Department of Electrical And Electronics Engineering

VIDYUTH

–Explore–Create–Inspire–

Technical Magazine JAN - JUL 2022

INSTITUTION

Vision of the Institute:
To be a premier center of learning in Engineering and Management education that evolves the youth into dynamic professionals with a social commitment

Mission of the Institute:

M1: To provide quality teaching- learning practices in engineering and management education by imparting core instruction and state-of-the-art infrastructure.

M2: To engage the faculty and students in acquiring competency in emerging technologies and research activities through Industry Institute Interaction.

M3: To foster social commitment in learners by incorporating leadership skills and ethical values through value-based education

DEPARTMENT

Vision of the Department:
"To be recognized for producing meritorious electrical engineers with research proficiency and social commitment".

Mission of the Department:

M1: Impart quality education with practice-based learning in producing electrical engineers with ethical values.

M2: Encourage the faculty and students to acquire mastery in cutting edge technologies.

M3: Implement research activities with social commitment.

Program Educational Objectives (PEOs)

PEO-I : Acquire a profound knowledge for a successful career in electrical engineering and allied fields

PEO-II :Pursue higher education and involve in research activities of electrical and electronics engineering.

PEO-III : Exhibit intellectual skills ethically and pursue life-long learning with social commitment.

EEE PBRVITS | DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Program Outcomes (POs)

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

PSO-1 : Analyze industrial electrical challenges by applying knowledge of fundamental electrical circuits, electronics and drives

PSO-2 : Apply standard practices in electrical power and control systems with safety and societal considerations.

DEPARTMENT PROFILE

The Department of Electrical and Electronics Engineering was established in 1998 with the approval of the All India Council for Technical Education (AICTE). The Department of Electrical and Electronics Engineering (EEE) is one of the oldest department in the institution, spanning 25 years of existence, and offers the undergraduate program B.Tech-EEE (and one post-graduate program, Power Electronics). The department has qualified and experienced faculty and excellent infrastructural facilities. It is well equipped with laboratories, audio-visual facilities, and software tools such as Multisim, MATLAB, and Pspice.

We also take up the social responsibility of inculcating awareness about energy conservation by promoting programmes about the same. Collaboration with industries for timely amendments of curriculum and laboratories is another credential of the department. The long-term goal of the department is to develop a centre for research and development activities in the thrust areas of solar and wind energy. The main objective of the department is to provide a better solution for industrial problems and to carry out academic and sponsored research projects.

The department is committed to providing students with exposure to state-of the art technologies by signing a Memorandum of Understanding (MoU) with reputed companies. The students exhibit their co-curricular and extra-curricular skills through the activities of the EEE student association and other student exhibition platforms. The Department of Electrical Engineering is committed to excelling in Electrical and Electronics Engineering through education and research with well-qualified and experienced faculty and technical staff members.

PROFESSOR DESK

Welcome to the Department of Electrical and Electronics Engineering, PBR VITS, Kavali, Andhra Pradesh. As a well-known fact, we cannot imagine the world without electricity. The Department of Electrical and Electronics Engineering is a center of preeminence where we nurture young talents by imparting technical training to them so that they can take up the challenges of real world. The Department of Electrical and Electronics Engineering was established in the year 1998 with an objective to develop professionals through quality education with an intake of 60 students.

The B.Tech and M.Tech programs are designed to achieve a balance between depth of knowledge acquired through specialization and breadth of knowledge gained through exploration. The courses offered by the department provide a comprehensive foundation in the core topics of EEE coupled with an area of specialization relevant to emerging engineering challenges.

The faculty in the department is a rich blend of personnel with industrial and professional experience. The dedicated staff members have sound knowledge in emerging areas like power systems, power electronics, and control engineering, etc. The breadth and depth of the research interests of the academic staff ensures a high standard of lecture courses and provides excellent opportunities for challenging and stimulating final year projects. All faculties supplement their delivery using videos, animations overhead projectors. The faculty keeps up with the latest technologies by publishing in reputed journals and presenting at various national and international conferences.

The department is active in organizing the various workshops and seminars for the growth and development of faculty and students' research knowledge further. Our department students are also highly encouraged to implement their innovative research ideas with the help of the expert faculty members and the available standard lab facilities in the department.

"Education can be a powerful weapon to change the world"

Dr. V. MadhuSudhana Reddy
Professor & HOD, EEE.

BETTER AI, BETTER POLICE FORCE

Data-driven policing is relatively new to the artificial intelligence (AI) scene, and many police departments across the country are interested in using this technology to help solve some of their systemic challenges, such as privacy protection, better resource allocation and bias reduction. Yao Xie, associate professor and Harold R. and Mary Anne Nash Early Career Professor in industrial and systems engineering, and associate director for the Machine Learning Center at Georgia Tech, has been working on data-driven policing for years. Funded by the Atlanta Police Department and the City of South Fulton, GA, in an effort to use data to solve some of their larger challenges, Xie has been working on this area since late 2016, leveraging AI to help make policing more effective and efficient.

An important part of police investigations is to understand whether cases are related in order to catch serial or organized crime operators. However, the amount of time it takes one or several officers to pore over thousands of cases looking for similarities is impractical. So, Xie's first project with the Atlanta Police Department was to develop and help implement an algorithm that could find these correlations faster, narrowing down the number of cases that need to be individually examined from thousands to 50 or so.

"Back in 2017, there were 23 similar house break-ins in the North Buckhead neighborhood in about a 5-mile radius," Xie explains. "There was a clear pattern in the way this individual broke in and ransacked particular rooms. By using this algorithm, Atlanta police were able to narrow down the cases they examined and link all of these crimes together and attributed them to one perpetrator, who was caught and prosecuted."

Redrawing Police District Boundaries

Another segment of Xie's work with the police — optimizing police zone design — sought to make police patrolling more effective.

Police districts across the country are generally divided into geographical zones, contained or designated by imaginary borders. Each zone is then subdivided into "beats," or the smaller territories that individual officers are assigned to patrol at different times of the day.

The Atlanta Police Department has six different zones — Northwest, Southeast, Southwest, Downtown, and more — which are broken out into approximately 80 beats, with roughly one patrolling unit per beat with one or two officers in each car. When someone calls 911, the dispatcher must decide who is the closest and most available unit to send to respond.

"How the boundaries are drawn becomes very important because of the limited number of police officers that are tightly controlled by staffing budgets," says Xie. "The design the department was working with hadn't changed in 10 years. The population is now very different, as well as other factors like traffic patterns and changes in police workload."

Xie spent a year looking at the information the Atlanta Police Department had gathered about their patrolling layout, and she used statistical machine learning and AI to solve their optimization problem.

By having an algorithm work through massive-scale, real-world data from 2011 through 2018, with millions of instances and 200 unique categories, the department was able to redraw their zone lines in March of 2019 with a better understanding of police workload and predicted response times — with crime rates dropping as a result.

In 2020, Xie and the Atlanta Police Department are continuing to monitor and understand how effective the new zone design is now that it has been in place for more than a year. In addition, Xie worked with another police department in the City of South Fulton to redesign their beats, which had not been changed for more than 40 years. The design was passed by the City Council in January 2020 and implemented afterward.

"We're working together to do systematic analysis on where we see the most improvement, where we're not, and what we can do better," says Xie.

CH SRINIVASULA REDDY
Lecturer, Department of EEE

SWINGING THROUGH THE FIELDS

Hu and his team are developing the robot in partnership with the UGA Soybean Breeding and Molecular Genetics Laboratory to more efficiently conduct field research. However, Hu speculates that the robot could become a valuable asset to farmers as a persistent, rather than intermittent, tool to monitor crops.

In the center of the brachiating robot is a small platform that houses sensors, such as thermal detectors or 3D cameras. Two arms extend from the platform, each bearing a grasper with the ability to precisely sense where the cable is and when to clamp around it. The movement of the machine is reminiscent of a child swinging on a jungle gym; it swings from one arm until it has enough momentum for the other arm to reach up and catch the next portion of the cable.

Mechanical devices such as unmanned aerial vehicles have begun to be used to survey fields. However, these drones must be flown by humans and only for short periods of time. In comparison, the brachiating robot uses very little power and could use small solar panels to charge during the day and independently traverse the fields via wires at night. Plus, nighttime monitoring would be advantageous, because plants exhibit some of their most distinctive behaviors after the sun sets, such as respiration and opening of the leaf pores.

One of the challenges in developing the brachiating robot has been designing specific electronics and software for the hardware components of the machine.

"We have inertial measurement units that allow us to determine how fast the different linkages are moving, how fast the body is moving, and where they are in space," said Michael Bick, an undergraduate student in mechanical engineering. "We use all of that information, constantly updating as we swing to try to follow the ideal path that uses the least amount of power required."

The robot is unlikely to entirely replace farm workers any time soon. They still must carefully determine whether fruit and nuts are ripe before picking them. However, the robot may be able to augment the workforce where labor is lacking. A Georgia immigration law in 2011 caused laborers to leave the state, and the state lost $140 million of crops that were left unpicked. With the brachiating robot as a tool for persistent monitoring, farm owners may be able to better determine which plants are ripe, and which may need more attention.

The robot is far from finished. The most recent development in the project was the addition of "wrists" for the robot that would allow it to turn 90 degrees and swing onto an adjacent parallel wire. Instead of traveling along a line, the brachiating robot could cover the entire 2D plane of a crop field.

In the not-so-distant future, instead of graduate researchers trudging through a field of soybeans, you might see primate-like robots swinging around on wires above fields, making sure plants are healthy and Georgia families are fed and full.

BOGALA CHANDINI
(17731A0204)

SURGE ARRESTER VOLTAGE SELECTION

A surge arrester is a protective device used on power distribution networks to limit overvoltage transients that can damage equipment and disrupt the flow of electricity. When surges occur, the arrester immediately limits, or clamps, the overvoltage condition by conducting the surge current to ground. After passage of the surge, the arrester returns to its initial state. Selecting the best surge arrester depends on several factors. This article throws light on the voltage level to be selected for surge arresters based on the system earthing (grounding) configuration…

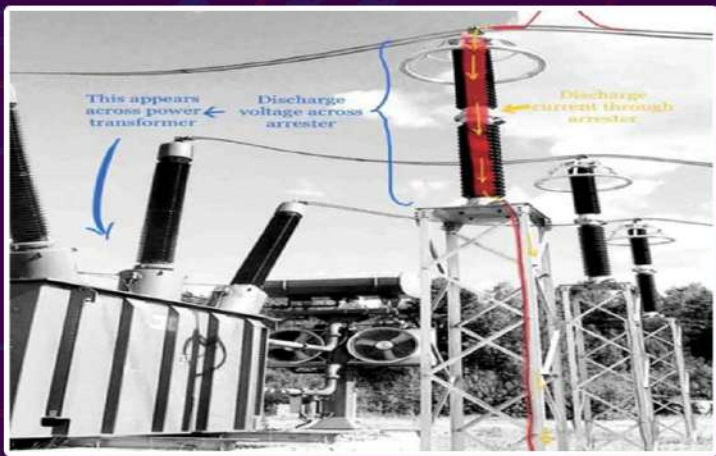
Surge arresters are voltage limiting devices used to protect electrical insulation from voltage spikes (surges) in a power system. The job of a surge arrester is to protect the system from damage due to overvoltage conditions.

In the past surge arresters were called Lightning Arresters, this name was based on their primary function of protecting electrical insulation from lightning strikes on the system. The more generic term 'Surge Arrester' is now used to encompass overvoltage conditions, which can occur from numerous other sources, such as switching operations and ground faults.

In modern era, gapless ZnO or zinc oxide surge (MOSA) arresters are mainly used for surge protection.

Surge arrester working principle

When a voltage surge traveling along the conductor reaches the point at which a lightning arrester is installed it breaks down the insulation of the arrester momentarily, allowing the voltage surge to discharge to ground. As soon as the system voltage drops below the predetermined value, insulation between the conductor and ground is restored and further current flow to ground stops. (Refer figure 2)



To perform this protective function satisfactorily, arresters must

- Not allow current to flow to the ground as long as the system voltage remains normal.
- Provide a path to ground, when the system voltage rises to a predetermined value above normal, to dissipate the energy from the surge without raising the voltage at which the circuit is operating.
- Stop the flow of current to ground, as soon as the system voltage drops below the predetermined value, and restore the insulating qualities between the conductor and ground.
- Not be damaged by the discharge and be capable of automatically repeating discharging process
- frequently when required in line with energy rating and as per operation duty test.

The performance of any arrester is dependent on a good connection to ground. Arresters will not function without a proper ground; they are totally useless. The arrester should be placed as close as possible to the equipment, that is to be protected and leads connecting arresters to ground should be kept as short as possible & without any loop.

KOLLURU YAMINI
(18731A0212)

STRATEGIES FOR SUSTAINABILITY

India needs 24x7 availability of power for its economic growth; however, this power cannot be achieved by renewable energy sources alone. Thermal energy cannot be written off till storage becomes cost-effective for Round-the-Clock supply through Renewable Energy. Although generation of thermal energy involves increase of carbon footprints, still there are ways for minimizing that. Optimization is possible and required in all fields of power generation too.

The government has decided to add 80 GW thermal power capacity by the year 2031-32, as power demand of the country has increased at an unprecedented rate due to rapid growth of the economy. It has been decided not to compromise on availability of power for economic growth. The required power cannot be achieved by renewable energy sources alone, nuclear capacity cannot be added at a rapid pace hence coal-based thermal capacity must be added for meeting our energy needs.

India currently has 27 GW under construction, and further 25 GW was earlier envisaged. But it is decided now that to work on at least 55 GW – 60 GW of thermal capacity. As demand ramps up, this capacity would be added. While the carbon emission from this added capacity may be a cause for concern in terms of increased carbon footprint – the country and generators have opportunities that can pay rich dividends besides reducing the carbon footprint.

The three basic inputs for power are land, water and fuel. We have so far focused on fuel alone in our shift towards RE in the form of solar and wind. If we decide to focus on land and water in partnership with players with demonstrated success, we can have dramatic turn around. We can add waste utilisation to our portfolio to accelerate it. In the long run the cost of natural resources like land and water are bound to go up. The environmental costs are already high, the polluter today must compensate in a big way. Waste disposal similarly is a key issue of consideration not only because of its environmental impact but also because of the economic cost of waste disposal.

Land use optimization:

Cost of land is exorbitant in a thickly populated country with increasing awareness of civil rights. The aggregate cost of land includes the cost of land, the valuation of tress or construction on land and the cost of rehabilitation of people affected. It was always a consensus to avoid cultivable, irrigated, fertile land for power plants. A consensus has emerged now to go for high-capacity units (800 MW and above) in brownfield sites avoiding fresh land acquisition. This often involves dismantling of old, inefficient small capacity units and creating space for new high-capacity units.

The sprawling spread out industrial townships are now accommodated in high-rise vertical smart towers. Natural Draft Cooling Towers (NDCT) instead of Induced Draft Cooling Towers (IDCT) are now preferred even at pit head because of the space constraints. Gas Insulated Switch Yard (GIS) as against Air Insulated Switch Yard (AIS) is preferred as it requires less space though a cost must be paid as a tradeoff. Air cooled condenser in place of water-cooled condenser similarly reduces the ground footprint besides reducing water consumption with a small rise in heat rate as a tradeoff. There have been considerable efforts to place the balance of plant facilities to optimize the layout further.

Water use optimizationWater and electricity supply have a historic link. The big names – like Tennessee Valley Authority or Damodar Valley Corporation in India (Water and Electricity Authorities) – are abound, since river valley projects provided water for irrigation as well as electricity. The hydroelectric development in India has been hit by Public perception created against hydro projects, protest against land acquisition for dams, rehabilitation and resettlement issues, lack of fund and technology besides geological surprises. India is endowed with a hydro power potential of around 1,48,700 MW – out of which 51.8 GW has been harnessed till now in form of small and Large Hydro projects.

In order to promote economic growth of the country, faster addition of electricity was required, for which government policy shifted towards addition of thermal projects mainly the Coal Based Power Plants in the country. Coal based plants today constitute around 56% of the total installed capacity whereas it meets 75% of the country's energy requirement.

The linkage between supply of water and electricity has weakened as a result.

However, we must keep in mind that water to our households is delivered after being pumped, in places like Noida for example, water from a distance of 100 Km in Ganga is pumped, mixed with pumped up ground water with high TDS, the households again use a R.O unit to get drinking water and throwback about 65% of the water. In water supply, a considerable amount of electricity is associated – be it in irrigation or in drinking water.

If we build waterbodies and plan lake cities like Udaipur, Bhopal or Hyderabad, we not only bring down the temperature in urban settlement – we reduce electricity consumption substantially because of the reduced HVAC consumption. In peak summer, on a hot day, the coal consumption for electricity was 2.5 MT and on a cloudy day it was 2 MT about 20% lower.

Unlike Hydropower stations that generate electricity by the flow of water through turbines involving minor evaporation loss in dams, thermal power consumes about three litres of water per unit of electricity, a substantial volume, a lot of optimization into the power cycle has been incorporated, condenser material upgraded and the cycle of concentration has been raised to 5 from 3.5 only the water with high TDS is used as blowdown for ash handling.

Water in the constitution of India is a state subject, except for the matters of regulation and development of interstate rivers – which is in the union list, water sharing between nations and among states remain a contentious issue exacerbated by increasing water requirements for industrial use. While welfare strategies prioritise allocation to domestic and agriculture, the link between industry and GDP leading to wellbeing cannot be set aside. The river catchments and groundwater aquifers are hydrogeological entities having no congruity with the administrative and political boundaries. Hence, it is extremely difficult to contain and manage water resources with the political and administrative limits as the management units. This has made water management and regulation a complex process in the country. This calls for water use optimization in thermal power stations. Before the directive to use treated sewage water, the water for power plants was obtained through irrigation schemes like creation of reservoirs and canal lining that involved massive investment.

Air cooled condensers now at North Karanpura and Patratu Plants of NTPC would reduce water consumption to about 40%, this shall be the future mode of cooling. It would be used in tandem with dry bottom ash system, thus the entire ash handling system would not utilize any water, dry fly ash handling systems are already in place for quite some time.

NTPC declared Commercial Operation of the final part capacity of 20 MW out of 100 MW Ramagundam Floating Solar PV Project at Ramagundam, Telangana with effect from July 01, 2022. The project spreads over 500 acres of its reservoir. With the presence of floating solar panels, the evaporation rate from water bodies is reduced, helping in water conservation. Approximately 32.5 lakh cubic meters per year water evaporation can be avoided.

. NTPC had declared Commercial operation of 92 MW Floating Solar at Kayamkulam (Kerala) and 25 MW Floating Solar at Simhadri (Andhra Pradesh) earlier. From environment point of view, the other obvious advantage is minimum land requirement mostly for associated evacuation arrangements. The water body underneath the solar modules helps in maintaining their ambient temperature, thereby improving their efficiency and generation.

The blue planet with 70% water has only 4% potable water. A deeper analysis would reveal that the problem of water scarcity is only periodic, it is only about the lean season, managing the water bodies, preventing evaporation loss and harvesting rain water in cascaded storage. Among the various energy storage technologies available, most matured and domestically available technology is the Pumped Storage Hydro Projects (PSPs). Considering the maturity of the technology, life span of the system, cost of the energy over its lifetime, minimum environment impacts in its vicinity, PSP technology is considered to be appropriate for large grid scale application.

Out of 500GW of RE sources as per the INDC, 420GW will be from VRE (Variable Renewable Energy) only comprising of Wind and Solar energy sources – which are intermittent in nature resulting in mismatch of the supply and demand of the VRE generation in the grid rendering surplus power in the grid. The surplus power needs to be either consumed or stored in some form of energy storage system, otherwise VRE generation will have to be curtailed. Curtailment of VRE sources i.e., wind and solar power is already being witnessed in some states in Southern India – where generation from VRE has exceeded 20% of the total energy capacity. The Pumped Storage Hydro Projects are also called Water Battery (PSP) to store the energy in form of potential energy. PSPs primarily use indigenous technologies and domestically manufactured materials. Most of the Electrical and Mechanical parts of PSPs are made in India in comparison to electro chemical and chemical batteries, which are import dependent. PSPs are clean, green, safe, and non-explosive and don't produce any poisonous/ harmful by-products or pose disposal problems.

Each Pumped Storage Project has two reservoirs. One is the upper reservoir at higher elevation and a lower reservoir at lower elevation at the outlet of the Tail Race Tunnel. Other civil components have almost similar attributes like a normal Hydro Project. Water is pumped from the lower reservoir to the upper reservoir at a higher elevation where it is stored in form of potential energy until needed to be retrieved. The water, when released from the upper reservoir work to rotate a turbine and generates electricity. In case of PSP, the single unit of a machine acts as a pump as well as a turbine but rotates in reversible directions.

Pumped storage Projects may be classified into 3 configurations:

• On Stream Pumped Storage Schemes where both reservoirs are located on any perennial river/stream.

• Off Stream Pumped Storage Scheme Open Loop, where one of the reservoirs is located on any perennial river/stream.

• Off Stream Pumped Storage Scheme Closed Loop, where none of the reservoirs is located on any river/stream.

There is also an uncanny linkage between soil and water. If water is poured on porous soil it not only drains the water it leads to soil erosion and landslide as we often witness in the Himalayan region. Cascaded water bodies connected through elaborate piping network would prevent soil erosion, facilitate energy storage and make more water available for the lean season. Water supply across the country can be taken up with cascaded storage capacity obviating the need for desalination and sewage treatment.

The charcoal treatment of soil at Heartfulness Institute Kanha Shanti Vanam has received national and international acclaim for establishing a rain forest in the arid Ranga Reddy district of Telangana. The charcoal treatment of soil developed by them has been recognised by ICAR and Ministry of Agriculture – and specially mentioned in Jal Charcha – the journal of Ministry of Water Resources Govt. of India, further through tissue culture the climate endangered flora is being revived at this site and other sites in Madhya Pradesh.

Coal based power generation can work closely with organizations like Heartfulness Institute and participate in Carbon offset projects such as afforestation that capture and store carbon dioxide emissions. These actions can create carbon offset credits that can be sold to companies or entities looking to offset their emissions. Besides the Heartfulness Institute has the potential to reduce cost of compensatory afforestation for power producers since land is being made available to them for free by various state governments. They have a model for large scale plantation involving Heartfulness volunteers from across the country.

Waste utilization:

Blue Coal or biochar: NTPC Ltd., has successfully implemented a technology to convert Municipal Solid Waste (MSW) into high Gross Calorific Value (GCV) fuel that can be co-fired in conventional boilers at its Dadri Plant in Delhi NCR. In doing so, NTPC has achieved a rare feat of being among the global pioneers to convert waste to energy. The new technology has been installed at NTPC Dadri power plant – where solid waste is being treated to produce coal. Presently, on a daily basis, 20 tonnes of solid waste is converted to produce 10 tonnes of coal pellets. The breakthrough in the technology is expected to address the issue of air pollution, green-house gas emissions, waste management and renewable energy generation in a cost effective and environment friendly way. The heart of the plant is a reactor using unique indigenously developed technology, which can process the carbonaceous component of municipal solid waste into charcoal. The reactor can also be used for 'torrefaction' of biomass such as crop straws, tree leafs, forest residue into charcoal. Charcoal will substitute the fossil fuel being used in various applications and will be effective in reducing green-house gas emissions. This step, in future is expected to reduce the menace of MSW and will assure a clean and better environment for all.

Further, in the process of transforming solid waste to power, NTPC is collaborating with municipalities of East Delhi Municipal Corporation along with Kawas, Varanasi, Indore and Mohali. The municipal solid waste will be segregated and processed to utilise combustion fraction for conversion to coal or for power generation, biodegradable fraction for production of methane gas for use as bio CNG, and the recycled residue shall be used for construction purpose after required processing.

NTPC is in the process of purchasing around 20,000 tonnes of agriculture residue per day to make pellets and mix that with natural coal for co-firing. NTPC is presently using 70 to 80 tonnes per day of crop residue-based pellets with coal in its thermal power plant at Dadri in Uttar Pradesh. The project was started in 2017 to reduce air pollution and generate renewable energy by avoiding stubble burning, which was causing huge pollution in Delhi and NCR. The company has envisaged consumption of 1 million tonnes of agro pellets in 2020 for its power plants.

Ash utilization:

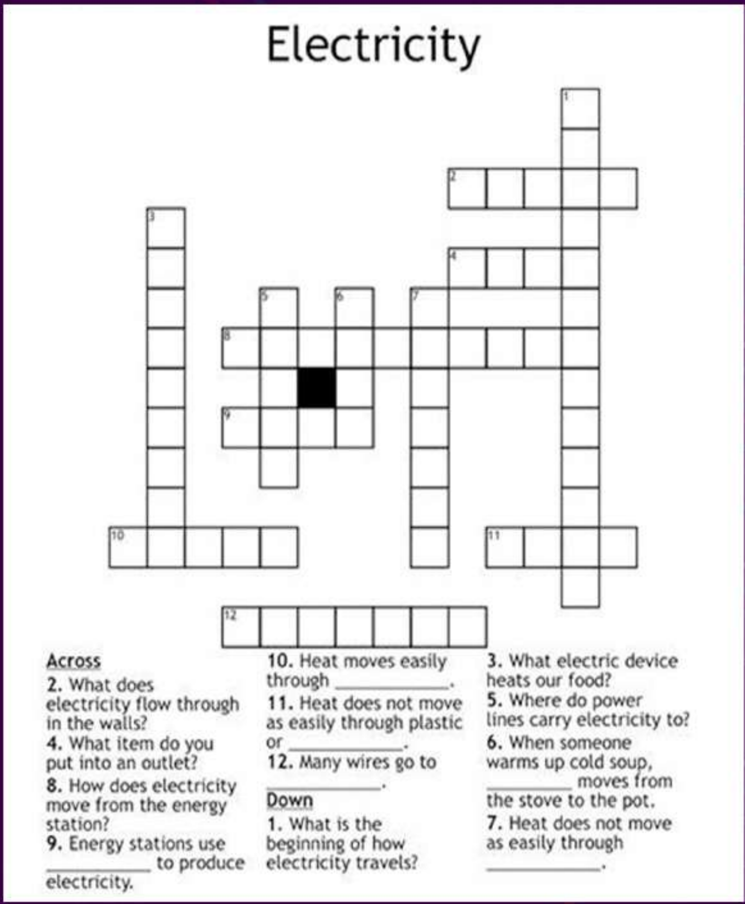
MOEF & CC is consistent in its denial of land for ash dyke, so 100% Ash needs to be utilized in manufacture of cement, brick or highway building. The demand for ash at pit head stations is low and export potential need to be explored. Ash can be better traded since construction material is in short supply, we may have to store ash in high-capacity silos and transport ash in vessels. Also, we should explore extraction of minerals from ash like silica, alumina, Iron, Rare-earth and arsenic etc., but we must target the entire value chain. The power saving by avoiding crushing of ore for extraction of mineral is bound to reduce carbon footprint.

Salient elements of the strategy:

• Partnerships: Collaborate with successful players focusing on land, water, and waste utilization.
• Diversification: Expand efforts beyond fuel-centric approaches to embrace broader sustainability aspects.
• Strategic Investment: Allocate resources toward carbon-offset projects like afforestation.
• Innovation: Explore technological advancements for ash utilization and mineral extraction.

SHAIK HAJIRA
(18731A0232)

ELECTRICITY CROSS WORD



G. BHUVANESWAR REDDY
(20735A0231)

TECHNICAL QUIZ

1. What is the primary purpose of magnetic sensors?
(a)Measure temperature
(b) Detect magnetic fields
(c) Record sound waves
(d) Measure pressure

2. Which of the following is not a common application of magnetic sensors?
(a)Magnetic door switches
(b) Magnetic levitation trains
(c) Temperature sensors
(d) Compasses

3. Anisotropic Magneto-Resistive (AMR) sensors are known for their sensitivity to:
(a)Magnetic fields in a specific direction
(b)Temperature fluctuations
(c)Light variations
(d)Radio frequencies

4. Semiconductor magneto-resistors are commonly used in:
(a)Audio equipment
(b) Microwave ovens
(c) Magnetic field sensing applications
(d) Solar panels

5. Synchro's are primarily used for:
(a)Temperature sensing
(b)Measuring angular or rotary movement
(c) Detecting light intensity
(d)Pressure measurement

6. In synchro's, the rotor and stator are typically connected through:
(a)Electrical wires
(b) Gears
(c) Magnetic fields
(d) Optical Fibers

7. In magneto-resistive sensors, what does AMR stand for?
(a)Active Magnetic Resonance
(b) Anisotropic Magneto-Resistive
(c)Advanced Magnetic Radiation
(d)Ambient Magnetic Reflection

8. What is the primary advantage of using semiconductor magneto-resistors in magnetic sensors?
(a)Low sensitivity
(b)High sensitivity and miniaturization
(c) Resistance to temperature changes
(d)Low cost

9. Hall effect sensors are based on the principles described by physicist Edwin Hall in what century:
(a)18th century
(b)19th century
(c)20th century
(d) 21st century

10. What phenomenon do inductance sensors rely on for measuring changes in magnetic fields
(a)Eddy current induction
(b)Capacitive coupling
(c)Magnetic resonance
(d)Ohm's law