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ieema journal

VOLUME 12 • ISSUE NO. 9 • MAY 2021 • PGS. 84

ISSN 0970-2946 • Rs. 100/-

Electrical Fire Prevention via Automated Real-time Audits

As Fire kills many, the question: Who is Responsible?

Electrical Fire in Covid-19 Hospitals A Preventable Emergency

Codes for Fire Safety?

Electrical Fire Safety!

COVID-19 Stay Safe

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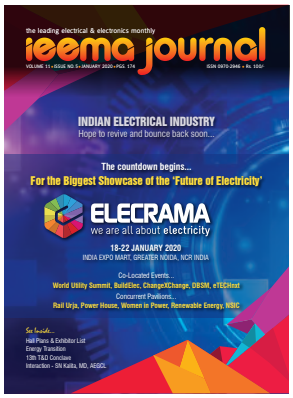

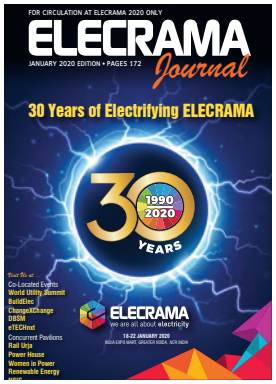

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ieema
your link to electricity

Dear Friends,

Hope this message finds you and your loved ones healthy.

India's brutal second wave of Covid-19 has gripped the nation. As the country recorded the world's highest daily cases, hospitals and individuals are raising SOS, civil society is on its toes and courts are stepping in.

Increasing Covid-19 caseloads and a broken supply chain are at the heart of the oxygen shortage India is staring at. As prices of oxygen cylinders shoot up in the wake of the shortage, industries have stepped up to meet the growing demand, following the directive from the central government to divert industrial oxygen toward medical usage.

During this hour of crisis, we at IEEMA urge our members to stand united to fight the pandemic. The COVID-19 pandemic continues to produce a great deal of uncertainty, stress and trauma. We are going through a global health crisis, which is unprecedented in our lifetime.

But we must not lose hope. When we look back, humanity has survived and emerged stronger from catastrophes, wars and recessions without ever losing their joy of living & giving. A small shift in our perspective can generate miracles. Let's continue to express our gratitude and fortify our resilience.

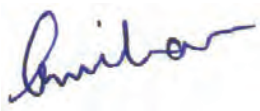
Today, many of our friends and families are struggling with health issues and other

concerns. We must do everything we need to do to protect and help each other.

Please stay safe and stay home. We shall surely regain our freedom, enterprise and socializing.

आज रास्ता बना लिया है, तो कल मंजिल भी मिल जाएगी,
हौसलों से भरी यह कोशिश जरूर रंग लाएगी...

Stay Positive !



Anil Saboo

the leading electrical & electronics monthly
ieema journal
Volume 12 Issue No. 09 May 2021 CIN U99999MH1970GAP014629
Official Organ of Indian Electrical & Electronics Manufacturers' Association
Member: Audit Bureau of Circulation & The Indian Newspaper Society

For suggestions and feedback please write to us on shalini.singh@ieema.org

Dear Members,

The second phase of Covid-19 has turned out to be stronger than all expectations, as a result of a variety of factors and their manifestation which has taken everyone including the establishment off guard. In 2020 the exodus of workers was a painful sight which brought home, realisation of how important it is to ensure the availability and retention of workers in the Industry. In the present context of 2021 the movement of labour has been via traditional means of transport but at the same time interrupting the value and supply chains.

Unlike 2020 there is no declared national lockdown but a national lockdown like situation persists as there are states and cities with declared lockdown and in many cases even if there is no lockdown there is hardly any production due to interrupted supply and value chains.

In 2020 due to national lockdown force majeure was applied on delay in supply and execution of contracts as the government had issued a notification to this effect. IEEMA has represented for the same to Central Government, all State Governments and Utilities.

The impact of the continued pandemic will be seen in industrial output, commercial activity and the economy. It will also have wide social and psychological ramification. while we are now in May 2021, we still do not have sight of near normalcy and disequilibrium continues. This will take time and in view of such uncertainty IEEMA recommends to encourage work from home

wherever possible and to follow safety protocol at workplace and home.

IEEMA continues to be vigilant to the needs of our member in such testing times and will endeavour to ensure that its voice is heard in the decision making of the government which is also stretched due to the unprecedented stress of the pandemic.

This is a time when IEEMA members need to hold together and collectively ensure the health of their families and industry.

Stay Safe and Stay Strong!.

Sunil Misra

CASE STUDIES

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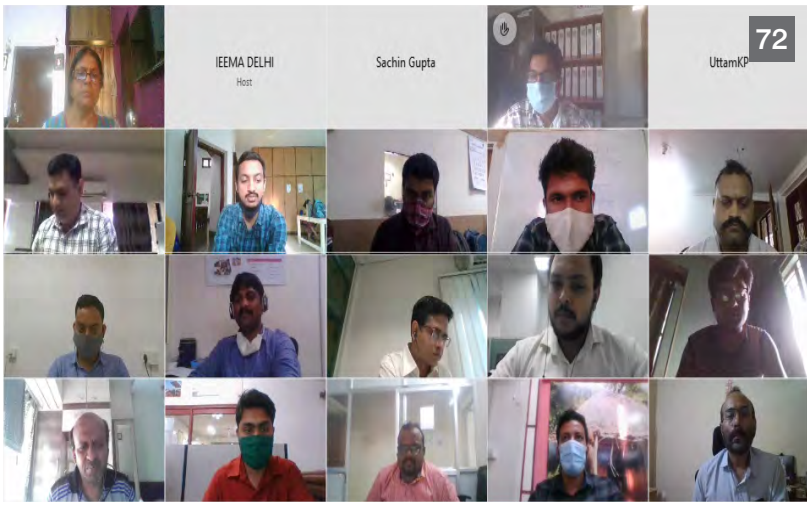

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Edited, Printed and published by Mr Sunil Kumar Misra on behalf of Indian Electrical and Electronics Manufacturers' Association, and Printed at India Printing Works, India Printing House, 42, G. D. Ambekar Road, Wadala, Mumbai 400 031 and Published at 501, Kakad Chambers,132, Dr. Annie Besant Road, Worli, Mumbai 400 018.

Electrical Fire in Covid-19 Hospitals

A Preventable Emergency

THE HINDU

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DELHI

50 patients evacuated after fire in Safdarjung Hospital ICU

STAFF REPORTER

NEW DELHI, APRIL 01, 2021 00:22 IST
UPDATED: APRIL 01, 2021 00:22 IST

SHARE ARTICLE PRINT

A series of frequent and unfortunate fire incidents in COVID Hospitals has been a cause of concern since the last year. The COVID emergency is not going away soon and all the emergency infrastructure built to fight the pandemic poses serious risks given its weak foundation.

Power Systems are particularly vulnerable given the sudden increase in non-linear loads comprising of ventilators and related medical devices – a crucial defense aid in fighting COVID.

With improper electrical systems, further marred by non-compliance to electrical standards and poor workmanship, hospitals are staring at the high risk of weakening the immune systems of their electrical systems and leading to fire!

If courage is contagious, ignorance is pandemic!

The pandemic has put stress on the Hospitals like never before. Almost unprepared for the scale and nature of COVID's medical emergency, it is natural for the Hospital's Management to prioritize the most urgent and important objective – treatment of patients. And often, amongst all the essential tasks, it is the minor ones that generally get the least priority and lead to trouble later. Thus, poor Power Quality (PQ) and electrical safety issues are bound to receive less attention in a situation where patients are increasingly struggling for medication and treatment. But the seemingly minor electrical issues have taken a severe turn and caused a fire in the establishments. More importantly, fire incidents in hospitals cannot be dislodged as one-time exceptions, as a closer look clearly highlights the pattern and the nature of risks looming over the Hospitals.

Protecting Hospitals from failure

Hospitals have been tirelessly operating in the pandemic, constantly stressed for resources including space, medication and care. City after city has built large make-shift hospital facilities. From sports stadiums to hotels, a variety of facilities are being turned into make-shift healthcare facilities. Given the large scale of the problem and short availability of time and resources, very little can be assured for standards and underlying quality of work for the electrical systems. This only means, the risks to the safety and reliability of power systems are higher than ever before.

While the doctors, nurses, medical professionals, and researchers are working day and night, providing maximal care to the COVID-19 patients, the risks are not restricted to COVID alone. Hospitals are up against yet another hectic and exhausting challenge – ensuring uptime, safety and proper functioning of all critical devices and systems, mostly driven by electricity, in an extremely challenging situation. Any technical difficulty can become overwhelming for the hospital facility in such a stressed situation. A strong indication of the stressed and crumbling systems is the events of electrical fires in recent times in the hospital facilities that were dedicated to COVID treatment.

As Hospitals protect patients from COVID, it is also evident that the Hospitals themselves need better and proactive protection from the risks to reliability and safety of the facility.

Underlying electrical issues in Hospital fires

Power Quality issues

A Hospital's critical nature demands extremely careful wiring. The presence of power quality issues, such as high harmonics in the electrical system, is often the root cause of overheating of cables and equipment, further leading to system failures, and in extreme cases, short circuits and instances of fire. This is further accentuated by poor workmanship or poor quality of electrical hardware being deployed under time and financial stress.

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NEWS / CITY NEWS / MUMBAI NEWS / 9 DEAD AS FIRE SWEEPS THROUGH HOSPITAL INSIDE MUMBAI MALL

TOP SEARCHES: Mumbai latest news | Maharashtra Lockdown News | Maharashtra Corona cases | Mumbai Cor

9 dead as fire sweeps through hospital inside Mumbai mall

Richa Pinto | TNN | Mar 27, 2021, 03:35 IST

A- A+

Nine patients died on Friday after a fire swept through Sunrise Hospital, a Covid care facility in Mumbai's Bhandup area, located inside a mall marred by violations.

All but one of the victims from the 107-bed hospital were senior citizens. Two more bodies recovered were of patients who had died of Covid earlier, said the hospital. In all, 78 patients were brought down with ladders and lifts or led out by firemen using the Dreams Mall's staircases. The 11 who succumbed were declared dead on reaching other hospitals. Asphyxia was cited as the reason.

Firefighters try to douse a fire that broke out at a coronavirus disease (COVID-19) hospital in Mumbai (Reuter...

As Hospitals continually equip themselves to serve more patients, reliable electrical supply must be ensured for the seamless and safe functioning of the facility. The addition of new electrical loads, whether it is ventilators, or converting the basement to a make-shift healthcare facility, a thorough assessment to check the preparedness of the existing electrical system to function in a safe and reliable manner should always be the first priority. From minor voltage or current disturbances to the emergence of a previously undetected poor grounding issue, power quality issues can lead to a spike in risks to the facility that Hospitals may not be in a position to control swiftly.

Poor electrical wiring and cabling

Power-hungry electrical equipment such as MRI, CT Scans, and X-Ray machines, Ventilators and other medical devices, used in hospitals need uninterrupted power supply. A durable cable network is thus absolutely essential to carry this power supply without overheating. However, hospital authorities in India ignorantly prefer low-grade wires in order to save costs which results in overheating, and to add to this PVC used in cables creates a lot of smoke in case of a fire incident. Statistics show that more people die due to smoke than due to actual fire in a fire incident.

The ventilation system in a hospital also has a role to play in this scenario. If the hospital is air-conditioned, an efficient mechanical ventilation system must be installed to avoid electrical fires from spreading.

Faulty electrical installations in an oxygen-rich environment

Areas such as operation theaters and ICUs have a high concentration of oxygen. Any electrical short circuit in these areas, could lead to electrical shock to surgeons or patients. In the worst cases, these electrical faults may result in sparks and could lead to fires. In order to achieve uninterrupted power, or for surge control, UPS systems are used which are supported by batteries. In many cases, these batteries are installed in close proximity to the Medical equipment. These batteries often release harmful and flammable gases which adds to the threat of fire accidents. Hence, it is important to provide special attention to electrical wiring, earthing and switchboard installation.

With the addition of Ventilators, air-conditioners, high-capacity machines in the ICUs, testing facilities for COVID, the addition of more rooms, and increased use of flammable alcohol-based sanitizers or PPE kits, risks of fire are only going higher. Add to it the poorly designed power systems built with even poorer workmanship, it all works like oxygen to start an electrical fire and feed it further.

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News / India / Fire at Covid ICU ward in Nagpur hospital leaves three dead

Fire at Covid ICU ward in Nagpur hospital leaves three dead

At least three people have died in a fire that broke out at a hospital in Maharashtra's Nagpur on Friday evening. The fire reportedly broke out in the Covid ICU ward of the hospital.

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#Unite2FightCorona

India Today Web Desk

Nagpur

April 9, 2021 UPDATED: April 10, 2021 08:48 IST

Compliance to standards and the growing extent of the problem

Hospitals are a very important element of the healthcare system. The emergence of new makeshift hospitals in the current pandemic is well justified but are they complying with the Electrical Safety Standards?

The safety and reliability of electrical networks in any building is vital. But in the case of hospitals, it is even more critical. Where most commercial facilities witness less or no human activity after closing hours, hospitals are bustling with full human presence and activity 24X7. Even so, high-power medical machinery entails the need for uninterrupted high-voltage power at hospitals. To add to this, hospitals are home to patients undergoing treatments for critical ailments. In case of an electrical fire accident, moving these patients becomes a formidable challenge. All these factors cumulatively make hospitals the most vulnerable place for electrical accidents which may prove fatal if not addressed in the right way at the right time.

Here is a summary of the news reports from recent times that highlight the nature of fire in COVID hospitals, its root causes and the damage to life and the serving facility:

The Indian EXPR

JOURNALISM OF COURAGE
SINCE 1932

APRIL 24, 2021, PUNE, LATE CITY, 14 PAGES

SECOND INCIDENT AT COVID FACILITY IN MUMBAI IN A WEEK

15 of 17 ICU patients killed in Virar Covid hospital fire

Delhi
urges
guidan

As PM questio
of CM's appeal
Delhi crosses 3

SHIVAM PATEL
NEW DELHI, APRIL 23

APPEALING TO Prime M
Narendra Modi for persona
vention and guidance in t
the escalating Covid crisis t
brought the national ca
healthcare system to its
Delhi Chief Minister
Kejriwal warned Friday th
tragedy" will unfold if "qu
meaningful steps" are no
to resolve the situation, es
an acute shortage of oxyg
Speaking for nearly fi

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Column 1	Column 2	Column 3	Column 4	Column 5	Cover Story
City	**Fire Incident**	**Name of the Hospital**	**Source Link**	**Severity and Cause**	
Mumbai	9 dead as fire sweeps through hospital inside Mumbai mall (Source: Times of India)	Sunrise Hospital (COVID care facility), Mumbai	https://timesofindia.indiatimes.com/city/mumbai/9-dead-as-fire-sweeps-through-hospital-inside-mumbai-mall/articleshow/81716443.cms	9 patients died in the Hospital that operated on a provisional occupation certificate granted by the BMC though the building had received notices for irregularities in construction and violation of safety norms.	
Kanpur	Kanpur hospital fire: Survivors recount panic, chaos (Source: New Indian Express)	LPS Institute of Cardiology and Cardiac Surgery, Kanpur	https://www.newindianexpress.com/nation/2021/mar/28/kanpur-hospital-fire-survivors-recount-panic-chaos-2282808.html	Dense smoke filled up the centrally air-conditioned building leading to death of 2 patients. A short-circuit is suspected to have led to the fire, according to police.	Electrical Fire in Covid-19 Hospitals – A Preventable Emergency
Nagpur	Fire at Covid ICU ward in Nagpur hospital leaves three dead (Source: India Today)	Hospital in Wadi area of Nagpur	https://www.indiatoday.in/india/story/fire-covid-icu-ward-nagpur-hospital-death-toll-casualties-updates-1789279-2021-04-09	3 people have died in a fire that broke out in the Covid ICU ward of the hospital. The fire reportedly started from an AC unit of the ICU.	9 April 2021
Ujjain	Fire in hospital in Ujjain, patients moved out (Source: Livemint.com	Patidar Hospital, Ujjain, Madhya Pradesh	https://www.livemint.com/news/india/madhya-pradesh-fire-in-hospital-in-ujjain-patients-moved-out-11617526741608.html	A fire that broke out at the ICCU Department of a private hospital required around 80 patients to be shifted and rescued.	4 April 2021
Delhi	Delhi: Fire at Safdarjung ICU, 50 patients evacuated (Source: The Hindu)	Safdarjung hospital, Delhi	https://www.thehindu.com/news/cities/Delhi/50-patients-evacuated-after-fire-in-safdarjung-hospital-icu/article34209943.ece	The fire started due to a short circuit in a ventilator machine. Officials said the wires caught fire, which led to a lot of smoke in the ward.	1 April 2021
Bhandara	10 Babies Killed In Maharashtra Hospital Fire; “Heart-Wrenching,” Says PM (Source: NDTV.com)	Bhandara District General Hospital	https://www.ndtv.com/india-news/ten-children-killed-in-massive-fire-at-maharashtra-hospital-2349911	10 Babies died after a fire broke out at around 2 a.m. A short circuit is believed to have set off the blaze.	9 January 2021
Rajkot	Five Covid-19 patients die in fire at ICU of Rajkot hospital (Source: The New Indian Express)	Uday Shivananda Covid Hospital, Rajkot	https://indianexpress.com/article/india/five-covid-19-patients-die-in-fire-at-icu-of-rajkot-hospital-7071194/	Patients in the ICU were on ventilators and they experienced hypoxia due to smoke in the room. The staff attempted to switch on firefighting system but due to smoke, they couldn’t do it and the fire spread rapidly.	28 November 2020

Fire in Covid-19 Hospitals - Prevention must be the goal

Hospitals that use several non-linear loads and sensitive electronics alongside heavy-duty air conditioners and heaters, other large or small medical testing instruments, and are therefore always at the risk of poor power quality. While the first responsibility to ensure compliance to building codes for safety and reliability rests with designers, careful maintenance and monitoring of PQ on an ongoing basis is also important. With rising number of electrical fires in hospitals, several state and regulatory agencies have ordered a fire audit of the facilities. While a proactive fire audit of the COVID hospitals is a welcome move, the fire audits are testing the ability of the facility to protect itself from the fire, if it were to occur, not prevent the fire.

Building a proactive approach to fire safety

Electrical fire in Hospitals is never a sudden phenomenon or an accident. In fact, it's a result of a long-time alarm that has kept ringing but has gone unnoticed in the din of other important priorities. But compromised safety of Hospital facilities poses high risks to the reliable conditions for patient care, for COVID, and beyond.

Wire your electrical networks right

Poor quality cables could lead to a serious fire incident at a hospital. It is vital that attention be paid to the wiring in the entire health facility. The global norm is to use 'Low Smoke and Zero Halogen (LSOH) wiring. However, in India, Flame Retardant Low Smoke (FRLS) wires are used widely. Reports suggest that these wires may not necessarily help avoid fire incidents completely. One good measure is to connect all the signaling devices with Fire Survival Cables. Fire Survival Cables are designed to withstand high temperatures for a certain amount of time. They reduce the threat of forming caustic acids and limit corrosion damage to equipment in case of fire incidents.

The Indian Standards (IS) for Fire Survival Cable which have been under consideration by the Bureau of Indian Standards (BIS) are now published by BIS in a Gazette notification dated 19 March 2021. In observation of a rising number of accidental deaths due to electrical fires, historically as well as in recent times, mostly caused due to short-circuits resulting from melting of cables, the Fire Survival Cable Standards hold immense importance in raising the benchmark for safety of Hospital Buildings.

Pay attention to earthing

A common practice in the Indian setup is to use separate earthing connections for all the electronic medical or non-medical equipment, but it is unjustified. If earthing is not done properly, it may damage the equipment or give electrical shocks to a surgeon or patient. All conductive metal in an equipotential area should be connected to a common equipotential earthing point with a special heavy-duty cable. This reduces the possibility of leakage currents that can cause micro-electrocution when the surgeon or patient comes into contact with the equipment.

Ensuring good Power Quality to prevent electrical fire

There are several tools to proactively identify the vulnerabilities in power systems, including power quality issues, much before they lead to extreme events of electrical fire.

Thermal Imaging is highly helpful in understanding the potential overheating in the electrical network.

Periodic measurements and monitoring of harmonic distortion helps in early identification and prevention of heating in the electrical cables.

Isolation Transformers for sensitive imaging devices or diagnostic equipment

Use of 3+1 Core Cables, owing to their larger surface area, help in reducing the hot spots, thereby reducing the risk of electrical fires.

Triplen Harmonic Filters help to minimize the electrical fire risks emanating in infrastructure with heavy IT/ ITeS, Building Automation with non-linear loads, Computational Infrastructure, UPS Batteries etc.

Conclusion

A proactive approach to fire safety is the only way to ensure foolproof safety of the electrical systems from instances of fire. Hospitals must invest and upgrade their knowledge and experience in resolving the urgent and growing safety concerns on priority. This calls for addressing every root cause - from following the right Standards in cables to improving Power Quality.

Proactive prevention of the PQ issues in Hospitals requires much groundwork and addressing the root causes. A course correction from the current practices is required at every stage – from design to installation and maintenance when the facility is in operation. Following high standards and not falling for savings in upfront costs must be the norm.

All the hard work, sacrifice and care in saving the lives of COVID patients cannot be at stake of an increased risk of electrical fire from underlying electrical causes that are fully preventable ■

Amol Kalsekar

Chief Manager – Wire & Cable in Buildings
International Copper Association India

Electrical Fire Prevention
via Automated Real-time Audits

We are all appalled and disgusted to read of the news of electrical fires. Fires that have had fatalities become sensational news for a few days, with eminent personalities providing their condolences. The government does it bit by offering compensation packages to the victims.

One of the most gut wrenching cases occurred in Bhandara (Nagpur) in the early morning hours of 9th January 2021. It's hard to write about the loss because we lost 10 newborn babies, and have learnt nothing! I am driven to this hard conclusion in the wake of several fires reported in hospitals across the country over the last 3 months. Many with fatal consequences.

I was optimistic to see this tweet on the very same day from the Maharashtra Chief Ministers Office (@CMOMaharashtra) response to the events in Bhandara. It was the first time there was recognition within the government that this event was more than just a short circuit; more than just an accident, rather an inability to act on an existing electrical condition. A condition that was identified and could be fixed, if an trained auditor got there at the right time.

This specific tweet raises a fundamental question:

In a system where audits are an expense that needs approvals to ensure checks and balances are maintained, how do we ensure that our facilities are operating safely?

Imagine, somebody having an heart attack right in front of you, and instead of getting that person the required medical help, you have to go get permission and budgetary approvals.

You are correct. I cannot compare humans to an electrical system in a building. The truths is, I am merely comparing risk to human life. If and when a heart attack occurs, we know the aftermath can be difficult to control and with unpleasant consequences. An electrical short circuit is similar in many ways, where, if there is an incident, the aftermath can be deadly.

Let us discuss what we must really do to protect ourselves and others. We all understand that monitoring the health of the heart is essential for maintaining a healthy body with the risks of a heart attack minimised. With the advances in medical science, we have learnt the importance of monitoring select phenomena and early diagnosis e.g. Cholesterol levels and Hypertension.

Our best bet against short circuits is acting on events preceding it. A recently completed Ph.D. Dissertation by Jean-Mary Martels (2018) from University of Ilmenau (Germany) sheds some interesting light on the causes of electrical fires. 86% of all electrical fires were preceded by visibly identifiable electrical conditions such as light flickering/dimming, slow moving appliances, power interruptions, fuse blowing, breaker tripping or bulbs burning out. Many times, such electrical conditions are ignored. If we can read these signals in advance, then maybe we can be warned in advance.

Furthermore, there are other factors such as a brain stroke, kidney failure, etc that lead to fatalities. Electricity is no different. Inspired by the work performed by Martel, we at Jhaveri Power Labs, have studied and classified 20 electrical faults that lead to fire risk, electrocution, equipment loss or efficiency losses. A total of 12 of these issues can lead to electrical fires. Let us study them in detail.

	Electrical Fire Risk	Description of fault	Why does it occur
1	Short circuit	Extremely high current flowing between two live wires via an unintentional low resistance path. It generates excessive heat that becomes an ignition event for the fires.	Exposed wires Failure in devices
2	Arcing	The flow of electricity after the breakdown of a non-conductive material. Arcs generate up to 3750 C of heat and are a primary cause of electrical fires. There are two types of arc: **(a) Parallel arcing** is when the arc flows between two wires of different electric potential. These can be detected in over current conditions **(b) Series arcing** occurs when the arc flows between two wires of the same potential such as in the case of loose connection or a partially broken wire.	Loose connections Insulation damage Rodents
3	Over current (Overload)	Excessive currents flowing through wires and switchgear exceeding the rated currents. It generates excessive heat that becomes an ignition event for the fires. Overload conditions also increase the probability of arcing events	Damaged equipment Unplanned addition of electrical loads
4	Earth Leakage	High leakage current flowing into earth wire. Currents greater than 20mA can cause electrocution. Higher currents can also cause connections to the earthing systems to heat up and become ignition events.	Equipment degradation Improper wiring
5	Critical overvoltage	High voltages observed from the electric supply company. Voltage higher than 10% of nominal can cause excessive current for resistive loads that leads to overheating. Under certain conditions higher voltages will also lead to components such as capacitors exploding. Over voltages also increases the probability of arcing events.	Poor power quality from utility
6	Critical undervoltage	High voltages observed from the electric supply company. Voltage lower than 10% of nominal can cause excessive current for non-linear and motor loads such that it leads to overheating.	Poor power quality from utility Poor sizing of cables

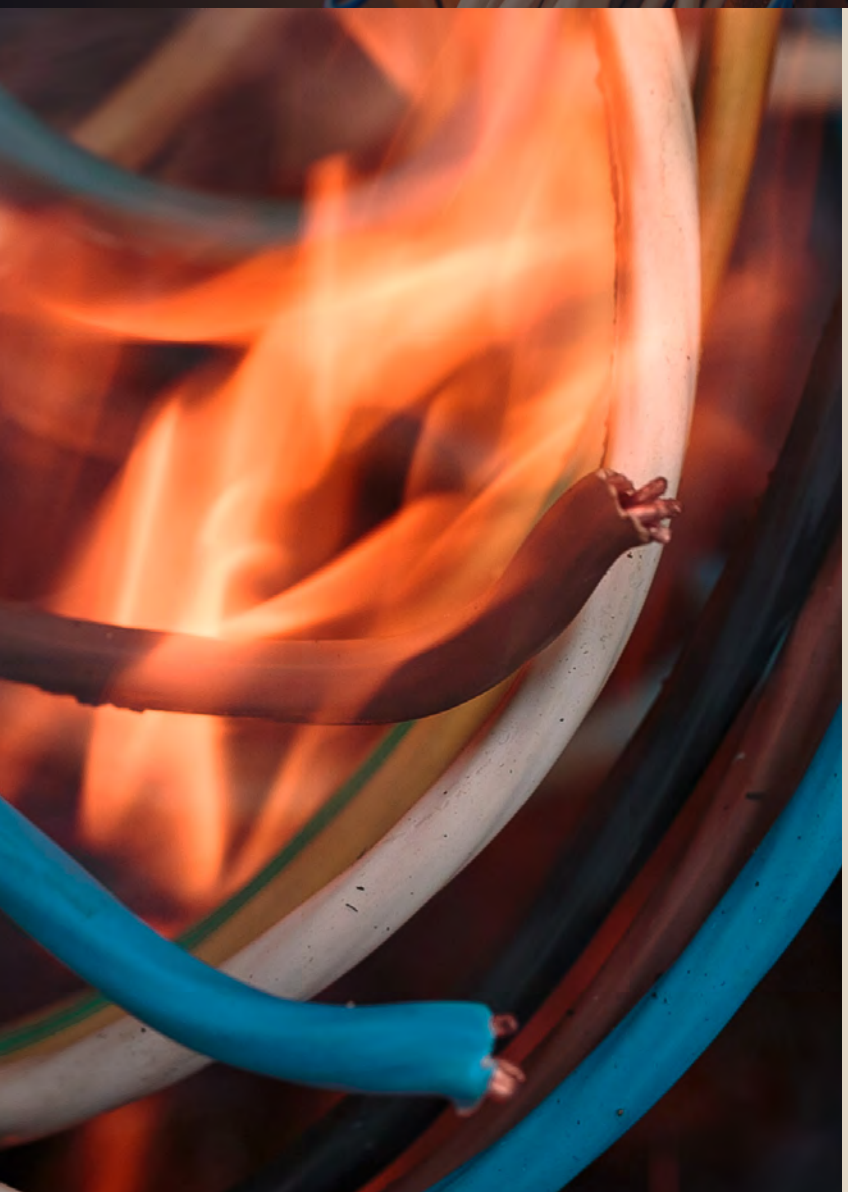
7	Phase loss	Disconnection of at least 1 phase from a 3 phase supply. This condition leads to excessive currents for 3 phase equipment such as motors and power supplies that becomes a source of ignition for fires.	Disconnection from supply Damage to wiring or switchgear
8	Neutral loss	Disconnection of the neutral wire. This is one of the most critical conditions in facilities that have 3 phase supply. A neutral loss is very difficult to diagnose manually. A loss of neutral will appear as a normal operating condition but only under certain unbalanced loads will it trigger extremely high voltages that are greater than 50% of the nominal voltage. These voltages are sufficient to trigger explosions in capacitors in air conditions or power supplies.	Disconnection from supply Damage to wiring or switchgear Overload/ unbalanced loads
9	Surge	Sudden increase in voltage for a few microseconds. Typically observed during load changes or lighting conductions. If there is not adequate surge protection it can lead to equipment failures and components exploding.	Poor power quality from utility Sudden load changes
10	High Earth Voltage	Increased voltage measured between earth and neutral. This voltage is an indication of poort earth resistance, poor connection to neutral or faulty equipment. A poor connection, loose connection, oxidized busbar or carbon formation are all possible causes. High earth to neutral voltages is an early sign of exposed wires in some cases. Not correcting this fault early enough will lead to overheating of busbar contacts and in some cases arcing events.	Poor earthing Faulty neutral Leakage in devices Poor quality of busbar and contacts
11	Current Unbalance	Uneven current between 3 phases. Unbalanced currents lead to higher currents in the neutral wires. In facilities that have 3 ½ core wiring it can also lead to overheating of neutral and neutral loss conditions.	Poor electrical design unbalanced loading
12	Current Harmonics	Distortion in the shape of the current waveform. Current harmonics have become a much talked about topic when it comes to power quality issues. Although, triplen harmonics (3rd, 9th, 15th, etc harmonics) can lead to 3 times the current through the neutral wire The high neutral current can lead to neutral wire overheating and even a neutral loss condition. Current harmonics also lead to overheating of transformer windings which is another fire risk.	Poor equipment design Harmonic generating electronic loads Transformer saturation

How does one identify these faults, without having a PhD in electrical engineering? Automation can lead the way. Just like we monitor biological signals to prevent heart attacks, it is necessary that we develop methodologies to protect ourselves from electrical fires by careful monitoring of these electrical conditions.The key is to monitor these 12 conditions continually and in real time. With advances in electronic technologies, there are devices available for early detection, monitoring and reporting all of these 12 critical issues. But common practice only relies on protection for short circuit, overload and earth leakage. In effect, we are only protecting ourselves for 25% of the overall fire risks.

An obvious question to ask -- aren't these issues covered when we follow the standards for installation? Precisely! They ought to be. IS732 is the standard for electrical wiring prescribed to be followed by the National Build Code. Many of these 12 issues are required to be avoided by taking proper precautions during design. Unfortunately manual implementation and manual verification make it impossible to ensure compliance to the requirements stipulated by IS732. Furthermore, the only practise in place to verify compliance in continual operation are periodic manual audits (if budgets are approved). These manual audits, if and when performed, focus on identifying issues that are identifiable visually or by thermal scans at specific locations and during the limited time that an auditor is present at site. In our analogy it is like using a thermometer when an ECG is required. ■

Dr. Tejas K Jhaveri
Founder, Jhaveri Power Labs

Role of Cables in Electrical Fires



Fire safety is a key issue to consider when we talk of the electric cable and wire industry. Electrical fires are a frequent occurrence in India. We read and hear of instances in the news regularly describing ghastly fire accidents causing massive damage to property and claiming innocent lives. Majority of electrical fires are a result of short circuit due to old wiring, damaged or poor quality of equipment and faulty outlets.

Be it slums, high-rises, restaurants, industrial units, studios or old buildings – each has witnessed massive fire incidents this year. The violation of fire safety regulations has turned each into a tinder box, said experts. According to the Maharashtra Fire Prevention and Life Safety Measures Act, 2009, buildings are supposed to conduct a fire audit twice a year – in January and July – and submit the fitness certificates to the nearest fire deparment.

So, at least 10 to 12 fire accidents take place in Mumbai every day. In most of cases the fire is caused due to short circuit, and especially in crowded cities, and high rises where countless lives have been lost. It is high time that even the establishment owners take onus of the high degree of risk that comes with the use of poor quality cables and should conduct proper research before making the final

selection. The quality of cables should not be compromised for the sake of price.

With the rapid growth in infrastructure and urbanization there is a growing need for specialty cables. Fire survival cables, especially, have seen a steady demand in places inhabited by people with limited mobility like hospitals, clinics or with unfamiliar layout of buildings like malls and cinema halls and crowded places like offices, schools, etc. where the need to evacuate people during fire breakouts is of primary concern. Cables play a key role in safety of an establishment with respect to fires, as they are a vital link between emergency equipment and their power or control source and hence it is crucial that they must remain functional even during a fire.

IEEMA Journal speaks to the experts from the wire and cable industry to know about the challenges, innovations and awareness being done by their company in regards to electrical fire safety.

The increased standard of living of an average Indian house hold with the economic growth has also increased our dependence on electricity in our day to day life. This also means a typical household has more electrical appliances today than ever before. Also, the common trend in urban India is high rise residential construction with the increase in density of population per square foot area. Considering these facts, it's important for us to give the electrical wiring its due attention and follow safe wiring practices to avoid fire accidents.

IEEMA Journal speaks to the experts from the wire and cable industry to know about the challenges, innovations and awareness being done by their company in regards to electrical fire safety.

Mr Shreegopal Kabra

Managing Director & Group President of RR Global

What are the biggest challenges related to electrical safety in India?

The main challenge in our Country that there is abysmally low focus on wires as these products go behind the walls and hence are not included in customer's priority. Electrical contractors settle for low-cost, substandard cables, which poses serious safety hazards. Majority of the fire accidents in India are caused by electrical short circuits, which mainly occur due to poor quality wires and cables. PVC wire is most commonly used in India despite the fact that they are very dangerous. When they come in contact with flame, these wires generate a lot of poisonous, dense smoke that results in limited visibility and is hazardous for people to breathe. Most of the deaths in an event of fire outbreak are not caused by fire itself but because of suffocation caused due to inhalation of toxic smoke emitted from burning wires. That's precisely the reason usage of LS0H wires has become a norm globally. In India, however PVC is still used widely due to two-fold reasons: lack of awareness and cost.

What are the current trends and innovations impacting the Indian wire and cable industry?

In recent years, there has been a shift towards fire survival cables, also with the mandate of National Building Code of India (NBC), usage of fire survival cables is picking up in public buildings and constructions, such as hospitals, theatres, shopping complexes, tunnels, etc. Second major trend that is seen globally is increased usage of Low Smoke Zero Halogen (LS0H) instead of PVC Wire due to its safety hazards.

In your view, how can the industry and government work together to strengthen electrical safety in India?

We are constantly speaking to the media, government bodies, contractors and builders. We run media campaigns around the same. I urge that IEEMA the apex association of the Indian electrical equipment manufacturing, to work extensively in this direction alongwith NBC, BIS and Central Electrical Authority regarding requirement for stringent laws for electrical safety standard.

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Mr Shashi Amin

Executive President & Chief Business Officer (Cables), Polycab

How do you see the challenges related to electrical safety in India?

Electrical negligence may lead to accidents or even worse, deaths. Starting off with a few statistics, more than 40% fire accidents in a building happen due to electrical issues, most of which are triggered by loose wiring and connections or its poor maintenance. Over 2000 electrocution deaths happen in India every single year.

Another major issue is the fact that there is minimal awareness among people with regards to standards of electrical safety. Even though we have a National Building Code that dictates the dos and don'ts to prevent electrical hazards, the implementation of it is rather remiss.

People that do not have adequate training and skills are also a contributing factor to low grade electrical safety because it leads to incorrect fitting and improper maintenance. While we are on the topic of improper wiring, I would also like to mention how it is extremely critical to upgrade wiring systems after a point of time, which is often neglected. Buildings stand for 25+ years without any modifications in their electrical systems. This is extremely dangerous and should also be closely looked at. Hence, when it comes to electrical safety, I think it is fair to say that we are way behind.

How are the trends changing with innovations impacting the Indian wire and cable industry?

I guess with new innovative methodologies pouring in, and technology becoming stronger than ever, there is scope to make wires and cables more efficient, dependable, and safer. For example, switching to XLPE from PVC for cables as a choice of insulation is a wise one considering the superior electrical properties of XLPE. Or for that matter, considering a shift from normal FR PVC to Low Smoke Zero halogen in wires is also a judicious decision because FR PVC emits smoke and toxic gases upon catching fire.

Speaking more on the subject, I believe that it is due to such technological changes and innovations that we are now able to make evacuation during times of fire accidents safer and easier.

We now have Fire Survival Cables that can withstand temperatures as high as 950 degrees and emit absolutely negligible smoke. Both of these features can be made excellent use of in case there ever is any fire breakout in a building full of people. We are well-aware of the kind of lives that are lost to asphyxiation during fires every year. It is technology like this that makes it better for cable and wire manufacturers like us to provide top-notch innovative solutions.

What is your opinion on the safety hazards related with PVC wire? In your view, why are the wires still being used in India?

The main risk during use comes from accidental fires. Although PVC coatings are designed to be fire retardant, once they burn, they can generate gases such as carbon monoxide, carbon dioxide and hydrochloride gas. Many of these gases are the same as those produced by burning other plastics, wood or coal and are highly hazardous and present both acute and chronic health hazards to occupants, firefighters, and surrounding communities. Hydrogen chloride gas is a corrosive and toxic gas that can cause skin damage and long-term respiratory damage. It also emits black smoke which becomes a major obstruction to evacuation in case of fire accidents. In addition, it contributes to acidification and global warming.

As a safer alternative in the future, we recommend Low Smoke Zero Halogen (LSZH) based wires. It has a flame-resistant jacket that does not emit any toxic fumes on burning, which means it is free from halogenic materials such as Chlorine and Fluorine. Switching from PVC to LSZH would be a wise decision from the perspective of a cleaner environment as well.

In your view, how can the industry and government work together to strengthen electrical safety in India?

I believe that there's a lot that can be done if industry and the government were to work in tandem with each other. The industry can make suggestions based on the ground reality and the government can use their

authority to implement the relevant ones. Making regulations and standards is one expectation which the industry has from the government. To improve the status of electrical safety in India, there need to be some norms and policies that would ensure standardization. For example, the industry can work very closely with the government to facilitate formalising and executing legislations for the use of fire survival cables and wires in the constructions of places like high rise buildings, malls, hospitals, schools etc where there is a high density of people. This would bring down the number of deaths caused due to fire accidents significantly. Currently there is no check to ensure safe evacuation during a fire. Taking this one measure is going to bring major changes to the electrical safety scenario.

Additionally, activities like workshops to educate electricians and workers from the government's end, technical training to contractors, setting up of inspection committees etc will go a long way!

What are the steps being taken by your company for increasing awareness around electrical safety in the country?

Well, we have not done much thus far, but going forward we have a few initiatives in mind that will help achieve the purpose. Polycab as a brand considers it a responsibility to educate and aware people of the many possible negative effects of poor electrical safety. In addition, we believe that providing people with solutions to tackle this and informing them about their options is an absolute must. In near future, we plan to make use of our reach and take initiatives like electrician meets to help and spread the required technical knowledge to the people who actually are responsible for implementation of safe electrical measures. Also, we plan to execute digital campaigns to bring the message out in the open and educate the general masses.

Restrictions due to the ongoing pandemic are definitely going to create roadblocks, but we will try to make the most of whatever limited resources we have to work with.

Mr Gautam Seth

JMD, HPL Electric & Power

How do you see the challenges related to electrical safety in India?

Electricity is an inseparable part of our life and making forays into ever newer sectors of our lives. As we are moving ahead in the world of technology, new appliances, gizmos and gadgets are increasing the load on the electrical infrastructure. Due to lack of up-gradation of their capacity, most of the fire accidents happen, and the reason is a short circuit. If we talk about the challenges related to electrical safety in India, many major electrical accidents have taken place over the last decade due to short circuits, which have resulted in loss of lives and property. In India the major challenge is with the installation, operation and maintenance of the electrical supply and use, which is done in a very unsafe manner without following proper protocols, this leads to fatal electrical accidents in majority of cases. The main issue is that the lack of awareness on safety standards and installation and operations protocols for electrical systems, leading to accidents. Therefore, there an urgent need to create public awareness of the hazards through different media platforms. Secondly, training of electrical workforce with regards to safety plays a major role in keeping electrical systems in good operational condition and also reduces the hazards of short circuits and electrical fires.

How are the trends changing with innovations impacting the Indian wire and cable industry?

Indian wire and cable industry is moving away from the unorganized space to the organized sector consisting of pan-India branded and big players. If we talk about

CAGR, then the wire and cable market in India is growing at CAGR of 15 per cent and market size is expected to keep growing in the coming years. The growth of the organized sector in wire and cable segment is leading to the sector becoming more competitive and lot of innovative products are being offered.

What is your opinion on the safety hazards related with PVC wire? In your view, why are the wires still being used in India?

Polyvinyl Chloride (PVC) is a popular material among wire and cable manufacturers in India and other industries. It is used for diverse applications including wire insulation. The reason why PVC is a popular material is that it does not conduct electricity. This property makes it a perfect material for electrical applications including cables and wires. PVC is also known for its long-lasting toughness so much so that it has an in-service life of about 100 years. Wire and cable manufacturers in India have been using PVC to bring safety and ease of use within the industry. Here PVC adds to the lifespan for the cables making it quite useful and efficient. Another property of PVC is that it is safe. The electricity industry has had its focus on safety as its most important goal. With PVC, they have been able to achieve that. The material has been designed after intensive research and development. It has repeatedly fulfilled international safety and health requirements. Additionally, PVC is non-toxic and has virtually no effect on the environment in comparison to the other instrumentation cable alternatives.

PVC has been known to withstand high temperatures and extreme duress. While the material does catch fire, its composition extinguishes the fire on its own particularly when the source of fire is taken away. In that case, PVC will not continue to burn. Igniting PVC is a difficult process and when heated, it produces very little heat. Unlike other materials, PVC chars rather than burning as drops, significantly reducing the danger of a continued fire.

In terms of its manufacturing, PVC is relatively easy to make and is cost-efficient. This allows customers to buy PVC-coated wires and cables at a low cost in India. It is often seen as a good investment as it does not require much repairing or replacement. For a developing country like India, cost-effectiveness is a primary concern especially when it comes to safety standards. Here PVC has been a significant achievement.

In your view, how can the industry and government work together to strengthen electrical safety in India?

Safety and related certification are a very important aspect of the industry, with major electrical equipments and systems being subjected to intense scrutiny for safety related aspects. In India, safety standards are quite high and have to conform to government specified standards which are comparable to the best in the world. Our domestic manufacturers have to get certification from government approved bodies to be able to compete in the market. All HPL products conform to the highest standards of safety and are certified with Indian and International standards such as ISI, CE, and KEMA.

What are the steps being taken by your company for increasing awareness of electrical safety in the country?

As the electrical and energy industry is growing rapidly in India, awareness of electrical safety also play an essential part. HPL has been promoting and creating awareness on electrical safety through its vendor network and keeps customers and distributors aware on key safety features and aspects of all our products. All our products are certified with Indian and International standards conforming to highest safety standards. We educate our customers to buy only certified products and on good operation and maintenance practices that enhance safety and durability of electrical systems and products.

Mr. Abhishek Gupta

Joint Managing Director, Gupta Power Infrastructure Ltd

How do you see the challenges related to electrical safety in India?

India a densely populated country where scant credence is given to fire safety norms, fire hazard is a serious issue here. Old buildings abound, from offices to big industries and from various housing complex to shopping malls. Though presently fire safety norms are being enforced in public places and large housing complexes a small mistake here can put many lives in danger. It's a huge challenge to face fire accidents. Currently, the main challenge plaguing electrical safety is the extremely low focus on cables and wires, protection devices, smart monitoring devices to control overloading in circuits one of the primary causes of fire.

I would like to cite here a highly overlooked factor. Conduit wiring which is all prevalent has an inherent problem –one does not notice the fault in the wires unless it is too late. Wire being a low priority item for Builders and promoters the electrical contractors settle for low-cost and substandard cables which can pose a serious safety hazard to the household. Statistics show that the majority of the fire accidents in India are caused by electrical short circuits, which boils down to the use of poor quality wires and cables.

I feel, we being manufacturers must take on this quality issue and with IEEMA's involvement innovate and ensure proper quality standards are maintained ensuring zero fire hazards.

It is also important that appropriate protection/ monitoring devices are installed so that faults are detected early on and rectified avoiding disasters.

How are the trends changing with innovations impacting the Indian wire and cable industry?

There has been a major shift towards the usage of fire survival wire and cable, particularly in the urban areas. Zero Halogen Flame Retardant (ZHFR) wires have a special thermoplastic insulation compound that suppresses the fire and allows a char to be formed. This reduces the poisonous carbon gases, smoke and carbon particles. These cables have unique technical features in terms of requirement of critical oxygen index and temperature index to prevent fire hazards.

The trend is yet to catch up with the Indian market, but as a company in a dynamic field, we have to foresee such trends and implement them to be a market leader and Gupta Power has been doing exactly the same.

OEMs should follow the mandate of BIS, ISI and NABL accreditation. The usage of fire survival cable is accelerating in public buildings and constructions, such as market complexes, hospitals, multi-storied buildings, parks, etc. To stay ahead of the curve, we have to keep up with the latest trends in the wire and cable industry. This helps us stay relevant and add value to the lives of our customers.

What is your opinion on the safety hazards related with PVC wire? In your view, why are the wires still being used in India?

PVC wires generate a lot of poisonous and dense smoke that hampers visibility and that smoke can result in choking due to breathing congestion. Now, we know that the reason for the majority of the fire deaths during an outbreak is not the fire itself, but because of the choking and suffocation that happens when we inhale toxic smoke from the dense flames emitted from burning wires.

Experts know that PVC wire is most commonly used in India. But at the same time they are also the most dangerous and pose the greatest safety hazard. It is like walking the edge of a mountain cliff knowing you can fall off anytime. It is being used mainly due to cost and little importance that Influencers give to the safety aspect in the building industry.

Zero halogen low smoke wire and cable, are taking over the global market and becoming the new phenomena in the industry. However, in our country, there is a resistance to adopt these wire and cable mainly due to an acute lack of public awareness. Industry leaders shall be responsible; it is our responsibility to build awareness surrounding the hazards.

In your view, how can the industry and government work together to strengthen electrical safety in India?

Disruptive changes or strengthening of the sector calls for serious measures and collaborations. And this will

involve all the stakeholders right from the government organizations to the consumer to collaborate together for a common goal. Stricter fire safety regulations by the National Building Code of India (NBC) need to be in place, that's a must. That is where the government's role comes into play. Today's government needs to strike the right balance between energy saving methods and a dedicated focus on cable quality. 5-Star Product rating for electrical safety can also go a long way in ensuring fewer safety hazards and better quality.

Now coming to the cornerstone of every business, the consumer; as the doctor prescribes medicines for their patients, electricians write memos for consumers. Awareness campaigns and educating the electricians and electrical contractors on these issues will lead them choose quality electrical products with safe and trustable standards. The damage caused by inferior electrical products can be long lasting and as a long term strategy, it's always wise to invest in good quality electrical products.

What are the steps taken by your company for increasing awareness around electrical safety in the country?

Awareness around safety and value addition are the core principles guiding the vision of Gupta Power. We strive to be a responsible company because we know if electricity can light up lives, then it ruin families too if not treated in proper way.

Our team constantly strives to keep up with the latest safety trends, build awareness and communicate with our stakeholders, be it the government, electrical contractors, electricians or the consumer through various seminars/ webinars, nukkad meet, electrician meets, outdoor campaigns and strategic media campaigns. We arrange unique factory visit programs for all types of electrical boards, contractors and workers to educate them of our quality products and its safety features too.

It is highly worthy to mention that the Indian Electrical & Electronics Manufacturers' Association (IEEMA) is working in a smart and hard way to drive safety awareness and focus on wire and cable quality.

Gupta Power will keep working towards creating an ecosystem that prioritizes electrical safety and quality standards by "Powering A Smarter Tomorrow".

Mr Naman Singhal

Director, Prime Cable Industries Pvt. Ltd.

How do you see the challenges related to electrical safety in India?

India is progressing in terms of Electrical safety, this can be seen by the quality driven approach of State Electricity boards, Electrical Contractors and other PSUs and Private Energy Consultants. We are seeing numerous efforts by our clients who are mainly electrical contractors in terms of electrical isolation, more emphasis on proper display of display boards and identification, inspection & testing of Cables and other materials and other precautions towards hazards.

But there still are various challenges for India to become really efficient in terms of electrical safety. Some that I can think of and believe are as follows-

1. In India the job of setting up infra for electricity distribution and transmission is mainly privatised by state electricity boards and other Energy sector PSUs. These jobs are usually taken up by huge MNCs and companies like GE power, Siemens, L&T ,etc which are very much capable of doing their task by following proper electrical safety measures. But the responsibility of its maintenance and repair over the long run falls back in the shoulder of the state electricity boards and Public Enterprises which I believe are still inefficient.
2. There is still an adequate amount of unqualified or unskilled labour force in the electrical sector. This also adds up to the problems in terms of following proper electrical safety precautions on the electrical sites.
3. Though we have witnessed the stringency over the quality of cables and other raw materials

both by the end users and the contractors, we believe there can be more control to it as we see various sub standard products still prevalent in the market. This control over such undermine quality products to enter the market will also lead to overall electrical safety.

4. I believe that there has been a change in the mindset of the Indian consumer in the previous year. But , art large the mindset is still focused on price rather than the quality. Which in turns also creates a barrier to electrical safety.

Awareness and better control policy by the government will help India become really efficient in terms of electrical safety.

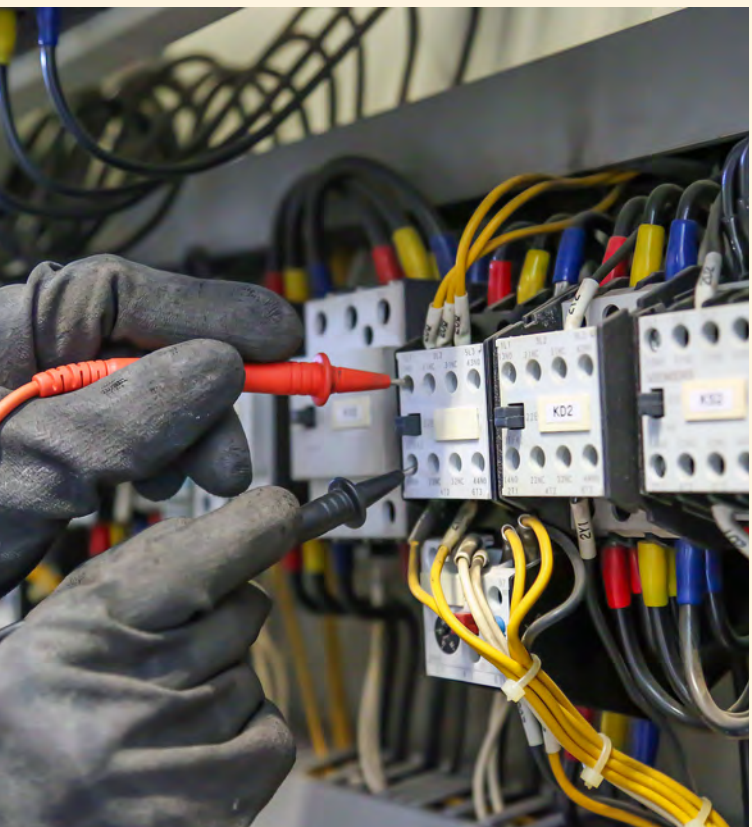
How are the trends changing with innovations impacting the Indian wire and cable industry?

There are various trends that have been impacted by innovations in the wire and cable industry.

We are seeing a great focus on the ZH-FRLS and FRLS cables. Almost every cable that we are quoting and manufacturing right now are FRLS cables. This in turn is also leading to better electrical safety.

We are also seeing the sector becoming more organised by the ways of skilled labour , automation and setting up of various manufacturing standards.

Our overall factory can now be termed as a smart factory , by the use of cloud base management softwares at the shop floor level. And if an MSME firm like ours is making this kind of a shift using innovation, we can surely see a great impact of innovation in the whole ecosystem of this industry.



What is your opinion on the safety hazards related with PVC wire? In your view, why are the wires still being used in India?

PVC is a widely used plastic compound in the insulation of wires and cables. Though it has numerous issues in terms of safety hazards as it is composed of hydrochloride. Melting of PVC releases toxic gases which can cause nausea and even burnt skin. Dioxin which is the most dangerous man made carcinogen is also present in this compound. PVC is the largest contributor to the world's dioxin burden.

The primary reasons for its wide use and still being prevalent in the industry despite causing several safety issues is that PVC is inexpensive as compared to other compounds that can be alternated. Other reasons are that PVC is also very durable, strong, chemically resistant, biologically resistant, easy to install and replace.

In your view, how can the industry and government work together to strengthen electrical safety in India?

It is the industry and the government together that can only achieve this goal of India becoming efficient in terms of electrical safety.

This can be done by creating awareness and better control policies. National level awareness campaigns can be done to make consumers at the ground level realise the importance of electrical safety. These awareness campaigns can also be a part of the CSR fund of the major companies in the industry.

Government can make some key changes in the electrical act by the means of valuable inputs from the industry, who are witnessing these issues of electrical safety on the ground level. This will lead to better control and management.

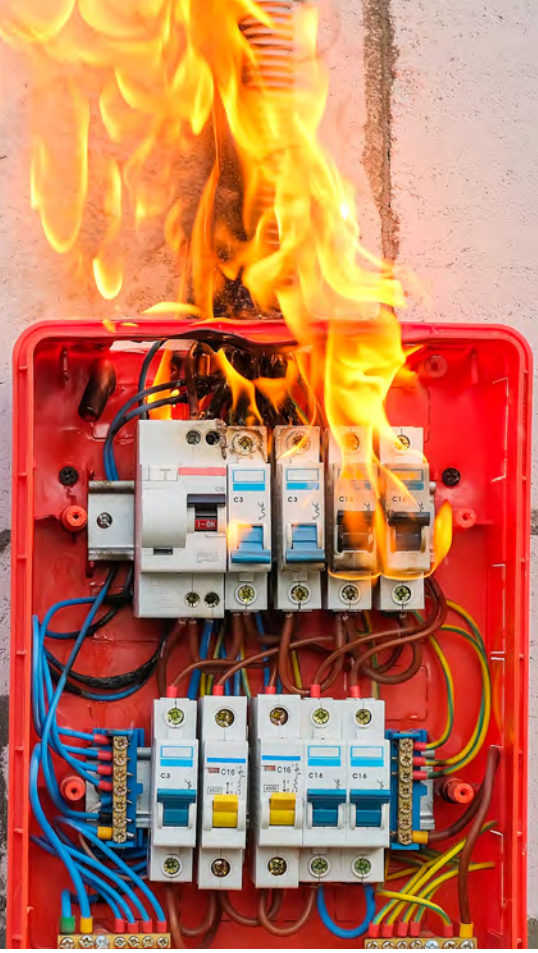
Another measure is to realisation of the influence of quality products on the overall electrical safety. On the industry part it should be very ethical and determined over the quality of their products and on the government hand is to be constantly keeping a check on the quality.

I hope together we will surely achieve this goal of making India efficient in terms of electrical safety in the coming future. ■

Shalini Singh, IEEMA

RESONANCE

A commonly overlooked cause of many fires



The electrical short circuit is known to be a major cause of incidences of fires. Many times, it is difficult to ascertain the real cause of the fire and an electrical short circuit is advanced as a likely cause. Some hazardous electrical conditions that lead to electrical fires are overloaded electrical circuits, temporary wiring, static discharges, loose electrical connections, poor maintenance, poor quality of equipments etc. All these are well understood conditions and conscious efforts are taken by electrical personnel to correct the abnormalities.

Here, in all these situations, we are dealing with known issues and well defined and clear remedies to overcome them. However, we will be discussing about a phenomenon called electrical resonance which has gained considerable significance over last some years. A resonance condition in an electrical network is akin to a short circuit condition with uncertain and unknown level of severity. When an electrical network is in a state where capacitive reactance due to power capacitors equals inductive reactance of the network, a parallel resonance condition develops. This causes heavy current through power capacitors. There is no dead short circuit and the heavy currents do not activate short circuit protections. Nevertheless, currents can be large enough to cause excessive heating in the associated circuits with consequential damage to the circuit elements viz. cables and switchgear and more particularly to capacitors. The resonance current is a high frequency current depending upon the frequency of resonance. Most common resonance frequencies are 250 Hz and 350 Hz. The power capacitors offer very low impedance to these high frequencies and they act like a sink for these frequencies making them prone to excessive heating and consequential failure. This is an electrical situation occurring in a reactive power circuit. This potentially hazardous condition is a sure recipe for major electrical accidents but has remained overlooked from the viewpoint of electrical safety considerations.

Resonance conditions can frequently occur as a combination of two factors:

- High content of nonlinear loads to the extent of about 70% of total load.
- Indiscriminate use of power capacitors for power factor improvement.

Earlier, about a decade or so ago, nonlinear load content was much less, say about 30% as against about 70 % linear load content. Similarly use of power capacitors with particular reference to Indian conditions was about 50% of what it is today. The increased use of power capacitors is the result of Power Factor incentives and KVAH billing. Both the above factors put together have led to increased chances of resonance occurrence at an undesirable harmonic frequency. The extent of use of power capacitors overseas compared to that in India still remains comparatively unaffected and much lower.

Let us understand the mechanism of resonance occurrence before we discuss remedial measures.

Nonlinear loads generate undesirable harmonic currents at frequencies which are multiples of fundamental frequency. The parallel resonance occurs at a frequency where the capacitive reactance equals inductive reactance of the system. It is desired that this resonance occurs at a safe frequency. A frequency which is not equal to or near to frequency of any harmonic current generated by the nonlinear loads is a safe frequency. More often than not, it is found that the resonance occurs at an undesirable harmonic frequency leading to amplification of that particular harmonic current.

Let us now discuss the remedial measures.

Avoid resonance at an undesirable harmonic frequency

A Power Capacitor should not be used without a series reactor. In most cases a 7% detuned reactor serves the purpose of shifting resonance point to a safe location away from harmonic frequencies present in the network. This prevents amplification of an undesirable harmonic frequency and at the same time it provides some amount of harmonic mitigation of mainly 5th frequency and to some extent 7th frequency. This, however, cannot be taken as universal remedy and wherever amplification of harmonic frequencies present in the network is still noticed it is necessary to use 14% reactors in place of 7% reactors.

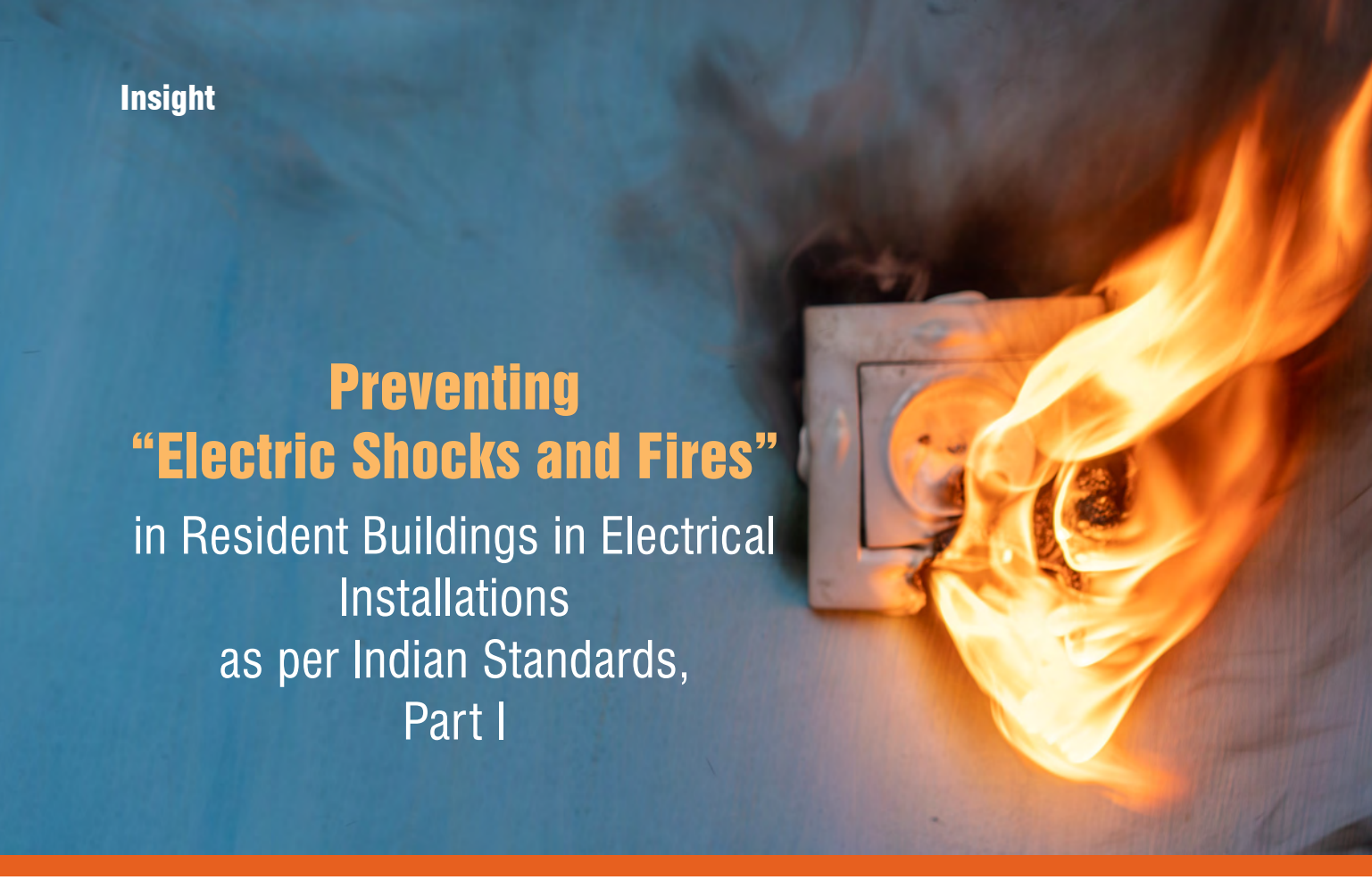
Facilitate self-correcting natural phenomenon of resonance elimination

Resonance fortunately, is a self-correcting phenomenon and whenever the resonance condition occurs power capacitors draw excessive current due to their low impedance to harmonic frequencies. In this process some capacitors fail thus taking the system out of resonance condition. Here we need to plan in a way that this process of self-correction is facilitated. If we encounter repeated capacitor failures it indicates that failures may be due to resonance condition and not due to poor quality of capacitors. A power quality study is to be done and once resonance occurrence is established remedial action can be taken by suitably altering the tuning frequency of Reactor-Capacitor combination. The circuit configuration for low voltage and medium voltage capacitors is different. In medium voltage applications some of the internal capacitor elements fail with heavy harmonic currents and activate unbalance protection. This takes the system safely out of resonance condition. However, we do not have to unbalance protection in low voltage capacitor applications. The use of self-healing capacitors coupled with overpressure interrupter mechanism in low voltage applications provides a safe mode of failure to power capacitors under heavy resonance induced currents. The self-protective nature of self-healing capacitors provides much needed protective cover to the system in the absence of any defined external protective mechanism when resonance induced heavy currents flow through capacitors.

Conclusion

Resonance occurrence in power systems is not uncommon leading to the flow of resonance induced heavy currents through capacitors. There is no well-defined protective mechanism designed to safely isolate the affected circuitry and handle the abnormality. The abnormal condition is hazardous having all the ingredients which can lead to fire and accident. The safety lies in avoiding indiscriminate use and replacement of power capacitors by adhering to the correct application of capacitors. ■

Baldev Raj Narang
CEO Clariant Power System



Preventing "Electric Shocks and Fires"

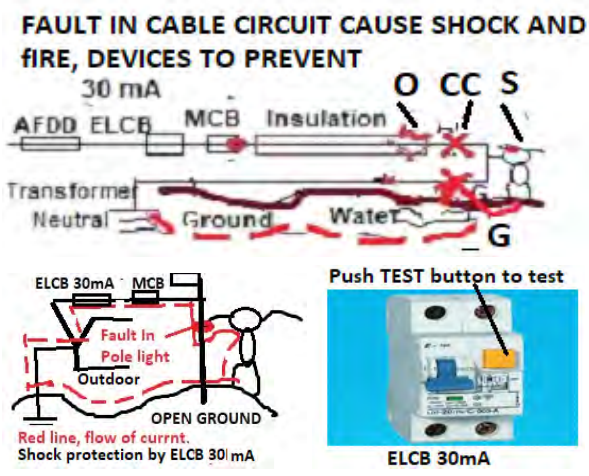
in Resident Buildings in Electrical Installations as per Indian Standards, Part I

- *Problem: every day we read; a loss of life due to shock. Many are not reported. About 2 major Electrical fires. Loss of lives and billions of Rs. loss*
- *Solution: Install ELCB 30mA Device in an electrical panel in the house.*
- *How to prevent shock and fire: This article is a consumer guide, where, when and why fire occurs.*
- *Consumer get confuse from so much internet information. Simple guide to understand, 4 pages.*

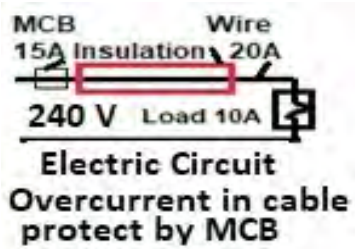
Electrical Installations must be protected to prevent shock and fire from

- **Shock:** Electric shock to humans. Water and outdoor, ground, will aggregate shock.
- Mandatory, Protection by device, Earth leakage circuit breaker (ELCB), 30mA.
- **Fire, Overcurrent:** Excess current in cables, PVC insulation melt, create smoke and fire.
- Protection by device, Miniature current circuit breakers (MCB)
- **Fire, Arc:** cable to ground fault. Water will aggregate arc and fire.
- Protection by device, ELCB 30mA (0.03A) to 300 mA (0.3A). 1mA is 0.0001A.
- **Fire, Arc:** Arc produces in-house due to cut in wire and etc.

Protection by device, Arc Fault Protective Devices (AFDD). Study in Part II



Protection against shock by Device ELCB 30mA



Protection against overcurrent, PVC insulation melt, by device MCB to prevent fire

Nr.	Symbol	Item	Cause	Remedy, protection	Comment
1	S	Shock	Touch open cable or Fault equipment	Mandatory, ELCB 30mA	Bathroom and outdoors, high risk
2	O, Fire	Over current in cable	Melting of PVC insulation, Fire	by device MCB	Major cause of fire
3	G, Fire	Cable insulation cut, copper touch ground	ARC and fire	by device ELCB	ELCB 30mA to 300mA
4	Fire, CC	Cut in cable inside Flat	Arc	By device AFDD Not in Indian standard	Mandatory in USA. Recommend by IEC
Electric shock: Protection by Device ELCB 30mA. Mandatory to install all circuits, lights and sockets.					
Caution: Bathroom and outdoor are high shock risk locations. Presence of water and open ground and water.					
Fire: from overcurrent cable, arc due to cable ground fault and Arc due cut in wires in flat					

Indian Standards and regulations for electrical equipment and installations

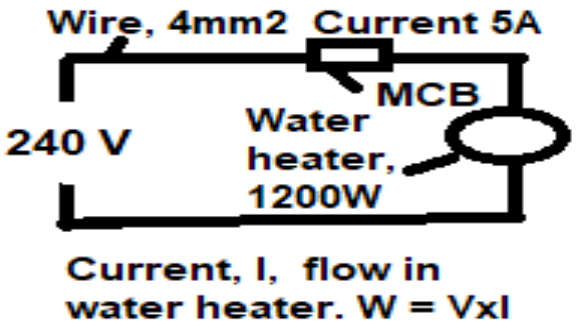
- Electrical installation must be done as per Indian Standards or regulations otherwise more shock and fire.
- What are standards? Electrical equipment is produced by Bureau Indian standards (IS), New Delhi. E.g., Water heater and etc. are marked with "IS". This item is produced as per IS standard or regulations.
- IEC Standards: Indian Electrical Standards are as per International Electrical Commission (IEC) standards, Europe. They develop electrical standards and are followed in the world.

Definitions

- ELCB 30mA device: Protection against shock. Earth leakage circuit breaker (ELCB)
- ELCB 30mA Device: Protection against fire due to ground fault. The main purpose of ELCB protection against shock but to give ADDITIONAL protection due to ground fault.
- RCD 30mA = ELCB 30mA device: As per IEC standard, ELCB is named as Residual current device (RCD).
- AFDD device: Fire from the small arc in flat: Protection by Arc fault detection device (AFDD)
- MCB device: Protection of wires from overcurrent, PVC insulation melt, to prevent fire by Miniature circuit breaker (MCB) to open a circuit automatically, act like switch on and off automatically.
- RCBO = RCD 30mA+MCB in one device = shock protection+ overcurrent in wire protection.
- V, Voltage 240V. I, current in a wire, unit A. W, power consumption of electrical items. W =VxI
- Electrical circuit: define as Voltage 240V apply to electrical items from a wire.

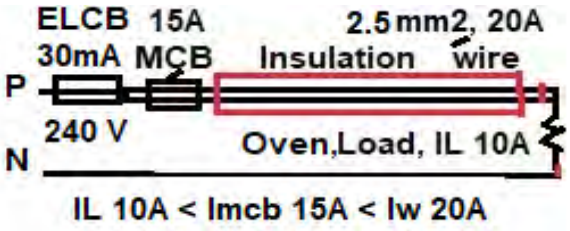
Electrical Circuit, Voltage, current and watts: W = VXI

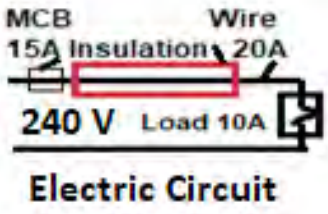
- Electricity Voltage. V: 240 V. Current, I, flow in wires when electrical items are switched on.
- Power of Electrical items is given in watts. Watts = VoltagexCurrent. W = Vx I.
- The current value depends on the type of electrical items. Bulb, 100 W, 0.5 A. Water heater, 1200 W, 5.0 A.



Locations of MCB and ELCB 30mA in Electrical panel inside flat:

Electrical panel on flat





Electric Circuit

Electricity and water: Do not mix together. Produce Shock, ARC and Fire

- Caution: Locations, Bathroom and Outdoor, high shock risk locations.
- Electricity and water: Do not mix well. A person gets heavy shock, arc, and fire.
- Bathroom presence of water. Outdoor, open ground and water.
- Presence of Water and outdoor ground locations: High shock risk locations.
- Outdoor Location: 90% of shock accidents and loss of life happens due to wet ground and water.
- Electric fire: 75% of the fire is from cable PVC insulation melt e, g. “overcurrent and cable earth fault.
- I tried to get ELCB 30mA in the market but 100mA was available. Our electricians are not aware current mA.
- DANGER: ELECTRICITY IS DANGEROUS. Take professional advice

YouTube Video

Path to the YouTube video from Eaton Co.: Title: Arc fault detection device (AFDD), circuit protection, https://youtu.be/UtOmau4ym1Q. Copy and google. Explain MCB, ELCB, RCBO and AFDD.

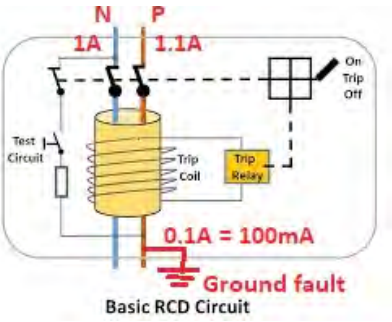
Shock Protection

Electric Shock and Protection

Cause: Presence of water, outdoor, open ground. Touch EARTHED metal parts, e.g., Metal light poles

Remedy: Mandatory to install device Earth leakage circuit breaker (ELCB) 30mA for all lights and sockets indoor and outdoor. Must be ELCB 30mA

ELCB 30mA gives additional protection against fire due to earth fault.



Basic RCD Circuit

ELCB, inside circuit

ELCB 30mA, single phase


ELCB 30mA, 3 phase

Electrical Panel: with 2 ELCB 30mA or each circuit with RCBO 30mA

- RCBO device= RCD (ELCB) 30mA+MCB for overcurrent in one device

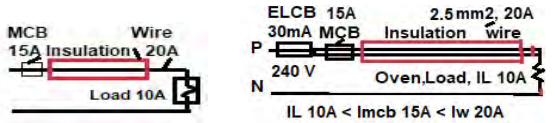
- ELCB, nuisance tripping is quite common. What is the solution? There are 2 options.
- Option: In Electrical Panel, install 2 ELCB 30mA or each circuit with RCBO (RCD+MCB) 30mA
- Cause: One ELCB is installed in an electrical panel, if a trip, complete darkness. A person may trip and hurt
- Remedy: In Electrical Panel, 2 ELCB to install, if one trip and then other ELCB supply. NO darkness or
- Install RCBO each circuit then supply will be switch off in one circuit and supply in other circuit is on
- Caution: RCBO in each circuit: I Prefer to install in a senior citizen home, school, high rise building etc.
- RCBO in each circuit is very popular in Europe.

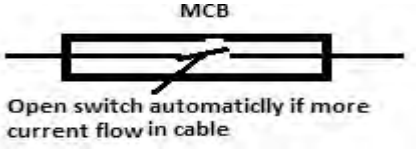
RCBO RCD(ELCB) 30mA MCB

Fire Protection

- Device MCB: Overcurrent in wire to protect.
- Device ELCB: Cable ground fault produces arc, protect by ELCB 30mA to 300mA.

Over current in a cable causes Arc and PVC insulation to burn to create fire. The main cause of fire

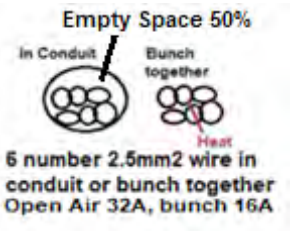




- Different sizes of wires are available. 1.5mm2 wire current rating 19A.
- If more current flow then PVC insulation burns and fires. protection by MCB, which open the circuits
- Cause: Overcurrent in cables. Remedy, Protection by device Miniature circuit breaker (MCB) or fuse

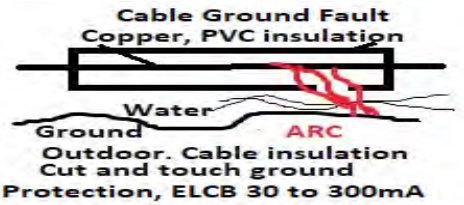
Current rating of wires: Current produce heat in wires. The main cause of the fire.

- Wire size current rating in OPEN AIR: 1.5 mm2 wire, Max. 19A. 2.5 mm2 wire, 32A, and 4 mm2, 42A.
- Wires bunch together: Inside wire does not dissipate heat so wires current rating are reduced.
- Example: Data: In conduit, 6 wires, 2.5 mm2 wires are enclosed. Answer: Current rating of wire is reduced to 32A to 16A.



Fire due to cable ground fault: Protection by ELCB 30mA to 300mA

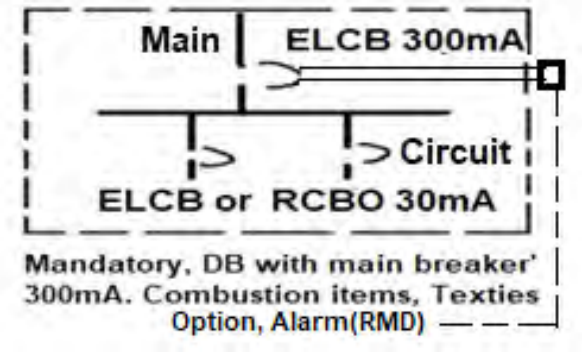
- Cause: Cable is cut and touches ground or earth then produce an arc. Water will aggerate arc
- Remedy: Protection by Device ELCB 30mA to 300mA.
- The main purpose to protect against shock but give additional protection against fire.



Electric Fire Protection, Combustion materials

- Locations: Combustible materials Storage: Textiles, wood, paper, etc.
- Solution: Mandatory, install ELCB 300mA as the main breaker in DB.

- Device ELCB 300mA prevents loss of life and billions of RS. loss, Cost only Rs. 2500.



Protection against fire, what is the Difference between RCD and AFDD device?

- Device ELCB, Ground fault: Protection against ground fault ELCB 30mA to 300mA
- Device AFDD, Arc faults: Arcing due to series (Cut in wire) and parallel (Phase to phase fault).
- 12, Protections Devices, applications and cost:

Nr.	Devices	Protection	Cost, Rs. *	Comment
1	MCB	Overcurrent (OC) in cables and fire	500	Select Correct size of cable
2	Mandatory, ELCB 30mA	Shock	1000	Protection from shock
	Also, protection from ground fault	Arc and Fire	1000	
3	As per IEC, recommend, AFDD	Fire from arc	8,000	Inside a flat in DB
	Combined devices in one module for protection against shock, fire from ground fault and fire from arc			
4	RCBO (RCD 30mA+MCB), one Device, install for each circuit	OC+shock	1500	Widely use in Europe, recommended
5	RCBO 30mA+AFDD, one device	OC+shock+fire+Arc	10,000	Inside a flat in DB
6	Combustion Materials, RCD 300mA	Mandatory, Fire	5000	Textiles, wood, paper

Caution, Bathroom, High Risk Shock Location

Location: Water, barefoot, touching earthed metal water pipes (now, plastic pipes). Water spray in all directions.

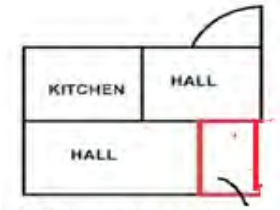
Mandatory, all circuits, lights and sockets, must be protected by ELCB 30mA.

Our bathrooms are small, about 10' by 6': NO sockets, light switch, water heater. Light, waterproof to IP44.

Exhaust fan 23OV AC, waterproof to IP44 or prefer 12V AC, available in the UK.

IP44 means internal protection (IP) of electrical items enclosure against particles and water.

Hair Dryer and mobile charge in Bathrooms: Many accidents happen and loss of life and death.



NO heater, sockets, switch, in Bathroom

Man was killed when charging phone in bathtube

Caution, Outdoor: 90% of shock accidents happen outdoor

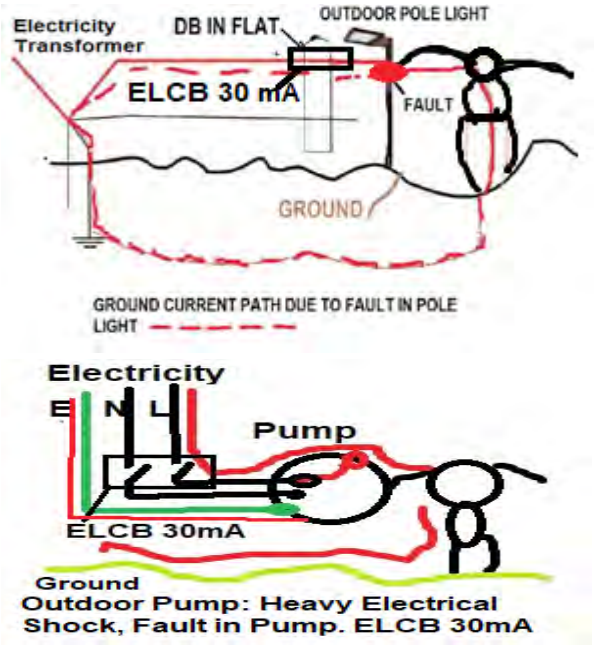
- Caution: Outdoor: MANY and 90% shock accidents happen outdoor.
- Caution: Prevent the loss of life: USE PRCD SOCKET AND PLUG FOR ITEMS. Cost only Rs.600. each
- Location: Water, barefoot, open ground and may touch electrical metal pole lights.

Mandatory, all circuits, lights and sockets, must be protected by ELCB 30mA.

All electrical items, waterproof to IP44.

Outdoor Heavy Shock, Examples

- Outdoor pole light: Person touching outdoor Pole light
- Outdoor Pumps: Person touching pump during fault. Generally, these are in agriculture farms.



Outdoor: Shock protection, precautions and devices use

PRCD Socket 30mA

PRCD Plug 30mA

NO socket outdoor

Socket Outdoor

Outdoor decorative lights, festoon lights, and lights are popular during festivals. 90% of shock accidents

- Caution: Prevent the loss of life: Mandatory to USE PRCD 30mA FOR SOCKET and PLUG FOR ITEMS. Available Havell Co. India. Cost Rs.600. each.
- PRCD 30mA: Protection-RCD(ELCB) for socket and plug 30mA
- Cause: Presence of water and open ground.
- Caution: Sockets to install indoor for outdoor use. Prefer NO NO sockets outdoor. If must, waterproof IP44.
- I strongly recommend to use PRCD Socket and plug 30mA otherwise loss of life.

ELCB Testing Meter to measure tripping time in milliseconds

- ELCB is NOT FAIL SAFE device.
- Electrical shock INTENSITY depends on 2 factors: Current flow in mA and time flow in ms. (0.0001=1mA)
- Caution: ELCB prevents shock and fire. New ELCB must be tested to measure trip time before use.
- ELCB is an electronic and mechanical switch device. This can be defective.
- Tripping time: NO trip, less than 15mA. A Trip, between 15mA to 30mA in 0.4s and 150 mA, 0.30 seconds

ELCB TEST METER

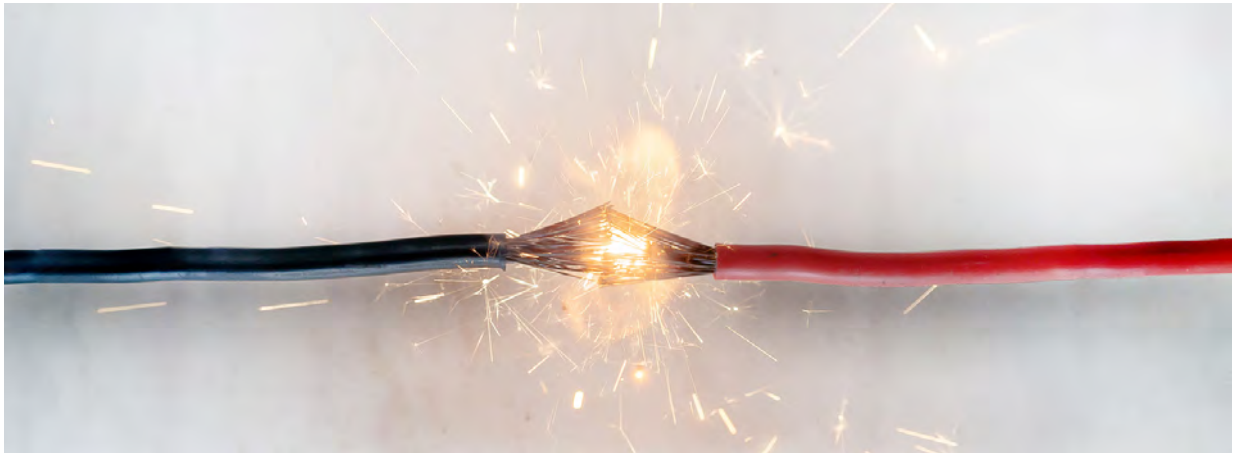
ELCB 30mA, push button to test

1, ELCB must be tested regularly to make sure they are safe.

- Yellow “TEST button” on the front of the device to press and make sure ELCB trip.
- As per IEC, the Frequency of test to trip is about six months.

Benefit to Install ELCB 30mA for lights and sockets to prevent shock and fire

- A small amount spent on ELCB 30mA, PAY US back from a loss of life and billions of Rs. loss.
- This benefits us, future generations, and society. Cost Rs. 1000. each.



- I hope, this article will be useful day to day to prevent loss of life due to electric shock and fire.

Golden rule to Prevent Shock

- Mandatory: ALL lights and sockets indoor and outdoor with device ELCB 30mA
- High Risk shock Locations: Bathroom and outdoor. Presence of water and open ground.
- Bathroom: NO NO Sockets, water heater and exhaust fan 240V, waterproof to IP44 or strongly prefer 12V AC. Light waterproof to IP44
- Caution: Outdoor: 90% shock accidents, loss of life. NO sockets outdoor. If must, Industrial type waterproof IP 44
- Outdoor electrical items to supply from INDOOR socket with PRCD 30mA socket or PRCD plug. Havell Co.
- Electrical panel in flat: Prefer to install each circuit with RCBO (RCD 30mA+MCB) = Shock+overcurrent Protection. Widely use in Europe. As per IEC, ELCB is named RCD.

Golden rule to prevent Fire

- ELCB 30mA device: Main purpose device is protected from shock, get ADDITIONAL protection against fire.
- Overcurrent in wire: Protection by device MCB
- Cable Ground fault: Cable, insulation is cut and touch the ground: Creates ARC. Presence of water aggregate fire
- ELCB 300mA device: Combustion materials storage, textiles, paper, wood and etc.
- AFDD device: Fire from the small arc in flat: MANDATORY in the USA. IT IS NOT IN INDIAN STANDARD

Final Golden rule, Prevent shock and Fire in Electrical Installations

- Install device ELCB 30mA for all lights and sockets, indoor and outdoor circuits in house
- Electrical Panel in house install 2 number ELCB 30mA or RCBO (RCD+MCB) 30mA for each circuit.

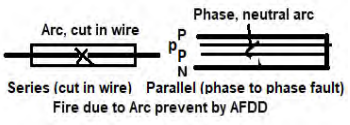
Training

- We will produce a “YouTube” video on this article in one month
- We conduct one day training for consumers, electricians, power Engineers and manager
- Training with visual and hand on experience gives a better understanding.
- Please, Email or whatsup for suggestions and comments.

Fire Protection by Device AFDD: ARC produce due to cut in wire, etc. This will be studied in Part II

Mandatory in the USA. As per IEC, this is recommended in high rise and prestige buildings and etc.

This is NOT in Indian Standard.



REFERENCE:

https://www.electricalsafetyfirst.org.uk/,Consumer Guide to prevent shock, easy to understand. ■

Gajaria Gokal
B.E. and M.E. (USA)

CASE STUDIES

On Transformer's Abnormal Situation (Part-4)

Introduction

CASE STUDIES on TRANSFORMER's Abnormal situation is getting accepted by maximum readers, especially by the field practitioners, reason being the consideration of this device as the most important common electro-mechanical equipment used by all section of electrical system. Reliability of the electrical system depends upon the healthiness of this device, as because, any eventuality on this device delinks the electrical network dragging the situation towards instability and possible way to blackout scenario also.

Hence, considering the importance of this element, the EVENT and EVENTUAL series had been started in this journal. We have completed few segments about this element like studies on instrument transformers, tripping analysis of transformers etc... Recent series is on the field case studies with technical notes on the abnormal behavior of the transformer with subsequent caution note with necessary recommendations. First THREE parts of this series had been published during February 2021, March 2021 and April 2021 with response of readers on this subject being in exponential trend.

On the basis of the positive response and suggestive feedback from the readers, we have considered the continuation of this series with few other case studies in this month. These studies shall be the continuation of the last month's technical case study series on the technical note to abnormal behavior of Power Transformers.

Each case study is of practical in nature, has covered the actual incidences occurred in the electrical system. This has been described with the presentation flow of describing the Situation with Observations, Action taken, Analysis and Final recommendations to the reader. These studies could be quite helpful for the operation, testing and commissioning engineers to develop awareness regarding the smooth control and operation of electrical system in the Grid Sub-Station.

We urge all our esteem readers to please share your suggestion and feedback, which shall be the motivational factor to improve further.

Humming sound on 11 KV side of 33/11KV Transformer

During one winter morning it was observed with humming sound from the premises of the 33/11KV transformer.

Observations:

1. The rating of the transformer was of 8 MVA 33/11 KV Outdoor transformer type.
2. The 11KV side was connected with cable box elongated to 11 Kv Bus through cable duct.
3. During summer season this transformer was getting loaded with its full load capacity.
4. Considering the future load in action another 8 MVA transformer was procured and loaded in the system.
5. So the load on the individual transformer on sharing was reduced and such situation prevailed during the winter season.
6. The said transformer was taken under shut-down for detail checking and found with no abnormality in the electrical testing.
7. The Cable box and the duct was inspected and found with the problem of entry of moisture in the form of dew during early morning at the cable box causing the hissing sound instead of humming sound as reported.
8. The cable box size was modified and passage of entry of moisture was also arrested.
9. So it was suggested to the grid personnel not to be panic for any abnormality observed and reason could the minor as like happened here.
10. The problem was rectified and similar clearance and modification was attended in all the transformer cable boxes.

Spark observed on the main tank

At one of the grid sub-station and during idle charging of the 220/33 KV, 40 MVA transformer, some sparks result at the tank joint of the main tank.

Observations

1. The top cover and bottom tank was fitted with solid gasket.
2. The earthing of the tank was checked and found with proper connection and provided at two different locations on opposite corner.
3. The earthing links usually provided between the Top cover and bottom tank were checked.
4. It was found with connection of only one link at one end of the transformer.
5. During initial charging, it was also observed with heavy inrush current, that captured by the relay and transformer had tripped on Earth fault. During that time, the spark had been found on the top cover.
6. But no action had been initiated after tripping on the checking of equalization potential earth link between top and bottom tank. The transformer was charged after change of the threshold limit of the 2nd harmonics setting in the relay.
7. During the second time charging, similar sparking was also observed, but transformer did not trip.

Action Taken

1. On detail checking, as it was found with one earthing link on one side of the transformer, another three links were provided on each side of the transformer between top cover and bottom tank.
2. The earth that provided to the tank of the transformer was also rechecked and found in order and connected to the earth pit and finally connection to the earth mat.
3. After that the transformer was charged and found with no such abnormalities like sparking.

Analysis:

1. During charging of any large electromagnetic unit, certain voltage gets induced on the metallic parts.
2. This induction voltage pattern may be of transient in nature with switching surge with large peak.
3. In this situation, the top and bottom part of transformer was not in proper equalization loop. Though one link was available on one side of the transformer.
4. But during high voltage charging of such large electromagnetic item, the development of induction voltage on the metallic body of the transformer may not be equally distributed due to asymmetric earthing link between top and bottom tank. Moreover, the voltage application with 2nd harmonic current generation may cause un-equal voltage generation on the un-equal earthing metallic body.
5. After the rectification and the use of equalization earth link helps to develop equipotential surface on all side of the transformer.
6. So the effective sparking got reduced.

Recommendations

1. When used with bell tank or top and bottom tank, both of the elements should be connected with equalization earth link and to be distributed with four links on all side of the transformer.
2. Similar earthing of transformer tank should also be on both end opposite corners and to be connected finally to the mat.

Humming sound in 11/0.415 KV Transformer

One 11/0.415 Kv Delta –star transformer of 250 KVA was running perfectly with of no sound. But few days of operation humming sound increased.

Observations and Rectifications:

1. The installation was on the DP structure with transformer being mounted on the cross section of the limbs.
2. The out-going were through ducts from the cable joint box.
3. There was fuse box at the bottom mounted marshalling box.
4. The primary connection was also through cables jointed from pole mounted structure through AB switch (Air Break Switch).
5. The positioning of the AB switch was in vertical position control (Opening and closing was getting done vertically position).
6. The delta connection primary winding was connected through horn gap fuses.
7. Initial days, it was observed with no abnormality sound. But after few days it was observed with humming sound from the transformer.
8. The transformer was taken shutdown and checked with all installation.
9. This time it was found with problem in the AB switch control.
10. The cross limb upon which the AB switch being connected was found lowered to one side due to slight leaning of the DP structure.
11. Because of this condition, the B phase limb was not getting proper contact and causing looseness.
12. The connection was being regarded as the impedance sparking, but due to less current on the primary side, its visibility was not prominent to go for modification.
13. The installation was set right and the system was again charged, this time the humming sound decreased but not fully as compared to the initial installation.
14. Once again action was taken for complete overhauling on opening of the CCA (Core Coil Assembly).
15. The assembly was opened, found with few core clamps being in loosen condition and a black spot at one side of the core.
16. The spot was checked thoroughly; it was found with removed lamination paint at the affected area.
17. The rectification work was attended on application of paint at the affected area and tightening of the core clamps.
18. Finally, the transformer was charged and the humming sound got reduced.
19. The transformer was of a small one, for which the rectification action was taken at site with the help of crane.
20. So, installation of the transformer also plays important role for working operation of the transformer.

Two transformers in parallel drawing different MVAR

Two transformers with of same rating and with of approximately same % impedance sharing of different MVARs

TRANSFORMER 1- (% Z= 12.808, P1= 2.86 MW, Q1= 3.12, S= 4.23 MVA. Pf1= 0.676 Lag)

TRANSFORMER 2- (% Z= 12.892, P2= 2.82 MW, Q2= 0.25, S= 2.836 MVA. Pf2= 0.986 Lag)

Observations:

1. Two 132/33 KV, 20 MVA transformers were available in a sub-station.
2. Both the transformers were made parallel from same bus arrangement.
3. One day it was observed with abnormal reading of one of the transformer from the current drawl, MVAR sharing etc..
4. The operators at the control center lodged the complaint with the protection group.
5. The protection engineers checked the system, like its measuring devices (Indication meters,

ammeters, energy meters, power meters etc..)

6. It was observed with same pattern of reading on all the meters.
7. Now the pattern of readings were taken from other numerical protection relays and compared with the readings of the indicating meters.
8. In all the cases, the readings were observed of similar as that of indicating meters.
9. So it was suspected with some problems on the transformers.
10. So it was decided to avail shut-down and test/ check the detail of the transformers.
11. Now on availing shut-down, when the checking was attempted, it was found with a peculiar incident.
12. The Tap-changer indicating number at the top diverter tank and the number at the bottom was found with mis-match and found with difference of 4.
13. The top was indicating with 7, bottom was at 11 for one of the transformer.
14. Similarly the number matching was checked with other transformer, but found with same number of 11 on both at top indication and bottom indication.
15. So the transformer with mis-match was checked on physical rotation by hand. On manual rotation and lowering the position to 10 from 11, the bottom position was changed but the top remained at the same no. 7.
16. Similarly raising the tap position manually, the bottom position was changing, but the top position was remaining at the same position of no. 7.
17. While inquiring the operation team about such abnormality, they also recalled the situation and confirmed that such incident had occurred only after the date of their raising the tap from original no 7 to no 11.

Action Taken:

1. After knowing the reason of such abnormality, it was decided to check the bevel gear arrangements.
2. So the mis-match showing transformer was attempted of checking the gear arrangement.
3. On opening the gear box, it was found the mis-match of the tooth and gear arrangement. Some tooth was in slipping conditions.
4. The total set-up was removed along with the pinion set. The removed pinion was ordered from the company.
5. The company representative was asked with the defective gear, pinion for replacement.
6. On attending this, manual and electrical operation was done for all the positions on matching of the number indication at both top and bottom positions.
7. The transformers were again loaded and found with similar set of readings with proper power factor also.

Flash at Bottom flange of 132 KV Bushing

One of the 40MVA 132/33 KV Power Transformer was found with flash over at bottom flange of the bushing on B phase.

Observations:

1. The detail observation and investigation was done for the flashed bushing.
2. The flash as reported was not severe, rather it was of arching in nature and resulted towards top cover of the transformer and flange.
3. The arching was between flange and top cover body.
4. The other bushings were also checked, but found with no abnormality.
5. The arcing was not in continuance form, only developing during initial charging, but not for all charging situation.
6. The connected LA monitor of this phase on 132 KV side was checked and found with no increase of any counter reading.
7. The bushing tan delta measurement was done, and results obtained were within the limit. (R Phase = 0.0042, Y phase = 0.0034, and B Phase = 0.0062).
8. No any abnormality was found like Bucholtz relay operation, Differential relay operation or any other relay operation.
9. But once it was found with operation of Differential relay operation with differential current on B phase.
10. On obtaining the differential operation, with arcing on the top cover, the transformer was taken shut-down for detail checking and diagnosis.
11. The detail testing of the transformer was done and found with no abnormality.
12. The results were compared with the field test reports and factory test reports. The results were all within limit.
13. But while checking the flange of this bushing, it was found with looseness and deposition of dust particle on all bottom of the bushings. The other bushing flange was found with no any abnormality.
14. This grid was near to the industry belt of ash brick and cement tile base factory. So the fly-ash was the reason of dust deposition and polluting the grid environment.

Action Taken:

1. The dust particle was wiped and washed properly. The tightness of flange on B phase was checked and tightened.
2. Tan delta of the bushing was taken and found with same value.
3. The transformer was charged and found with no abnormality for few months, but similar incidents repeated, but this time buch-holtz relay was coming for few of the occasions.
4. Now it was decided to replace the bushing.
5. On taking shut down, the B phase bushing was lifted and found with charred paper insulation wrapped over the B phase conductor.
6. This insulation was repaired and B phase bushing was replaced by a new one with proper tightening of the flange.
7. Internal inspection was done and found with arcing on corner of the core near to B phase turret.
8. Then onwards it was observed with no any abnormality during charging/ running of the transformer.

Technical Analysis:

1. The transformer body is considered as the reference potential and regarded as ZERO potential.
2. So any metallic piece adjacent to it should be kept at the same potential with equalizing bonding between them.
3. But in this case, the B phase bushing due to looseness was not maintaining with of equi-potential bonding.
4. Moreover deposition of dust particle was resulting of un-equal link between flange and top cover.
5. The reason of charring on paper wrapping over the B phase conductor was not under stood. This might have been resulted due to stress on the winding during charging of the transformer.
6. Similarly the reason of internal arcing after tightness of the flange and subsequent operation of the Buchholtz relay was also diagnosed.
7. This arcing was resulting at non-electrical part of the transformer, the magnetic core path, which was attended on providing clamp at the affected point.

OVER FLOW from OLTC tank

One 132/33 KV Y-Y 40 MVA transformer at one of the 132/33 KV Grid sub-station was found with intermittent overflow from the OLTC tank.

Observations and Action Taken:

1. The conservator tank for the OLTC was connected to the diverter switch and positioned below to the main tank.
2. The level of this tank was getting rise slowly and overflowing with interval of 1 month.
3. So, it was advised for solving the problem on attending the leakage issue with the oil seal used in the OLTC diverter switch.
4. Probable cause of such leakage could be as follows.
5. Problem in the equalizer pipe and its position to check whether in CLOSE mode or not for the isolation from the main tank.
6. Accordingly the valve used was checked at the interconnecting pipe between OLTC tank and main tank. It was found with in properly close condition.
7. Then this could be due to leakage at the terminal bead of the diverter switch.
8. So the diverter switch was lifted for checking of the leakage and found with the slight leakage of two number of terminal beads.
9. So to attend the same, the oil in the main tank need to be drained for approach of the origin points of the beads. The works need proper arrangement and continuous shut-down of the system. So temporary solution was planned to attend.
10. The pipe connected between the diverter switch and OLTC conservator tank was raised to the level of main conservator to attend the equal level of both tanks.
11. During expansion of oil as both tanks oil level is at same level, on maintaining same oil level, the leakage shall not result.
12. But this solution is temporary only. If this arrangement was continued for longer period, then due to mixing of both oil, the objectionable gases that resulted in the OLTC and availability on main tank may lead confusion about the probable fault on the main tank.
13. So the decision was planned for permanent rectification of the fault by drainage of the oil from main tank.
14. Accordingly the oil from main tank was drained for detail inspection. The problematic oil seals were replaced with the new set with proper tightening.
15. The position of equalization pipe was also checked properly before re-filling of the oil to main tank.
16. Now the problem was rectified properly.
17. The transformer was kept under observation for few months and found with no such abnormality.
18. Improper sharing of Load by AUTO Transformer: Two auto-transformers being connected in parallel

were catering the load to the system. Suddenly one day it was observed with abnormal load sharing by the transformers.

Observations

1. Both of these transformers were having percentage impedance of 12.2%
2. This was catering equal load by the transformers to the system.
3. Suddenly one day it was found with un-equal sharing by the transformers with one sharing little higher than the others.
4. The reason of sudden un-equal sharing was investigated.
5. The grid personnel were asked about the tap changing of the transformers.
6. They revealed the fact that for variation of the load, tap changing had been done from tap no 5 to tap no 9 and again it was changed to reduce the same to tap no 6.
7. After this operation only such incident has resulted.
8. So it was suspected upon the position of the tap and might be the un-equal position.
9. The lower box, matching at the OLTC (On-Load Tap Changer Box) was found both in tap no 6.
10. On availing the shut-down, the actual position on the top diverter switch was checked.
11. It was found with one as tap no 6 and other with tap no 9. The bevel gear was found with slipped from the teeth.
12. The bevel gear of the affected transformer was repaired and tap position was kept to equal point after detail checking of the operation.
13. The TTR (Transformer Turns Ratio) of the affected transformer was also checked and found in order.
14. Both of the transformers were energized and made parallel.
15. This time it was found with same sharing as it was doing earlier.

Technical Analysis:

1. During change of the tap from tap 5 to tap 9 to avail higher voltage, the tap had been changed successfully. So the abnormality could not be detected as sharing was also becoming equal during this time.
2. But abnormality started after reduction of the tap, when both of the tap was attempted to be kept at no 6.
3. At this point due to different tap position (one at tap no 6 and other at tap no 9), circulating current started to flow in the system.
4. The % impedance of the transformer was also changed for which the sharing did not become equal.

Recommendation

So it is recommended that during the change of the tap, always check the load sharing as per the % impedance. If found with the result as different than that of the previous, then check the physical position of the tap and correct the same on rectification before taking the action of re-energisation.

Case of Abnormal Sound of 33 KV PT

33 KV B phase PT at one S/S was observed with certain internal sparking sound, while charging. So the PT was isolated from supply. The glass window was replaced with topping of oil to it before charging.

Solutions

1. The IR value of the PT was taken
2. (Rph- E :- 75 Mohm Yph-E:- 100 Mohm Bph-E :- 0.4 Mohm).
3. The primary winding resistance was also measured
4. By Motwane Meter :- 15 KOhm, By digital meter :- 23.8 Kohm.
5. For confirmation of primary winding continuity the PT was charged and readings were checked on the secondary side in the Apex Module rack.
   - RY 35.03 KV, RN 20.01 KV
   - YB 35.13 KV, YN:- 20.10KV
   - BR :- 34.08 KV , BN:- 20.09 KV

Analysis of the Point:

1 The low insulation resistance of the PT might be due to ingress of moisture through indicator glass, that has resulted the degradation of the insulating oil and the solid insulation of the PT.

2 From the reading of the PT primary winding, this has been confirmed that the winding has been affected and results with carbonized open path and resulting the resistance in certain Kohm.

3 But when the PT was charged with 33 KV system, the sparking and flow of current on the carbonized open path was also developing the required voltage on the PT secondary as indicated by the APEX module.

However, the decision was taken to replace the B ph PT by a new.

Abnormal behavior of CT on circuit

One CT of 800-400-200/1-1-1-1 was used with 800/1 ratio, but the current response was obtained with lesser value as per the calculation.

Findings: The test result during commissioning of the CT was checked and found with no result with the said ratio as 800/1. The reason of non-testing with this ration was inquired with the testing engineer and obtained with the answer that the available KIT was unable to inject the said ratio. So this testing was only done up to 400/1 ratio. So it is concluded here that for the case of CT before commissioning the entire available ratio and other tests are to be performed.

Case of Abnormal Sound on 220 KV CT

While charging a new 220KV CT, abnormal sound was observed from the CT and the sound rises for loading of the CT.

1. While charging the CT on idle condition, the sound observed was like hissing with ionization.
2. As the sound was not that prominent, the CT was loaded. But this time the sound became prominent.
3. Immediately the CT was taken out of the circuit.

Analysis:

1. The detail checking of the CT secondary was done and found with opening of the spare core of one of the CT.
2. This time the detail testing of the CT and circuitry was done and found with no abnormality. So the necessary shorting and earthing was done and the CT was charged OK.
3 Because of opening of the spare core and weak in Earthing connection, high voltage developed on the CT secondary and space between the terminals start ionized on the secondary box, for which hissing sound was observed.

Then after charging the CT, current starts to flow on the primary, resulting comparatively high voltage on the secondary side and prominent sound was observed.

Recommendation:

It is recommended for the CT secondary connections that if any spare core is kept, then the same has to be shorted and properly earthed at CT secondary box.

Humming Sound on 220KV PT

Humming sound was observed from the running 220 KV PT after 6 months of commissioning.

Actual Observation:

a. When this PT was commissioned, no such humming sound had been observed.

b. After running of 2months, low humming was observed and increased and became prominent after 6 months.

Action taken:

a. Shut down was availed and checking of Tandelta point, Primary Neutral links aws done.

b. No such abnormality was found.

c. Decision of opening of the PT and checking of the CORE was decided.

d. On checking of the CORE it was observed with the following.

   i. The Core Clamps were loosening and core bolts was again fitted with spring washer

   ii. The tightness of all the flats, bolts and other auxiliaries were done.

Then the said PT was charged and found with no humming sound.

Ionization and sparking on the Holding point of CT

At one of the 132/33 KV Grid Sub-Station, while charging of a new CT, Sparking was observed between Live conductor and the Extended CT lifting Holder on the Top tank.

Actual Observation:

a. CT after detail checking, was installed in the circuit with connection of the LIVE jumper to the CT

b. But when this CT was charged, it was found with the ionization sparking of the CT from LIVE conductor to the lifting at both side of the tag.

c. So both the lifting tags were removed.

d. Even after removal, similar observation was found, but this time it was from live part to the top tank.

e. The CT was brought down for detail inspection on opening of the top cover.

f. On opening of the cover it was found with disconnection of equalizer conductor in open condition. During manufacturing, this one has to be connected to the TOP tank cover.

Analysis of the Incident

a. In practice the Top Tank CT (Live Tank CT), should be connected to the equal potential of the supply voltage.

b. In case not done so, the capacitive discharge current to start to flow to the tank cover.

c. In this condition as it was not connected internally due to different potential, the ionization current starts to jump at the nearest clearance. So it was resulting through the lifting tag, as it was resulting with lesser clearance.

So this link was connected and again installed for charging of the CT ■

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GM (Elect), at Odisha Power Transmission Corporation Ltd. – Odisha.

BARRIERS OF TRIGENERATION

The world is fighting with one invisible enemy –"Corona". Scientists predicted that earth will face many natural calamities if CO2 whose excessive presence will not be controlled. The epicentre of the deadly virus is CHINA where it was first detected, but why it was absent 50years ago? Maybe that time greenhouse gas emission was quite low! A time has come to reduce carbon footprint by applying energy-efficient technologies like TRIGENERATION - the paper will highlight barriers in India.

Introduction

Trigeneration is the conversion of fuel energy into three different useful energy products –electricity, steam/hot water and chilled water. Trigeneration is basically an extended co-generation system where chilled water is the extension. This heat thus produced by the burning of fossil fuel is used to produce chilled water.

Co-generation provides a wide range of technologies for application to various domains of economic activities. The overall efficiency of energy use in cogeneration mode can be up to 85% and above in some cases. For example, an industry requires 30 units of electricity and 25 unit of heat . Though separate heat and power route the primary energy input to the power plant will be (30/0.35) or 85.71 unit. If a separate boiler is used for steam generation then the fuel input to boiler will be (25/0.86) or 29.41unit. If the plant had cogeneration then the fuel input will be only 64.70units (30+25)/0.85. Thus fuel input reduced to (85.71+29.41) -64.70 = 50.42units, Trigeneration further reduce energy demand, but its application area is limited – electricity, chilled water and steam if used by any industry establishment like Hospital, shopping mall are the conditions of TRIGENERATION. A sketch of ideal trigeneration system show in figure 1 indicate that out of 100 heat unit as input 20% is only lost to atmosphere.

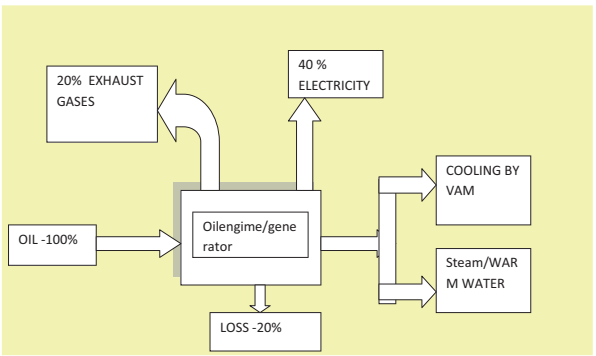


Fig-1 : Basic trigeneration system

So, one oil fired DG set can generate electricity, steam from exhaust gas –that can drive a VAM system providing partially steam for process heating.

In our country many –hospitals, the pharmaceutical industry, chemical plant are eligible for this regeneration system but this type of vision is not there from the top management. The developed countries like – Australia, Canada, UK have already implemented TRIGENERATION in their energy systems.

Performance evaluation of small scale trigeneration system

A CASE STUDY OF a pharmaceutical unit is presented where trigeneration could not be applied due to top management support This pharmaceutical unit produce paracetamol tablet base, ultrapure water required for injectibles, injections etc. This type of plant requires heating load, electricity and chilling load. The present energy system at a glance is shown in table -1

Table-1 : Basic Plant Parameters

Sl no	Parameters	Value
1	Grid Electricity Purchased /YR	122454 6kwh
2	Furnace oil consumption to run Boiler	765kilolitre
3	Highspeed diesel consumption	100litre
4	Monthly average load factor	0.23
5	Rated evaporation from boiler (F and A 1000c)	3000kg/hr
6	Working pressure	10.55kg/sq cm
7	Self generation energy	210kwh
8	Chiller capacity	80TRx4=320tr
9	Actual chiller running load	80.95kw

The ideal trigeneration plant performance can be described by the equation

$N_{tri} = W_{tri} + Q_{tri} + Q_E/Q_G$, where Q_G, W_{tri}, Q_{tri} and Q_E are the gross calorific value of fuel energy input, electrical power output, heat output and cooling output respectively

Trigeneration is one step ahead of CHP where separately chilled water is generated from single energy source. In this plant there are three energy sources –a block diagram of process is given

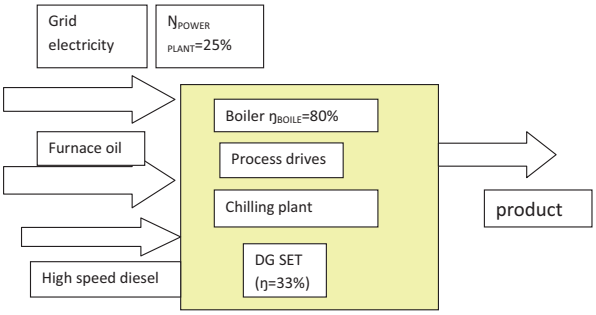


Fig : 2 : energy system layout of pharma unit Considering continuous operation of plant :

Input Energy

Energy input by grid electricity (Overall efficiency-35%)	1224546kwh	3327.09x106kcal
Energy input by high speed diesel(overall efficiency -33%)	100litre	0.898 x106 kcal
Energy input by furnace oil (overall efficiency=80%)	765kilolitre	6944.67x106kcal
Total energy input		**10272.65x106kcal**

[power plant heat rate =2717 kcal/kwh ,sp.gr of HSD =0.89 GCV of HSD =10960kcal/kg, Spgr of furnace oil=0.89 ,GCV of Furnace oil= 10200 kcal/kg}

Output Energy

Energy output by grid electricity	1224546kwh	1053.1095x106kcal
Energy input by self generation electricity	210kwh	0.180 x106 kcal
Energy input by steam generated in boiler	Actual pressure of steam; 7.65kg/sq cm Actual steam consumption : 8708071kg Enthalpy of saturated steam : 659.7kcal/kg	5744.71x106kcal
Total energy output		**6797.99x106kcal**

Overall efficiency = (6769.99/10272.65)x100=67.84%

Benefit by converting plant in CHP mode

This plant could be converted into a CHP mode but since it is running in two shifts –benefit from energy generation equipment –boiler and turbine cannot be derived. The electrical load curve shows the actual scenario :

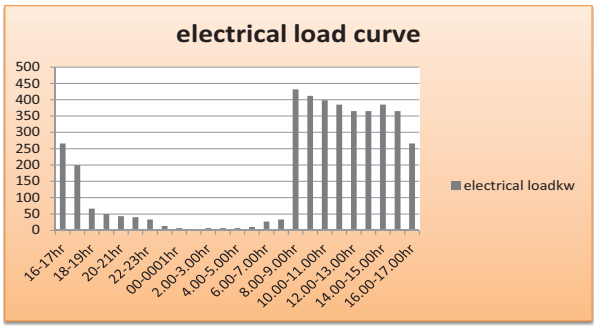


Figure 3: electrical load curve

The analysis of electrical load curve brought one interesting fact -out of 3919kwh as daily energy consumption,3108kwh only consumed between (8Am to 8PM). So the average electrical load during that period was 257 KW with a peak of 431KW. At this stage it is very clear that at 23% load factor the trigen plant will not run efficiently. This is one main barrier for the investor. Coupling of plant with grid is necessary. The scheme of proposed plant is shown in figure .

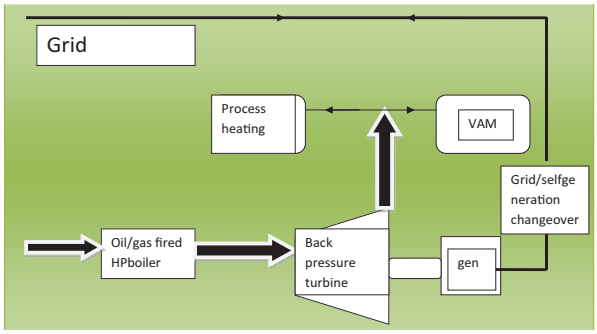


Fig :4: proposed trigen power plant for batch type pharmaceutical unit.

Process steam load	1000kg/hr
Steam pressure	8kg/sq cm
VAM steam load	1440kg/hr
Steam pressure 8kg/sq cm	
Peak power	431kw
Avg load	257kw
Boiler ,turbine ,transmission and generator efficiency	80%.85%.95%and 98%
Total steam load at 8kg/ sq cm	2440kg/hr
Let superheated steam enthalpy	Hs kcal/kg
Enthalpy of 8kg/sq cm saturated steam	661kcal/kg
Power developed by turbine	431k w
Since power to be generated from back pressure turbine	2440(Hs-661)860x0.95x0.95=431
Solving ,Hs	829kcal/kg
Heat load kcal	829x2400=2023052kcal/ hr
Estimated furnace oil (ER= 10:1)	2440/12=204kg/hr
Overall efficiency of trigen plant	82.91%

Thus the present boiler is to be changed and backpressure turbine to be purchased ,This trigen plant can export power to grid .Management attitude is the barrier for implementation .

Environmental Aspect

Geen house gas emission has definitely an effect on global warming

As discussed in earlier section, the amount of heat available in a trigen system is expressed as $Q_{tri}=(1-y)\ Q_{chp}$, where y is the fraction converted to produce cooling effect. hence above efficiency equation can be written as

$€_{tri} = W_{tri} + (1-y)\ Q_{chp} + y_{Qchp}/\ Q_g$, The amount of emission depends on type of fuel –CO2 emission factor for natural gas 0.194kgCO2/kwh

Similarly for coal-1.012kgCO_2/kwh,furnace oil =1.15kgCO2/kwh, thus the total emission is for a trigen system is $E_{tri}=A_gQ_g$.,for a conventional pharmaceutical plant having no trigen system the

Emission is given by the formula

$\mathbf{E_{conv}= W_{tri}\ A_{grid} + (1-y)\ Q_{chp}.A_{fo}/\eta_{boiler} + y,Q_{chp}.A_{grid}}$, savings in CO_2 emission could be realized when $E_{tri}/E_{conv.}>1.0$, In case of this pharmaceutical plant $E_{conv}=233.8$ and $E_{tri}=295.14$,this ratio is 1.266.

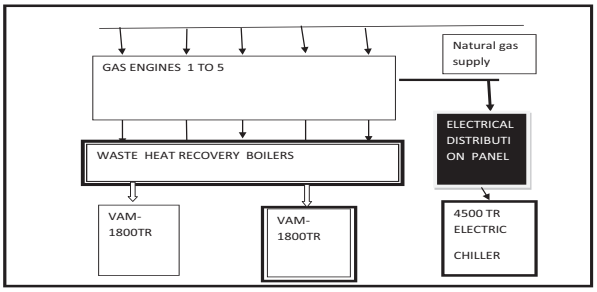
Sucess Story –of Trigeneration (Indonesia)

Shoppimg Mall At, Jakarta Indonesia

CENTRAL Park Mall authorities, Jakarta, Indonesia have installed 5 nos Janbachar JN20N gas engines alongwith to absorption chillers and three electric chillers.This resulted a savings of US$ 1.1 million of annual energy cost.Since local grid is not fully dependable –shopping mall authorities has installed 2700KW gas engine

,alongwith chiller .The objective was to create combined cooling ,heating and power facilities by avoiding grid .As per them waste gas heat from Janbacher machines 3500 TR of refrigeration is available by VAM against a demand of 8000 TR demand .The sketch is shown below :Fig 5:Trigen flow sheet at shopping mall, Jakarta

Energy savings calculation



Grid demand :13.6MW

Gas engine power:11-12 MW, balance power : 2—1.6 MW from grid

1	Total power available from gas engines	2700kw
2	Cycle efficiency of gas engine	27% (assumed)
3	Cycle efficiency =	Work done/heat input
4	Work done (output)	2700Kw
5	Heat input	10000kw
8	Equivalent heat (1kwh=860kcal)	86x105kcal
7	GCV of gas	8850kcal/kg
8	Weight of gas fired/hr	900kg/hr
9	Heat rejected to stack	860(10,000-2700)=6278000kcal/hr
10	VAM rating (assumed)	2970 kcal/TR
11	Heat utilized by VAM	3500TRx2970 or,10395000kcal/hr
3500 tr Vam is NOT to be replaced by 3500 TR electrical chiller of COP=4.0 ,additional electrical load would be 3500x3,516/4.0 or 3076.5KW		
Considering 12hr/day and 365 days/yr additional energy generated :365x12x3076kwh or,13.476million kwh		
extra emission of CO2=13634MT/annum		

Sucess Story-II (Australia)

King William Street -Trigeneration Project At Australia(Adelaide)

Salient feature : The 19 storied iconic building of "Adelaide" was constructed in mid 1960 .The management approached holistically to reduce energy and water demand and installed "trigenerarion plant " which dropped the peak demand by 310KW€ .

The combined heat, power and cooling system comprised of ENER G310 cogen unit and 250KW Shungliang absorption chiller ,a cooling tower and other associated pumps .

The 310KW € packaged trigeneration station provide the building with base load electrical supply .during peak hours export power during the offpeak period. Thus "Trigen" integrates with onsite boilers and chillers to provide hot water for space heating in winter, and chilled water for baseload air conditioning in summer

Advantages

- Provides 310kw€ of electricity at peak capacity.
- Produces upto 358KW of heat and 250 kw of cooling load.
- Exports power on off peak period.
- Rooftop solar array panels.

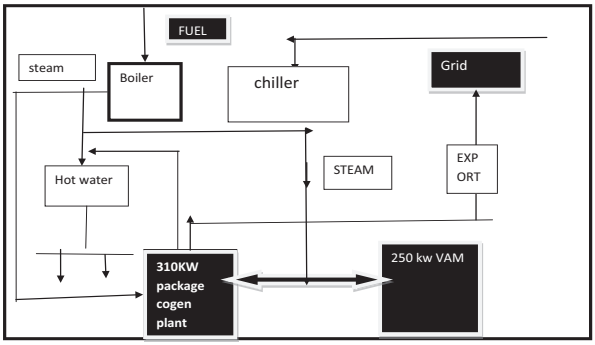


Fig 6 : Trigen System Diagram At Adelide, Australia

Benefits of trigeneration plant: Thermal equivalent to 358kw heating load is 307880 kcal/hr, hot water available at 600c is 5131kg/hr. similarly vapour absorption plant of 250kw is equivalent to 105TR capacity.

Savings Calculation

1	GRID DEMAND	NA
2	Cycle efficiency (assumed)	27%
3	Expected demand reduction	310kw
4	Power of packaged cogen	310kw
5	VAM rating	250kw
6	Cooling tower	1
	VAM CAPACITY	71TR

7	1 TR is equal to	4.516 kw (thermal)
8	HEAT EQUIVALENT TO 358KW	307380 KCAL/ HR
9	One 71tr VAM plant require 320kg/hr waste steam at 8.0kg/sq cm pressure	
10	Waste heat required =320x660 kcal/hr or 211200kcal/hr	
11	Input fuel based on 27% cycle effy =310/0.27=1148.14kw	
13	Power reqd =250x3.516/4.0=219kw	
14	Natural gas reqd / hr=1148.14x860/8892=110kg/hr(GCV of natural gas =8992kcal/kg)	
15	What if cogen plant is not installed : Additional 310kw cogen unit added with baseload of building to reduce peak demand and seasonal variation of hot and chilled water was not possible .	

Success Story – III (India)

A Trigeneration plant was set up at a New Delhi hospital, the plant has three major components ---a gas engine, a vapour absorption chiller, and an electrical chiller. (vapour compression) for meeting the balance cooling demand. The details of trigen plant are as follows

Equipment	Make	Size
Gas engine	Schmitt enertec	347 kw,nat gas fired
VAM	Thermex	105TR ,COP=0.7
Chiller	York	250TR,COP =4.0.
Cooling tower	Paharpur	512TR

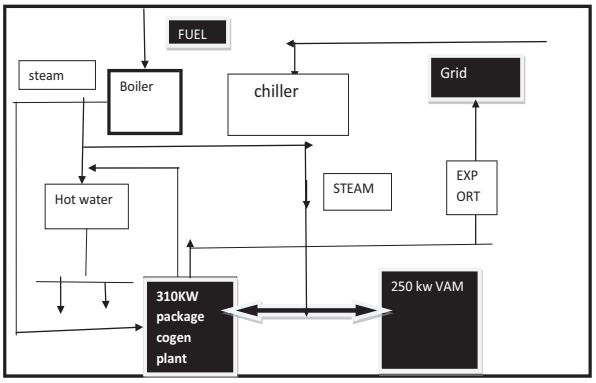


FIG -7 ; trigen system at delhi hospital, India

Savings Analysis

1	rated output from gas engine	347kw
2	Cycle efficiency (assumed)	27%
3	Work	347kw
4	Heat input	1285.18kw or, 1105259.2kcal/hr
5	Heat rejection to exhaust	860(1285.18-347) or, 806834kcal/hr
6	VAM capacity	105TR
7	1 TR is equal to	4.516 kw (thermal)
8	105TR	369.18 thermal kw
9	One 100tr VAM plant require 450kg/hr waste steam at 8.0kg/sq cm pressure	
10	Waste heat required = 450x660 kcal/hr or 297000kcal/hr	
ELECTRIC CHILLER AT DELHI HOSPITAL		
11	TR=250 ,COP=4.0	
12	Since 1TR= 3.516 thermal kw	
13	Power reqd =250x3.516/4.0=219kw	
SAVINGS POTENTIAL		
Replacement by VAM will save 92KW of power equivalent to 105TR cooling load		

Conclusion

Trigeneration is a successful proposition where heating,cooling, electrical power are necessary continuously. Often to minimize peak demand –extra captive generator is installed –which supply steam, hotwater, chilled water besides reducing peak demand. In our country implementation this concept requires thorough study of of electrical load,heating and cooling laad. Many private as well as govt hospital can go for it after careful study of three loads.

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6 D.Eagle ,The New Trigeneration players :Integrated cooling,heating and power systems are here "Distributed Generation (2004)

7 Trigeneration ,(pp 147-149) –BEE guide book on "Refresher Course for certified energy managers and auditors .

8 Field energy audit study report –conducted in a pharmaceutical unit at Kolkata .

List of Figures

Fig	Description
1	Basic trigeneration system
2	Energy system layout of pharmaceutical unit
3	Electrical load curve
4	Proposed trigeneration plant for batch type pharmaceutical unit
5	Trigen flow sheet at Shopping Mall,Jakarta
6	Trigen system diagram at Adelaide ,Australia
7	Trigen system at Govt Hospital, Delhi, India

Nomenclature

VAM	Vapour absorption machine
Q_G, are the gross,	Calorific value of fuel energy input
W_{tri},	Electrical power output
Q_{tri}	Steam for VAM c
Q_E	Heat output
y	Fraction converted to produce cooling effect
A_g	Emission factor for trigeneration system
E_{conv}	Emission in conventional system
A_{fo}	Emission factor for furnace oil
ŋ	Efficiency of boiler
Q_{chp}	Heat input in oil fired boiler operating in CHP mode
A_{grid}	Coal fired boiler emission factor

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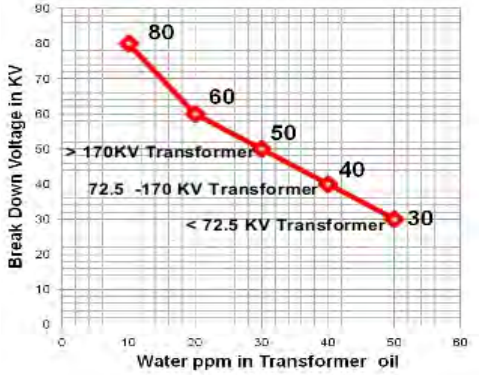
POWER TRANSFORMER OIL
Moisture Measurement

Moisture in Power Transformer

Most of the moisture in the oil-cellulose insulating system (even up to 99%) is contained in cellulose materials. The water content, both in liquid and solid insulation, influences the life of a transformer in many ways.

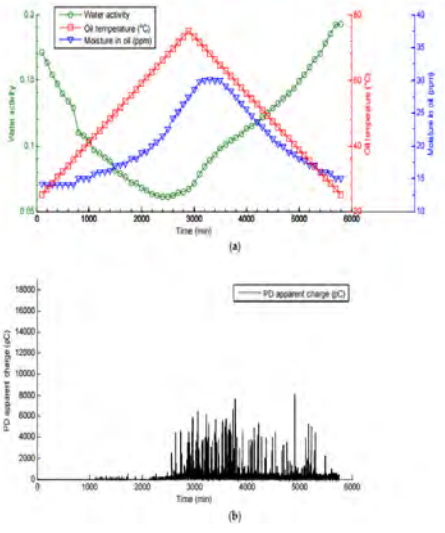
The thickness of the insulation and the changes in its temperature strongly influence moisture migration between the electro insulating liquid and cellulose. An increase in the insulation temperature causes water migration from paper to oil, whereas a decrease results in migration in the opposite direction.

With rise in moisture content in transformer, BDV value of Oil will go down.



Moist insulation, ignition of partial discharge can occur along with the growth of temperature

in the insulation, and the discharges may not extinguish despite a drop in the temperature. When temperature increases, migration of water from the cellulose to the oil takes place. A consequence of the increase in the moisture at the interface of the materials is a decrease in the surface resistivity of the cellulose. This leads to PD ignition at the surface. A drop in temperature of the insulation does not quickly dry the interfacial area due to the slow diffuse rate, which favours PDs.



1. Aging of the paper is proportional to the water content (WCP). Decrease of the degree of
2. polymerisation is higher if the initial moisture of the paper is higher, i.e. its mechanical properties are reduced proportionally.

Bubble Evaluation - Bubbles evolution results from the release of water vapour from transformer insulation, mainly winding paper. The bubbles of water vapour decrease the insulating liquid's dielectric strength. Under the influence of an electric field these bubbles can lead to partial discharges.

Transformer on-line monitoring systems have been installed in most of the 220 and 400 kV grid transformers since 2005 which are using capacitive Sensors to measure Temperature of oil & relative saturation of moisture on continuous basis.

Difficulty for site Engineers

Water content measurement done by Capacitive Sensors based Online monitoring system / Hand Held Devices are accurate 5or not ?

At various sites, moisture in transformer oil (Mineral Oil) is measured as below

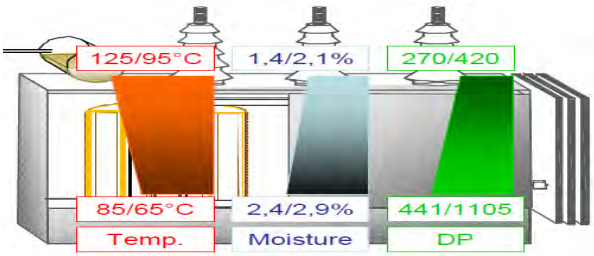
Site	With Sensor Base handheld kit/ Laboratory	Point of Oil Sampling	Ambient Temperature at time of sampling	Transformer Loading at time of sampling
1	With Sensor Base handheld kit	Bottom of Tank	Max Temp In Afternoon	Max / Any Load
2	With Sensor Base handheld kit & Laboratory			Max / Any Load
3	OLDGA		Continuous	Any Load
4	PPM Sensors (ODU)		Continuous	Any Load

As Lab facility is not available on all sites for measurement of moisture in transformer oil, capacitive sensor base PPM measurement hand held device / online oil moisture monitoring system are in use at various sites.

Hand Held - Sensor based PPM measurement kits are taking more time to get stable PPM value, & showing calculated PPM value from water activity & assigned constant coefficients.

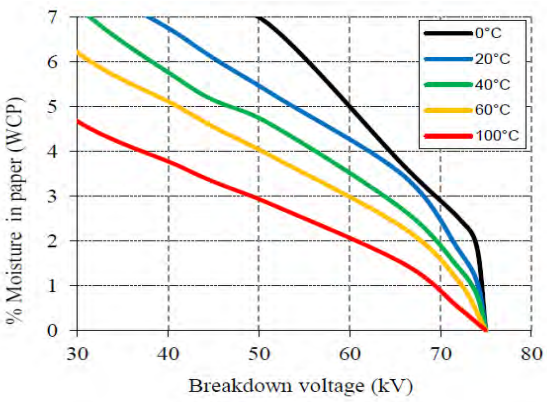
Guidelines – Oil sample Collection (Moisture Estimation)

Moisture measurement is to be done from Bottom Sampling Valve as moisture distribution shows comparatively higher moisture in bottom.



Collect Sample of Oil in Clean Glass or Steel bottle / Glass Syringe, in dry sunny weather to avoid moisture ingress from atmosphere. Always note down Oil Temperature at time of sampling from Oil Temperature Indicator.

Collect oil sample, between 40 to 70 Degree Celsius. (IS 1866:2017)



From above graph , it is observed that at lower temperatures the breakdown voltage in oil does not significantly change with the water content of the solid insulation. When evaluating the serviceability of transformers using dielectric strength based on oil moisture, it is usual that the oil sample temperature > 40°C.

From oil taken at lower temperatures, there is a much higher risk of underestimating the impact on dielectric strength at a higher load.

Moisture measured at different temperature can be converted to reference temp of 20 Degree Celsius by referring Annexure-A from IS1866:2017 (Only for Comparison Purpose).

NOTE 1 Corrected values are valid only for comparing results obtained at different oil temperatures. Actual values of water in oil at sampling points are the measured values, not the corrected ones.

NOTE 2 This formula is not applicable to temperatures below 20 °C.

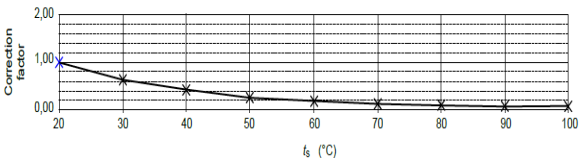


Figure A.1 – Typical correction factors

EXAMPLE

Measured water content	10 mg/kg
Sampling temperature	40 °C
Correction factor (from the formula given in Clause A.2)	0,45
Corrected dissolved water content (10 x 0,45)	4,5 mg/kg

As per IS1866:2017, recommended moisture limits are

Category	Type of Equipment
O	Power Transformers / Reactors with nominal system voltage of 400kV & Above.
A	Power Transformers /Reactors with nominal system voltage above 170kV and below 400kV. Also, power transformers of any rated voltage where continuity of supply is vital and similar equipment for special applications operating under onerous condition.
B	Power Transformers /Reactors with nominal system voltage above 72.5kV and below 170KV
C	Power Transformers /Reactors with nominal system voltage up to 72.5kV
Note: - Separated selector tanks of on-load tap-changers belong to the same category as the associated transformer.	

Property	Category	Recommended Action Limits		
		Good	Fair	Poor
BDV (kV)	O, A	>60	50 to 60	<50
	B	>50	40 to 50	<40
	C	>40	30 to 40	<30
Water content (mg/kg) O, A		<15	15 to 20	>20
	B	<20	20 to 30	>30
	C	<30	30 to 40	>40

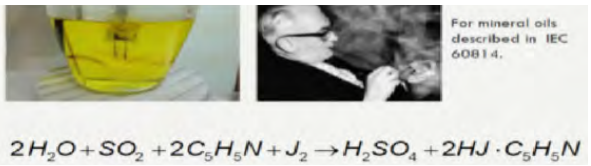
Various Methods - Measurement of Moisture in Transformer Oil.

Karl Fischer Titration Method - Laboratory Method

Capacitive Probes - On site instant PPM / Online PPM measurement.

Use of either of the method (Laboratory test / Use of capacitive sensors) for measurement of moisture in oil are acceptable methods as per IS1866:2017, IEC60422:2013, CIGRE & IEEE C57.102.2002

Karl Fischer Titration Method - Laboratory Method



Karl Fischer titration is an absolute method in analytical chemistry which determinates both free

and bonded water using volumetric or coulometric titration. Titration basically means to add a reagent of known concentration (titre) to an unknown substance, until the concentrations are balanced.

Lower (absolute) water content samples require coulometric titration, which uses an electric current to generate the reagent. The current releases the stoichiometrically corresponding amount of iodine from the iodine containing Karl Fischer reagent by electrolysis (according to Faraday's law), as shown in equation 2I- - 2e → I2 (2).

One mole of iodide reacts with one mole of water stoichiometrically, so that 1 mg of water is equivalent to 10.72 coulombs. Based on this principle it is possible to determine the amount of water directly from the quantity of electricity (number of coulombs) required for the electrolysis. The detection limit for coulometric titration is in the µg/g of water, which is convenient for measurement of water content in insulating transformer oils.

Capacitive polymer sensor

- A capacitive thin-film polymer sensor consisting of a substrate on which a thin film of polymer is deposited between two conductive electrodes.
- The sensing surface is coated with a porous metal electrode to protect it from contamination and exposure to condensation.
- The substrate is typically glass or ceramic. The thin-film polymer either absorbs or releases water vapor as the relative humidity of the ambient air rises or falls.
- The dielectric properties of the polymer film depend on the amount of absorbed water. As the relative humidity around the sensor changes, the dielectric properties of the polymer film change, and so does the capacitance of the sensor.
- The instrument's electronics measure the capacitance of the sensor and convert it into a humidity reading.

Minimum requirements for a capacitive thin polymer sensor

Measurement range (moisture) a_w or RS (%)	 0-1 0-100 %
Measurement range (temperature °C)	-xx - +xx °C Shall cover the whole operating temperature range typical in transformers
Accuracy (including non-linearity, hysteresis, repeatability, temperature dependence)	± xx or ±% of the reading. Manufacturer shall specify the operating temperature range, where the accuracy specification applies.
Response time (90%) at 20°C (min)	xx minutes.

- Mostly Capacitive Sensor operating range is -40 to +70 Degrees.
- Capacitive sensors are widely used in Online Oil Drying Units for continuous online monitoring purpose. Can also be installed permanently on High Capacity Transformers (More than 10 MVA) / Critical Transformer with continuous moisture monitoring.
- Capacitive sensors also in use for on-site "instant moisture in oil measurement". Due to high response time of sensor, sometime it takes time upto 10 minutes to give stable value of moisture. At that time 2 to 3 Ltrs of oil required to flush through kit.
- Capacitive sensor-based kits showing three parameters Water Activity, Oil Temperature & calculated PPM.

Select good quality reputed brand Sensors to get more accurate readings .

Response time

Response time is typically defined in manufacturers' datasheets as T60 or T90, which means the time it takes the sensor to reach 60% or 90% of the final value. However, when measuring in oil, the oil properties and movement have a clear effect on the response time. If there is no oil flow i.e. no oil exchange on the sensor surface, the response time becomes strongly dependent on water diffusion in oil. This is a very slow process and obscures the performance of the sensor.

As response time of capacitive thin polymer sensor is more , it required some time sometime upto 10 minutes to give stable PPM value.

Dependance between PPM Readings & Relative Humidity

In case ppm readings are required, the dependence function of the RH reading to the ppm humidity at a certain temperature must be determined. For this purpose following procedure can be used:

The humidity saturation in fluids is described by the temperature dependence:

$$W = a_W * 10^{A_1 - B_1/T}$$

Where A_1 and B_1 are the corresponding constants in the decimal logarithmic representation

W	= water content in the fluid acc. Karl Fischer (mg/kg)
a_w	= water activity (reading of the capacitive sensor)
T	= absolute Temperature (K)

Taking precautions that no moisture from outside can enter the equipment and by determination of

relative saturation and Karl-Fischer values at a certain temperature simultaneously, it is possible to

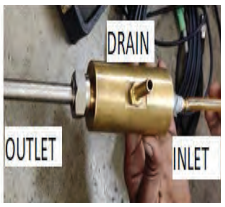
determine A and B for different insulating fluids. This has been done for a number of insulating fluids,

the result of the decimal logarithmic representation of A1 and B1 is shown on the following

	B_1	A_1
New mineral oil	1512	7,0
Aged mineral oil (colour 4.5, Loss factor 0,054, Interfacial tension 25 mN/m)	1760	8,1
New synthetic ester	643	5,4
New natural ester	604	4,4
New silicon insulating fluid	589	4,4

Handheld - Capacitive Polymer Sensor -Vaisala - MMP78

Hand Held Device Will show Water Activity, Oil Temperature & Calculated moisture PPM.



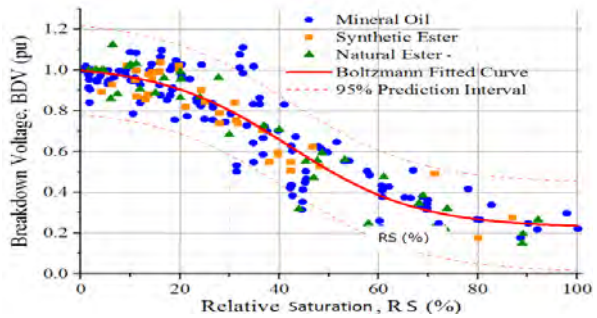
Water Activity _ Cigre 349

Water activity "aw" reflects the relative availability of water in a substance. When water interacts with solutes and surfaces, it is unavailable for other interactions. Thus water activity is the measure of the water in the material which is available for exchange with the surrounding environment.

Water activity "aw" gives information about the water molecules available for interactions with materials such as chemical reactions (depolymerization by hydrolysis), dissociation of and bubble effect. Therefore water activity represents an opposite value to describe the deteriorating impact of water in oil-paper-insulations.

Equivalent to relative saturation (%Rs), water activity "aw" is defined as ERH/100, where ERH is the relative humidity measured in the proximity of the hygroscopic material under equilibrium conditions. A value of unity indicated water saturation whereas zero indicates the total absence of available water molecule. Relative saturation is equivalent to the water activity in the sample.

Breakdown Voltage as a function of PPM & Water Saturation



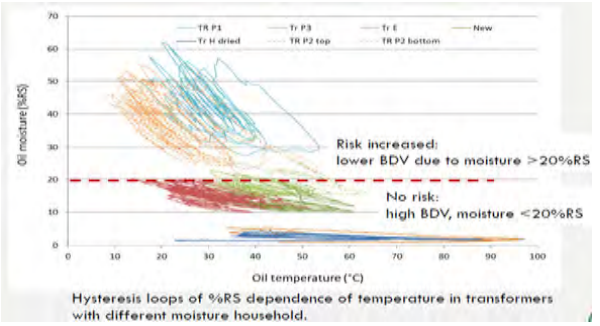
Oil breakdown voltage is decreasing with increase in % water saturation (%Rs) & with increase in water PPM in transformer oil. High value of %RS & High value of water PPM is alarming for transformer.

IS 1866:2017_% RS

Water saturation of insulating oil is also very useful for trending. Saturation is the ratio of the water content present in a mineral oil at a certain temperature to the solubility of the water in mineral oil at the same temperature, expressed in percent.

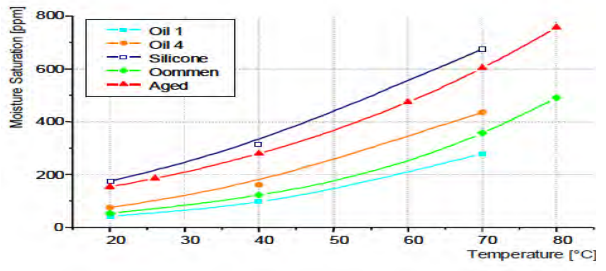
Percent Saturation water in Oil %	Condition of cellulosic Insulation
<5	Dry Insulation
>5,<20	Moderately Wet.
>20 , <30	Wet Insulation
>30	Extremely wet insulation

% RS – Temperature Curve from equipment in service



For new oil & for properly dried transformer, %RS is constant & well below 20%.
No risk: - High BDV, moisture <20%RS
For transformer with high moisture content, %RS is high at low temperature & above 20%.
Risk Increased: - Lower BDV, moisture >20%RS

Conclusion



- At higher temperature water solubility in oil is increases & water solubility in paper/ Cellulose decreases. This results in travelling of moisture from paper/ cellulose to oil. At higher temperature more water is present in oil.
- At higher temperature more moisture is present in oil, but at higher temperature oil can hold more moisture, as water solubility of oil increases at higher temperature.
- At higher temperature due to above mentioned process, moisture saturation (mg/kg) (ppm) value increases without acknowledging actual saturation of oil.
- Sample taken at higher temperature will always give high value of moisture saturation (mg/kg) (ppm), which may not be harmful. Good Oil can hold more moisture at high temperature & there will be less free water molecules for various hazardous chemical reactions inside transformers.
- Capacitive Sensors measures %RH or water activity, which can be converted to PPM. This give better clarity on condition of actual moisture in oil & Water activity (% Relative saturation) will give exact percentage of free water molecules in oil at various temperatures. High value of %RH indicates poor condition of oil.
- Portable hand held Test Kits (i.e Vaisala Make) & other online oil moisture measurement kit which are using capacitive polymer sensors for moisture measurement can be extensively used in field , with following ..
  - They should be manufactured by Good Reputed Brand, so that quality is unquestionable.
  - To be calibrated regularly – On field/ Laboratory as per OEM recommendations.
  - Results may change with rate of flow of oil & having very sluggish response time.
  - Due to sluggish response time, sometime it will take upto 10 minutes to give stable PPM results.
  - As sensors are also measuring Oil Temperature along with %RH / Water activity . Moisture in solid insulation can be calculated with appropriate algorithm .
  - Automation of Online Oil Drying unit can be done with use of capacitive polymer sensors . Online Oil Drying units can be switched On & Off based on %RH / calculated PPM value of moisture by polymer sensors.

REFERENCE

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2. IS1866:2017
3. CIGRE 349 _ June 2008
4. IEC 60814
5. D1-741 _CIGRE 2018 ■

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Indian Patents by IEEMA IOTs

Dr. Naveen Upreti, Assistant Director, IEEMA has published an Indian Patent titled

"A Systematic Constraint Removal Process (CRP) for Organizations"

Bottlenecks, barriers or constraints can be present anywhere in the system such as in any functional department, in any process or in the tiniest activity of any process. Organisations require a well-documented process that can help in removing constraints from the system. The invention provides a conceptual framework (CRP) with a unique approach to remove any kind of constraints from the organizational process or activities or any system with the aim to improve the overall system performance. In real-world scenario, constraints of the system are selected based on their cognition and understanding, especially in the context of multiple constraint system. The framework provides a method to identify the critical constraint of the system and can remove it from the system through different processes. ■

Ms. Bharti Bisht, RR-North, IEEMA has published an Indian Patent titled

"Footwear with Automatic Adjustable Heel Height"

High heels are a necessary part of every women wardrobe. Most of the time while going for a party or special occasion, it becomes an affinity of most of the women to use high heels as they feel incomplete without wearing such stuff. On one side it looks pretty nice but on the other side high heels often lead to a problem when it comes to running or walking fast as well as affecting the spine, hips, knees, ankles and feet while altering the posture and gait. High heels often lead to pain in the feet if worn for a longer period. The patent talks about ADJUSTABLE HEEL FOOTWEAR where the height of the heels can be adjusted automatically using a mobile application, which would help the women to adjust the heel so that only one pair of heels can be used with increased height as well as with decreased height as per her convenience. ■

Representations by IEEMA

Request to Government of Karnataka to allow manufacturing and list of Industrial Activities to be Considered as Essential Services and Requiring 24/7 Operations

IEEMA requested the Government of Karnataka to allow manufacturing, supply and functioning of following products, which are essential for Generation, Transmission and Distribution of Power and to improve upon economy and liquidity in the hands of the industry.

- Transmission Line Towers
- Conductors
- Boilers, Turbines, Generators
- Motors, A.C. Generators and Generating Sets
- Transformers
- Industrial Electronics
- Capacitors
- Switchgears
- Surge Arresters, Lighting Arresters, Voltage Limiters and Surge Suppressors
- Electric Lamps
- Cables and Winding Wires
- Insulators & Fittings
- Measuring and Indicating Instruments
- Elevators and Escalators
- Energy Meters

IEEMA submits that electricity is amongst the most significant infrastructure sector for the economy to function, as all other sectors, including medical services, agriculture, water and telecom etc. are totally dependent on it to run. Therefore there is a strong need for treating electricity and the downstream electrical equipment industry as priority industry, which need to be allowed to function, especially during the stressed times.

Representation to Assam Electricity Grid Corporation Limited on issues related to Electrical Transformer Industry - request for immediate intervention in view of COVID-19 situation and Lockdown

IEEMA Transformer Division has identified the following key issues which require your immediate intervention and resolution for the survival and overcome from this present situation.

Resumption of operations:

As Electricity is being notified by the government under essential services, hence transformers and transformer components manufacturing industry to be declared under essential product in the electric supply value chain and may be allowed for operation for the duration of lockdown period.

Liquidity Issues:

a) Release of the Outstanding Payment

In view of the COVID-19 situation and the continued lockdown, all manufacturers are facing acute shortage of funds due to impending wage bills and mandatory interest obligations. In view of this, it is requested that all outstanding utility payments are released for manufacturers to address their cash needs and remain afloat in this crisis.

b) Payment Terms:

In view of the present liquidity crunch faced, no manufacturer is in position to execute orders without prefunding from customers. Accordingly, it is requested that all fresh orders are released by utilities with at least 20% advance with remaining to be reimbursed on milestone completion basis such as drawing submission, material procurement, core and coil readiness, FAT readiness etc.

c) Bank Guarantees

Utilities & also customer from other segments may consider accepting the corporate guarantee in place of bank guarantees against advance for ongoing projects and performance during warranty period for projects executed and performing satisfactorily, to free up bank limits which will unlock a substantial amount of working capital to meet liquidity needs. Acceptance of corporate guarantee in place of bank guarantees will significantly boost liquidity in the system. Additionally, it is requested that 10% retention amount for the supply contract should be released in cases where the delay is not attributed to manufacturer with in one month of receipt at site.

On line Inspections:

In view of prevailing situation due to Covid-19, it is highly desirable that we make use of technology to avoid travel of personnel as far as possible. With that objective, we propose that state & central utilities permit on-line inspections using digital means or issue waiver till the situation stabilizes. PGCIL and UHBVN have already started following the same. As another alternative, provisions of self-certification or by a local third-party agency should be encouraged at least for next one year. This will save time and manufacturers can have smooth flow of units at production facility.

Liquidated Damages:

Customers may be requested to waive the LD for not fulfilling the delivery commitments for next year one year since it is only inevitable that deliveries will get delayed due to uncertainty prevailing in terms of supply chain and sustenance of operations. It is requested that any orders released in the next 6 months period are without LD clause.

Short Circuit Test:

As short circuit test of Power transformers is quite expensive at nearly 60%-70% of the unit cost, therefore the validity of short circuit may be considered for 10 years across all utilities. We propose that the procedure specified in IEC 600076-5 for evaluating short circuit performance of a transformer with a reference transformer already short circuit tested shall be applied & if all criterions are met, short circuit test shall be waived. This will help in faster manufacturing of the unit since testing time inclusive of waiting period, transportation time to test lab & back can be saved.

We request you to kindly consider the above recommendations for immediate relief and rescue of Transformer Industry.

The industry is at standby to cater to any requirement of Power sector, if such need arises. IEEMA members are completely committed to support and ensure 24×7 supply of electricity.

Representation made to PGCIL on the use of TMT Bars produced by secondary steel manufacturers for RCC works in Transmission line and substation

PGCIL has already approved primary steel producers for TMT bars, I would like to draw your immediate attention to the concern expressed by Shri Nitin Gadkari, the Hon'ble Minister of Ministry of Road Transport and Highways and Ministry of Micro, Small and Medium Enterprises on the adverse impact of price rise on the downstream industries and unaffordable cost escalation of public projects due to alleged profiteering and cartelisation by primary steel producers. It was further said that the increase in steel prices cannot be justified as there has been no increase in labour, raw material and power costs.

The Monopolies and Restrictive Trade Practices Commission (MRTP) is also well aware of the matter and has also taken cognisance of the collusive price leadership in the past, where in the primary steel companies had resorted to monopolistic steel pricing, without any justification, which had a sharp inflationary impact. The issue has been discussed on numerous other forums too.

As a matter of fact, the country's anti-trust regulator, Competition Commission of India (CCI) is already conducting a suo motto investigation of the producers for cartelisation and to find if primary producers have colluded to hike rates, which have shot up by more than 45 percent since June 2020. We firmly believe that there must be enough prima facie evidence available to both the Hon'ble Minister and the CCI to allege and investigate.

It is critical to note that the disparity between primary and secondary producers is much higher for products and markets, which are controlled by main producers. The disparity, mainly due to concerted price fixation, becomes much less in cases where the primary producers face competition from secondary producers, and hence are unable to charge cartelised prices.

It is also to be noted that the TMT bars is covered by BIS mandatory certification, and even NHAI has now permitted the use of TMT bar made from scrap recycling route to break this cartel.

Under the circumstances we strongly feel that PGCIL should emulate NHAI and extend the base of approved

suppliers, specially the plants with integrated in house facility, without compromising the quality checks.

Representation made to Secretary, Power on Chinese FDI in this critical segment of electrical equipment manufacturing

IEEMA has been strongly advocating for minimising our dependency on Chinese equipment since 2013. Consequent to our raising specific issues of threat to our electricity network from China sponsored cyber attacks, a Committee was formed under the CEA, Ministry of Power, Government of India, where IEEMA was a member. Report of this Committee titled "Cyber Security in Power System", copy attached for ready reference, needs revisiting under the given circumstances today. One element emerging from the report is the urgent need for identifying and isolating the equipment of Chinese origin in our electricity network, and examining the need for their replacement.

We have been also opposing the Chinese applications for registration as vendors in terms of Department of Expenditure, Ministry of Finance Order (Public Procurement No. 1) dated 23rd July, 2020 issued vide No. F.No.6/18/2019-PPD under Rule 144 (xi) GFR, 2017 for all such equipment and services where sufficient domestic capacity and competition is available. Even as suppliers with no local manufacturing, Chinese vendors have been destroying the Indian market in recent past by their predatory pricing practices.

Allowing Chinese FDI in this critical segment of electrical equipment manufacturing will lead to closing down of the home grown industry in the long run, which will not be possible to revive if required under any unforeseen emergency situation that may occur in the event of Chinese principals playing truant. Instances have now started surfacing that Chinese companies are manipulating their customers by not supplying the required Spares for equipment supplied in the past. Utilities, both at states and central PSUs, have reported that their efforts to reach out to the Chinese OEMs, either directly or through the concerned local

EPC players, are not yielding any result as the Chinese OEMs are not responding to their calls for spares. In view of the above, we earnestly request the Government of India not to open Chinese FDI in the power and electrical equipment manufacturing sectors. Government may further relook at the installed base of equipment of Chinese origin in our power (generation, transmission and distribution) network, with a view of their replacement with products manufactured indigenously or by manufacturers from friendly countries.

Flameproof Cable Testing Facility

Introduction

ERDA is a prime laboratory facilitated to evaluate all types of cables up to 245 kV voltage rating. ERDA is also well equipped with all types of fire behavior related testing for cables. As cables play a major role in all types of electrical projects and installations therefore, evaluation of cable becomes essential. The use of various types of cables is inevitable in transmission of power, control signals, communication etc. In many of the fire incidents caused due to spark or short circuit of electrical wiring and accessories, mainly cables may play a major role in initiating the fire and/or spreading of the fire. Cables provide a path for the flame enabling the fire to spread out in a large area within a short time. Damage occurs not only due to the flame but also due to toxic fumes. In many of the fire incidents, loss of human lives have been found not only because of fire but also due to suffocation, inhaling of poisonous gases and not finding a way of exit due to highly dense dark smoke. These types of fire incidents have increased awareness about use of a cable having good fire resistance properties. Generally, these properties are attributed to the construction of cables. For highly populated area/ mass gathering centers like theater, shopping complex, multistoried buildings etc. and places like power plants, communication centers, industries etc., it has become mandatory to use fire retardant cable, low smoke evolution cable, fire survival cable etc. depending upon the application. Various types of cables are now available with fire resistance properties according to the application. In the Indian Standard, these cables are classified into three main categories i.e. 01, C1 and C2 on the basis of their flammability characteristics.

Tests for Fire retardant cables

To evaluate the flammability characteristic of cables and the insulating materials, various tests are specified. The Bureau of Indian Standard (BIS) has also included various flammability tests in cable specifications. The various tests and their test facilities for the insulated cables are mentioned below.

- Oxygen Index Test
- Flame Retardant Test on Single Cable
- Flame Retardant Test on Bunched Cable
- Temperature Index Test
- Flame Retardant Test (Swedish Chimney Test)
- Smoke Density (3M3 Chamber) Test
- Smoke Density Test
- Acid Gas Generation Test
- Fire Survival Test (For Category C, W & Z)
- Toxicity Index Test
- Fire survival test facility of cable as per BS 8491 and BS EN 50200

Major test Facilities available at ERDA

State-of-the-art testing facilities for cables with improved fire performance categories are available in accordance with national and international standards. Following test facilities are available at ERDA for evaluation of FR, FRLS, LSZH and fire survival cables as per national and international standards.

- Oxygen Index & Temperature Index test facilities
- Smoke Emission – 3 cubic meter chamber
- Toxicity Index
- Flammability Test as per IS, IEC, ASTM, SS-424/1475
- Flammability test on Single Cable
- Flammability tests on bunched cables as per IS, IEC, BS

Rajib Chattopadhyay
Head BD & CRM
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Vertiv Introduces Liquid-Immersion Cooling Solution For Data Centres

The Liebert VIC is a single-phase immersion cooling solution that can support high-density loads of up to 100 kW per rack, utilizing warm water. The solution was developed in partnership with GRC (Green Revolution Cooling), the leader in single-phase immersion cooling for data centers. Available throughout India, Asia, Australia and New Zealand, the Liebert VIC offers improved cooling efficiencies in dense computing environments that increasingly support data-intensive applications such as the Internet of Things (IoT), edge computing and automation.

The Liebert VIC is a single-phase immersion cooling solution that can support high-density loads of up to 100 kW per rack, utilizing warm water. It uses the ElectroSafe™ dielectric liquid coolant, an odorless, non-toxic, single-phase coolant which is both electrically and chemically inert and has 1,200 times the heat capacity of air. This higher heat capacity means that servers with high heat densities can be cooled more effectively, reducing cooling energy costs up to 95 per cent.

Havells Launches Anti-Viral Range of Switches

Havells India Ltd has launched anti-viral and anti-bacterial switches with ViruzSafe technology under the Crabtree switches and electrical wiring devices portfolio. The new switches will be part of the company's Crabtree range

Crabtree has innovated the latest ViruzSafe technology–the new innovative switch ranges Crabtree Athena and Signia destroys 92.5 per cent of viruses on the switch surface within 1 minute of exposure. The anti-viral switch ranges comes at the starting consumer price of Rs.75 per unit, onwards.

As per efficacy level and time frame, anti-viral action ensures that the viruses are not transmitted upon by touch of switches to the users. Installing these switches will ensure substantially reducing chances of virus spread due to switch touch and safe environment for customers in their homes, offices and hospitals by avoiding transmission of virus, bacteria, pathogens via Switches.

Siemens Introduces Fluorinated Gas-Free RMU For Up To 24kV

Siemens Smart Infrastructure has introduced the 8DJH 24 switchgear, a ring main unit (RMU) for line voltages up to 24kV, completely free of fluorinated gases. This

medium-voltage switchgear for secondary electrical distribution has the same compact dimensions as the variant with sulphur hexafluoride (SF6) but uses the climate-neutral insulation medium “Clean Air”, which consists exclusively of natural components from ambient air.

The core of the unit is a three-position load-break switch with vacuum interrupter in the auxiliary path (blue switch). This new technological development from Siemens eliminates SF6 as an insulating medium, as well as any gas mixture based on fluorine (F-gases).

Schneider Electric Releases Compact 3-Phase UPS “Galaxy VL”

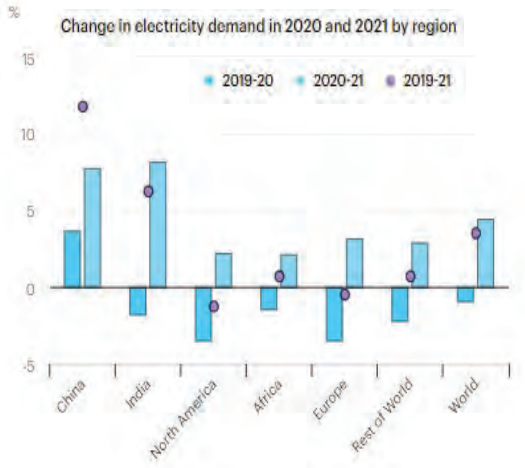
Schneider Electric has announced the global launch of the Galaxy VL 200-500kW (400V/480V) 3-phase uninterruptible power supply (UPS), the newest addition to the Galaxy family.

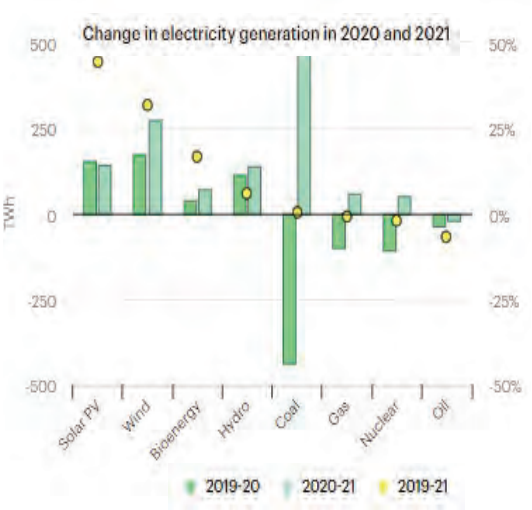
Available worldwide, this highly efficient, compact UPS offers up to 99-percent efficiency in ECOnversion™ mode for a full return on investment within two years (model dependent) for medium and large data centers and commercial and industrial facilities. A live, virtual “hands-on” eventfor data center professionals and partners will take place13thApril 2021 to demonstrate Galaxy VL’s capabilities and features from Schneider Electric’s Innovation Executive Briefing Center.

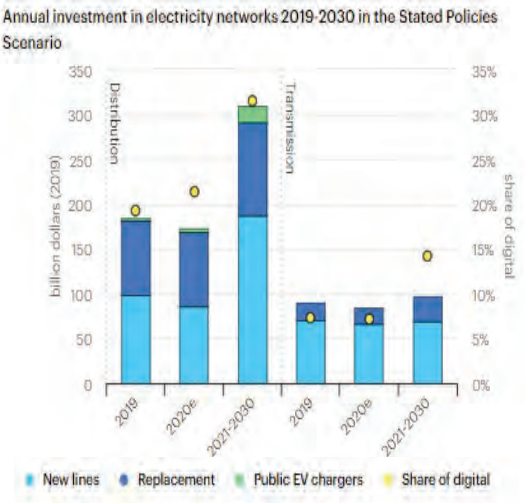
With data center floor space at a premium, the compact design of the Galaxy VL is half the size of the industry average at 0.8 sqm. Its modular and scalable architecture enables data center professionals to scale power incrementally, from 200kW to 500kW with 50 kW power modules, providing flexibility to grow as their business demands.

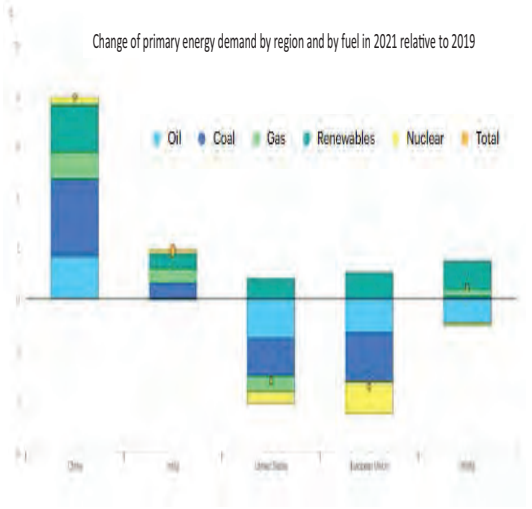
GLOBAL SCENARIO

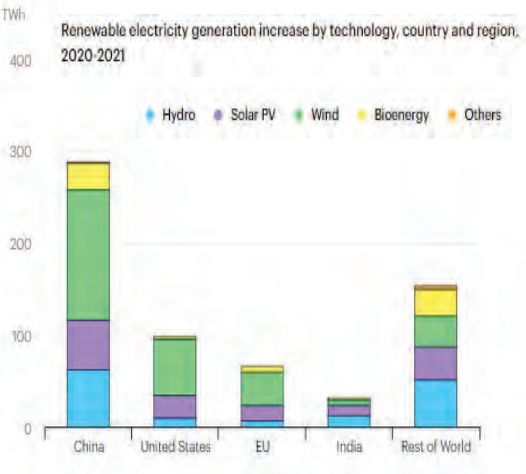
World Energy Outlook 2021

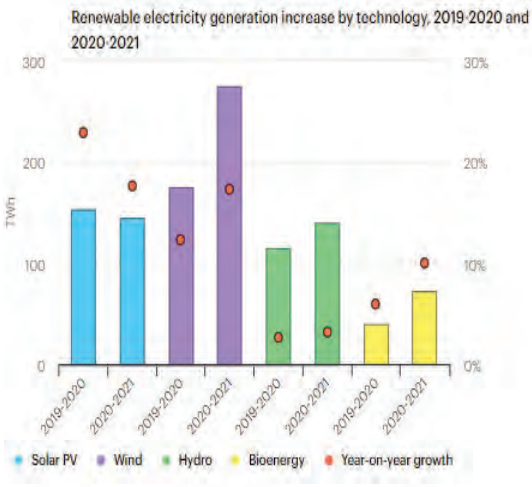








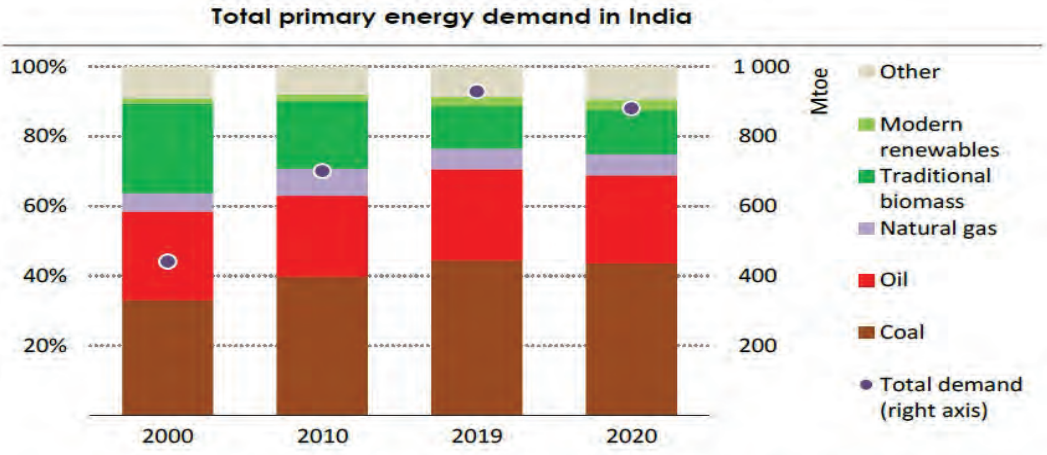




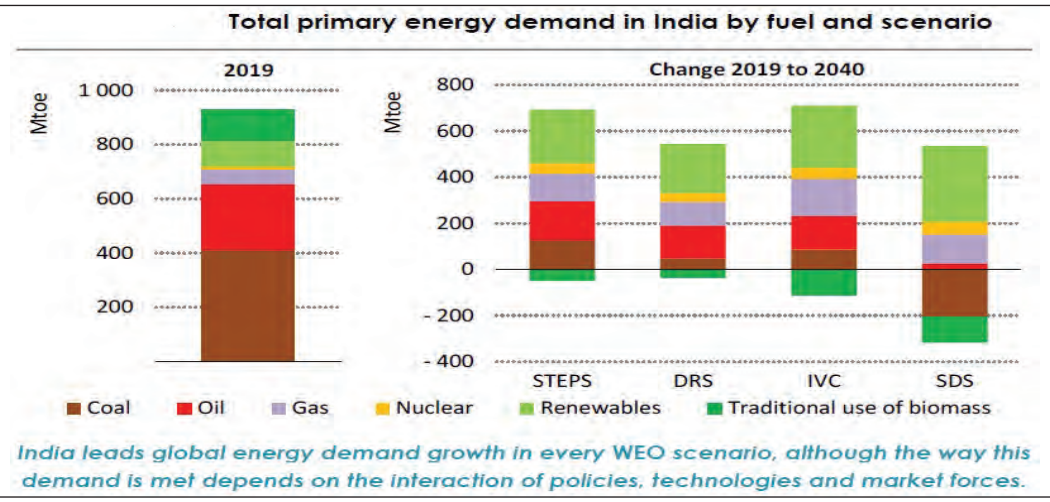
Source: IEA

INDIAN SCENARIO

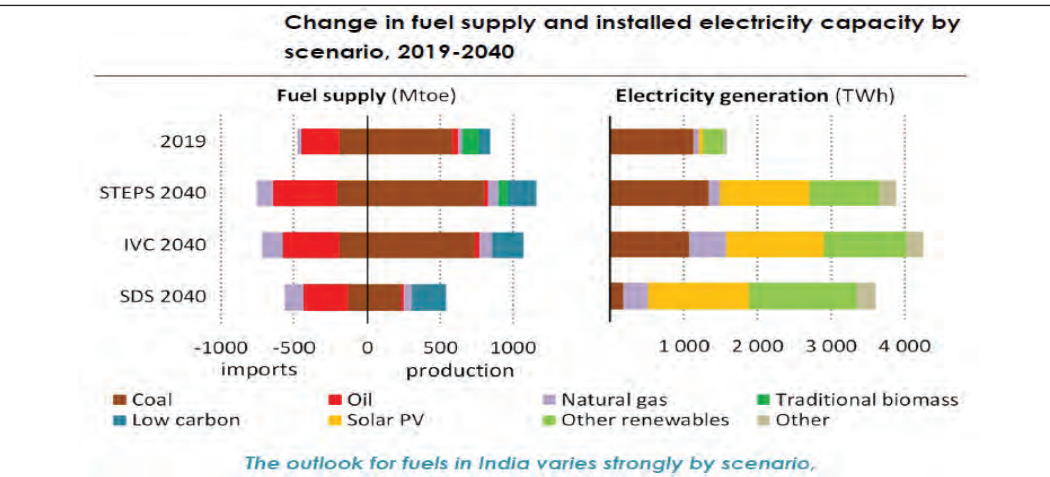
India Energy Outlook 2021



India's energy demand has tripled over the last three decades: the share of traditional biomass has fallen, leaving coal and oil dominant.



India leads global energy demand growth in every WEO scenario, although the way this demand is met depends on the interaction of policies, technologies and market forces.



The outlook for fuels in India varies strongly by scenario, but the expansion of the power system is rapid in all cases.

Source: IEEMA

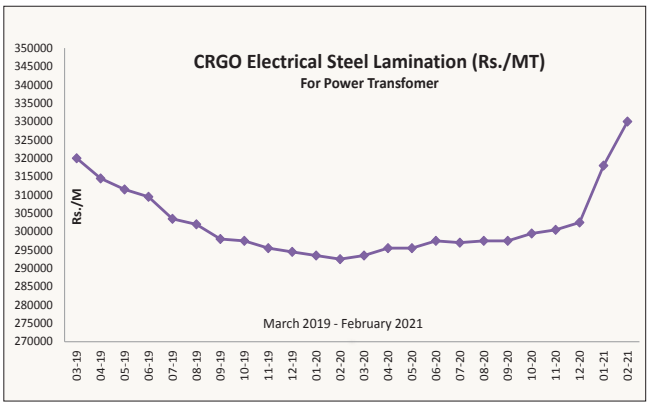
BASIC PRICES & INDICES

Basic Prices and Index Numbers

	Unit	as on 02.01.21
IRON, STEEL & STEEL PRODUCTS		
BLOOMS(SBLR) 150mmX150mm	₹/MT	42228.00
BILLETS(SBIR) 100MM	₹/MT	43020.00
CRNGO Electrical Steel Sheets M-45, C-6 (Ex-Rsp)	₹/MT	68500.00
CRGO ELECTRICAL STEEL SHEETS		
a) For Transformers of rating up to 10MVA and voltage up to 33 KV	₹/MT	255505.00
b) For Transformers of rating above 10MVA or voltage above 33 KV	₹/MT	330000.00
NON-FERROUS METALS		
Electrolytic High Grade Zinc -	₹/MT	215600.00
Lead (99.97%) -	₹/MT	174900.00
Copper Wire Bars	₹/MT	643624.00
Copper Wire Rods	₹/MT	663022.00
Aluminium Ingots - EC Grade (IS 4026-1987)	₹/MT	181257.00
Aluminuium Properzi Rods - EC Grade (IS5484 1978)	₹/MT	187207.00
Aluminium Busbar (IS 5082 1998)	₹/MT	238900.00

	Unit	as on 02.01.21
OTHER RAW MATERIALS		
Epoxy Resin CT - 5900	₹/Kg	720.00
Phenolic Moulding Powder	₹/Kg	100.00
PVC Compound - Grade CW - 22	₹/MT	157950.00
PVC Compound Grade HR - 11	₹/MT	158950.00
Transformer Oil Base Stock (TOBS)	₹/KLitre	74493.00
OTHER IEEMA INDEX NUMBERS		
IN-BUSDUCTS (Base June 2000=100) For The Month December 2020		286.78
IN - BTR - CHRG (Base June 2000=100)		436.27
IN - WT (Base June 2000=100		312.72
Wholesale price index number for 'Insulators' (Base 2011-12 = 100) for the month Dec. 2020		118.00
Wholesale price index number for 'Manufacture of Basic Metals (Base 2011-12 = 100) for the month December 2020		115.80
Wholesale price index number for' Fuel & Power (Base 2011-12 = 100) for the month December 2020		96.90
All India Average Consumer Price Index Number For Industrial Workers (Base 2001=100) December 2020		118.80

Estimated, NA: Not available QE/PVC/39



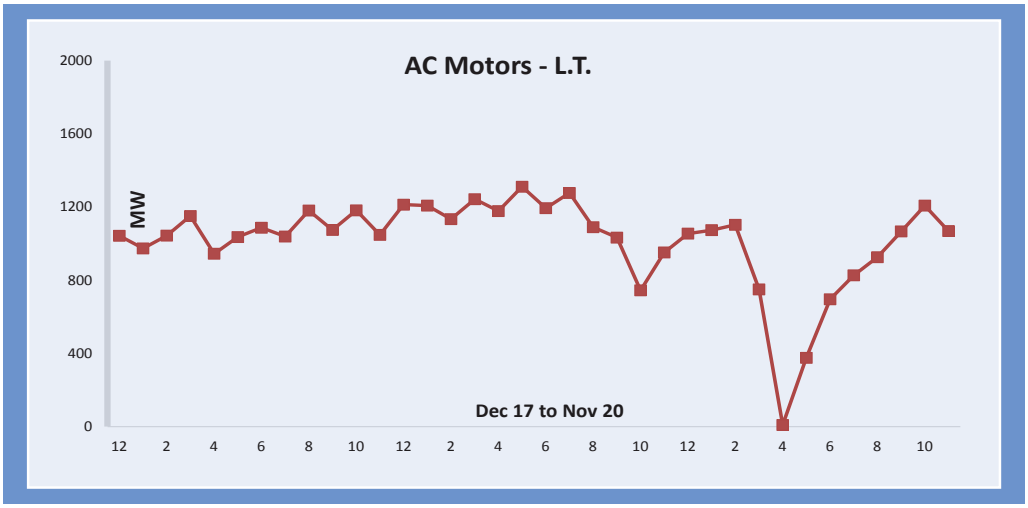
The basic prices and indices are calculated on the basis of raw material prices, exclusive of excise/C.V. duty wherever manufactures are eligible to obtain MODVAT benefit.

These basic prices and indices are for operation of IEEMA's Price Variation Clauses for various products. Basic Price Variation Clauses, explanation of nomenclature can be obtained from IEEMA office.

Every care has been taken to ensure correctness of reported prices and indices. However, no responsibility is assured for correctness. Authenticated prices and indices are separately circulated by IEEMA every month. We recommend using authenticated prices and indices only for claiming price variation.

Source : IEEMA

PRODUCTION STATISTICS



Name of Product	Accounting Unit	Production		
		For the Month	From Dec. 19 to	Highest Annual
		Nov. 2020	Nov. 2020	Production
Electric Motors*				
AC Motors - LT	000' KW	1069	10161	13404
AC Motors - HT	000' KW	333	3075	5091
DC Motors	000' KW	32	361	618
Switchgears*				
Contactors	000' Nos.	1194	11357	10625
Motor Starters	000' Nos.	183	1966	1986
Switch Disconnector Fuses	Nos.	46828	600291	947878
Miniature Circuit Breakers	000' Poles	16206	148945	166447
Circuit Breakers - LT	Nos.	265485	2957068	2736967
Circuit Breakers - HT	Nos.	4467	44848	75732
Custom Built Product	Rs. Lakhs	13385	142874	265267
HRC Fuses & Overload Relays	000' Nos.	1000	11079	16875
Power Cables*	KM	66011	598123	838017
Power Capacitors - LT & HT*	000' KVAR	3548	38246	53417
Transformers				
Distribution Transformers	000' KVA	2914	34368	58341
Power Transformers	000' KVA	12835	141910	234922
Instrument Transformers				
Current Transformers	000' Nos.	63	780	941
Voltage Transformers	Nos.	8699	96599	125292
Energy Meters*	000' Nos.	2156	22106	37299
Transmission Line Towers*	000' MT	80	894	1250
* Weighted Production				

Source : IEEMA

NA – Not Available

IEEMA Activities

Cyber Security IEEMA Leadership Web Meeting on 7th April 2021

A Cyber security IEEMA leadership Web Meeting was convened on 7th April. The meeting was chaired by Shri Anil Saboo, President IEEMA. The meeting was attended by MDs/CEOs of Leading organisations Siemens, GE(T&D), Schneider Electric, Secure Meters, L&T, ABB Power Products and Systems India Limited, ABB India , ZIV Automation. The meeting was also attended by Director General, IEEMA, Chairman & Vice Chairman Smart Grid Divisions and other senior members of the associations.

President IEEMA requested leading organisation to provide and allocate resources from their organisations in order to speed up the cyber security activities allocated by Central Electricity Authority, Ministry of Power to IEEMA.

Chairman Smart Grid Division mentioned upon the importance of IEEMA being part of the committee constituted by Ministry of Power for framing the CEA Regulations on Cyber Security.

All senior leadership from member organisations assured their whole hearted support in the Cyber security initiative.

Training programme on storage power (Batteries), Technology service & Maintenance

Training on storage power, Technology, Maintenance and service were held on 7th April 2021. The faculty of the programme was Mr. Uttam Kumar Panda from Exide Industries who is heading all sorts of sales & service activities of various branches and Zone since 2011 and Currently heading national responsibility of after sales services of Industrial batteries as Head – Service & Applications (Infra). He is B.Sc, Diploma in Mechanical Engineering. 80 participants from IEEMA member companies and IEEMA operations team attended the training. The session was elaborative and discussions were held on lead acid and Ni – Cd batteries.

Meeting on Power Transformer Standardization Manual

A meeting on Power Transformer Standardization Manual was convened on 7th April 2021 called by Ministry of Power. The Meeting was chaired by Shri Alok Kumar, Secretary, Ministry of Power and was also attended by JS, MoP; Chairperson, CEA; CMD-Power Grid, CE(PSE&TD); DG, IEEMA; Representatives from NTPC, NHPC, CPRI and Representatives from Transformer Industry.

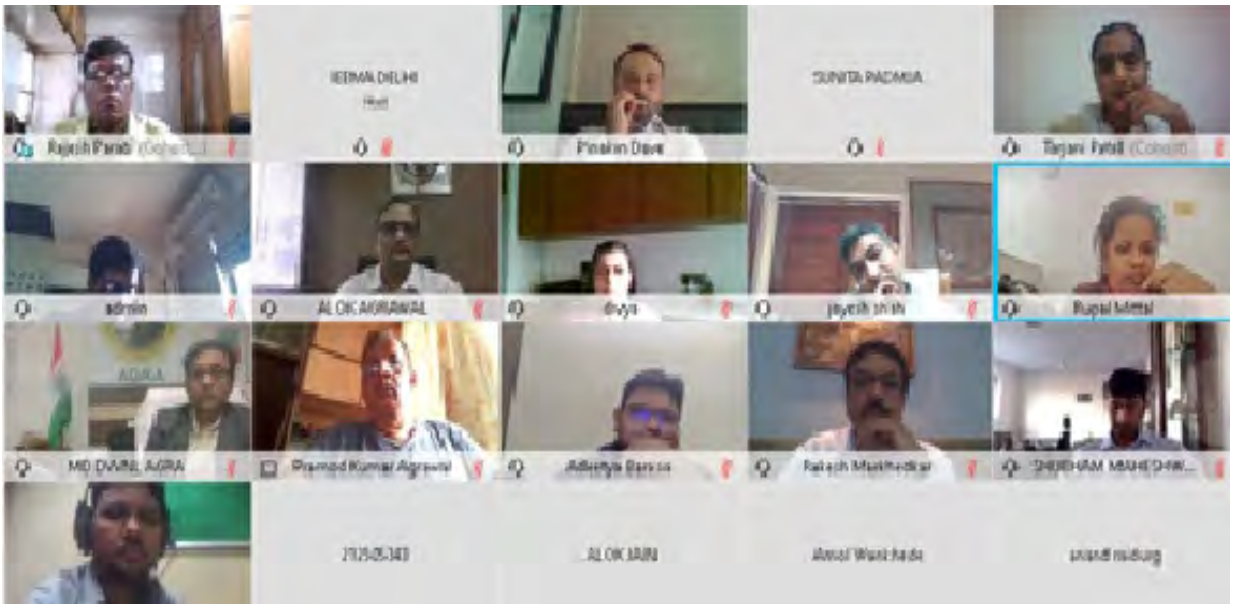
DG, IEEMA stated that a great amount of effort and time was put in preparing the manual over the last 5 years. He also mentioned that IEEMA has also prepared a manual on Power Transformers in 2014, which was not widely accepted by State Utilities; however the manual being published under CEA will have larger acceptance.

The manual will effectively standardize the product and bring simplification in the procurement process, reduced delivery period, facilitate interchangeability of different makes and ensure enhanced efficiency, quality and productivity.

Secretary (Power) concluded that initially the manual can be made voluntary for adoption of all Utilities and by Jan 2022, it can be made mandatory.

IEEMA requested to prepare similar standard specification for all the major electrical equipment such as Breakers, CT/PT, Surge Arrestor, Isolator, Cables, Capacitors, Conductors through CEA, Ministry of Power.

IEEMA Western region organised an awareness webinar on "Commodity Hedging with Bombay Stock Exchange"



The objective of the programme was to safeguard the business from any unpredictable movement in the commodity price volatility that can put the business into huge losses. The session was conducted by Mr. Pinakin Dave - Deputy General Manager Products & BD, BSE.

Mr. Jayesh Shah, Chairman, IEEMA Western Region gave the welcome address. Mr. Anil Saboo, President IEEMA in his opening remarks informed audience about the re-emergence of Covid-19 cases has turned financial markets nervous. He also felt that in today's competitive business world works on a wafer-thin profit margins and business owners like Manufacturers, Traders, Exporters & Importers are exposed to commodity & currency price risk movements, hence they must hedge themselves against extreme price risk.

He also welcome and thanked Shri Amit Kishore, IAS, MD, Dakshinanchal Vidyut Vitran Nigam Ltd, for taking time out for attending this important session organised by IEEMA.

Mr. Vijay Karia, Sr. Vice President, IEEMA in his introductory remarks informed audience about the biggest need to hedge the copper price risk or foreign currency risk is to safeguard the business from any unpredictable movement in the price that can put the business into huge losses, since we all know the commodity markets works on a low profit margin.

The session was well attended by IEEMA members. The vote of thanks is given by Mr. Rakesh Markhedkar, Vice Chairman, IEEMA Western Region.

Webinar on Partial Discharge Detection

IEEMA organised a Webinar on Partial Discharge Detection – A Condition assessment tool to prevent catastrophic failure in electrical assets. Webinar provides detail insights and information to delegates on Components in Electrical Assets and its failure, Impact of PD, Definition, causes and types of PD, Characteristics of PD, PD Detection Techniques - Online & Offline, Case Study, Various tools for PD measurement.

Interactive webinar was supported by Megger India and 200 plus participants have attended it. During the session lot of queries and clarifications related to PD in Cables and Transformers are answered by the speaker Mr. Mathew.

Interaction with Officials of Belenergo, Belarus

A web interaction was organised with Officials of Belenergo, Belarus for IEEMA International Business Division Core Committee on 2nd April 2021. Ms. Bhavika Mangalanandan, Head of Chancery, Embassy of India, Minsk, Belarus was instrumental in bringing this connect.

Belenergo, Belarus is the umbrella organization to which all power, energy, transmission, distribution companies of the country and of the states are affiliated to. All power equipment manufacturers and distributors are also affiliated to Belenergo.

INDEX TO ADVERTISERS

INTERNATIONAL NEWS

India closer to building world's biggest nuclear plant: EDF

French energy group EDF took 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, western India.

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 Indian officials, 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.

US takes steps to protect electric system from cyberattacks

The Biden administration is taking steps to protect the country's electricity system from cyberattacks through a new 100-day initiative combining federal government agencies and private industry.

The initiative, announced by the Energy Department, encourages owners and operators of power plants and electric utilities to improve their capabilities for identifying cyber threats to their networks. It includes concrete milestones for them to put technologies into use so they can spot and respond to intrusions in real time.

The department is also soliciting recommendations from electric utilities, energy companies, government agencies and others for how to safeguard the energy system supply chain.

"Innovative partnerships like these are essential to addressing the urgent cybersecurity challenge because much of our critical infrastructure is owned and operated by the private sector," Emily Horne, a spokeswoman for the White House's National Security Council, said in a statement.

The effort, which also involves the Cybersecurity and Infrastructure Security Agency, underscores the heightened concern about the prospects for cyberattacks that disrupt the power supply. Anne Neuberger, the deputy national security adviser for cyber and emerging technology, said in an interview with The Associated Press this month that the administration was undertaking a new effort to help electric utilities, water districts and other critical industries protect against potentially damaging cyberattacks.

Kalpataru Power Completes Acquisition of Brazilian Company Fasttel

Kalpataru Power Transmission Ltd (KPTL) in a stock exchange filing said that it has completed the acquisition of Brazilian company Fasttel on April 7, 2021. In the first week of February 2021, KPTL had announced that it was acquiring 51 per cent equity stake and management control in Brazilian EPC company Fasttel Engenharia

Ltda, popularly referred to as Fasttel and headquartered in City of Curitiba, State of Paraná. KPTL had then indicated that the transaction was likely to close in the first quarter of FY21.

The acquisition was done by Kalpataru Power Do Brasil Participacoes Ltda, a wholly-owned Brazilian subsidiary of KPTL. The acquisition cost is estimated at around $8.8 million.

Founded in 1988, Fasttel specializes in engineering, procurement, and construction (EPC) and maintenance of power transmission lines, substation and distribution systems across various voltage ranges up to 750kV. The company mainly operates into three business areas, comprising of EPC of substation, transmission and distribution network services with revenue of around $47 million in 2020 and has a profitable track record. The company has presence in Brazil with an order book of around $95 million as on date, KPTL had said in February this year.

LG Energy, General Motors to build $2.3 billion EV battery factory in US

South Korean battery maker LG Energy Solution Ltd said its joint venture with American automaker General Motors Corp. will build a $2.3 billion electric vehicle (EV) battery factory in Tennessee in the US.

Ultium Cells, the joint venture between LG and GM, will build a second US factory with an annual capacity of 35 gigawatt-hours, similar to the first one under construction in Ohio, LG Energy said.

“With the joint venture’s factory construction, LG Energy Solution has secured additional EV battery production capacity in the U.S. and will actively target the rapidly growing U.S. EV market,” LG Energy said in a statement.

The Tennessee factory will have 35 gigawatt-hours of annual capacity when it opens in late 2023, which is enough to provide battery packs for more than 500,000 electric vehicles, the Korean firm said.

LG Energy said in a regulatory briefing on Friday that it and GM will each invest $933.5 million for the battery production line through 2023, reports Yonhap news agency.

The planned construction of the EV battery factory came as GM plans to phase out internal combustion engine cars by 2035 and set a goal of offering 30 all-electric models by the middle of the decade, which would require a stable supply of EV batteries.

LG Energy currently operates a lithium-ion battery factory in Michigan and is building a new factory in Ohio through Ultium Cells, which will be completed in 2022.

Starwood Energy proposes $8 bln investment in Texas power infrastructure

Investment firm Starwood Energy Group proposed spending $8 billion to build 11 natural-gas fired power plants in Texas, the company said, a plan that would compete with a similar proposal from Berkshire Hathaway Inc .

Starwood, in a letter to the Public Utility Commission of Texas (PUCT), said its proposal would help solve reliability problems that came to a head after nearly half the state’s power generation was knocked out during a February freeze.

The storm killed more than a 100 people, left about 4.5 million Texans without power for days, and sent wholesale electricity prices soaring. At least three companies declared bankruptcy as a result and many others are suing over the unexpected price spikes.

Starwood proposed building new natural-gas fired power plants generating a total of 11 gigawatts, enough to power 2.2 million Texas homes on a hot summer day, according to a Reuters analysis.

It would finance the project by creating a new regulated company to hold the assets and recover a rate of return on the investment approved by the PUCT. The firm requested the rate of return not exceed 9%, according to the letter, which was also sent to the state’s grid operator, the Electric Reliability Council of Texas (ERCOT).

“Starwood Energy believes its plan will create a single point of accountability to manage emergency issues in ERCOT in a cost effective and transparent manner,” said Starwood CEO Himanshu Saxena in a letter to ERCOT and the Texas PUC.

A representative for the Texas PUC had not yet seen the proposal. Billionaire Warren Buffett’s Berkshire Hathaway earlier pitched a plan to spend $8 billion to build 10 new natural gas-powered plants in the state.

Starwood proposed that revenues generated in excess of the fuel and operating costs of the plants when they were running would be returned to ERCOT for distribution to its customers. ERCOT would have full rights to dispatch the facilities as necessary, the letter said.

NATIONAL NEWS

Andhra Pradesh: Power utilities ready to support hospitals

Power utilities in Andhra Pradesh are laying special focus on providing uninterrupted power to Covid-19 treatment facilities. The discoms are supplying 17.2 million units of electricity per annum to hospitals and Covid care centres.

State energy secretary Srikanth Nagulapalli said that power utilities were on the forefront in the fight against the pandemic even during the first wave. “Electricity employees had served as warriors at field level, ensuring uninterrupted power to all hospitals in the first wave, and won accolades from the general public,” said Srikanth.

The energy secretary, who conducted a review meet on power supply to hospitals, requested the utilities to put all efforts in this second wave of the pandemic and turn out to be the champions of service.

Mumbai: E-vehicle registrations up 115% in 2020-21 as ‘fuel prices rise’

E-vehicle registrations up 115% in 2020-21 as ‘fuel prices rise’Mumbai: Electric vehicle registrations have seen a 115% rise in Mumbai during the 2020-21 Covid-19 pandemic compared with the previous financial year, latest transport department statistics showed. They also revealed CNG vehicles were preferred by motorists too, and were just 12% short of the number of diesel vehicles registered in 2019-20.

The number of electric vehicles registered in 2020-21 totalled 1,442 compared with 672 in 2019-20. These included more than 90% two-wheelers, especially scooters.

Statistics also showed of the total e-vehicles registered in 2020-21, as many as 885 were done between January and March this year. Maximum e-vehicles were registered in the island city (Tardeo RTO) at 463 followed by 426 at Andheri RTO, 321 at Borivli and 232 at Wadala.

Transport experts said one of the reasons why people opted for e-vehicles was the rising cost of diesel and petrol, which neared the Rs 90 a litre and Rs 100 mark earlier this year, respectively. “It is also environmentally friendly, noiseless and smooth to ride, other than the cheaper fuel cost and maintenance,” said the owner of an e-scooter from Mulund.

The city has seen a spurt in the number of shops selling e-vehicles while car manufacturers are also coming up with new models of e-cars and e-SUVs. The e-car also brings savings to your wallet. While petrol or diesel cars could cost Rs 3-4 per km, the e-car costs 50 paise. In a single fast charge, one can drive up to 120km, sources said.

IEX starts cross-border electricity trade for integrated South Asian market

The Indian Energy Exchange (IEX) announced starting of cross-border electricity trade on its platform in first-of-its-kind initiative for exchanges to expand their power markets beyond India to the south Asia region towards building an integrated regional power market.

This follows notification of cross-border trade electricity (CBET) regulations by the Central Electricity Regulatory Commission (CERC) in 2019 and the recent notification of CBET rules in March.

NTPC Vidyut Vyapar Nigam (NVVN) has secured approval from the Central Electricity Authority (CEA) for Nepal's participation in the day-ahead market on IEX.

Currently, the cross-border trade with neighbouring countries for India stands at about 18 biliion units conducted through the medium to long term bilateral contracts.

As per the CEA and CERC, India imports 8.7 BU from Bhutan and exports 2.37 BU and 7 BU to Nepal and Bangladesh respectively. The power trade with these countries is expected to increase to about 40 BU by FY22 and 70 BU to FY27, according to a study by IRADe.

INNOVATION: IIT-H develops dual carbon low-cost battery

Indian Institute of Technology, Hyderabad (IIT-H) researchers have developed an alternative for lithium-ion batteries — a dual carbon battery. It is more sustainable and low cost. This battery may find potential use in high-voltage applications, sophisticated battery-run medical devices, regenerative braking systems in electric vehicles and stationary grids.

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.

"The advantage of these batteries is that they don't use any toxic, heavy and costly metals such as cobalt, nickel, manganese as a current collector. These metals are not easily available in India.

The event will engage the leaders to help shape the global, regional and local agenda in the energy sector including Power, Energy Transition, Oil & Gas, Renewables, Coal, Digital Transformation among others.

The batteries use carbon as an active material thereby making it 25% cheaper and lighter," said Surendra Kumar Martha, associate professor, department of chemistry and lead investigator of research team. In the dual carbon battery, developed by IIT-H, the researchers have utilised self-standing carbon fiber mats as both electrodes (cathode and anode).

NTPC announces contest for ideas on fly ash utilization

State-run power giant NTPC has announced a contest inviting ideas on innovative utilization of fly ash. According to a company statement, the contest aims to generate ideas to achieve 100 per cent utilization of fly ash produced at the power plants.

The contest commenced on April 20, 2021 and will close on May 19, 2021. Through the contest, NTPC looks forward to encouraging both its employees and general public at large to contribute their ideas towards the conservation of the environment.

NTPC has declared total prize money of Rs 12 lakh with the first winner receiving Rs 5 Lakh.

Sustainable ash utilization is one of the key concerns at NTPC. Fly ash is a by-product of power generation with coal.

Fly ash generated at NTPC stations is ideal for use in the manufacture of cement, concrete, concrete products, cellular concrete products, bricks / blocks / tiles etc.

To facilitate easy availability of dry fly ash to end-users, dry fly ash evacuation and safe storage systems have been set up at coal-based stations.

India needs $401 BN capex to fight climate change: Report

The country needs over USD 400 billion in capital investment which could save over 100 GW of energy and 1.1 billion tonne of greenhouse gasses between 2015 and 2030, if it goes ahead with the measures to control pollution under the Paris climate agreement, says a report. Since the country is set to far exceed most of its 2015 Paris Agreement targets on climate change, analysts are keenly watching whether India raises its pollution curtailment targets or signals a 'net carbon neutrality' deadline at the two-day Climate Summit.

The government's push towards blending ethanol up to 25 per cent and move towards green hydrogen are encouraging, Bank of America Securities said in a note on the opening day of the two-day climate summit being pushed by US President Joe Biden.

"Over 2015-30, India could drive USD401 billion in capex, which could lead to over 106 gw in energy savings, and 1.1 billion tonne per annum reduction in Co2 and impacting 99 stocks with a market capitalisation of USD 1.4 trillion," BofA said in a note.

The report expects India to step up its emission curtailment targets by 2047 and announce the same at the summit. Several large global economies have committed to be carbon neutral by 2050; and China has set a 2060 target. The US has rejoined the Paris Agreement under Biden and could make major announcements at the summit.

CORPORATE NEWS

Tata Power Gives Mumbai Country's Largest Natural Ester Transformer

Tata Power has announced the commissioning of India's largest natural ester-filled 110/33/22kV, 125 MVA power transformer, in the Mumbai transmission network The transformer has been commissioned at the BKC (Bandra Kurla Complex) receiving station, and was built in active collaboration with Hitachi ABB Power Grids and Cargill, a release by Tata Power said.

The natural esters used in these transformers have a high fire point (350 degree Celsius) and eliminate the risk of fire. The fluid is made from a carbon neutral renewable resource, is biodegradable, nontoxic and nonhazardous in soil and water.

This fluid allows designing the transformer with increased capacity and reduced carbon footprint, making it an ideal solution for congested cities like Mumbai, as opposed to conventional mineral oil-filled transformers.

Speaking on the initiative, Dr. Praveer Sinha, CEO & MD, Tata Power noted, "We have always been committed towards providing greener and sustainable solutions for our customers while ensuring uninterrupted power supply. We will continue to implement newer technological innovations and aim to reduce the carbon footprint along with improving overall performance."

KEC International wins Rs 1,245 crore orders in T&D, Railways, Construction segments

Global infrastructure EPC major KEC International announced it has secured new orders worth Rs 1,245 crore across various business segments including Power Transmission & Distribution (T&D), Railways, Civil Construction and Cables.

The company said it has secured Rs 629 crore orders for T&D projects in India, SAARC, Middle East, and the Americas. In the railways business, it said it has bagged orders of Rs 446 crore while the civil business secured orders of Rs 107 crores for infra works. New orders awarded in the cables business stood at Rs 63 crore.

"With these orders, our total order inflow for FY21 stands at Rs 11,876 crore with year-on-year growth of 5 per cent despite the challenging environment. Our railway order book continues to grow with orders in both conventional and new areas," Vimal Kejriwal, MD & CEO, KEC International Ltd. said.

Tesla strengthens India team ahead of rolling electric cars

As Tesla firms up its plans to roll out its first all-electric car in India this year, the Elon Musk-run company has hired top executives in the country who has taken charge of some of its operations in the country.

After Musk confirmed Tesla's arrival in India, Karnataka chief minister BS Yediyurappa declared in February that the US-based electric vehicle and clean energy company will set up its production unit here. Tesla has already registered its office in Bengaluru.

Now, it has ramped up hiring for top positions and has onboarded IIM Bangalore alumnus Manuj Khurana as Policy and Business Development head for India operations.

Oberoi Group signs MoU with EESL to further its sustainability initiatives

With the aim to augment its sustainability initiatives, The Oberoi Group has signed a Memorandum of Understanding (MoU) with Energy Efficiency Services Limited (EESL), a joint venture of 4 PSU's under the Ministry of Power. EESL through its Building Energy Efficiency Program (BEEP) will assist The Oberoi Group in implementing several well-established energy efficient initiatives, including clean energy systems across its properties. These initiatives will help reduce the Group's overall carbon footprint and strengthen its energy conservation efforts.

Under the partnership, EESL, through its nationwide network, will collaborate with all Oberoi Group Hotels to evaluate opportunities for saving energy and lowering

emissions. EESL will recommend select energy programs from its portfolio with proven track records of successful implementation. Additionally, as a part of The Oberoi Group's efforts towards sustainability, tailor-made energy efficiency initiatives for each of their hotels & resorts will be executed.

EESL will provide technical support and extend its procurement advantage through its partners across the energy sector. The potential energy efficiency measures will include lighting, electric motors & pumps, air-conditioning, ventilation systems, indoor air quality systems and electric vehicles along with charging infrastructure.

Speaking about this partnership, Mr. Saurabh Kumar, Executive Vice Chairman, EESL said, "Energy efficiency is becoming central to sustainable growth of businesses. EESL has pioneered energy efficiency improvement across India and empowered millions of people through its innovative schemes. Our partnership with The Oberoi Group stands testament to the exemplary vision and progressive approach of a hospitality leader in joining the forces of achieving sustainable development of the country."

GE Power to acquire 50% equity stake in NTPC GE Power Services

GE Power India said that it has acquired 50 per cent stake in NTPC GE Power Services Pvt Ltd. Earlier this month, GE Power India's board had approved the acquisition of 50 per cent stake in NTPC GE Power Services Pvt Ltd (NGSL) for Rs 7.2 crore. NTPC and GE Power Systems GmbH had 50 per cent stake each in NGSL.

GE Power India completed acquisition of 50 per cent of the issued and paid up share capital of NGSL on 19 April 2021," a BSE filing.

The acquisition of shares of NGSL from GE Power Systems GmbH is a related party transaction as the company and GE Power Systems GmbH are GE Group Affiliates. The said related party transaction will be at arm's length price.

Upon completion of the acquisition of shares from GE Power Systems GmbH, the company would enter into renovation and modernisation of thermal power plants segment and partner with NTPC Limited, which is a PSU and a pioneer in thermal power plants, the company had said earlier.

L&T Construction Awarded significant Contracts for its Various Businesses

The construction arm of L&T has secured orders from prestigious clients for its various businesses.

Power Transmission and Distribution Business:

The Power Transmission & Distribution business has won orders to design and construct two 132/11kV Substations in Dubai, UAE.

The scope of these turnkey orders involves supply of advanced equipment including Gas Insulated Switchgear. While enhancing the capacity of the network to cater to the demand growth of the domestic, commercial, and industrial sectors, these substations will also ensure the highest standards of reliability, availability, and efficiency of power supply.Additional orders have been received for ongoing projects in India.

Building & Factories Business:

The Factories Business of Buildings & Factories has secured another order from a leading cement manufacturer to construct a 3.5 MTPA brownfield cement plant in Nimbahera, Rajasthan. The scope includes civil, mechanical and equipment erection Works.

Transportation Infrastructure Business:

The Railways Strategic Business Unit that resides within the Transportation Infrastructure business has won an order from the Central Organisation for Railway Electrification (CORE). This Engineering, Procurement & Construction (EPC), Package EPC-15A order involves 25 KV Overhead Electrification, Power Supply, Signaling & Telecommunication and associated works for 383.4 RKM/459 TKM of Railway Lines in the Northeast Frontier Railway.

The project is part of "Mission Electrification" initiative of the Central Government aimed to electrify the entire Indian Railway Network to reduce the carbon footprint as well as reduce the expenditure on diesel.

The business is already executing three major EPC contracts from CORE: EPC-01 (Delhi – Jaipur line), EPC-07 (Various sections of the Southern Railway) and EPC-06 (Various sections of the North Western Railway).

2x10 MVA GIS Substation under the IPDS scheme of Government of India inaugurated in Bhagalpur

As part of the 'Azadi ka Amrit Mahotsav', 2x10 MVA GIS Substation was inaugurated in Bhagalpur, Bihar under the IPDS scheme of Government of India. The 2x10 MVA GIS Substation was commissioned by South Bihar Power Distribution Co. Ltd (SBPDCL).

The inauguration ceremony is a part of 'Azadi ka Amrit Mahotsav' celebrations marking 75 years of India's independence.

The inauguration ceremony was attended by officials from South Bihar Power Distribution Co. Ltd (SBPDCL) and Power Finance Corporation.

2x10 MVA GIS Substation for Bhagalpur was sanctioned in 2018 under IPDS scheme with sanctioned cost of Rs 8.99 crore, with grant of Rs 5.40 crore from Government of India. The GIS Substation was declared complete on 6th April, 2021, overcoming the challenges posed by the prevailing Covid situation.

The GIS Substation will benefit approximately of 1.21 lakh people of Bhagalpur and the surrounding areas. It has further reduced the land requirement curtailing the operational and maintenance cost. The GIS Substation also ensures safer working environment for the attending personnel.

SPARKS SANS SHOCKS

YOU KNOW THE FEELING? Hangry

A portmanteau that describes the irritability that arises from hunger, succinctly gets at a very particular human emotion.

Shouldn't we have more of these terms? Here are some clever nominees

BURALYSIS:
The paralyzing anxiety you feel when confronted with bureaucracy.

PRETEDIUM:
The mixture of frustration, ennui, and anxiety that washes over you when you realize you've been cornered by a known long-talker.

CINE-VOID:
The guilt follows browsing Netflix and seeing an "important" film that you know you should watch but choosing John Wick: Chapter 2, a movie you'll convince yourself you've never seen.

REMBARRASSMENT:
A feeling of humiliation at the memory of an awkward or shameful experience from long ago, often unrelated to current circumstances.

CREDITPHORIA:
The pleasure, denial, delusion, and mania of being in a store you don't belong in and buying an item you cannot afford.

PREMOJI:
The feeling of searching on your smartphone for an emoji that doesn't exist.

.....

Sandy began a job as a school counselor and was eager to help. One day during recess, she noticed a girl standing by herself on one end of a playing field while the rest of the kids enjoyed a game of soccer at the other. Sandy approached the girl and asked if she was all right. The girl said she was. But a little while later, Sandy noticed the girl in the same spot, still by herself. Approaching again, Sandy offered, "Would you like me to be your friend?" "My doctor says you should be drawing more fruits and vegetables." "OK," said the girl, looking at Sandy suspiciously. Feeling she was making progress, Sandy then asked, "Why are you standing here all alone?" "Because," said the girl with great exasperation, "I'm the goalie!"

'We've moved a few things around. Travel books are in the Fantasy section, Politics is in Sci-Fi, and Epidemiology is in Self-Help. Good luck.'

The problem with political jokes is that they get elected.

(Henry Cate)

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Publication Date	1st working day of the month of the issue
Cover Pages	210 GSM Art Paper *
Inside Pages	70 GSM LWC Paper *
Magazine Size	203 mm x 280 mm

ADVERTISEMENT TARIFF W.E.F. 1ST NOV. 2018

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Tel:+91 - 22-24930532

Published and Posted on 1st of every month at Mumbai
Patrika Channel Sorting Office, Mumbai 400 001.

R. N. I. No. MAHENG/2009/29760
Postal Regd. No. MCW/120/2021-23
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