carbon battery consisting of zero transition metal is environmentally benign. It may cut down the overall battery cost by 20-25% and is expected to curb the unpredictability in market price.

The use of ubiquitous carbon as electrode active material as well as current collector replacing heavy metals brings in the aspects of lightness and flexibility. The fabricated 5.0 voltage (nominal voltage 4.6 V) cell provides an energy density of 100-watt hour per kilogram approximately and can be extended up to 150- watt hour per kilogram with further modifications.

The research team believes that developed cells may find potential uses in high voltage applications, sophisticated battery-run medical devices, regenerative braking systems in electric vehicles, and stationary grids.

# ENERGY-HARVESTING CARD TREATS 5G NETWORKS AS WIRELESS POWER GRIDS

A team from Georgia Tech has just announced a world-first: a 3D-printed rectifying antenna the size of a playing card that can harvest electromagnetic energy from 5G signals and use it to power devices, turning 5G networks into wireless power grids.



Wireless communications put a lot of energy into the air, and over the years we've covered a number of efforts to harvest that energy. Short-range Wi-Fi signals have been the target of several projects, TV broadcasts and radio signals have been the focus of others. One device even hopes to increase the life of a smartphone's battery by 30 percent just by harvesting some of the radio waves the phone itself is generating.

But 5G communications offer a whole new opportunity. "5G has been designed for blazing fast and low-latency communications," reads the Georgia Tech team's latest study, published in the peer-reviewed journal Scientific Reports. "To do so, mm-wave frequencies were adopted and allowed unprecedently high radiated power densities by the FCC. Unknowingly, the architects of 5G have, thereby, created a wireless power grid capable of powering devices at ranges far exceeding the capabilities of any existing technologies."

Millimeter-wave energy harvesting has been possible for some time, says the team, but hasn't been practical in many cases because long-range power harvesting tends to require large rectifying antennas, and the larger these rectennae get, the narrower their field of view becomes; you have to keep the rectenna pointed right at the wave energy source to make them work.

The team solved this issue using a component called a Rotman lens – the spiky-looking plate in the middle of the card. Rotman lenses are handy in a range of mm-wave applications as a beam-forming tool, effectively turning a single, large, high-gain, narrow-angle antenna beam into a series of simultaneous antenna beams covering a much wider angle. They allow radar systems, for example, to see targets in multiple directions without having to rotate or move the radar itself.

By adding a Rotman lens to their rectenna design, the team says it has now got a printable, bendable energy harvesting system that's directionally agnostic, receiving power from any direction, and capable of pulling in 21 times as much power as "a referenced counterpart" offering the same angular coverage.

We're still not talking about huge amounts of power here; the team says that it should be possible to harvest around 6 microwatts at around 180 meters (590 ft) from a 5G transmitter. But that kind of figure will be more than enough to power a range of small sensors and devices, particularly in the Internet of Things space, simply by harvesting energy that would otherwise be wasted. And the fact that the new rectenna design is printable, flexible and works well even when it's bent means it could be of use in wearable applications as well.

# INDIA'S FIRST-OF-ITS KIND 3.6 GW HYBRID PROJECT TO BE SETUP IN RAJASTHAN AT COST OF RS 30K CR

The Government of Rajasthan has been advancing to establish a first-of-its-kind 3.6 GW integrated project including 3,600 MW solar, 900 MW wind and 2,520 MW pump hydro storage plant.

Renewable energy project developer Greenko Energy will be developing this hybrid project at a cost of Rs 30,000 crore. The solar, wind and pump hydro storage projects will be set up in Pali, Jaisalmer and Shahpura respectively in Rajasthan.

The state has been promoting power storage solutions under the Rajasthan Solar Energy Policy 2019. The Rajasthan Renewable Energy Corporation Ltd (RRECL) has received several proposals for energy storage projects following the policy incentives.

Commenting on the development, Dr. Subodh Agarwal (IAS), CMD of Rajasthan Renewable Energy Corporation Ltd said, "among the projects seeking the policy advantage is a hydropower based storage project proposed to be developed in Baran district of the state. The excess solar-generated electricity will be used to pump water in a reservoir at a designated height. The potential energy of the water will be reclaimed using turbine driven generators. It will be first of its kind integrated project in the country with a combination of solar, wind and hydropower for uninterrupted power supply."

The hydro storage project proposed in Shahpura, Baran district of Rajasthan will be developed at an estimated cost of Rs 11,882 crore. The storage facility will be a standalone pumped storage project of 2520 MW. It will use 1.7 TMC of water but will not consume it as the same will be cycled between top and bottom reservoirs.

"Greenko Group, with a current operational capacity of ~7 GW and a pipeline of ~8 GW, India's leading New Energy company is thankful to the Govt. of Rajasthan for recognizing the importance and potential of Pumped Storage solutions and the numerous benefits they would bring to the State besides offering lowest cost Energy Storage solutions compared numerous technologies globally available today. The Project when completed by 2023-24 would be "World's Largest Renewable Energy Asset" and strengthen and contribute immensely to Rajasthan's efforts as a model state in the adoption of solutions for a sustainable future," said Anil Chalamalasetty, Founder, MD & CEO of Greenko Group.

He further added, "the Integrated Renewable Energy Storage Projects (IRESPs) will ensure achieving long-term stability and reduction of electricity prices by ~20% nationally while enabling Grid Stability, Security and Feasibility for a future of deep decarbonisation of the Indian Energy sector."

# LADAKH TO GET FIRST GEOTHERMAL ENERGY PROJECT IN INDIA

State owned oil and exploration major ONGC will be working on the project in the new Union territory

Oil and Natural Gas Corporation (ONGC) announced on Monday, Feb 8 that it will be implementing India's first geothermal field development project in Ladakh. Geothermal energy involves using the heat generated by the Earth's core for use. Regular people get their closest experience of this geothermal energy near hot springs, which are heated by this heat from the earth's core only.

Globally, over 16 GW of geothermal energy capacity has been created, with the US leading as the leading producer at 3.6 GW. Iceland, which produces just under 800 MW is run predominantly on geothermal energy in fact. By its very nature, geothermal plants can generate energy 24X7, unlike almost every other power source.

India has been believed to not offer ideal conditions for tapping into this 'clean energy' source, something that will be challenged by the attempt in Ladakh. Ladakh, with its cold climate, could benefit much more easily thanks to the many direct heat applications that could benefit the region from geothermal energy.

"A memorandum of understanding (MoU) to formalise this has been inked by ONGC Energy Centre (OEC) with the Union Territory of Ladakh and Ladakh Autonomous Hill Development Council, Leh on February 6," ONGC said in a statement.

ONGC has planned this field development in Ladakh in three phases.

Phase-I involves exploratory-cum-production drilling of wells up to 500 metres depth and setting up of a pilot plant of up to 1 megawatt (MW) power capacity. Phase-II would involve a deeper and lateral exploration of the geothermal reservoir by drilling of an optimal number of wells and setting up of a higher capacity demo plant and preparing a detailed project report.

Phase-III would involve commercial development of the geothermal plant.

"Puga and Chumathang in Eastern Ladakh happen to be the most promising geothermal fields in India. These areas were discovered in the 1970s and initial exploratory efforts were made in 1980s by the Geological Survey of India (GSI).

"But, development efforts to exploit geothermal energy by the government as well as private agencies did not materialise for some reasons. After the creation of UT Ladakh, efforts were taken up earnestly by ONGC Energy Centre, culminating in this MoU," according to the statement .

India has seven geothermal provinces and a number of geothermal springs.

Geothermal resources in India have been mapped by GSI and broad estimate suggests that there could be 10 gigawatt (GW) geothermal power potential, as per the Ministry of New and Renewable Energy (MNRE).

# SMART LIGHTING SOLUTION HARVESTS DAYLIGHT FOR UNDERGROUND LIGHT

Is it possible to develop a 'smart' device that can harvest daylight and then relay this to underground spaces like car parks? Such technology is in progress and it fits with the sustainability drive.

The quest for new forms of lighting, with lower energy costs and a reduced environmental impact, is occupying the time of many physics laboratories around the world. For example, researchers have developed a new dye for solar cells that allows effective power-conversion efficiency at a low cost. The dye permits solar cells to carry on functioning under low-light conditions, and this promises a new generation of self- and low-powered devices.

With the daylight harvesting innovation, this comes from Nanyang Technological University. Here researchers have taken relatively simple technology to create something novel. The researchers have used a acrylic ball, a single plastic optical fibre (a cable that carries a beam of light from one end to another) together with computer chip-assisted motors.

The device is positioned on the ground. During times of daylight, the acrylic ball functions as the solar concentrator. This leads to parallel rays of sunlight to coalesce to form a sharp focus at the opposite side of the device. The focused sunlight can be harvested into the end of a fibre cable. The collected energy is then transported via the cable, underground. Under the ground, light is emitted from fibre cable to the point it is required.

The computer function can automatically adjust the position of the fibre's collecting end. This acts to optimize the quantity of sunlight received and transported. Mechanical adjustments are made, tracking the Sun as it traverses across the sky.

In terms of the application of the technology, in Singapore there is a desire to go deeper underground to create new spaces. This includes infrastructure and utilities, as well as shopping malls and car parks. This is fostering a demand for round-the-clock underground lighting and new, greener solutions are being developed to meet this need in a sustainable manner.

The research appears in the journal Solar Energy, where the research is titled "Hybrid daylight harvesting system using static ball lens concentrator and movable optical fiber."

***I do not want that our loyalty as Indians should be in the slightest way affected by any competitive loyalty whether that loyalty arises out of our religion, out of our culture or out of our language.***
***I want all people to be Indians first, Indian last and nothing else but Indians.— Babasaheb Ambedkar***

# GLOBAL WIND POWER ADDITIONS TO 2030 WILL BE CLOSE TO 1TW

The global wind industry could install nearly 1 terawatt (TW) of new capacity between now and 2030, with much of that added by China, consultancy Wood Mackenzie said on Monday.

China's target of having 1,200 GW of wind and solar by 2030 could result in 408 GW of new wind capacity from 2021 to 2030, almost half of the global total, the report said.

The rest of the Asia Pacific region could add 126 GW to 2030, with India accounting for half of that, while Europe's decarbonisation plans could add 248 GW of new wind capacity.

The extension of a production tax credit in the United States could bring 35 GW of new capacity from 2021 to 2023. From 2024 to the end of the decade, new U.S. offshore capacity is expected to average 4.5 GW per year, the report said.

Wood Mackenzie said a record 114 gigawatts (GW) of capacity was added worldwide last year, up by 82% year on year. China accounted for 72 GW, while the rest of the world added almost 43 GW in 2020, a 15% increase.

A report by the Global Wind Energy Council last week said 93 GW of new capacity being installed in 2020 but the world needed at least 180 GW of new wind energy every year to limit global warming to well below 2°C above pre-industrial levels.

# HUMOUR

Strong Man

The local bar was so sure that its bartender was the strongest man around that they offered a $10,000 bet. The bartender would squeeze a lemon until all the juice ran into a glass, and hand the lemon to a patron. Anyone who could squeeze one more drop of juice out would win the money.

Many people — weightlifters, wrestlers, body builders, etc had tried over time, but nobody could do it.

One day this scrawny little man came in, wearing thick glasses and a safari suit, and said in a tiny, squeaky voice, "I'd like to try the bet." After the laughter had died down, the bartender said okay, grabbed a lemon, and squeezed away. Then he handed the wrinkled remains of the rind to the little man.

But the crowd's laughter turned to total silence as the man clenched his fist around the lemon and 5-6 drops fell into the glass. As the crowd cheered, the bartender paid the $10,000, and asked the little man, "What do you do for a living? Are you a lumberjack, a weightlifter, or what?"

"No," replied the man. "I work as a project manager in a software company!!"

Knowing where to tap is very important

A giant ship engine failed. The ship's owners tried one expert after another, but none of them could figure but how to fix the engine.

Then they brought in an old man who had been fixing ships since he was a young. He carried a large bag of tools with him, and when he arrived, he immediately went to work. He inspected the engine very carefully, top to bottom.

Two of the ship's owners were there, watching this man, hoping he would know what to do. After looking things over, the old man reached into his bag and pulled out a small hammer. He gently tapped something. Instantly, the engine lurched into life. He carefully put his hammer away.

The engine was fixed! A week later, the owners received a bill from the old man for ten thousand dollars. "What?!" the owners exclaimed. "He hardly did anything! So they wrote the old man a note saying, "Please send us an itemized bill."

The man sent a bill that read:

Tapping with a hammer..... $ 2.00

Knowing where to tap..... $ 9,998.00

Effort is important, but knowing where to make an effort in your life makes all the difference.

# 3-PHASE DISTRIBUTION TRANSFORMERS 11 OR 433 KV/415-240V (OUTDOOR TYPE) – 5

**20 BUSHINGS:**

20.1 The bushings shall conform to the relevant standards specified and shall be of outdoor type. The bushing rods and nuts shall be made of brass material 12 mm diameter for both HT and LT bushings. The bushings shall be fixed to the transformers on side with straight pockets and in the same plane or the top cover for transformers above 100 kVA. For transformers of 100 kVA and below the bushing can be mounted on pipes. The tests as per latest IS 2099 and IS 7421 shall be conducted on the transformer bushings.

20.2 For 33 kV, 52 kV class bushings shall be used for transformers of ratings 500 kVA and above. And for transformers below 500 KVA, 33 kV class bushings, for 11 kV, 17.5 kV class bushings and for 0.433 kV, 1.1 kV class bushings shall be used.

20.3 Bushing can be of porcelain/epoxy material. Polymer insulator bushings conforming with relevant IEC can also be used.

20.4 Bushings of plain shades as per IS 3347 shall be mounted on the side of the Tank and not on top cover.

20.5 Dimensions of the bushings of the voltage class shall conform to the Standards specified and dimension of clamping arrangement shall be as per IS 4257

20.6 Minimum external phase to phase and phase to earth clearances of bushing terminals shall be as follows:

| Voltage | Clearance | |
|---|---|---|
| | Phase to phase | Phase to earth |
| 33 kV | 350 mm | 320 mm |
| 11 kV | 255 mm | 140 mm |

The clearances in case of cable box shall be as below:

| Voltage | Clearance | |
|---|---|---|
| | Phase to phase | Phase to earth |
| 33 kV | 350 mm | 220 mm |
| 11 kV | 130 mm | 80 mm |
| LV | 25 mm | 20 mm |

20.7 Arcing horns shall be provided on HV bushings.

20.8 Brazing of all inter connections, jumpers from winding to bushing shall have cross section larger than the winding conductor. All the Brazes shall be qualified as per ASME, section – IX.

20.9 The bushings shall be of reputed make supplied by those manufacturers who are having manufacturing and testing facilities for insulators.

20.10 The terminal arrangement shall not require a separate oil chamber not connected to oil in the main tank.

## 21 TERMINAL CONNECTORS:

21.1 The LV and HV bushing stems shall be provided with suitable terminal connectors as per IS 5082 so as to connect the jumper without disturbing the bushing stem. Connectors shall be with eye bolts so as to receive conductor for HV. Terminal connectors shall be type tested as per IS 5561.

## 22 LIGHTNING ARRESTORS:

22.1 9 kV, 5 kA metal oxide lightning arrestors of reputed make conforming to IS 3070 Part-III, one number per phase shall be provided.( To be mounted on pole or to be fitted under the HV bushing with GI earth strip 25x4 mm connected to the body of the transformer with necessary clamping arrangement as per requirement of purchaser.) Lightening arrestors with polymer insulators in conformance with relevant IEC can also be used.

## 23 CABLE BOXES:

23.1 In case HV/LV terminations are to be made through cables the transformer shall be fitted with suitable cable box on 11 kV side to terminate one 11kV/ 3 core aluminium conductor cable up to 240 sq. mm. (Size as per requirement).

The bidder shall ensure the arrangement of HT Cable box so as to prevent the ingress of moisture into the box due to rain water directly falling on the box. The cable box on HT side shall be of the split type with faces plain and machined and fitted with Neo-k-Tex or similar quality gasket and complete with brass wiping gland to be mounted on separate split type gland plate with nut-bolt arrangement and MS earthing clamp. The bushings of the cable box shall be fitted with nuts and stem to take the cable cores without bending them. The stem shall be of copper with copper nuts. The cross section of the connecting rods shall be stated and shall be adequate for carrying the rated currents. On the HV side the terminal rod shall have a diameter of not less than 12 mm. The material of connecting rod shall be copper. HT Cable support clamp should be provided to avoid tension due to cable weight.

23.2 The transformer shall be fitted with suitable LV cable box having non-magnetic material gland plate with appropriate sized single compression brass glands on LV side to terminate 1.1 kV/single core XLPE armoured cable (Size as per requirement).

## 24 TERMINAL MARKINGS:

High voltage phase windings shall be marked both in the terminal boards inside the tank and on the outside with capital letter 1U, 1V, 1W and low voltage winding for the same phase marked by corresponding small letter 2u, 2v, 2w. The neutral point terminal shall be indicated by the letter 2n. Neutral terminal is to be brought out and connected to local grounding terminal by an earthing strip.

## 25 CURRENT TRANSFORMERS:

25.1 CT s shall be provided for transformers of rating 63 kVA and above and if required by purchaser for ratings below 63 kVA on secondary side.

25.2 Current transformer shall be mounted inside the tank or outside with suitable marshalling box on LV side of the transformer.

25.3 The current transformers shall comply with IS 2705.

25.4 All secondary leads of bushing mounted CT's shall be brought to a terminal box near each bushing.

25.5 The CT terminals shall have shorting facility.

25.6 CT should not get saturated upto 200% of rated current.

25.7 CT shall have the following parameters

| Parameter | Value |
|---|---|
| Accuracy class | 0.5 |
| Burden | 20 VA |
| Application | Metering |
| ISF | 5 |

**26.1** The following standard fittings shall be provided:

i. Rating and terminal marking plates, non-detachable.

ii. Earthing terminals with lugs - 2 Nos.

iii. Lifting lugs for main tank and top cover

iv. Terminal connectors on the HV/LV bushings (For bare terminations only).

v. Thermometer pocket with cap - 1 No.

vi. Air release device

vii. HV bushings - 3 Nos.

viii. LV bushings - 4 Nos.

ix. Pulling lugs

x. Stiffener

xi. Radiators - No. and length may be mentioned (as per heat dissipation calculations) / corrugations.

xii. Arcing horns or 9 kV, 5 kA lightning arrestors on HT side - 3 No.

xiii. Prismatic oil level gauge.

xiv. Drain cum sampling valve.

xv. Top filter valve

xvi. Oil filling hole having p. 1- ¼ „ thread with plug and drain plug on the conservator.

***"As democracy is perfected, the office of president represents, more and more closely, the inner soul of the people. On some great and glorious day the plain folks of the land will reach their heart's desire at last and the White House will be adorned by a downright moron."***

***– H.L. MENCKEN***

xvii. Silicagel breather

xviii. Base channel 75 x 40 mm for up to 100 kVA and 100 mm x 50 mm above 100 kVA, 460 mm long with holes to make them suitable for fixing on a platform or plinth.

xix. 4 No. rollers for transformers of 200 kVA and above.

xx. Pressure relief device or explosion vent.

**27 FASTENERS:**

27.1 All bolts, studs, screw threads, pipe threads, bolt heads and nuts shall comply with the appropriate Indian Standards for metric threads, or the technical equivalent.

27.2 Bolts or studs shall not be less than 6 mm in diameter except when used for small wiring terminals.

27.3 All nuts and pins shall be adequately locked.

27.4 Wherever possible bolts shall be fitted in such a manner that in the event of failure of locking resulting in the nuts working loose and falling off, the bolt will remain in position.

27.5 All ferrous bolts, nuts and washers placed in outdoor positions shall be treated to prevent corrosion, by hot dip galvanising, except high tensile steel bolts and spring washers which shall be electro-galvanised / plated. Appropriate precautions shall be taken to prevent electrolytic action between dissimilar metals.

27.6 Each bolt or stud shall project at least one thread but not more than three threads through the nut, except when otherwise approved for terminal board studs or relay stems. If bolts and nuts are placed so that they are inaccessible by means of ordinary spanners, special spanners shall be provided.

27.7 The length of the screwed portion of the bolts shall be such that no screw thread may form part of a shear plane between members.

27.8 Taper washers shall be provided where necessary.

27.9 Protective washers of suitable material shall be provided front and back of the securing screws.

**28 OVERLOAD CAPACITY:**

28.1 The transformers shall be suitable for loading as per IS 6600.

**29 LIGHTNING ARRESTORS:**

29.1 9 kV, 5 kA metal oxide lightning arrestors Distribution class type of reputed make as per relevant standard , one number per phase shall be provided to be fitted under the HV bushing with GI earth strip 25x4 mm connected to the body of the transformer with necessary clamping arrangement

*(To be continued)*

*Courtesy: www.mstcecommerce.com>RenderFileViewVideo*

***Whoever said that the definition of insanity is doing the same thing over and over again and expecting different results has obviously never had to reboot a computer. – WILLIAM PETERSEN***

# ELECTRICAL MAINTENANCE UNIT
# (QUESTION & ANSWERS) - 7

101. What is battery?

The combination of two or more cells is called the battery.

102. What are the classifications of cell?

a. Primary cells.

b. Secondary cells.

103. What are the differences between primary cell and secondary cell?

Primary cells are those cells, which cannot be re-charged after the substances (electrolyte, electrode and container) used in it becomes useless.

The common primary cells in use are,

a. Simple voltaic cell (one fluid cell).

b. Daniel cell (two fluid cell).

c. Leclanche cell (two fluid cell).

d. Dry cell.

e. Standard cell or Weston cadmium cell.

Secondary cells are those cells, which can be re-charged and use again once they discharged or used for the work for number of times without re-newing it's materials.

Most commonly used secondary cells are,

a. Lead acid cell.

b. Nickel iron alkaline cell.

c. Nickel cadmium alkaline cell.

104. What is polarization? What is local action?

**Polarization**

The hydrogen bubbles which are clinging over the surface of copper electrode (anode) becomes a thin film of hydrogen over the copper electrode. This hydrogen film increases the internal resistance and reduces the emf of the cell and hence the cell soon becomes inactive. This effect is known as polarization.

**Local action**

In voltaic cell it is observed that, when the cell is not connected to the load and not supplying any current zinc will continuously dissolving in the electrolyte. This is due to the impurities (copper, iron, tin, and lead) in the commercial zinc. So that whenever commercial zinc is used as a electrode, separate small cells are developed between the impurities and zinc with the presence of electrolyte. These local cells consume always zinc and the emf developed by those local cells are always opposite to the main emf. The action of these cells is known as local action.

105. What are the advantages of secondary cells over primary cell?

a. It gives high current capacity.

b. Its internal resistance is very low.

c. It gives a constant current.

d. It posses very high efficiency.

e. It posses fairly constant emf.

f. It posses good mechanical strength.

g. It posses large storage capacity.

h. It can be renewed by charging after it is discharge.

i. It is durable.

106. What is Plante plate and Faure plate?

There are two types of positive plate preparation. They are Plante plate and Faure plate.

**Plante plate**

As per plante process positive plate PbO2 are prepared by a process of repeated charging and discharging of pure lead. Positive plates, which are made by this process, are also called 'formal plates'. This process of positive plate preparation required very long time for it's manufacturing and so it is very costly.

**Faure plate**

Faure plates are generally made up of rectangular lead grid into which the active material lead peroxide PbO2 is filled in the form of paste.

107. How negative plate is made up of?

The negative plate of a lead acid cell is made up of spongy lead 'Pb'. The negative plates are also of rectangular lead grid and the active material Pb in the form of paste is held firmly in this lead grid.

108. Why negative plates are one more than positive plates?

Negative plates are one more than positive plates so as to get negative plates on both the sides of positive plates. This is to prevent the buckling action of the lead on positive plate in the multi plate lead acid cell. The other reason is that both the sides of positive plates will become active and the efficiency of the positive plate and the cell will increase.

109. What is electrolyte?

Electrolyte is the medium through which the current produces chemical changes.

Electrolyte is a mixture of sulphuric acid o 1.85 specific gravity (concentrated sulphuric acid) diluted with distilled water in the ratio of 1:3 approximately, so the specific gravity of the dilute sulphuric acid is 1.280.

110. What are the types of grouping of cells?

There are three main ways of grouping.

a. Series grouping.

b. Parallel grouping.

c. Series parallel grouping.

111. What are the advantages of series grouping and parallel grouping?

**Advantages of series grouping**

a. The total emf increases and is equal to 'nE'. Where n – total number of cells in series and E – emf of one cell.

b. The internal resistance 'r' also increases and equal to 'nr'. So total resistance of the circuit also increases and is equal to R + nr ohms. Where R – external load resistance.

c. Total current is equal to one cell current. That is there is no current increase. If the internal resistance is negligible or less then current will be maximum.

**Advantages of parallel grouping**

a. In parallel grouping emf of one cell will be the total emf of the grouping.

b. Total internal resistance of the parallel group is equal to r/n.

c. Total resistance of the group is equal to R + r/n.

d. Total current = E / (R +r/n) amps.

So we can understand that parallel useful when the external resistance is small as compared to internal resistance of the parallel group. But at the same time series grouping is useful when the internal resistance is small compared to the external resistance of the group.

112. What are the methods of charging of battery.

Mainly there are three types of charging of battery.

a. Constant current charging system.

In this system the charging current is kept to constant by varying the supplied DC voltage by the help of rheostat or filament lamps in series with the battery, so as to over come the increased back emf of the battery or of the cell.

Charging current = V – Eb / R + r amps.

b. Constant voltage or potential charging.

In this system the voltage is kept to constant, so the charging current in the beginning will be high when the back emf or counter emf of the battery is low and current will be small when the back or counter emf increases as the battery gets charge.

c. Trickle charging system.

The continuous charging of a battery at a very low rate for keeping the battery ready in good working condition is called the trickle charging. This is to maintain the losses occurring at the idle period. The value of the trickle charging current is approximately 2% of the full charging current of the battery.

***Will Great Britain have an unwilling India dragged into war or a willing ally co-operating with her in the prosecution of a defence of true democracy? — MAHATMA GANDHI***

113. What are the factors on which the capacity of the battery depends?

The capacity of the battery is measured in ampere-hour. The capacity of the battery depends upon the following factors.

a. Number and area of the positive plate.

b. Discharge voltage. A cell should not be discharged below 1.8 V. If it is discharged below 1.8 V it may cause to reduce the capacity.

c. Discharge rate. Capacity decreases with increase rate of discharge.

d. Specific gravity of electrolyte. With rapid rate of discharge causes to weaken the electrolyte so the chemical action also weakens and there by the capacity decreases. When the specific gravity increases the capacity of the battery increases.

e. Quantity of electrolyte. Electrolyte level should be at the top plate level.

f. The design of separator. The design of the separator should be thin.

g. Temperature. When the temperature increases the resistance of the battery decreases and the capacity increases.

114. Explain Kirchhoff's laws.

Kirchhoff's laws are used in complex network circuits to determine the equivalent total resistance and the current flowing in various conductors of that circuit.

Mainly there are two laws.

a. Point law or current law.

b. Mesh law or voltage law.

**Point law or current law**

The point law states that, the algebraic sum of the currents meeting at any point or junction or node of a network is zero. In other words the sum of the currents flowing towards the junction or node or any point of network is equal to the total current flowing away from that junction.

**Mesh law or voltage law.**

The mesh law states that, in any closed electrical circuit the algebraic sum of the potential drops is equal to the sum of the impressed emf's acting in that close circuit. In this the important factor is to determine the emf sign to calculate the total emf.

115. What are the types of wiring?

Mainly there are two types of wiring systems.

a. Tree system.

b. Distribution system.

*(To be continued)*

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

***Lokmanya Tilak said "Swaraj is my birthright" but now the people of India must say, "Surajya is my birthright". — NARENDRA MODI***

# AN INNOVATIVE DESIGN OF THREE PHASE 315 KVA, 11/0.433KV OIL IMMERSED DISTRIBUTION TRANSFORMER - 2

Weight of complete set of core in kg

= (3* W/H * 4 * C/L) + (2 * Width of 1st step * 0.86) * gross area of core * density of core material * 0.97 * $10^{-3}$

Weight of copper conductor,

= 3 * 3.142* mean diameter of coil * turns * conductor area * density of copper * $10^{-6}$

Size of copper conductor:

| | |
|---|---|
| LV - 9.00*3.3/ 0.35PI | Strip wire |
| HV - 3.00/0.30 PI | Round wire |

Total number of LV turn is 40. And total number of HV turn is 1848. Which has seven tapping position at different tap number in the winding of coils. And has no transposition in the winding. Temperature rise of oil is 45°C and winding temperature rise 40°C.

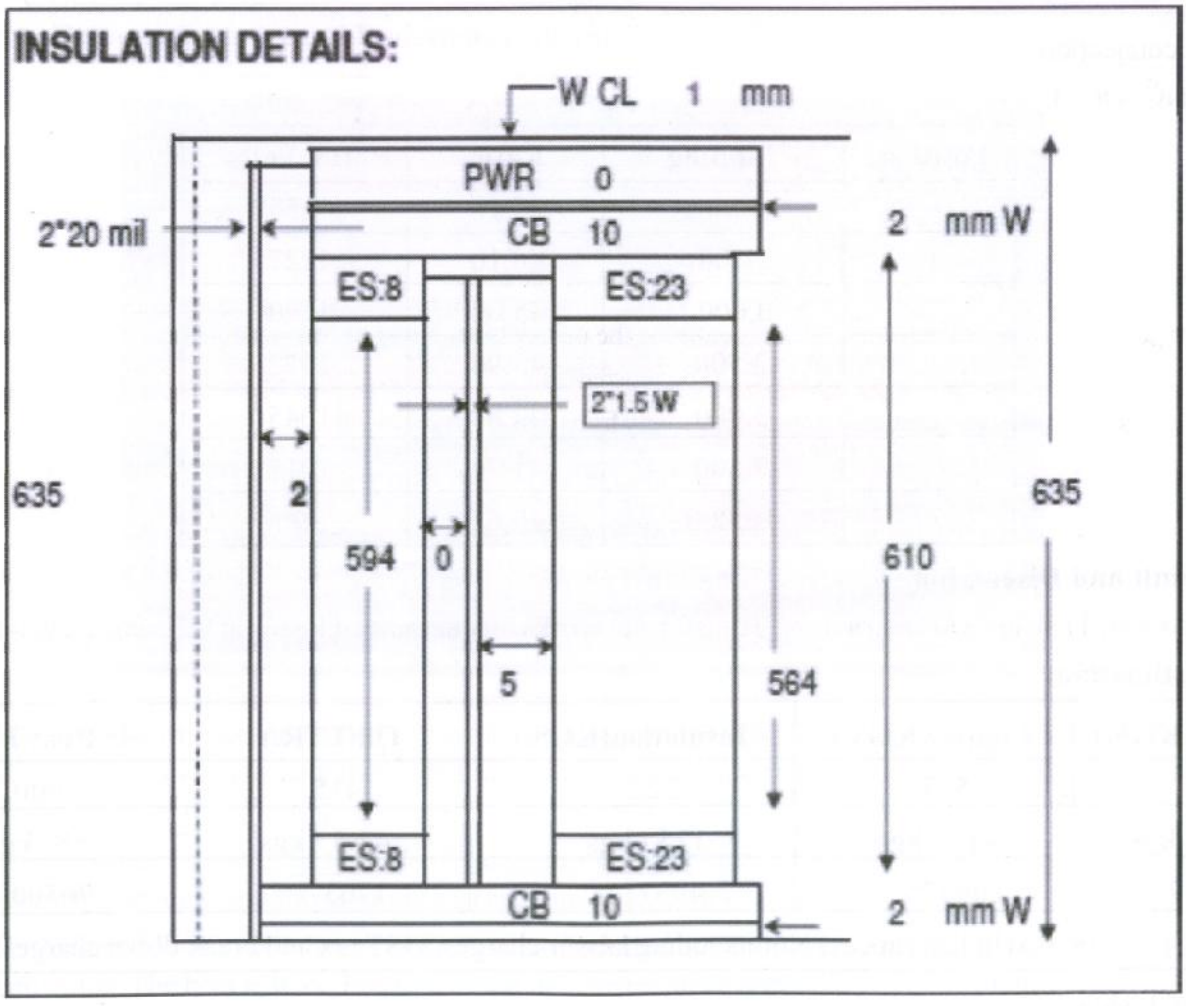



**Fig 1 Insulation Details**

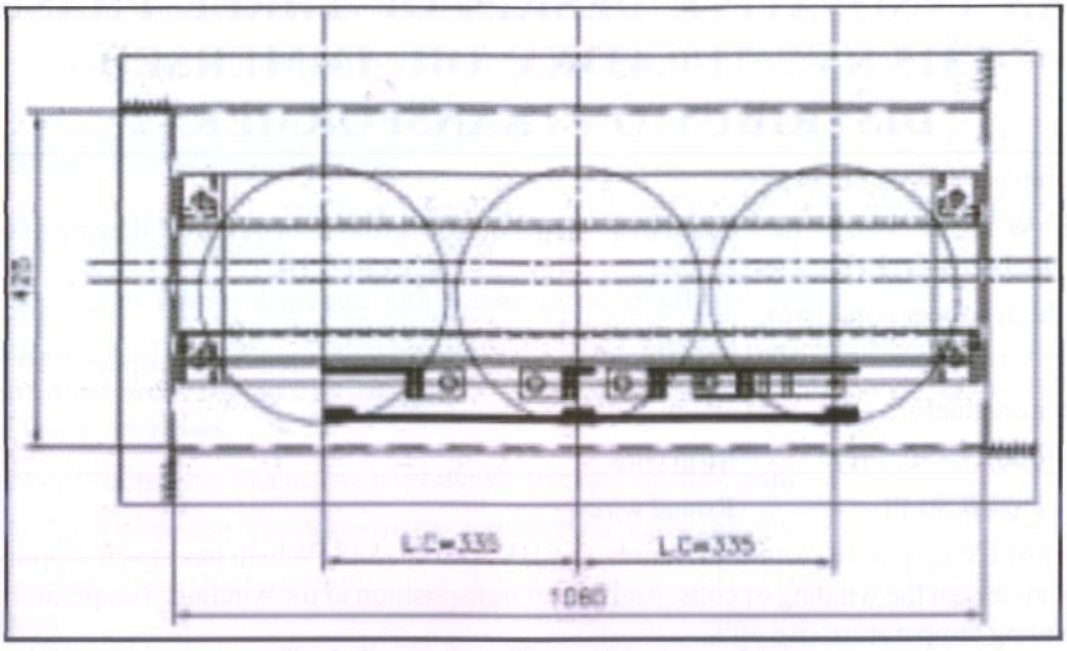



**Fig 2 Geometry of core type transformer**

LV/HV connection

TAPPING: OCTC

| Position | % Tapping | Ratio | HV Volts |
|---|---|---|---|
| 1 | 5.00 | 47.18 | 11550 |
| 2 | 2.500 | 46.10 | 11275 |
| 3 | 0.000 | 45.00 | 11000 |
| 4 | -2.500 | 43.90 | 10725 |
| 5 | -5.000 | 42.80 | 10450 |
| 6 | -7.500 | 41.70 | 10175 |
| 7 | -10.000 | 40.62 | 9900 |

## III. Result and Discussion

The 315KVA, 11/0.433KV Distribution Transformer works on guaranteed losses in Efficiency level-1

**Cost Estimation:**

| Core(KGS.) | Copper(KGS.) | Insulation(KGS.) | Oil(LTR.) | Ms Item(KGS.) |
|---|---|---|---|---|
| 469 | 505 | 32.3 | 415 | 900 |
| 161 / kgs | 415 / kgs | 125 / kgs | 42.5 / kgs | 85 / kgs |
| 75509/= | 209575/= | 40375/= | 17637/= | 76500/= |

Total = 4,19,596.00 (Indian rupees) Not including labour charges, GST tax and break down charges.

## IV. Conclusion

This paper proposed to design a 315kVA, 11/0.433kV, Delta/Star, Distribution Transformer with the guaranteed losses. Total loss of the 315kVA, 11000/433V transformer is about **2532**W at 100% Load. Resistance per

phase at 75ÚC on LV side 0.002035 ohms and on HV side 4.6014 ohms. And if we use FR3 oil which is made of grown soya beans and has fire point 360ÚC and

Environmental Friendly. Proven to increase the life of transformers paper insulation material by decades, increasing the transformer asset's life

**V. Future Scope**

In the Design of 315kVA, 11/0.433kV Distribution Transformers we can minimize the losses by using a better quality of CRGO and copper (PICC) and increase the life of transformer by using a better quality of insulating oil i.e., Edible oil instead of mineral oil. Edible oil not only increase the life of Transformers but also environmental friendly.

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*Sam Higginbottom University of Agriculture, Technology and Sciences*
*Courtesy: International Journal of Engineering Development and Research (www.ijedr.org)*

# HOW GENERATORS WORK - 2

**Generator Exhaust Systems and Emissions Controls**

As machines that burn fossil fuels and run continuously, even if that run time is erratic, generators must be equipped with components to cool them off and to filter emissions. Generator cooling and ventilation systems reduce and remove heat in a variety of ways:

- Water. Water can be used to cool off generator components. This type of coolant system is typically limited to specific situations or very large units of 2,250 kW and higher.
- Hydrogen. Hydrogen is a very efficient coolant that is used to absorb heat given off by a running generator. The heat is transferred to a heat exchanger and a secondary cooling circuit, often located in large, on-site cooling towers.
- Radiators and fans. Smaller generators are cooled through a combination of a standard radiator and fan.

The fumes emitted by generators are just like the exhaust given off by other gas or diesel powered engines. They include toxic chemicals, like carbon dioxide, which must be filtered and removed from emissions. The generator exhaust system manages this task.

Exhaust pipes are connected to the engine where they direct fumes up, out, and away from the generator and the facility. The pipe extends outside the building housing the generator and should terminate far away from doors, windows, and other areas of air intake.

In addition to exhaust systems, some generators are subject to federal emission controls. The generator emissions monitored are: Nitrogen Oxide (NOx), Hydrocarbons, Carbon Monoxide (CO), and Particulate Matter.

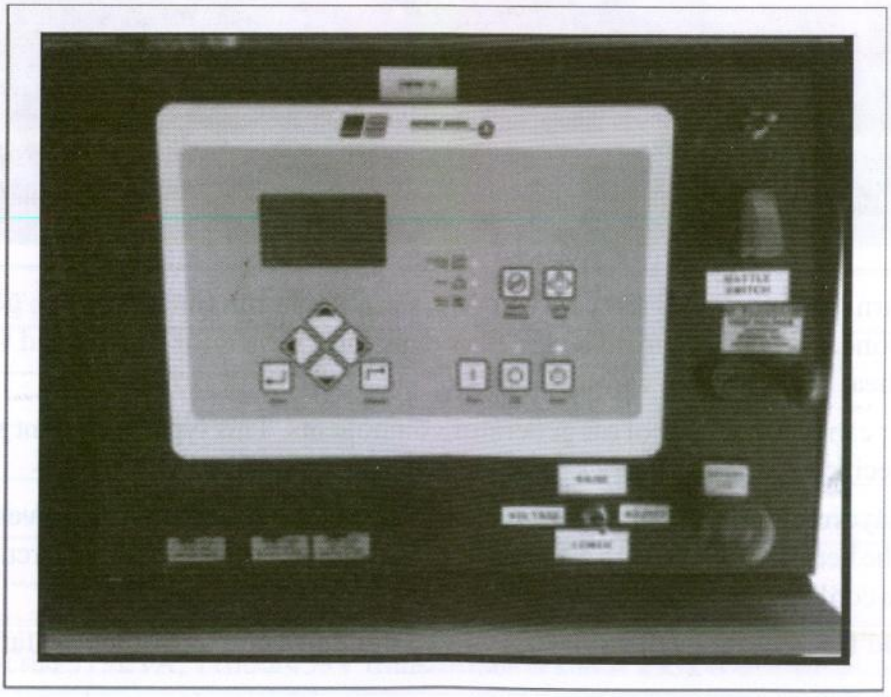
In general, emergency generators and generators that run for less than 100 hours per year are not subject to federal generator emissions requirements, however, permanently installed prime generators and standby generators are subject to federal emissions requirements under three EPA rules:

- **National Emission Standard for Hazardous Air Pollutants (NESHAP) – For Reciprocating Internal Combustion Engines (RICE).** 40 Code of Federal Regulations Part 63, *Subpart ZZZZ*. Also known as the RICE rule.
- **New Source Performance Standards (NSPS) – Standards of performance for stationary spark ignition engines**. 40 CFR, Part 60, *Subpart JJJJ*. Also known as the spark ignition NSPS rule.
- **Standards of Performance for Stationary Compression Ignition Internal Combustion Engines**. 40 CFR, Part 60, *Subpart IIII*. Also known as the compression Ignition NSPS rule.

The good news is that many newer gensets already meet generator emissions standards thanks to manufacturing improvements. Older gensets may be grandfathered in, making them exempt from federal regulations, and subject only to state and local emissions standards. Emissions control requirements vary by manufacturer, generator size, and production date so the best way to determine your emissions requirements is to talk to your generator dealer or manufacturer.

For a deeper look at emission regulations, read this white paper from Cummins, *"The Impact of Tier 4 Emission Regulations on the Power Generation Industry"*.

**The Generator Control Panel And Automatic Transfer Switch (ATS)**



One of the most important components of modern-day generators is the generator control panel. The control panel is the brains of the generator and is also the user interface of the generator; the point at which you'll access and control generator operation.

Many control panels feature an Automatic Transfer Switch (ATS), which continuously monitors incoming power. When the power level drops or cuts out entirely, the ATS signals the control panel to start up the generator. Likewise, when incoming power is restored, the ATS signals the control panel to shut the generator down and reconnects to power grid.

In addition to 24/7 monitoring, the generator control panel provides a wealth of information for site managers:

- **Engine gauges** provide important information about oil and fluid levels, battery voltage, engine speed, and operational hours. In many gensets, the panel will even automatically shut down the engine when it detects a problem with fluid levels or other aspects of generator operation.
- **Generator gauges** provide valuable information about output current, voltage, and operating frequency.

**What Kind of Maintenance Does A Generator Require?**

Generators are engines and require routine engine maintenance to ensure proper operation. Since many generators are relied on to provide back-up power in the event of emergencies, it is crucial for operators to conduct regular checks and inspections of their gensets to ensure the machine will operate as needed, when needed.

The best generator maintenance routine is the one recommended by the manufacturer, but, at a minimum, all generator maintenance plans should include regular and routine:

- Inspection and removal of worn parts.
- Checking of fluid levels, including coolant and fuel.
- Inspection and cleaning of the battery.
- Conducting of a load bank test on the generator and automatic transfer switch.
- Checking of the control panel to ensure accuracy of readings and indicators.
- Changing of the air and fuel filters.
- Inspection of the cooling system.
- Lubrication of parts as needed.

Be sure to maintain a maintenance log for recordkeeping. Include all readings, fluid levels, etc. along with the date and the hour meter reading of the generator. These records can be compared against future records and used to help detect abnormalities or changes in operation which may clue you in to hidden issues that could become major problems if left unchecked.

Generators can last for decades when properly maintained. These simple, small investments will definitely pay off over time by saving on expensive repairs or even full genset replacement. If generator maintenance isn't something you can manage in-house, many generator dealers offer maintenance contracts or can recommend qualified maintenance technicians to help you keep your generator in tip-top shape year after year after year. It's time and money well spent if it can keep your business up and running when the power goes out.

*(To be continued)*

*Courtesy: Critical Power Products & Services*

***India offers demographic dividend, democracy and demand ... 3D. I have added a new D. De-regulation. — NARENDRA MODI***

The following HID sources are listed in increasing order of efficacy:

- mercury vapour
- metal halide
- high pressure sodium
- low pressure sodium

**Mercury Vapour**

Clear mercury vapor lamps, which produce a blue-green light, consist of a mercury-vapour arc tube with tungsten electrodes at both ends. These lamps have the lowest efficacies of the HID family, rapid lumen depreciation, and a low colour rendering index. Because of these characteristics, other HID sources have replaced mercury vapour lamps in many applications. However, mercury vapor lamps are still popular sources for landscape illumination because of their 24,000 hour lamp life and vivid portrayal of green landscapes.

The arc is contained in an inner bulb called the arc tube. The arc tube is filled with high purity mercury and argon gas. The arc tube is enclosed within the outer bulb, which is filled with nitrogen.

Colour improved mercury lamps use a phosphor coating on the inner wall of the bulb to improve the colour rendering index, resulting in slight reductions in efficiency.

**Metal Halide**

These lamps are similar to mercury vapor lamps but use metal halide additives inside the arc tube along with the mercury and argon. These additives enable the lamp to produce more visible light per watt with improved colour rendition.

Wattages range from 32 to 2,000, offering a wide range of indoor and outdoor applications. The efficacy of metal halide lamps ranges from 50 to 115 lumens per watt typically about double that of mercury vapour. In short, metal halide lamps have several advantages.

- high efficacy
- good colour rendering
- wide range of wattages

However, they also have some operating limitations:

- The rated life of metal halide lamps is shorter than other HID sources~ lower-wattage lamps last less than 7500 hours while high-wattage lamps last an average of 15,000 to 20,000 hours.
- The colour may vary from lamp to lamp and may shift over the life of the lamp and during dimming.

Because of the good colour rendition and high lumen output, these lamps are good for sports arenas and stadiums. Indoor uses include large auditoriums and convention halls. These lamps are sometimes used for general outdoor lighting, such as parking facilities, but a high pressure sodium system is typically a better choice.

**High Pressure Sodium**

The **high pressure sodium (HPS)** lamp is widely used for outdoor and industrial applications. Its higher efficacy makes it a better choice than metal halide for these applications, especially when good colour rendering is not a priority. HPS lamps differ from mercury and metal-halide lamps in that they do not contain starting electrodes~ the ballast circuit includes a high-voltage electronic starter. The arc tube is made of a ceramic material which can withstand temperatures up to 2372F. It is filled with xenon to help start the arc, as well as a sodium-mercury gas mixture.

The efficacy of the lamp is very high (as much as 140 lumens per watt). For example, a 400-watt high pressure sodium lamp produces 50,000 initial lumens. The same wattage metal halide lamp produces 40,000 initial lumens, and the 400 watt mercury vapor lamp produces only 21,000 initially.

Sodium, the major element used, produces the "golden" colour that is characteristic of HPS lamps. Although HPS lamps are not generally recommended for applications where colour rendering is critical, HPS colour rendering properties are being improved. Some HPS lamps are now available in "deluxe" and "white" colours that provide higher colour temperature and improved colour rendition. The efficacy of low-wattage "white" HPS lamps is lower than that of metal halide lamps (lumens per watt of low-wattage metal halide is 75-85, while white HPS is 50-60 LPW).

**Low Pressure Sodium**

Although **low pressure sodium (LPS)** lamps are similar to fluorescent systems (because they are low pressure systems), they are commonly included in the HID family. LPS lamps are the most efficacious light sources, but they produce the poorest quality light of all the lamp types. Being a monochromatic light source, all colours appear black, white or shades of gray under an LPS source. LPS lamps are available in wattages ranging from 18-180.

LPS lamp use has been generally limited to outdoor applications such as security or street lighting and indoor, low-wattage applications where colour quality is not important (e.g. stairwells). However, because the colour rendition is so poor, many municipalities do not allow them for roadway lighting.

Because the LPS lamps are "extended" (like fluorescent), they are less effective in directing and controlling a light beam, compared with "point sources" like high-pressure sodium and metal halide. Therefore, lower mounting heights will provide better results with LPS lamps. To compare a LPS installation with other alternatives, calculate the installation efficacy as the average maintained foot-candles divided by the input watts per square foot of illuminated area. The input wattage of an LPS system increases over time to maintain consistent light output over the lamp life.

The low-pressure sodium lamp can explode if the sodium comes in contact with water. Dispose of these lamps according to the manufacturer's instructions.

**BALLASTS**

- Fluorescent Ballasts
- HID Ballasts

All discharge lamps (fluorescent and HID) require an auxiliary piece of equipment called a ballast. Ballasts have three main functions:

- provide correct **starting voltage**, because lamps require a higher voltage to start than to operate
- **match the line voltage** to the operating voltage of the lamp
- **limit the lamp current** to prevent immediate destruction, because once the arc is struck the lamp impedance decreases

Because ballasts are an integral component of the lighting system, they have a direct impact on light output. The ballast factor is the ratio of a lamp's light output using a standard reference ballast, compared to the lamp's rated light output on a laboratory standard ballast. General purpose ballasts have a ballast factor that is less than one; special ballasts may have a ballast factor greater than one.

*(To be continued)*

*Courtesy: U.S. EPA Green Lights*

***If I find the constitution being misused, I shall be the first to burn it.***
***– Babasaheb Ambedkar***

# OPERATION AND MAINTENANCE MANUAL FOR UNI-SOLAR POWERBOND EPVL - 2

**System Performance Verification**

Once you have validated that the solar array has been correctly wired and configured, the final step is to verify that the system is performing properly.

The following tests can only be performed once the inverter has been connected into the circuit and commissioned in accordance with manufacturer instructions.

These tests, together with the majority of the checks included in the visual audit, should be performed every time there is an operation and maintenance visit.

- Measure and record the operating voltage of each series string and verify that all strings feeding the same inverter have a similar operating voltage (within ± 5V of each other). Any difference greater than 5V between strings needs to be investigated
- Measure and record the operating current of each series string and verify that all strings with the same number of laminates, have a similar operating current (within ± 1A of each other). A variation in operating current can indicate areas of the array which are shaded or need cleaning
- Check the alarm status of each inverter
- Record DC and AC power at the input and output of the inverter, and determine inverter operating efficiency
- Perform and record insulation resistance ($R_{iso}$) on the input to each inverter

**Inspection / Routine Maintenance**

A grid connected solar system is a potentially dangerous, high voltage electrical generator. It should be inspected at least every six (6) months to ensure that all system components are working correctly.

Proper maintenance should occur at least before the onset of both summer and winter.

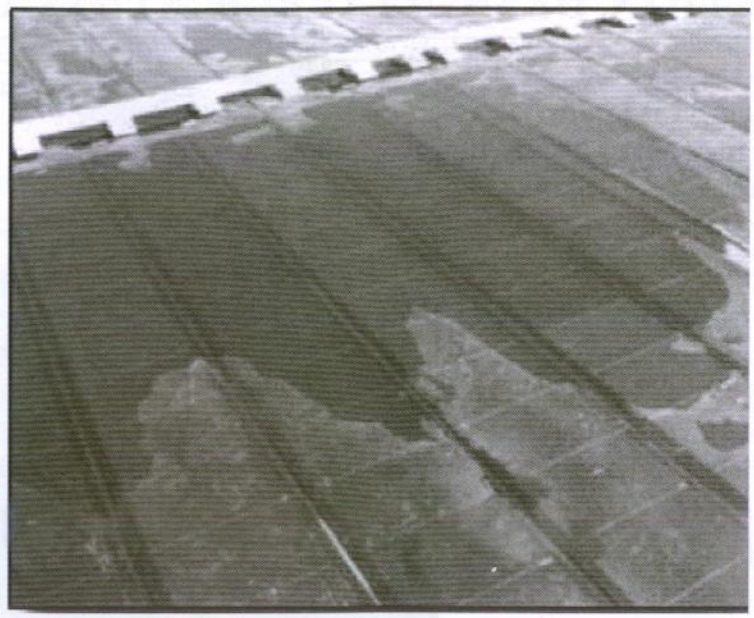
If your system is fitted with monitoring software, this can give you advance warning of potential problems.

This can give you the opportunity to perform corrective action before a problem becomes serious.

Ground fault alarms should always be investigated.

On each operation and maintenance visit, the following should be validated:

- Ensure that appropriate safety signs are in place at each access point to the installation
- 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. If this de-bonding gets worse over subsequent maintenance visits, then contact your USO representative for repair advice
- Check the top surface of each laminate for any scratches or surface damage. Patch any surface damage in accordance with USO repair guidelines (contact your USO representative) without delay
- Clean laminates which are particularly dirty or have localized shading (bird droppings, leaves, etc.)
- During the pre-summer visit, check the extent of dirt on the solar array and perform cleaning if this is warranted (refer to the Cleaning Process section on page 10)
- Verify that all laminates are located in areas that have no shading, and remove temporary objects that may be shading the array and reducing system performance. For example, prune trees that may be shading the array during the summer months.
- Ensure that the drainage system is not blocked and that there is no potential for water pooling on the laminates
- Inspect cables, verifying that adequate strain relief is provided and the connections are tight



**Water pooling: laminates should not be subjected to water pooling**

## Maintenance Verifications

The following tests should only be performed by trained and qualified personnel. The best weather conditions that will provide the most accurate system tests are cloudless days with strong sun conditions.

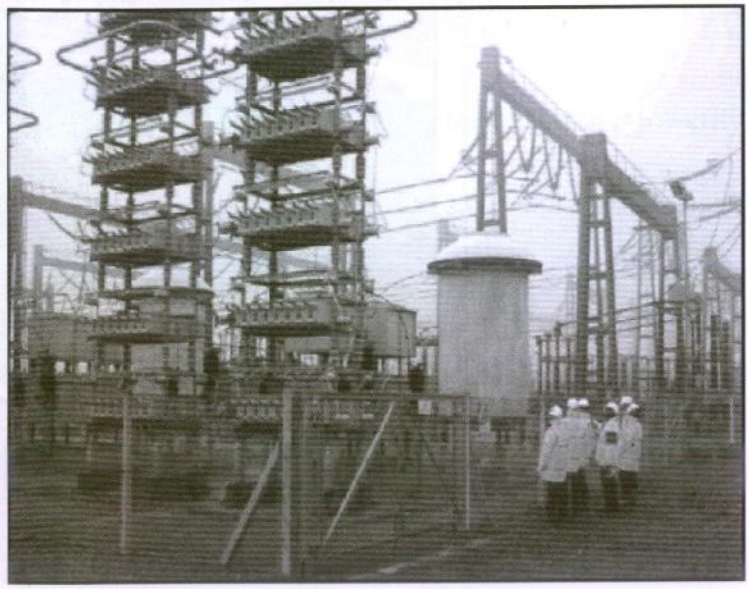
- Before starting PV system maintenance, check that non-current metal parts (array frames, metal roofing pans, junction box enclosures, DC disconnect switch enclosures, inverter enclosures) are grounded properly
- If more than one ground rod is being used, verify that all ground rods are bonded together with appropriately sized conductors
- Measure and record the open circuit voltage of each series string, verifying that all strings that are feeding the same inverter have the same polarity and a similar open circuit voltage (within ± 5V of each other). If the variation in string voltages is greater than 5V, check the individual connections to that string of laminates
- Measure and record the operating current of each series string and verify that all strings with the same number of laminates have a similar operating current (within ± 1A of each other). A variation in operating current can indicate areas of the array which are shaded or are particularly dirty and should be investigated further
- Check the alarm status of each inverter and also the historical alarm log if this is available (refer to inverter manufacturer's manual). Any alarm which indicates either a low resistance or an earth leakage fault should be investigated as soon as weather conditions permit, by suitably qualified personnel
- Record DC and AC power (at the input and output of the inverter) and determine inverter operating efficiency
- Perform and record insulation resistance ($R_{iso}$) on the input to each inverter
- Check that system fuses and DC disconnect switches are operational
- Perform maintenance on the inverter(s) as stipulated by the manufacturer (clean filters, etc.)

*(To be continued)*

*Courtesy: Unisolar*

# SUBSTATION DESIGN / APPLICATION GUIDE

## 1. Introduction



The purpose of this document is to provide a general guide to the design of an Air Insulated Switchgear (AIS) and a Gas Insulated Switchgear (GIS) of an AC substation. The document is divided into 12 chapters starting from Electrical Arrangement to Lightning and Earthing Protection.

In general this application guide will provide some basic understandings about the HV equipments on substation designs for HVAC and HVDC substation projects.

This guide is written specifically for new electrical graduate engineers who embark on a career on HVAC and HVDC substation projects.

The chapter two covers the electrical arrangements, the basic concepts and factors affecting the design of AC substation.

The chapter three includes the AC substation arrangement. The substation different configurations are characterised by their bus-bar arrangements and generally any number of circuits can be provided by repeating the pattern. The AC substation comprises three main components and these are classified as primary system, secondary system and auxiliary supply system.

The chapters four and five deal with protection equipment and protection of main components of substation. These chapters will help application engineers to select suitable electrical equipments such as CT's, VT's, relays etc. for the appropriate protection functions. The protection should be done to prevent any disruption of supply and damage to the electrical equipments.

The chapters six and eight cover Compensation and Flexible AC transmission System (FACTS). FACTS is an acronym for Flexible AC Transmission System. The philosophy of FACTS is to use reactive power compensation devices to control power flows in a transmission network, thereby allowing transmission line plant to be loaded to its full capability.

The chapter seven covers Auxiliary System.

The chapter nine covers Wind Farm substation equipments. Electricity generated from renewable sources now accounts for around 4% of the UK's supply, with more planned, including an increase in the amount generated from Offshore and Onshore farms.

The chapters ten and eleven cover Ferro-resonance and Quadrature Booster.

The Chapter twelve includes HVDC equipment/description.

The chapter thirteen covers Lightning and Earthing protections, which prevent any damage to substation equipment and loss of power to public.

## 2. Electrical Arrangement

### 2.1 Factors Affecting The Design

**Service Continuity (under fault and maintenance conditions)**

- what security of service does the load require, what length of outage can be tolerated and would this cause loss of revenue or endanger plant?

- is insulator pollution going to necessitate more than normal maintenance?
- will outages for maintenance require alternative circuits in the substation or are they available elsewhere in the network?

**Cost**

- this must be balanced against the facilities desirable

**'Protection**

- can adequate relay protection be obtained simply?

**Operational Facilities**

- does the system require splitting under maximum plant conditions to limit fault level?
- will it be necessary to isolate any loads with undesirable characteristics (e.g. rectifier drive rolling mills, arc furnaces) except under emergency conditions?

**Extension**

- almost invariably required, though not always considered
- what outage can be allowed for extension work?
- if outage to be minimal, may mean extra initial cost

**Service Continuity i.e. Strategic Importance**

- permissible level of disturbance from a single fault
- extent of circuit disconnection due to bus-bar outage
- extent of circuit loss due to circuit breaker/plant maintenance
- associated costs of loss supply, PowerGen, NPower etc. vs Domestic user

**Operational Flexibility**

- duplication of circuits to give alternative routes
- switching of generation for peaks and troughs in demand

**Amount of Power to be Transmitted**

- sectioning of bus-bars to cater for large numbers of generators/power modules

**Number of Circuits Entering the Substation**

- some arrangements are limited to a finite number of circuits

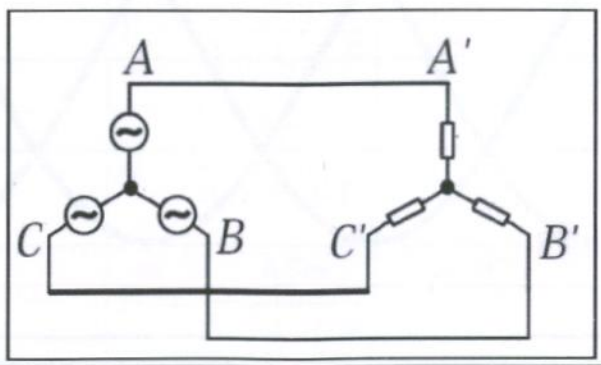
**Future System Requirements**

- the need to extend or develop installations for future circuits

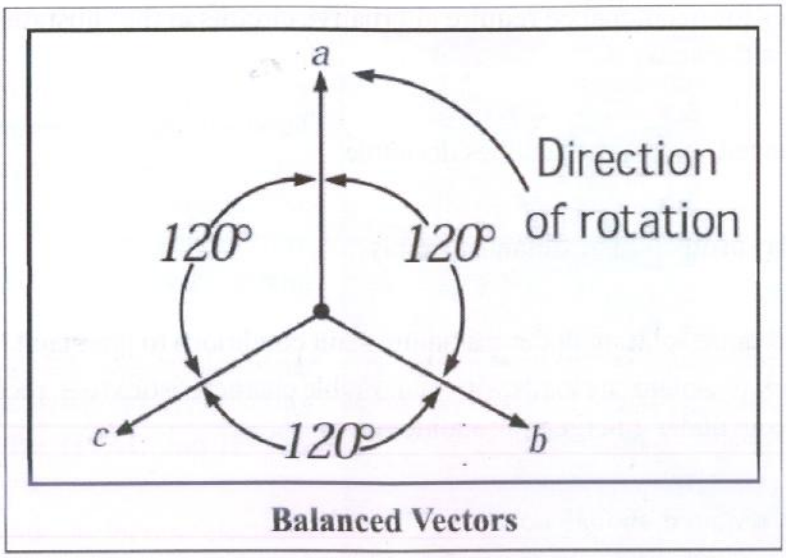
**Level of Skill of Operating Staff**

- affects the complexity of installation and maintenance features

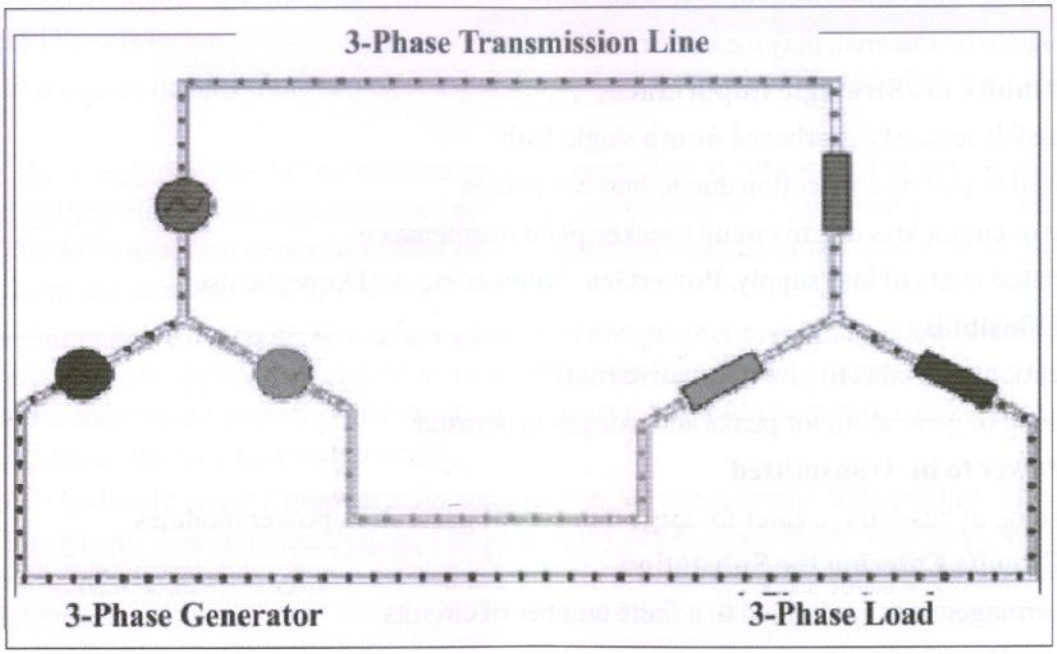
## 2.2 3-Phase System

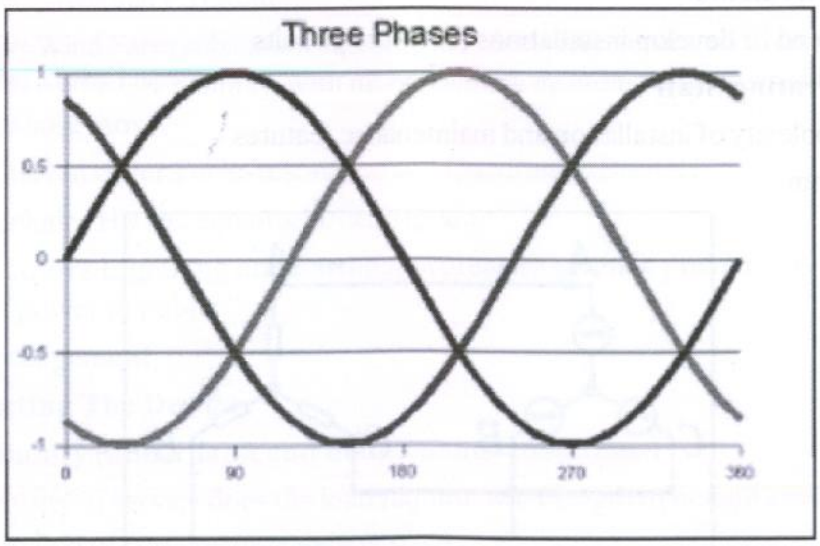


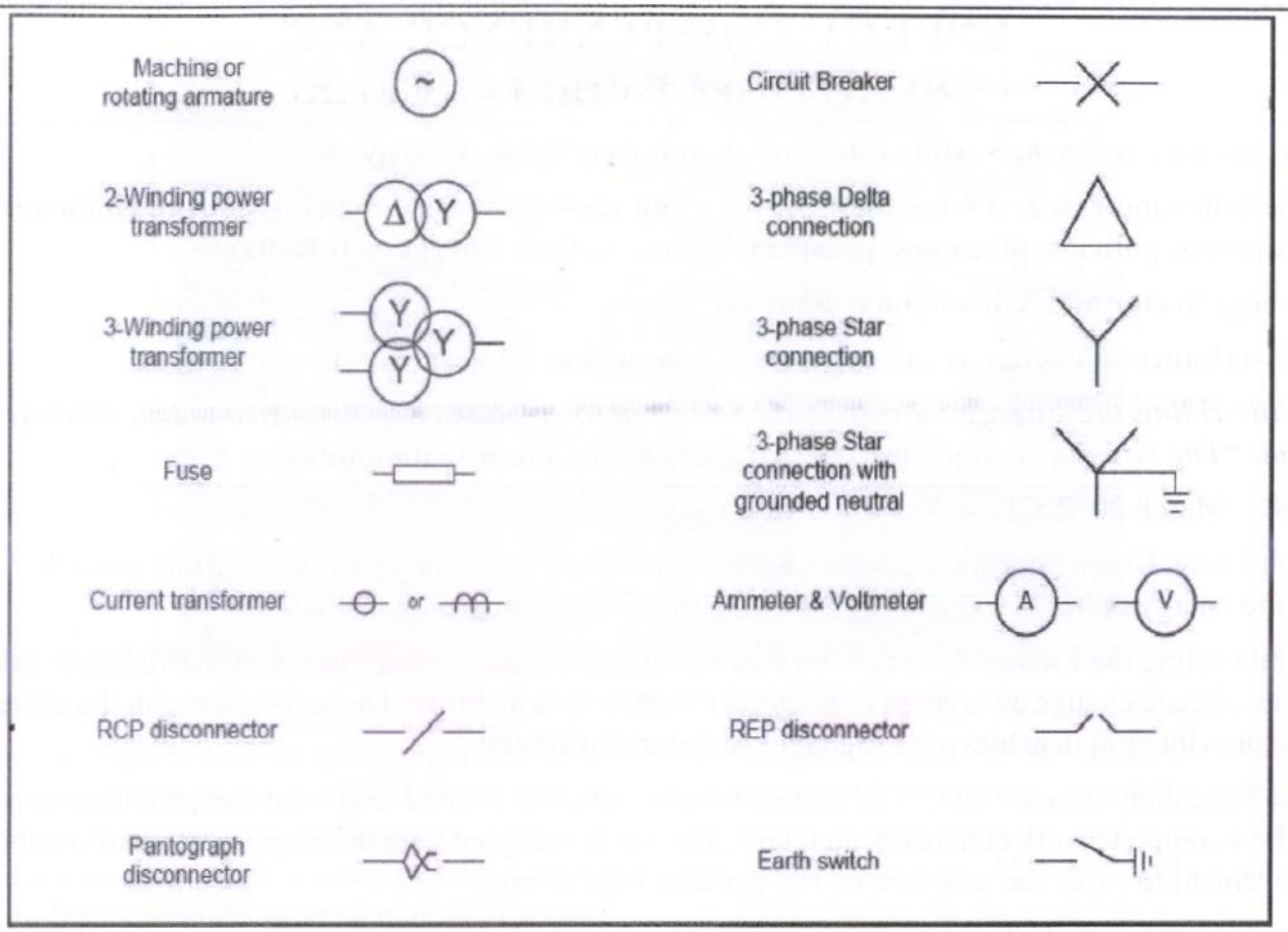
## 2.3 Phase Balanced Loads

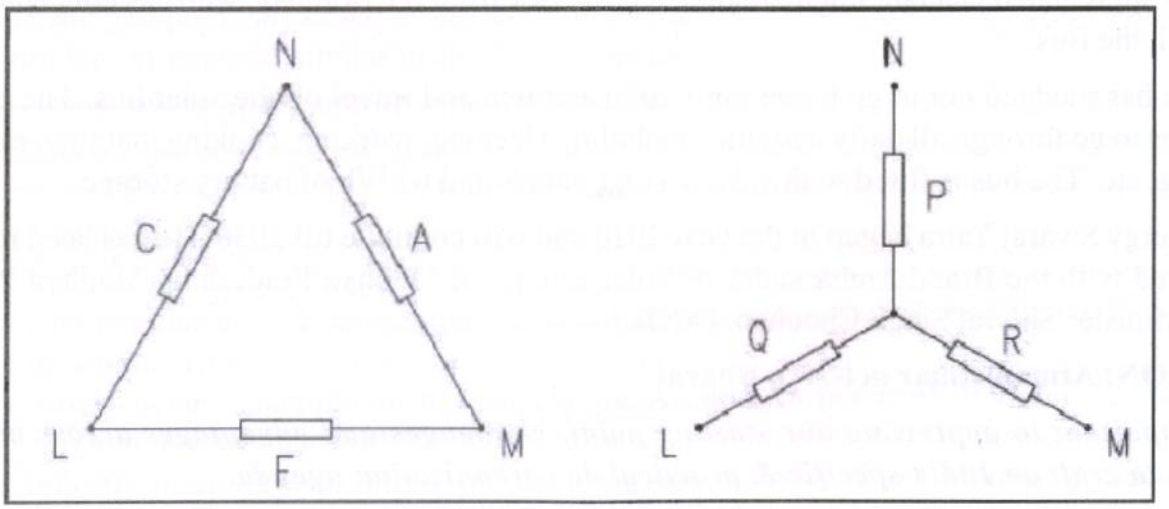



**Balanced Vectors**






$$P = \frac{AC}{A+C+F}$$

$$Q = \frac{FC}{A+C+F}$$

$$R = \frac{AF}{A+C+F}$$

*(To be Continued)*

*Courtesy: V Ayadurai Bsc, C.Eng, FIEE*

*Engineering Expert*

# ENERGY INDEPENDENCE AND ENERGY SELF RELIANCE - 8

**Sustainable Growth, Sustainable Energy and Renewable Energy**

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

**Energy Sector and Atmanirbhar Bharat:**

**Self-reliance in energy sector must for Atmanirbhar Bharat: Ramesh Pokhriyal**

***While riding the Energy Swaraj Yatra Bus from his residence to his office today, Pokhriyal said, "The climate change awareness is essential to attain sustainability.***

ANI March 20, 2021,

New Delhi: Union Education Minister Ramesh Pokhriyal 'Nishank' on Friday said that self-reliance in the energy sector is integral for achieving the goal of Atmanirbhar Bharat.

While riding the Energy Swaraj Yatra Bus from his residence to his office today, Pokhriyal said, "The climate change awareness is essential to attain sustainability. The self-reliance in the energy sector is integral in achieving the goal of Atmanirbhar Bharat."

The Education Minister said, "The Energy Swaraj Yatra Bus is fitted with solar energy and equipped to be a complete work cum residential unit. The bus is designed with the purpose to create a public movement towards the adoption of 100 per cent solar energy."

He also appreciated Chetan Singh Solanki, a professor from IIT Bombay, who has conceptualised and built the Bus.

Solanki has pledged not to go home until 2030 and live and travel on the solar bus. The bus has facilities to go through all daily activities including sleeping, working, cooking, bathing, meeting, training, etc. The bus is fitted with 3.2 kW solar panels and 6 kWh of battery storage.

The Energy Swaraj Yatra began in the year 2020 and will continue till 2030. He has been recently conferred with the Brand Ambassador of Solar Energy of Madhya Pradesh by Madhya Pradesh Chief Minister Shivraj Singh Chouhan. (ANI)

**OPINION: Atmanirbhar net-zero Bharat**

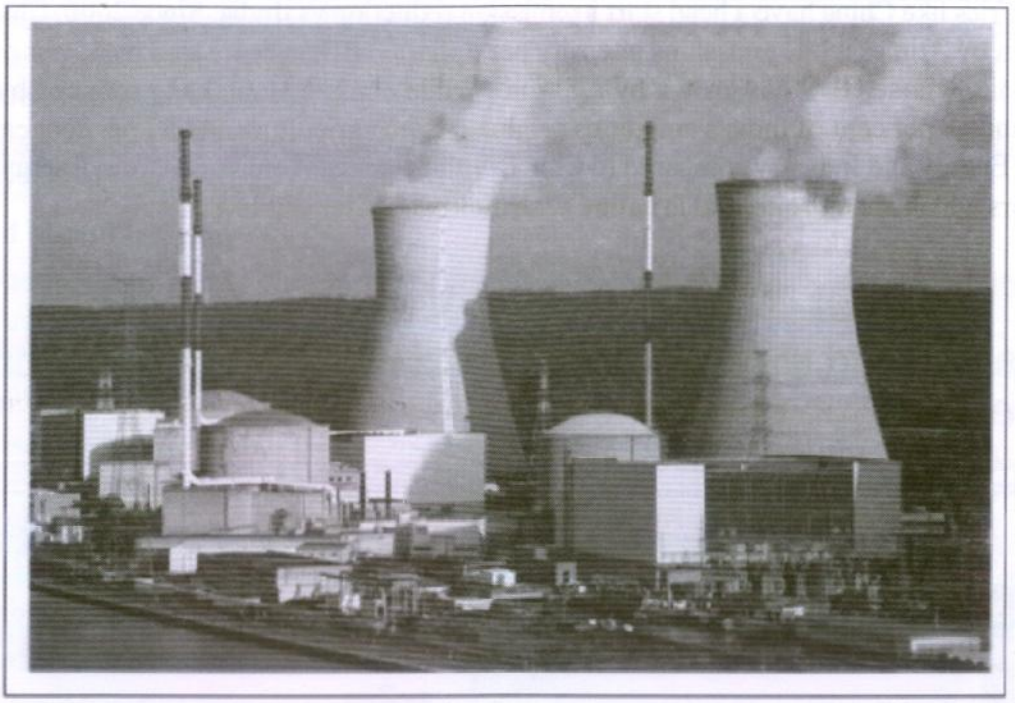
***It is important to appreciate our starting point, challenges and advantages across multiple factors to craft an India-specific & practical de carbonization agenda.***

ETEnergyWorld

January 08, 2021, 12:34 IST

New Delhi: With mounting pressure to limit warming between 1.5-2° levels, over 120 countries including Japan, South Korea, France and UK have committed to reaching net-zero emissions. The world's largest emitter China has also joined the club by committing to reach net-zero emissions by 2060. US, the world's second largest emitter is also likely to follow suit under Biden's leadership.

*We may not have sewage, drinking water, and Olympic gold medals, but we do have democracy. — **ARAVIND ADIGA***

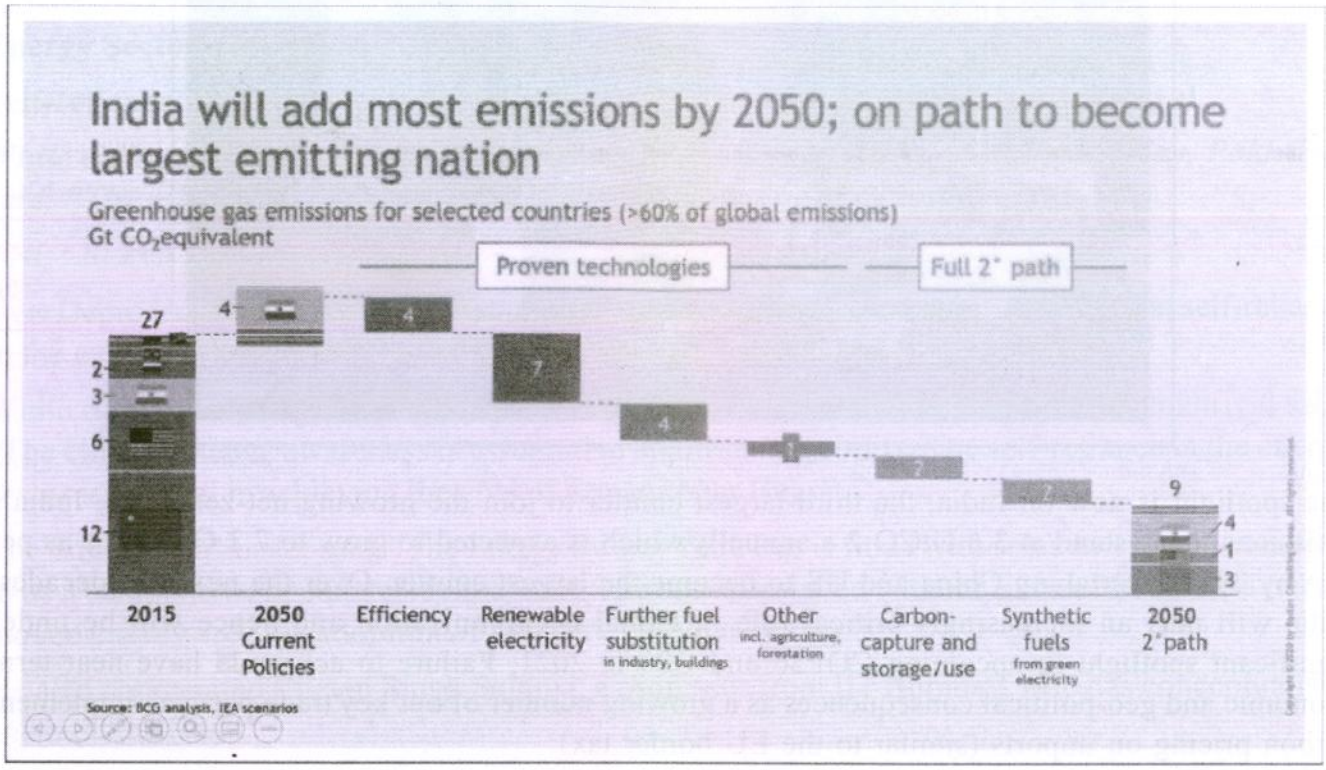


The spotlight is now on India, the third-largest emitter to join the growing net-zero club. India's emissions today stand at 3.6 GtCO 2 e annually which is expected to grow to 7.3 GtCO 2 e as per IEA by 2050, overtaking China and US to become the largest emitter. Over the next few decades, India will play an increasingly critical role in global decarbonization and hence will be under significant spotlight in upcoming COP26 and G20 in 2021. Failure to act could have near term economic and geo-political consequences as a growing number of our key trade partners implement carbon pricing on imports (similar to the EU border tax).

However, de carbonization and low carbon policies will have far reaching consequences and 2nd order effects on the economy and growth. Hence it is important to appreciate our starting point, challenges and advantages across the following three factors to craft an India-specific & practical de carbonization agenda:

1. India needs to "catch-up" on several key sectors like infrastructure & manufacturing to continue our growth momentum versus other net-zero countries. India's GDP per capita is around five times lower than China with key gaps in fundamental sectors like infrastructure, manufacturing and energy. Around 18 per cent of India's economy is agriculture dependent with limited de carbonization levers while Chinese economy is more industry oriented with only 7 per cent contribution of agriculture in GDP. Sectors like cement, steel, refining are also among the most "emission intensive", however their continued growth will be critical to support a growing economy.
2. We need to rapidly increase energy access, while decarbonizing generation sources and increase energy security. Energy consumption per head in India is at around 25 GJ, which is five-to-six times lower than most developed countries. India depends on imports for 47 per cent of its energy supply with oil imports set to double by 2050. In contrast, China relies on imports for 1/4 th of its energy need. India's energy mix is more fossil fuel reliant with only 8 per cent energy coming from renewables whereas renewables form 14 per cent of China's energy consumption.

3. Countries like China have a head start in emission reduction vs. India. Since 2000, Chinese GDP has grown by 7 times while emissions intensity per dollar GDP has decreased by 65 per cent compared to India, whose GDP has grown by 2.5 times while emissions intensity reduced by 55 per cent. Around 18 per cent of India's emissions originate from agriculture and 57 per cent emissions come from Energy and Industry compared to China, with 81 per cent emissions from Energy and Industry, sectors which are more central in nature with multiple abatement levers.




Given India's critical role in the future of global de carbonization, we will need to play our part while balancing domestic priorities around economic growth, job creation and self-reliance.

Continued investments are needed in growing sectors like cement, steel, infrastructure and energy which form the backbone of our growing economy. Growth in domestic energy generation, transmission & distribution infrastructure will be needed to fuel our growing domestic and commercial energy needs. Our starting position also lends a unique advantage. We have the ability to "leapfrog" developed nations, who have to transition mature CO 2 intensive industries, and "build green". One example is the way we leapfrogged fuel norms from BS-IV to BS-VI in 2020. Investing in building leadership in growing low-carbon technologies also presents an opportunity for India to find new growth avenues and potential global leadership. The following 16-point agenda is a combination of how we can balance these interconnected priorities and realize new opportunities in a low carbon world.

**Energy Sector**

a. Rapidly grow green energy generation sources while gradually decommissioning coal assets - balanced by job creation, skilling & labour reforms
b. Revitalize almost 25 GW of "stranded-gas" assets which can be used as balancing source
c. Leverage the fundamental linkage across all energy sectors – renewables, power, oil and gas – to enable sector coupling and increase renewables in energy mix to over 50%, decreasing dependency on imported oil & gas

d. Expand energy infrastructure with an emphasis on transmission infrastructure and reduction in AT&C losses, from present 18% to the 5% average in developed nations, to support sector coupling and move towards energy security

e. Introduce market reforms in power sector to optimize long-term PPA based trade and streamline REC mechanism in order to bring low-cost renewables to market

**Industry and Manufacturing**

a. Foster demand of clean technologies and alternate fuels in industry to capture their potential and reduce emissions without derailing sector's growth – 44 GW of water electrolysis possible in India, 280 MT carbon capture required for 2° path, potential to grow domestic biogas usage in industry to 6,800 PJ

b. Promote industrial energy efficiency to reduce energy consumption while investing in waste management for efficient disposable of waste as well as recovery of wasted energy

c. Provide incentives to attract investments in indigenizing manufacturing of emerging low-carbon technologies such as water electrolysis and carbon capture to cater to domestic demand as well as establish India as leading regional supplier, as envisaged under "Atmanirbhar Bharat" initiative

**Transport and Infrastructure**

a. Implement comprehensive mobility transition program to promote key clean fuels across transport segments by creating clear role for CNG, EVs & Biofuels and evaluating LNG & Green Hydrogen in niche transport use-case

b. Continue push on emissions norms for IC engines and efficiency improvement through CAFE norms

c. Reduce urban transport emissions by expanding public transit and establishing conducive environment for ridesharing

d. Improve efficiency of logistics infrastructure via infrastructure upgrades such as dedicated freight corridors and robust railways network to shift freight from road to rail

**Agriculture**

a. Increase adoption of sustainable farming practices to decrease GHG emissions from agriculture – prevent overuse of fertilizers and improve nutrient management to reduce N2O emissions, lower CH 4 emissions from rice cultivation through better water management

b. Use feed additives and high-quality feeds like grains, with support from improved breeding practices to reduce CH 4 emissions from ruminant livestock like cows, goats, sheep

c. Enhance natural carbon sinks by restoring and rewetting peatland, adopting multi-layered farming approaches like shade coffee, implementing grazing practices that stimulate grass productivity and root growth to allow accumulation of soil organic matter

**Adaptation and resilience**

a. Incorporate climate adaptation practices across city planning, infrastructure development and agriculture to build resilience against climate hazards and secure long-lasting returns on investments.

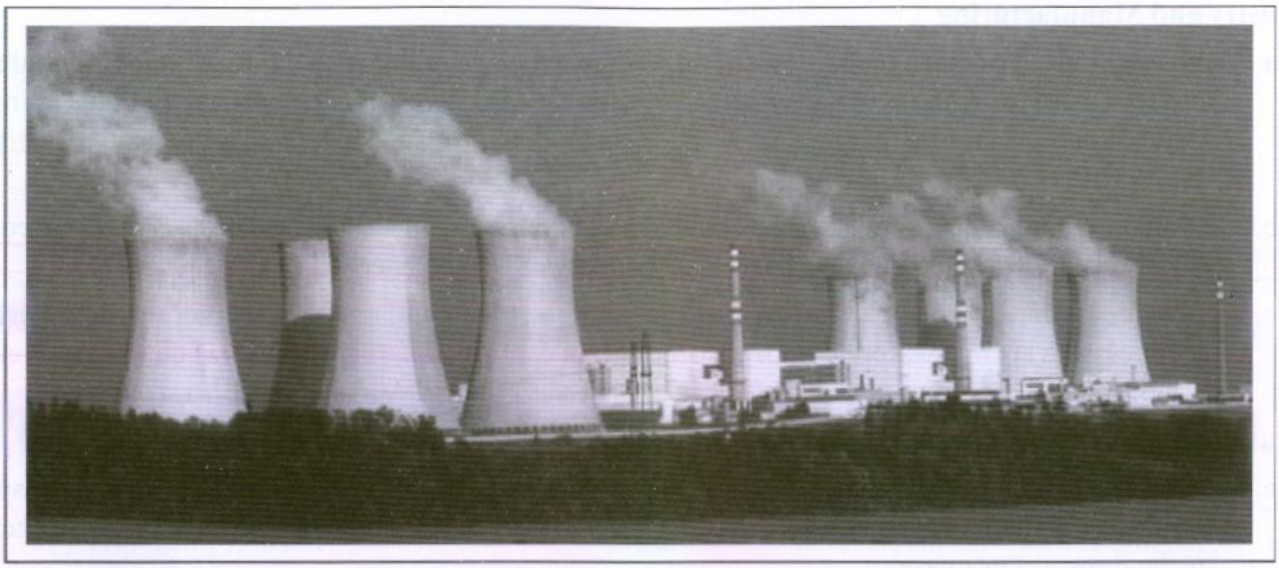
India, as the only G8+5 nation on track to achieve its Paris target, is ideally placed with the potential to emerge as a climate leader by championing a sustainable and low-carbon growth model which can be replicated by other developing nations to prevent further irreversible climate damage and ensure human survival.

***(To be continued)***

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

# INDIA CLOSER TO BUILDING WORLD'S BIGGEST NUCLEAR PLANT

EDF company said it had filed a binding offer to supply engineering studies and equipment to build six, third-generation EPR reactors in Jaitapur in Maharashtra.



French energy group EDF took Friday a key step towards helping to build the world's biggest nuclear power plant in India, a project blocked for years by nuclear events and local opposition.

The company said it had filed a binding offer to supply engineering studies and equipment to build six, third-generation EPR reactors in Jaitapur in Maharashtra.

Once finished, the facility would provide 10 gigawatts (GW) of electricity, roughly enough for 70 million households. Construction is expected to take 15 years, but the site should be able to start generating electricity before its completion. Finalisation of the contract was expected "in the coming months", an EDF statement said.

EDF, which is in exclusive talks with officials in India, would not build the power plant itself, but would provide the nuclear reactors in a deal that includes US partner GE Steam Power.

The state-owned PSU Nuclear Power Corporation of India controls the national nuclear energy sector, and the EDF offer was submitted to the country's nuclear operator NPCIL.

Although no financial details have been released, the contract is estimated to be worth in the tens of billions of euros (dollars). It faced opposition however from local inhabitants since the idea was first floated around 20 years ago, and was delayed after the 2011 nuclear disaster in Fukushima, Japan.

The Shiv Sena campaigned against the plan, though it has become less vocal recently.

EDF estimates the project will create around 25,000 local jobs during the construction phase, and around 2,700 permanent jobs. Earthquake risks and the potential impact on local fishing have been cited as key issues.

But Xavier Ursat, head of EDF's nuclear division, told AFP that the company estimates that the site's "geological conditions are excellent and fully comparable to what we find in a country such as France." India already has several agreements for exchange of nuclear technologies and expertise with countries like US, France, Russia and Japan. Russia - India's traditional ally - supplies nuclear fuel and has built reactors in the country, for example.

At present, there are 22 functioning nuclear reactors in India, most of them pressurized heavy water reactors, providing about three percent of the country's power.

# JALLIANWALA BAGH MASSACRE

The **Jallianwala Bagh massacre**, also known as the **Amritsar massacre**, took place on 13 April 1919, when Acting Brigadier-General Reginald Dyer ordered troops of the British Indian Army to fire their rifles into a crowd of unarmed Indian civilians in Jallianwala Bagh, Amritsar, Punjab, killing at least 379 people and injuring over 1,200 other people.

On Sunday, 13 April 1919, Dyer, convinced a major insurrection could take place, banned all meetings. This notice was not widely disseminated, and many villagers gathered in the Bagh to celebrate the important Hindu and Sikh festival of Baisakhi, and peacefully protest the arrest and deportation of two national leaders, Satyapal and Saifuddin Kitchlew. Dyer and his troops entered the garden, blocking the main entrance behind them, took up position on a raised bank, and with no warning opened fire on the crowd for about ten minutes, directing their bullets largely towards the few open gates through which people were trying to flee, until the ammunition supply was almost exhausted. The following day Dyer stated in a report that "I have heard that between 200 and 300 of the crowd were killed. My party fired 1,650 rounds".

The Hunter Commission report published the following year by the Government of India criticised both Dyer personally and also the Government of the Punjab for failing to compile a detailed casualty count, and quoted a figure offered by the Sewa Samati (a Social Services Society) of 379 identified dead and approximately 1,200 wounded, of whom 192 were seriously injured. The casualty number estimated by the Indian National Congress was more than 1,500 injured, with approximately 1,000 dead.

Dyer was lauded for his actions by some in Britain, and indeed became a hero among many of those who were directly benefiting from the British Raj, such as members of the House of Lords. He was, however, widely denounced and criticised in the House of Commons, whose July 1920 committee of investigation censured him. Because he was a soldier acting on orders, he could not be tried for murder. The military chose not to bring him before a court-martial, and his only punishment was to be removed from his current appointment, turned down for a proposed promotion, and barred from further employment in India. Dyer subsequently retired from the army and moved to England, where he died, unrepentant about his actions, in 1927.

Responses polarized both the British and Indian peoples. Eminent author Rudyard Kipling declared at the time that Dyer "did his duty as he saw it". This incident shocked Rabindranath Tagore (the first Indian and Asian Nobel laureate) to such an extent that he renounced his knighthood and stated that "such mass murderers aren't worthy of giving any title to anyone".

The massacre caused a re-evaluation by the British Army of its military role against civilians to *minimal force whenever possible*, although later British actions during the Mau Mau insurgencies in Kenya have led historian Huw Bennett to note that the new policy was not always carried out. The army was retrained and developed less violent tactics for crowd control.

The level of casual brutality, and lack of any accountability, stunned the entire nation, resulting in a wrenching loss of faith of the general Indian public in the intentions of the UK. The ineffective inquiry, together with the initial accolades for Dyer, fuelled great widespread anger against the British among the Indian populace, leading to the Non-cooperation movement of 1920–22. Some historians consider the episode a decisive step towards the end of British rule in India.

Britain never formally apologised for the massacre but expressed "regret" in 2019.

தமிழ்நாடு அரசு

மக்கள் நல்வாழ்வு மற்றும் குடும்பநலத்துறை

இந்திய மருத்துவம் மற்றும் ஹோமியோபதி ஆணையரகம்

# நிலவேம்பு குடிநீர்

## இவற்றில் சேரும் மருந்துகள்

நிலவேம்பு

வெட்டிவேர்

விலாமிச்சம்வேர்

சந்தனம்

பேய்ப்புடல்

கோரைக்கிழங்கு

சுக்கு,மிளகு

பற்பாடகம்

### குடிநீர் அளவு

5 வயது முதல் 12 வயது வரை உள்ள குழந்தைகளுக்கு 10 மி.லி. தினமும் 2 வேளை அருந்தவும்.

பெரியவர்களுக்கு 50மி.லி. தினமும் 2 வேளை அருந்தவும்.

எல்லா வகை காய்ச்சலும் குணமாகும்

# TENETS FROM TIRUKKURAL FOR GOOD GOVERNANCE AND GOOD LEADER

Tiruvalluvar devotes 700 Kurals out of 1330 Kurals to give his commands for Good Governance and Good Leadership to lead towards Excellence. The three Kurals chosen below list out important positive characteristics which leads to success and prosperity and the negative characteristics that may lead to failure and even ruin.

***Serukkunj Sinamum Sirumaiyum Illaar***
***Perukkam Perumitha Neerththu Kural 431***
*செருக்குஞ் சினமும் சிறுமையும் இல்லார்*
*பெருக்கம் பெருமித நீர்த்து. குறள் 431*

**"Behold the man (leader) who is free from haughtiness and anger and littleness; there is a dignity about him that adorneth his prosperity."**

***Ivaralum Manbirantha Manamum Maana***
***Uvagaiyum Eetham Iraikku Kural 432***
*இவறலும் மாண்பிறந்த மானமும் மாணா*
*உவகையும் ஏதம் இறைக்கு குறள் 432*

**"Parismony, over confidence and excessive *amour propre* are faults in the Prince (Leader)"**

***Thinaiththunayang Kutram Varinum***
***Panaithunaiyak***
***Kolvar Pazhi Naanuvar Kural 433***
*தினைத்துணையாங் குற்றம் வரினும்*
*பனைத்துணயாக்*
*கொள்வர் பழிநாணு வார். குறள் 433*

**"Behold the men (leaders) who are jealous of their reputation: though their faults may be small even like a millet seed; they look upon it as of a measure of a palmyra palm."**

***(To be continued)***

# HOME FESTIVALS - 5

## வைகாசி - Vaikasi (May/June)

This month is devoted to the worship of Lord Murugan, who is honoured on Vaikasi Vishakham (above). He is shown at far left as Palani, the renunciate, dressed in loincloth, wearing a necklace of rudraksha beads, sacred ash covering His body and holding the sannyasin's staff. To the right He is shown as a prince, with His peacock, and farther to the right as the six-headed Arumugam. Devotees approach Him doing penance by piercing their bodies with small spears and carrying various offerings, including pots of milk and a *kavadi,* a kind of portable arched shrine. At lower right is depicted Naga Chathurthi, celebrating an ancient story in which a young boy bit by a cobra was saved from death when his sister's prayers caused the sands of the cobra's anthill to counteract the poison.

***(To be continued)***

# NOTRE DAME

The main aim was to showcase the cathedral's stunning Gothic architecture and improve visual comfort for its visitors. It was also important to accentuate architectural details that the previous lighting neglected, such as the magnificent 20-meter long frescoes sculpted into the choir wall. Efficiency was also a priority.

The lighting design from Armand Zadikian innovatively navigates the cathedral's complex architecture. Light sources were placed in discreet locations at various support points throughout the interior, integrating the lighting and architecture. The design provides an immense sense of width and height, showcasing the cathedral's architectural beauty.

Over 400 LED luminaires were used, with a lower power of 35 kW, compared to 150 kW before. There are 15 pre-programmed lighting arrangements available for different events, such as tours, Sunday masses, large ceremonies and organ concerts.

LED lights now accentuate the details of the sculpted frescoes on the choir wall. Precise beams are strategically projected onto specific areas of the artwork. Visitors can now appreciate skill and emotion of the sculptures. The new light emphasizes the intricate detail of the characters' facial expressions and carefully carved figures. Bathed in soft light, the iconic decor now contributes to the cathedral's atmosphere during visits, masses and concerts alike.

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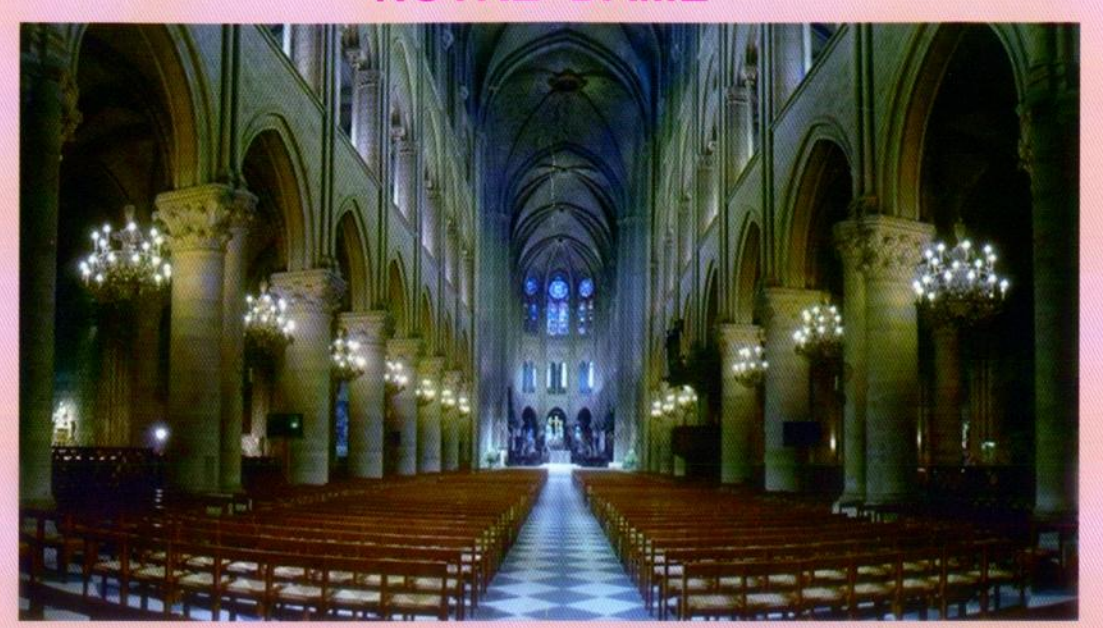
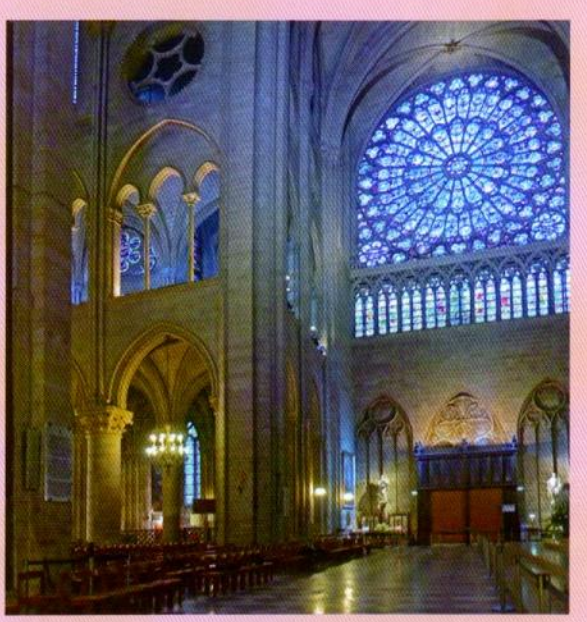
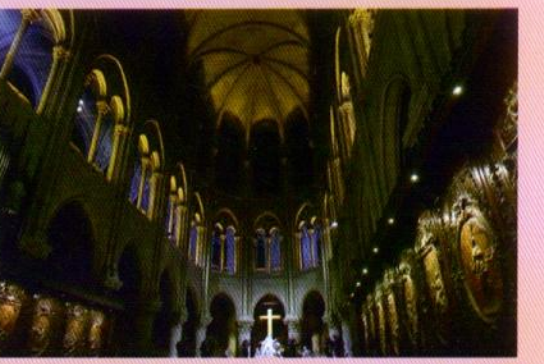
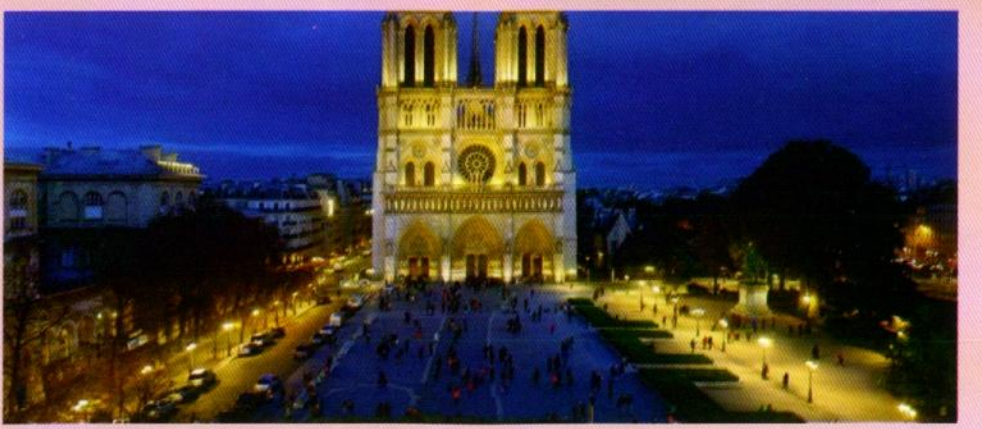
# NOTRE DAME









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