BEES Magazine

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K S R Institute for Engineering and Technology

Department of Electrical and Electronics Engineering

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Together We Make Difference

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Editorial Board

Prefabricated Construction

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Introduction

Prefabricated construction is the practice of assembling a variety of components of a structure at a manufacturing site and transporting those sub-assemblies to the location of the construction jobsite. Prefabricated construction is sometimes thought of as a low-end and mass produced mode of construction. In reality however, it is quite the opposite. Prefabricated construction is becoming more common, improving in quality and has become available in a variety of budgets. Despite the perception of prefabrication, there are numerous benefits to this type of construction. This article assesses the advantages that prefabricated construction presents for both businesses and customers.

Eco-Friendly

Modular construction is often commended for energy efficiency and sustainable construction. Traditional construction methods require extra materials that lead to increased waste. However, since prefabricated sub-assemblies are constructed in a factory, extra materials can be recycled in-house. This is a considerable improvement over sending waste directly to a landfill from a traditional construction site. Also, the controlled environment of a factory allows for more accurate construction, tighter joints and better air filtration, which in turn allows for better wall insulation and an increase in energy efficiency. For more on the benefits of green technology in the construction industry click HERE.

Financial Savings

One of the greatest advantages of prefabricated construction would be financial savings. Although the perception of custom-made pieces may seem expensive, with prefabricated or modular construction, this is not the case. Modular construction targets all budgets and price points, creating an affordable option. Prefabrication manufacturers often receive bulk discounts from material suppliers which then trickles down to the cost of a construction project. Modular construction also sidesteps the possibility of unreliable contractors and unproductive staff. Additionally, the reduction in construction time can significantly save on construction financing costs.

Flexibility

Modular construction can be easily be disassembled and relocated to different sites. This significantly reduces the demand for raw materials, minimizes expended energy and decreases time overall. Also, modular construction allows for flexibility in the design of the structure allowing for a limitless number of opportunities. Since prefabricated construction units can be used in

different spaces, its neutral aesthetics is able to blend in with almost any building type.

Consistent Quality

Since prefabricated construction occurs in a controlled manufacturing environment and follows specified standards, the sub-assemblies of the structure will be built to a uniform quality. Construction site-built structures are dependent upon varying skill levels and the schedules of independent contractors. These all contribute to the craftsmanship and overall quality of given structure. With prefabrication, each sub-assembly is built by an experienced crew in a weather-resistant factory, with multiple quality checks throughout the entire process. Some components of the building are constructed using precise machine equipment to ensure conformity to building code.

Reduced Site Disruption

Since many components of a building are completed in the factory, there is significantly less truck traffic, equipment and material suppliers around the final construction site. This limits the disruption of traditional jobsites that suffer from noise, pollution, waste and other common irritants. This streamlined approach to construction provides a far more efficient atmosphere for productivity, and eliminates unnecessary distractions and interference that are typical of construction sites.

Shorter Construction Time

Portable construction takes significantly less time to build than on-site construction. In many instances, prefabrication takes less than half the time when compared to traditional construction. This is due to better upfront planning, elimination of on-site weather factors, subcontractor scheduling delays and quicker fabrication as multiple pieces can be constructed simultaneously. Shorter construction times allows construction companies to take on multiple projects at once, allowing businesses to grow rather than putting all their focus and resources on one or a few projects at a time.

Safety

Since sub-assemblies are created in a factory-controlled environment utilizing dry materials, there is less risk for problems associated with moisture, environmental hazards and dirt. This ensures that those on the construction site, as well as a project's eventual tenants are less likely to be exposed to weather-related health risks. Also, an indoor construction environment presents considerably fewer risks for accidents and other liabilities.

Customers who choose this option are able to enjoy a high quality, quicker, cost-effective, and eco-friendly construction method. Furthermore, construction companies may soon increase their investment in modular construction processes, benefiting both their business and customer relationships. Prefabricated construction is proving to be an extremely viable option, and as manufacturing technology continues to improve, expect to see its benefits and advantages rise in the future.

Batteries in Solar Energy

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Introduction

The sun is the source of almost all energy available on Earth. Solar energy is produced from nuclear fusion in the sun's core, where hydrogen is fused into helium. This releases a huge amount of energy in the form of light and heat, and a small amount of this energy strikes the Earth's surface—up to 1kW/m2, though the actual value depends on location, season, weather conditions and other factors. Solar energy, which is almost unlimited if we can collect it and convert it to an appropriate form, can be harnessed in the three following ways:

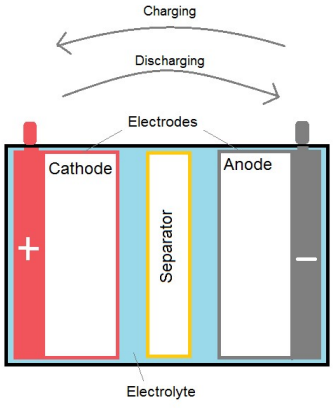
Solar thermal collector: absorbs sunlight to collect heat Photovoltaic (PV)cell: converts sunlight directly into electrical energy Concentrated solar power: uses mirrors to concentrate a large area of sunlight onto a small area

There are three main parts of solar energy systems: solar panels, solar charge controllers, and an inverter and battery storage system. Solar energy systems engineers must consider the following parameters: PV cell maximum power, sunlight intensity, angle of the sunlight (PV panel tilt angle), and the amount of sunhours (generally calculated by the amount of sun hours per day).

How Does a Battery Work?

A battery is a portable energy source that converts chemical energy to electrical energy. Simply put, batteries contain three basic parts: the electrodes, the electrolyte and a separator. There are always two electrodes in a battery: the cathode is connected to the positive end, while the anode is connected to the negative end. When the battery powers a load, it discharges, and current flows from the cathode to the anode. When the battery charges, current flows from the anode to the cathode.

Electrodes are immersed in an electrolyte, a liquid or gel substance that contains the electrically charged ions that react with the electrodes. This chemical process causes the battery to generate electricity. The separator physically separates the electrodes. Without it, the electrodes would come into contact and be short-circuited, destroying the battery.



The main parts of a battery: cathode, anode, electrolyte and separator. Batteries provide electricity in the form of direct current (DC), but an inverter can be used to achieve alternating

current(AC). The most important parameters of any battery are the following:

- Nominal cell voltage
- Nominal capacity
- Battery type
- Number of cells in the battery string

A battery string in a substation.

The capacity of a battery indicates how much energy it can store, which can be measured in ampere hours (Ah). This gives an approximate measure of how much current the battery can provide in an hour. If a more accurate definition is required, the battery voltage must be considered, as voltage decreases during discharge. The total energy of a battery can be given in watt-hours (Wh), It is amazing that batteries are currently available on the market with capacities up to 3000Ah.

Different Battery Types

Batteries can be roughly grouped into two types: regular (nonrechargeable) and rechargeable. This article focuses on the rechargeable batteries used in renewable energy systems. In this battery type, the chemical reaction is reversible, allowing both discharging as well as recharging. There are three main types of rechargeable batteries: lead-acid, nickel-cadmium (NiCd) and lithium-ion.

Types of rechargeable batteries.

Lead-acid batteries, designed as flooded (wet) or valve-regulated lead-acid (VRLA), can be manufactured with a nominal cell voltage of 2V or 12V. Nickel-cadmium battery cells have a nominal voltage of 1.2V. Lastly, the nominal voltage of lithium-ion batteries can range from3.3-3.7V, depending on the chemistry of the cell.

Life Span of a Battery

It's almost impossible to estimate how long a given battery will last, as there are many factors that influence the life cycle of a battery. These include battery type, the number of charging/recharging cycles, operating conditions like temperature, how fully the battery was discharged, among others.

If all battery systems are properly managed, a battery will die after all the active materials have been consumed or the positive grids have deteriorated due to corrosion, which occurs throughout the battery's lifetime. Failure to follow appropriate design and system management guidelines will almost always guarantee a battery system's early failure. There are eight ways to kill a battery:

- Overcharge
- Overdischarge
- Excessive charge rates
- Excessive discharge rates
- Improper equalization
- Too hot or cold operational environment
- Extended storage period
- Improper battery for a given application

Solar energy is available during the day, but energy is also necessary during the night. This makes batteries a very important part of the solar energy system, as they can provide constant electrical power whether the energy source is available or not. Solar energy system owners need a reliable battery with a long lifespan—not to mention an affordable price.

What's a Good Battery for Solar Energy Systems?

Deep-cycle storage capability is a mandatory feature for batteries in a solar energy system. Lead-acid batteries have this feature, as they can be discharged up to 80 percent of total capacity without any repercussions. Flooded lead-acid batteries are the most commonly used batteries in solar energy systems, as they also have a long lifespan and are cost-effective.

The disadvantage of flooded lead-acid batteries is that they are difficult to maintain, a definite drawback because solar plants are typically installed in terrain that can be challenging to access. The electrolyte of flooded lead-acid batteries evaporates, so these batteries must be refilled. They must also have an exhaust system to prevent hydrogen gas from accumulating to dangerous levels, so the battery station requires ventilation. Another problem with flooded lead-acid batteries is disposal, because of their toxicity. Thankfully, due to battery development in the automotive industry, it's now possible to recycle these batteries.

Gelled electrolyte VRLA batteries use a silica gel instead of a liquid electrolyte. These batteries cannot be spilled and are very low maintenance. However, because they are quite expensive and have less capacity than other battery types, gelled electrolyte VRLAs are not popular in solar applications.

Absorbed glass mat (AGM) VRLA batteries offer the advantages of gelled electrolyte VRLA batteries while avoiding their disadvantages. As an electrolyte, they use fine fiber boron-silicate glass mat instead of a gel, so they can't be spilled even when broken. Their self-discharging rate is even better than with flooded lead-acid batteries, and they also better at withstanding temperature variations. However, one clear disadvantage is that AGM batteries are two to three times more expensive than flooded lead-acid batteries.

Nickel-cadmium batteries are not as popular for use in solar energy systems. In recent years,the electric car industry has been focusing on lithium-ion batteries and has invested a lot in their development. Thus, lithium-ion batteries are becoming increasingly popular in renewable energy applications, offering good quality and a long lifespan (approximately five years, according to Tesla).

Lithium-ion batteries are the most common energy storage technology used today. However, these batteries have disadvantages for use in renewable energy systems.

Currently, flooded lead-acid batteries are the most popular batteries used for solar energy applications, and they will probably remain dominant in that space over the next few years.

E-Waste Management

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Introduction

Growth in the IT and communication sectors has enhanced the usage of the electronic equipment exponentially. Faster upgradation of electronic product is forcing consumers to discard old electronic products very quickly, which, in turn, adds to e-waste to the solid waste stream. The growing problem of e-waste calls for greater emphasis on recycling e-waste and better e-waste management.

E-Waste management

Electronic waste or e-waste is generated when electronic and electrical equipment become unfit for their originally intended use or have crossed the expiry date. Computers, servers, mainframes, monitors, compact discs (CDs), printers, scanners, copiers, calculators, fax machines, battery cells, cellular phones, transceivers, TVs, iPods, medical apparatus, washing machines, refrigerators, and air conditioners are examples of e-waste (when unfit for use). These electronic equipments get fast replaced with newer models due to the rapid technology advancements and production of newer electronic equipment. This has led to an exponential increase in e-waste generation. People tend to switch over to the newer models and the life of products has also decreased.

E-waste typically consists of metals, plastics, cathode ray tubes (CRTs), printed circuit boards, cables, and so on. Valuable metals such as copper, silver, gold, and platinum could be recovered from e-wastes, if they are scientifically processed. The presence of toxic substances such as liquid crystal, lithium, mercury, nickel, polychlorinated biphenyls (PCBs), selenium, arsenic, barium, brominated flame retardants, cadmium, chrome, cobalt, copper, and lead, makes it very hazardous, if e-waste is dismantled and processed in a crude manner with rudimentary techniques. E-waste poses a huge risk to humans, animals, and the environment. The presence of heavy metals and highly toxic substances such as mercury, lead, beryllium, and cadmium pose a significant threat to the environment even in minute quantities.

Consumers are the key to better management of e-waste. Initiatives such as Extended Producer Responsibility (EPR); Design for Environment (DfE); Reduce, Reuse, Recycle (3Rs), technology platform for linking the market facilitating a circular economy aim to encourage consumers to correctly dispose their e-waste, with increased reuse and recycling rates, and adopt sustainable consumer habits. In developed countries, e-waste management is given high priority, while in developing countries it is exacerbated by completely adopting or replicating the e-waste management of developed countries and several related problems including, lack of investment and technically skilled human resources. In addition, there is lack of infrastructure and absence of appropriate legislations specifically dealing with e-waste. Also, there is inadequate description of the roles and responsibilities of stakeholders and institutions involved in e-waste management, etc. In 2016, the Ministry of Environment, Forest and Climate Change (MoEFCC) released the updated E-waste (Management) Rules, which came in supersession of the E-waste in India (GOI, 2016).

Global E-Waste Problem

International treaties such as Basel Convention aim at reducing and regulating the movement of hazardous waste between nations. Even with the Convention, illegal shipment and dumping of e-wastes continue to take place. It is estimated that 50

million tonnes of e-waste was generated globally in 2018. Half of this is personal devices such as computers, screens, smartphones, tablets, and TVs, with the remainder being larger household appliances and heating and cooling equipment.

The rate at which the e-waste volume is increasing globally is 5 per cent to 10 per cent yearly. In India, the volume of e-waste generated was 146,000 tonnes per year (Borthakur and Sinha, 2013). However, these data only include e-waste generated nationally and do not include waste imports (both legal and illegal) which are substantial in emerging economies such as India and China. The reason is that large amount of waste electrical and electronic equipment (WEEE) enters India from foreign countries. Switzerland is the first country in the world to have established and implemented a formal e-waste management system that has recycled 11 kg/capita of e-waste against the target of 4 kg/capita set by the European Union (EU).

E-Waste Problem in India

India ranks 177 amongst 180 countries and is amongst the bottom five countries on the Environmental Performance Index 2018, as per a report released at the World Economic Forum 2018. This was linked to poor performance in the environment health policy and deaths due to air pollution categories. Also, India is ranked fifth in the world amongst top e-waste producing countries after the USA, China, Japan, and Germany and recycles less than 2 per cent of the total e-waste it produces annually formally. Since 2018, India generates more than two million tonnes of e-waste annually, and also imports huge amounts of e-waste from other countries around the world. Dumping in open dumpsites is a common sight which gives rise to issues such as groundwater contamination, poor health, and more. The Associated Chambers of Commerce and Industry of India (ASSOCHAM) and KPMG study, Electronic Waste Management in India identified that computer equipment account for almost 70 per cent of e-waste, followed by telecommunication equipment phones (12 per cent), electrical equipment (8 per cent), and medical equipment (7 per cent) with remaining from household e-waste.

E-waste collection, transportation, processing, and recycling is dominated by the informal sector. The sector is well networked and unregulated. Often, all the materials and value that could be potentially recovered is not recovered. In addition, there are serious issues regarding leakages of toxins into the environment and workers' safety and health.

Impact of Recycling E-Waste in Developing World

Almost all e-wastes contain some form of recyclable material, including plastic, glass, and metals; however, due to improper disposal methods and techniques these materials cannot be retrieved for other purposes. If e-waste is dismantled and processed in a crude manner, its toxic constituents can wreak havoc on the human body. Processes such as dismantling components, wet chemical processing, and incineration are used to dispose the waste and result in direct exposure and inhalation of harmful chemicals. Safety equipment such as gloves and face masks are not widely used, and workers often lack the knowledge and experience required to carry out their jobs properly. In addition to this, manual extraction of toxic metals leads to entering of dangerous material in the bloodstream of the individual doing so.

The health hazards range from kidney and liver damage to neurological disorders. Recycling of e-waste scrap is polluting the water, soil, and the air. Burning to retrieve metal from wires and cables has led to the emission of brominated and chlorinated dioxins as well as carcinogens which pollute the air and, thereby, cause cancer in humans and animals. Toxic chemicals that have no economic value are simply dumped during the recycling process. These toxic chemicals leach into underground aquifer thereby degrading the local groundwater quality and rendering the water unfit for human consumption as well as agricultural purposes. When e-waste is dumped in landfills, the

lead, mercury, cadmium, arsenic, and PCBs make the soil toxic and unfit for agricultural purposes. Very recent studies on recycling of e-waste has pointed towards increasing concentrations of PCBs, dioxins and furans, plasticizers, bisphenol-A (BPA), polycyclic aromatic hydrocarbons (PAH), and heavy metals in the surface soil of the four metro cities of India, that is, New Delhi, Kolkata, Mumbai, and Chennai where e-waste is being processed by the informal sectors (Chakraborty et al., 2018 and 2019). In those studies, it has been observed that the sites engaged in metal recovery processes are the prime sites for such persistent toxic substances. Studies from the same group also reported that the persistent organic pollutants produced or released during the recycling process are escaping in the ambient air due to their semi-volatile nature.

How Can Governments, City Administration, and Citizens Help?

The ASSOCHAM report (2017) suggests that the government may look at collaborating with the industry to draw out formal/standard operating procedures and a phased approach towards the agenda of reducing e-wastes to the lowest. Alternatively, the government may also refer methods adopted by other countries for efficient collection and recycling of e-wastes. For example, South Korea, one of the largest producers of electronics managed to recycle 21 per cent of the total 0.8 million tonnes of e-waste that it produced in 2015, said the study.

Considering the adverse impacts caused by untreated e-waste on land, water, and air; the government should encourage the new entrepreneurs by providing the necessary financial support and technological guidance. Establishment of start-ups connected with e-waste recycling and disposal should be encouraged by giving special concessions. The unorganized sector has a well-established collection network. But it is capital-intensive in case of organized sector. Therefore, if both the sectors coordinate and work in a harmonious manner, the materials collected by the unorganized sector may be handed over to the organized sector to be processed in an environment-friendly way. In this kind of scenario, the government can play a crucial role between the two sectors for successful processing of the e-waste. It is high time that the government takes a proactive initiative to recycle and dispose of e-waste safely to protect the environment and ensure the well-being of the general public and other living organisms.

The citizens have a very important role to play in e-waste management. We casually throw many small gadgets along with dumped waste and many people openly burn those accumulated waste. A number of hazardous substances such as dioxins and furans are released in the process which we breathe. This is a very unhealthy practice, which we should immediately stop. Some of the very progressive Resident Welfare Associations (RWAs) have separate bins clearly marked for collecting e-wastes. All the other residential societies should follow this practice. Students and Women SHGs can be mobilized for this activity in their respective RWAs.

Conclusion

E-waste management is a great challenge for governments of many developing countries such as India. This is becoming a huge public health issue and is exponentially increasing by the day. In order to separately collect, effectively treat, and dispose of e-waste, as well as divert it from conventional landfills and open burning, it is essential to integrate the informal sector with the formal sector. The competent authorities in developing and transition countries need to establish mechanisms for handling and treatment of e-waste in a safe and sustainable manner.

Increasing information campaigns, capacity building, and awareness is critical to promote environment friendly e-waste management programmes. Increasing efforts are urgently required on improvement of the current practices such as collection schemes and management practices to reduce the illegal trade of e-waste. Reducing the amount of hazardous substances in e-products will also have a positive effect in dealing with the specific e-waste streams since it will support the prevention process.

E Learning Tools

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Introduction

An eLearning professional is only as good as their best tools. As well as learning management systems, there are now all kinds of nifty online apps that can help you to organize your work, research trends, create course content, network with peers, and communicate with learners.

The team at Learn Upon organizes eLearning projects and helps customers with course content every day. So we asked members of our development, customer support and design teams to recommend the top eLearning tools they can't work without. Whatever your role, you'll find something here that's sure to make your training a little smoother and more polished.

Google Drive

Google Drive is our favourite form of cloud storage here at Learn Upon. With teams working in different locations across the globe, Google Drive provides a safe and central location where all team members can access the files they need at any time.

Many eLearning teams have members that work remotely, are based in different offices, or travel frequently. Google Drive is useful for ensuring that team members have instant access to the most recent version of a file, avoiding the delay and potential confusion of email chains.

Google Drive is also ideal for storing brochures and educational documents that account managers may need access to from eLearning conferences and other remote locations.

Momentum

Momentum is a to-do list extension that can be used with the Google Chrome browser. The main strength of this eLearning tool is that it's so easy to use.

When you first install the Momentum plugin, you'll be asked for your name, location, and a focus for the day, which will be used to personalize your to-do list later.

An online to-do list is an essential eLearning tool. Momentum's ease of use makes it our favorite! Its simplicity makes it all the more likely you'll add and track tasks, improving your productivity.

Google Calendar

Google Calendar is one of our favorite eLearning tools for staying on top of team meetings and keeping up with employees, customers, partners, etc. It offers many handy features, such as the ability to add notes, send text notifications and schedule recurring reminders.

It's important for eLearning professionals to have their days fully organized. After all, organization is the key to productivity!

One of the major benefits of using Google Calendar is how widely used it is, so you don't have to worry about compatibility across devices or organizations. You can also set recurring events, where training sessions can be scheduled weekly, annually, etc.

Mural

ELearning projects, such as the curation of course content, requires the input of a variety of people. Mural is an ideal program to use for people to organize, share and develop their ideas.

Essentially, Mural is a collaboration and brainstorming design board where teams can collaborate and share ideas, no matter where they are, making it perfect for businesses with global offices or remote workers. Mural makes it visually pleasing to track tasks and projects, in addition to creating storyboards, etc.

Mural allows team members to visually contribute their ideas to an eLearning project while collecting all information in one place, which is ideal for eLearning employees who can't be in the office all the time, or need to travel a lot.

Because Mural enables team members to collaborate and share ideas in the same place, it avoids confusing email threads and increases productivity.

Just Press Record

Just Press Record is a hugely helpful app that makes for a great eLearning tool. It's a mobile audio recorder that allows you to record, transcribe, share and organize audio. Recorded audio content

can also be synced between devices (including iWatch) via iCloud.

The ideas discussed in eLearning conference presentations and webinars often makes for great course content. Rather than painstakingly taking notes and having to transcribe them afterwards, Just Press Record does it for you. It's not only productive, it saves you time too!

If you utilize blended learning, Just Press Record is perfect for recording and sharing in-person training sessions or webinars.

Tomato Timer

Tomato Timer is a website and app dedicated to combating procrastination, resulting in more effective time management. Tomato timer is based on the Pomodoro Technique.

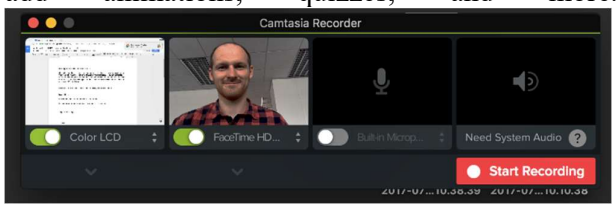
This technique uses a timer to break down work into intervals, traditionally 25 minutes, separated by short breaks. This tool is simple to use and you can even customize your timer.

Camtasia

Camtasia is a screen recording and editing software suite that makes it easy to capture what's happening on your computer. During the editing process, you can add "hotspots" to the video that make any element on screen clickable.

There's lots of ways that Camtasia can be used for eLearning. Instructors will find it useful for recording videos that learners can watch at their convenience, while account managers can use it to show prospective customers how LMS features work.

Camtasia is an awesome content creation tool for eLearning; you can also create SCORM courses, add animations, quizzes, and more.



Elucidat

While there are countless eLearning authoring tools on the market, Elucidat is particularly strong at creating responsive online and mobile course content that's compatible with HTML5. Elucidat uses cloud technology, which makes for a great collaboration tool.

Elucidat's built-in review and commenting features makes it easier for remote eLearning team members to work together. It's also great for course developers and instructional designers who need to develop online learning content that loads quickly and runs on a huge range of browsers and devices.

YouTube

YouTube has become the go-to place for people looking for all forms of video content. It hosts a huge repository, where users can upload videos or create playlists to curate content in a way that suits their interests.

Video content is a big trend in eLearning, and it's a tool all eLearning professionals should utilize. Adding video content to your eLearning courses makes them more interactive and fun. YouTube tends to be the first place people go when they want to learn something fast, making it a great place for instructors to add eLearning videos. Plus, video content uploaded to YouTube can be easily embedded into most eLearning content.

Microsoft Office Suite

No list of eLearning tools would be complete without Microsoft Office, the popular package of productivity software programs.

PowerPoint, Word, and Excel are used in organizations across the world to create documents, presentations, and managing reporting processes.

Microsoft Office Suite is one of the most popular eLearning authoring tools out there. PowerPoint and Word form the basis of many training programs. It integrates easily with many learning management systems. For example, LearnUpon can export training reports to Excel and email them to your team automatically.

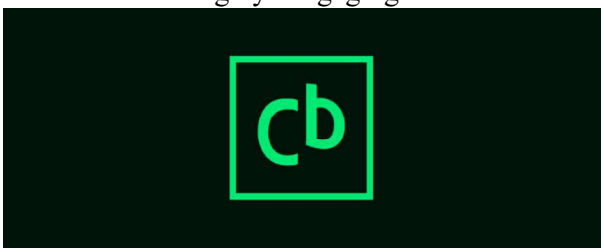
Adobe Captivate

As a rapid eLearning authoring tool, the main benefits of Adobe Captivate are responsive design at an affordable monthly fee. Adobe Captivate's library of over 25,000 templates and assets are popular with course developers and instructional designers.

Captivate is a great eLearning authoring tool in which eLearning developers and designers can work projects through from storyboarding to exporting a completely responsive course.

Courses created in Captivate are responsive across a large range of devices. The games, interactions, layouts, and cutouts included in the library can

contribute to highly engaging course content.



Google Docs

Google Docs provides an alternative to Microsoft Office. The main advantage is that the suite of eLearning tools is free. Spreadsheets, presentations and slides are created and stored online, making collaboration across teams a breeze.

At LearnUpon, we find Google Docs most useful for allowing multiple team members to collaborate on the creation and editing of shared documents. With all files stored in the cloud, team members can give feedback and make edits in real-time.

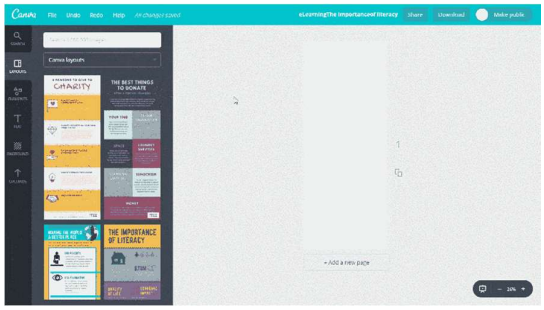
Wistia

Wistia is an incredibly handy video hosting platform. It provides organizations with a customizable video player that fits their needs. Videos can be shared securely and are easy to manage and track.

Wistia is a perfect eLearning tool for hosting your training content. You can create onboarding videos for new hires in your organization, or product tutorials for your customers. It also has great analytics, so you know if your audiences are watching your videos.

Canva

If you're a design newbie or looking for a quick way to make an infographic, header, or slide, Canva is the perfect eLearning tool for you. It's easy to use, and excellent for your speedy design needs.



Canva has lots of templates for a wide variety of customizable content types that can be added to your eLearning content quickly and easily. It enables you to make your course material more visual and engaging for your learners with minimal effort.

Grammarly

Worried you're making spelling or grammar mistakes in your training content? Then Grammarly is perfect for you! It's a tool that ensures your grammar is first-rate by pointing out if you've used "your" instead of "you're", or if you've forgotten a dreaded Oxford comma.

Bad grammar and incorrect spelling in eLearning content comes across as unprofessional, so having correct grammar in your courses is essential. Grammarly ensures that your learner can easily comprehend their training and be clear about what they are meant to achieve.

Zoom

When you think of Zoom, you probably think of it's premier function - a video communications tool. Zoom gives you the ability to communicate via video for meetings, presentations, webinars, and more. But here at LearnUpon, we consider it a great course creation tool too.

By recording your Zoom sessions, you'll have some some great eLearning content at your fingertips!

Valuable knowledge and learning happens in team meetings, product sessions and presentations. If you record these events through Zoom, you can use them as course content in your eLearning training.

Here's our step-by-step guide on how to record your Zoom meetings to create eLearning videos.

Pexels

There's a multitude of free stock image websites out there, but we think Pexels is a great one. Pexels provided high quality, free images that are all tagged and easily searchable through their discover pages.

Using images in your eLearning course content has many benefits. They boost retention, help break down complex topics, and makes your content visually pleasing.

Pexels is the perfect site to use when adding images to your eLearning courses. Read our how-to on creating engaging images for your eLearning courses.

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Graphene

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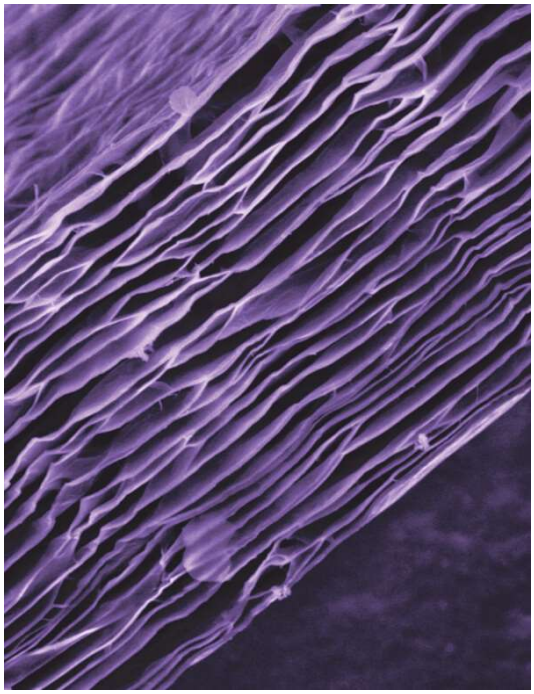
Introduction

The wonder material graphene — an array of interlinked carbon atoms arranged in a sheet just one atom thick — promised a world of applications, including super-fast electronics, ultra-sensitive sensors and incredibly durable materials. After a few false starts, that promise is close to realization. And a suite of other extremely thin substances is following in its wake.

Graphene got its beginnings in 2003, when scientists at the University of Manchester found they could peel off a gossamer film of the material just by touching a piece of ordinary sticky tape to a block of purified graphite — the solid form of carbon that's mixed with clay and used as the "lead" in most pencils. Graphene proved stronger than steel but extremely flexible, and electrons could zip through it at high speeds. It earned its discoverers the Nobel Prize in 2010, but researchers spent years struggling to manufacture it on larger scales and figuring out how its remarkable properties could best be used.

Today graphene is finding its way into different types of products. "Graphene is here," says Mark Hersam of Northwestern University. Layered over zinc, graphene oxide is actively being developed as a replacement, with higher storage capacity, for the sometimes unreliable graphite now used in battery anodes. And nanotubes were recently used as transistors to build a microprocessor, replacing silicon (unlike flat graphene, nanotubes can be coaxed into acting like a semiconductor). Though the microprocessor was primitive by modern computing standards, akin to the processing level of a Sega Genesis, materials scientists think it could ultimately pave the way for more efficient, faster and smaller carbon components for computer processors.



At the same time, a new generation of two-dimensional materials is emerging. The success of graphene further fueled the ongoing effort to find useful atomically thin materials, working with a range of different chemicals, so as to exploit the physical properties that emerge in such super-thin substances. The newcomers include an insulator more efficient than conventional ones at stopping the movement of electrons, and another that allows electrons to glide across it at a good percent of the speed of light, with little friction. Researchers think some of these may one day replace silicon in computer chips, among other potential uses.

Other materials now in development have even higher aspirations, such as advancing scientists toward one of the most tantalizing goals in chemistry — the creation of high-temperature superconductors.

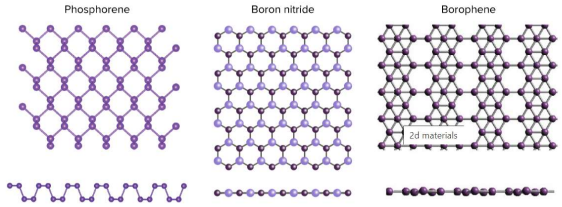
Speedy electrons

In graphene, carbon atoms link up in an orderly honeycomb pattern, each atom sharing electrons with three neighboring carbon atoms. That structure allows any added electrons to move speedily across its surface. Ordinarily, a single electron might move through a conducting metal like copper at 1.2 inches per minute (given a 12-gauge wire with 10 amps of electricity). But in early experiments on graphene, electrons zipped along at 2.34 billion inches per minute — which could make for electronics that charge in just a few minutes and eventually in a matter of seconds.

Two sides of boron

Boron would seem an odd fit for electronic applications. It's better known as a fertilizer, an ingredient in fiberglass or (combined with salt) a laundry-detergent additive. But make it very thin and very flat, and boron begins to act more like a metal, conducting electricity easily. Two-dimensional boron, called borophene, is also ultra-flexible and transparent. Combined with its conductive properties, borophene's flexibility and transparency could eventually make it a go-to material for new gadgets, including ultra-thin, foldable touch screens.

Like graphene, borophene's structure allows electrons to fly through it. It's such a good conductor that it's now being studied as a way to boost energy storage in lithium-ion batteries. Some researchers even think it might be coaxed into superconducting states at relatively high temperatures — though that's still very cold (initial tests show the effect between minus-415 to minus-425 degrees Fahrenheit). Most current superconductors work close to absolute zero, or nearly minus -460 degrees F. A superconducting material allows electrons to move through it without any resistance, creating the potential for a device that accomplishes robust electronic feats while using only a small amount of power.



In the form of borophene, boron can conduct electrons like a metal. Yet, as part of a 2D-film of boron nitride, it can block the flow of electrons quite effectively. "In other words, 2D boron and [2D] boron nitride are on opposite ends of the electrical conductivity spectrum," Hersam says.

Boron nitride's insulative property has come in handy for research on other 2D materials. Take that ephemeral black phosphorus: One way scientists have managed to keep it stable enough to study is by sandwiching it between two sheets of boron nitride.

Even as it is blocking electrons, however, boron nitride will allow photons to pass, says physicist Milos Toth of the University of Technology Sydney, who coauthored an article about the potential of boron nitride, and other 2D materials, in the 2019 Annual Review of Physical Chemistry. That's ideal for creating things called single-photon sources, which can emit a single particle of light at a time and are used in quantum computing, quantum information processing and physics experiments.

Magnetic material

Another atomically thin material creating quite a buzz in materials science circles is a compound of chromium and iodine called chromium triiodide. It's the first 2D material that naturally generates a magnetic field. Scientists working on chromium triiodide propose the material could eventually find uses in computer memory and storage, as well as in more research-focused purposes such as controlling how an electron spins.

There's a hitch, Hersam says: "This material is extremely hard to work with," because it is both tough to synthesize and unstable once it's made. Right now the only way to work with it is at extremely low temperatures, at minus-375 degrees Fahrenheit and below. But boron nitride might again come to the rescue: Some chromium triiodide samples have been preserved for months on end inside boron nitride sandwiches.

Because of its finicky properties, chromium triiodide may not itself end up built into devices, Hight Walker says. "But when we understand the physics of what's happening, we can go look for this 2D magnetic behavior in other materials." A number of 2D magnetic materials are now being explored — single-layer manganese crystals woven into an insulating material is one possibility.

Thin sandwiches

Wrangling any of these thin layers into something usable may ultimately depend — literally — on how they stack up. Different super-thin materials would be layered together so that the properties inherent in each material can complement one another. "We have insulators, semiconductors, metals and now magnets," Hight Walker says. "Those are the pieces that you need to make almost anything you want."

One potential application especially exciting to Hight Walker is in quantum computing. Unlike traditional computing, in which bits of information are either ones or zeroes, quantum computing allows each "qubit" of information to be both one and zero at once. In principle, this would allow quantum computers to quickly solve problems that would take an impossibly long time with conventional machines.

Right now, though, most qubits are made of superconductors that have to be kept freezing cold, limiting their real-world use and motivating the search for new types of superconducting materials. For this reason, researchers are eager to explore borophene's ability to superconduct. (Graphene, layered a certain way, also has shown potential superconducting properties.)

But a stacked material involving several superconducting layers separated by strong insulators could enable smaller, more stable qubits that don't require quite as low temperatures — which could reduce the overall size of quantum computers. Right now, these are room-sized affairs, much like early computers were. Reducing their size is going to require novel approaches and, possibly, very thin materials — layered sheet by little sheet..

THE FUTURE GRID

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Introduction

The basic technologies used to deliver electricity from generator to customer were largely unchanged from the 1880s to the 1980s. But technological advancements in the past few decades have significantly improved the efficiency, reliability, and security of that electricity delivery and will continue to do so.

For one thing, the distinction between transmission and distribution is increasingly blurry; technologies such as micro grids, distributed generation, energy storage, and demand response in buildings are shifting the electricity system from a central-station model alone to a more distributed model.

Direct current—already used in many products in a building from computers to lighting and possibly the future sole power source into buildings—will be increasingly used to improve the efficiency of long-distance transmission and reduce losses from distributed generation sources, such as solar PV.

Energy storage will allow the electricity system to be optimized over the course of a day while also increasing the utilization rate of transmission and distribution lines, smoothing the integration of variable renewable energy resources, and providing backup power in the event of a power outage.

Transmission operators will need control systems with the capability to process millions of data points per second, because there will be a proliferation of sensors, such as phasor measurement units (PMUs), collecting data from the grid. In turn, operators will be able to move from still largely reactive to more proactive decision making.

Investments will continue to be needed in both long-distance transmission infrastructure and distribution infrastructure to deliver cost-effective, reliable, and clean electricity.

These new technology options are generally of two types.

The first technology option type focuses on more accurate measurements and projections of transmission operating conditions. This is much like setting the speed limit of a highway under anticipated snow conditions. Understanding the local road conditions and adjusting the speed limit accordingly is better than conservatively assuming that it can snow at any time and permanently setting the speed limit at 40 mph.

One example of the first technology option type is dynamic line ratings (DLR). DLR provides more accurate capacity ratings (that is, the amount of power that can flow on a line) for individual lines under a given set of system and environmental conditions. It uses real-time line temperature and/or sag measurements to determine the line rating. For example, windier conditions increase cooling effects and can accommodate a higher flow without overheating the line. Practical DLR implementations require rating forecasts in addition to real-time measurements to aid in making operations decisions.

The Belgian transmission system operator Elia has deployed a utilitywide DLR system with sensors on 30 transmission lines. This has increased exchange capacities with France, Netherlands, Luxembourg, and Germany. Elia discovered that DLR provided savings of about €0.25 million (US$0.28 million) during a single four-hour congestion event by allowing for the additional import of 33 MW.

The second technology option type focuses on the flexible and dynamic control of transmission systems to optimize existing assets' operations. This is similar to driving with a good map or GPS and avoiding congested roads. Flexible Alternating Current Transmission Systems (FACTS) — a common name for power electronic-based devices that allow for flexible and dynamic control of transmission systems — are examples of hardware solutions to control flow on the transmission network.

Distribution network operator UK Power Networks is testing modular FACTS power flow control devices. The first pilot installation solved a critical bottleneck on a 132-kV power line in southeast England. It has enabled an additional 95 MW of renewable sources to be connected to the system without building new electrical cabling and substations. The pilot, which began in 2018, has saved customers over £8 million (US$10.4 million) to date.

Transmission topology optimization is an elegant software alternative to flow control hardware. It enables flow control by adjusting the system topology (that is, opening or closing existing circuit breakers). This changes the flow distribution, defined by Kirchhoff's Law, to achieve operational objectives. Topology optimization software supports operator decision-making analogously to how a GPS supports drivers. It finds the best routing options for current or forecasted system conditions. The benefits do not end here. These technology options complement building new lines. This is similar to the way that better maps and GPS technology do not replace the need for building new roads but enable more efficient use of existing roads to ease congestion during the construction of new roads.

The technology options can magnify the cost-effectiveness and capabilities provided by new investments. For example, existing low-capacity lines can limit the use of high-capacity transmission investments. Using the new technology options to relieve power flows on low-capacity lines can better use the new high-capacity lines, yielding a more favorable benefit/cost ratio.

As the above examples illustrate, these technology options reduce transmission congestion costs and renewable curtailments significantly — sometimes eliminating them entirely. Partially because of the aforementioned industry transition, transmission congestion and its associated costs have been increasing. This can hinder utilities from achieving their goals or result in unwanted rate increases for end users and potential stranded costs for developers and utilities.

A number of projects and studies suggest that wide deployment of these technology options can provide economic benefits ranging from €10 to €100 million (US$11.1 to US$111.2 million) annually for an average transmission or distribution system operator of 100-kV+ assets, even before considering the additional benefits of complementing new builds. Overall, the need for operational technologies will likely rise as the pace of the industry's clean-energy transition accelerates. Utilities and system operators should consider taking advantage of these newly available and proven technology options that enhance transmission operation to continue their successful transition to a new paradigm, as they have demonstrated their capability of adopting their generation operations to integrate large amounts of renewables within the last decade..

Automating Engineering Insights With Machine Learning

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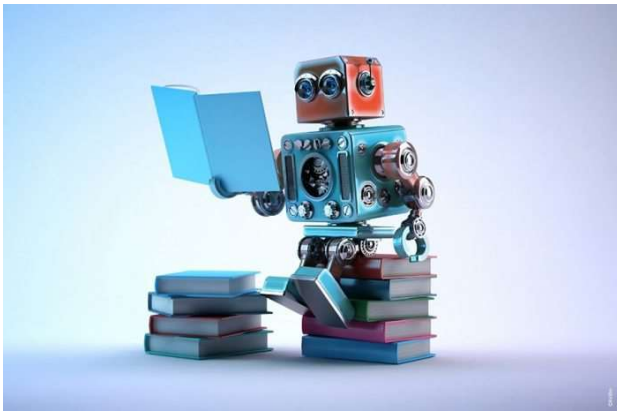
Introduction

Machine learning has already delivered remarkable results in certain niches where pattern recognition is obvious, but it's making even bigger and longer lasting impacts on businesses that demand broad insights and efficiencies in their industries. The investments of tech giants in machine learning applications are drawing a lot of attention. Google's largest collection of developers outside its US headquarters is a research group dedicated to machine learning. Microsoft open sourced CNTK, Baidu released PaddlePaddle, Amazon decided to support MXNet on AWS, and Facebook created two deep learning frameworks. The wave of machine learning applications in the consumer space will spill over into industry, which will help engineers and managers improve business operations with automated data analysis. In addition to driving innovation, machine learning offers practical, here-and-now business improvements such as operational uptime, production yield, and engineering efficiency.

Machine Learning Feeds on Data

The ability to network intelligent systems to improve data visibility is well-documented as both an Internet of Things (IoT) benefit and a Big Analog Data™ challenge. ABI Research (QTR 1 2017) says sensor and machine data from industrial equipment is expected to top 78 exabytes by 2020, and somewhere among all that data will be evidence of a machine failure, manufacturing defect, or critical validation test missed by today's technology. Vast data sets will help train better models from machine learning algorithms and yield faster results, but only if they're available. Today's system designers need to view organized data collection as the first step to implementing machine learning technology and develop more comprehensive DAQ and management strategies for connected systems.



Driving Innovation

Dealing with design flaws during product development can be expensive, which is why design verification and validation test receives so much time, attention, and budget. Before machine learning can help focus costly engineering time on the product areas that need the most test and validation, historical test data needs to be organized and accessible.

Improving Yield

Most manufacturers today screen for pass/fail conditions and save data for forensic analysis, calibration records, and genealogy. Some manufacturers use more advanced automated test methods, but machine learning models can help them screen for product defects regardless of root cause. Did the silicon-level components on the current build come from a new fab? Does the design include counterfeit components? Is the wave-soldering temperature off because of a faulty sensor? Endless anomalies can cause defects, so setting up test limits for all of them is not practical (or possible). Machine learning technology will alert manufacturing test engineers to defects missed in the design and test phases of product development.

Increasing Uptime

Many companies in process manufacturing or other process industries have extensive databases of maintenance and operational data for their industrial assets. Maintenance engineers manually work with this data today, but future machine learning methods will process this data to classify operational states and detect anomalies. Properly trained systems will identify irregularities that need attention and alert maintenance personnel for troubleshooting.

Taking Advantage of the Edge

In many ways, the stage is already set for machine learning. The convergence of rugged processing and sensor fusion with machine learning will help engineers build better systems that can interpret data at the edge without needing to communicate with the enterprise stack. Some technology can already train and run models at the edge to give engineers the following system architecture options: model training and deployment in the cloud, at the edge, or both. Pushing intelligence to the edge with real-world signals reduces the latency of decisions and the need for costly infrastructure, which helps as billions of new devices come online and compete for limited bandwidth.

Platforms Will Harness the Power of Machine Learning

One key element to watch for is the incorporation of machine learning in technology platforms that help developers focus on new problems, save time stitching together adjacent technologies, and avoid getting lost in middleware. Engineers rarely want to spend time dealing with questions that have already been answered or deemed necessary only because of toolchains. What cloud analytics are supported? Whose cloud? Are there RTOS compatibility issues when deploying the models? Integrating machine learning into cloud, software, and hardware platforms will provide precurated technology stacks so engineers can focus on new challenges.

Machine learning applications today can impressively find pictures of a dog in a photo album, but business leaders are looking to engineers, platforms, and the next wave of machine learning to help find uptime, yield, and efficiency in a sea of Big Analog Data.

Drones in the Electric Power Industry

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Introduction

The electric industry's interest in drone technology is growing at a rapid pace. Utilities have wasted no time jumping on board since the Federal Aviation Administration authorized drones for commercial use in 2015. As drones continue to be woven into utilities' transmission and distribution operations, signs point to a bright future for the technology in the electric power industry.

Benefits Drones Provide Electric Utilities

The task of maintaining and inspecting high voltage transmission and distribution lines can be difficult, dangerous and costly. As a result, utilities are increasingly looking toward drones as a safe and effective tool to assist them in their T&D operations.

On average, U.S. utilities collectively spend between $6 billion to $8 billion a year to inspect and maintain their power lines with helicopters and ground crews. Drones drastically cut the costs of power line inspections for utilities. They also improve safety, increase reliability and reduce response time across transmission and distribution systems. Accessing remote areas of high voltage power lines, either when conducting routine inspections or surveying damage after storms, presents difficult and dangerous obstacles. With drones, these difficulties could all but be eliminated. Monitoring substations, switchyards and transmission lines with drones presents a welcome solution for utilities to improve safety and minimize hazardous work. Drones also give utilities the ability to quickly and efficiently identify threats to the energy grid.

With these benefits, it's easy to understand the growing attraction to drones. A handful of utilities, including San Diego Gas & Electric, Xcel Energy, National Grid, Southern Company and Duke Energy, have either implemented or are in the process of testing the use of drones in their operations. Drones are proving to offer tremendous value to utilities and have the potential to revolutionize how they operate.

Benefits Drones Provide EPC Companies

Not only do drones act as a valuable tool for utilities, but they also provide EPC companies with the ability to capture data for project purposes. Drones can capture more than just an image. By collecting data that provide operational information and construction details, drones also have the ability to assist engineers in the process of designing the electrical infrastructure. For example, Light Detection and Ranging, referred to as LIDAR, is a remote sensing technology that measures distance by using a laser. The data are generated as 3D information which is then able to be utilized by many design applications. Drones can also gather other useful data through infrared

sensors, ultraviolet cameras and radio frequency sensors.

Beta Engineering has utilized drones on several EPC projects and knows first-hand the benefits they provide. When it comes to monitoring projects with numerous solar panels or miles of transmission lines, drones allow for quick and accurate informational feedback to aid in the successful design and completion of a high voltage EPC project.

Renewable energy sources

Due to the nature of the infrastructure associated with renewable energy generation, inspections using traditional methods can be tricky. Take the locations of wind farms for example – the best place to harness the wind's power is often offshore or at the top of mountains – places which don't offer easy access for maintenance and inspection crews.

The use of drones provides far greater efficiencies during the inspection process. Engineers can 'travel' there as-the-crow-flies and explore turbines from the air – revolutionising the way engineers collect data.

A similar efficiency emerges with photovoltaic panels, as drones capture much more than just video. Heat-mapping cameras can pick up faults across solar farms, for instance, which may not always be visible to the naked eye.

Cable route planning

Drones have a crucial role in the pre-construction preparation phase too. The technology makes cable route planning much more efficient as the bird's-eye-view highlights where there may be obstacles – such as woodlands, wetlands, water courses and railway lines – to overcome during the cable-laying phase.

The remote viewing capabilities of drones enable engineers to carry out quick – and relatively inexpensive – inspections of large expanses of challenging terrain. Details which were previously difficult to obtain during the investigatory stages now provide engineers with a window of opportunity to speed up the entire design process.

Power line inspection

Drones cut the cost of power line inspection significantly – an important benefit given utilities companies are increasingly demanding more efficient processes which improve safety, reliability and reduce any 'down-time' associated with inspections.

Whether carrying out a routine visit or looking into potential damage following adverse weather, power lines present a number of challenges when it comes to inspection. By using drones, many of these difficulties could be all-but eliminated, providing quick and efficient access to these hard-to-reach places.

Plant maintenance

Drones can streamline the whole process of routine inspections. The complexities and dangers associated with high-voltage maintenance call for extensive planning and inspection prior to work being carried out.

By adopting drone technology to carry out the first stage of inspection work, an electrical plant – for example – can be inspected from overhead, without having to isolate equipment or disrupt day-to-day operations.

With the advantages of safely capturing images and collecting data increasingly coming to the fore, the technology is ideally positioned to become a crucial part of the electrical engineering toolkit.

Program Outcomes (POs)

PO1	**Engineering Knowledge:** Apply the knowledge of mathematics, science, and engineering fundamentals to solve the complex electrical engineering problems.
PO2	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex Electrical and Electronics Engineering problems enabling attainment of conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/Development of Solutions:** Design solutions, components or process for complex Electrical Engineering problems to meet the specified needs considering public health, safety and environmental considerations.
PO4	**Conduct Investigations of complex problems:** Exercise research knowledge and technical methodology for design, analysis and interpretation of data to converge to a suitable solution.
PO5	**Modern Tool Usage**: Use modern engineering tools, softwares and equipments to predict, analyze and model engineering problems.
PO6	**The Engineer & Society:** Apply reasoning skills to assess societal, health, safety, legal and cultural issues relevant to the professional engineering practice and take consequent responsibilities in the society
PO7	**Environment and Sustainability:** Realize the impact of the professional engineering solutions and demonstrate the knowledge for sustainable development in environmental context
PO8	**Ethics:** Apply and realize the professional ethics and responsibilities in Electrical engineering practice.
PO9	**Individual and Team Work:** Exhibit Individuality, Leadership and Team spirit in multidisciplinary settings.
PO10	**Communication:** Communicate, comprehend, write reports, design documentation and presentation effectively on complex engineering activities
PO11	**Project Management & Finance:** Demonstrate the Electrical engineering and management principles adhering to financial strategies to manage projects as a member or leader in a team
PO12	**Life Long Learning:** Inculcate independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

PSO 1: Electrical drives and control: Graduates will Analyze, design and provide Engineering solutions in the field of Power Electronics and Drives

PSO 2: Embedded system: Graduates will Simulate, experiment and solve complex problems in Embedded System.

KSR INSTITUTE FOR ENGINEERING AND TECHNOLOGY

VISION

To become a globally recognized Institution in Engineering Education, Research and Entrepreneurship.

MISSION

- Accomplish quality education through improved teaching learning process.
- Enrich technical skills with state of the art laboratories and facilities.
- Enhance research and entrepreneurship activities to meet the industrial and societal needs.

Department of EEE

VISION

To produce world class Electrical and Electronics Technocrats and Entrepreneurs with social responsibilities.

MISSION

- Impart quality education in the field of Electrical and Electronics Engineering through state of the art learning ambience.
- Enrich interdisciplinary skills and promote research through continuous learning.
- Enhance professional ethics, entrepreneurship skills and social responsibilities to serve the nation.

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