ELECTRICA

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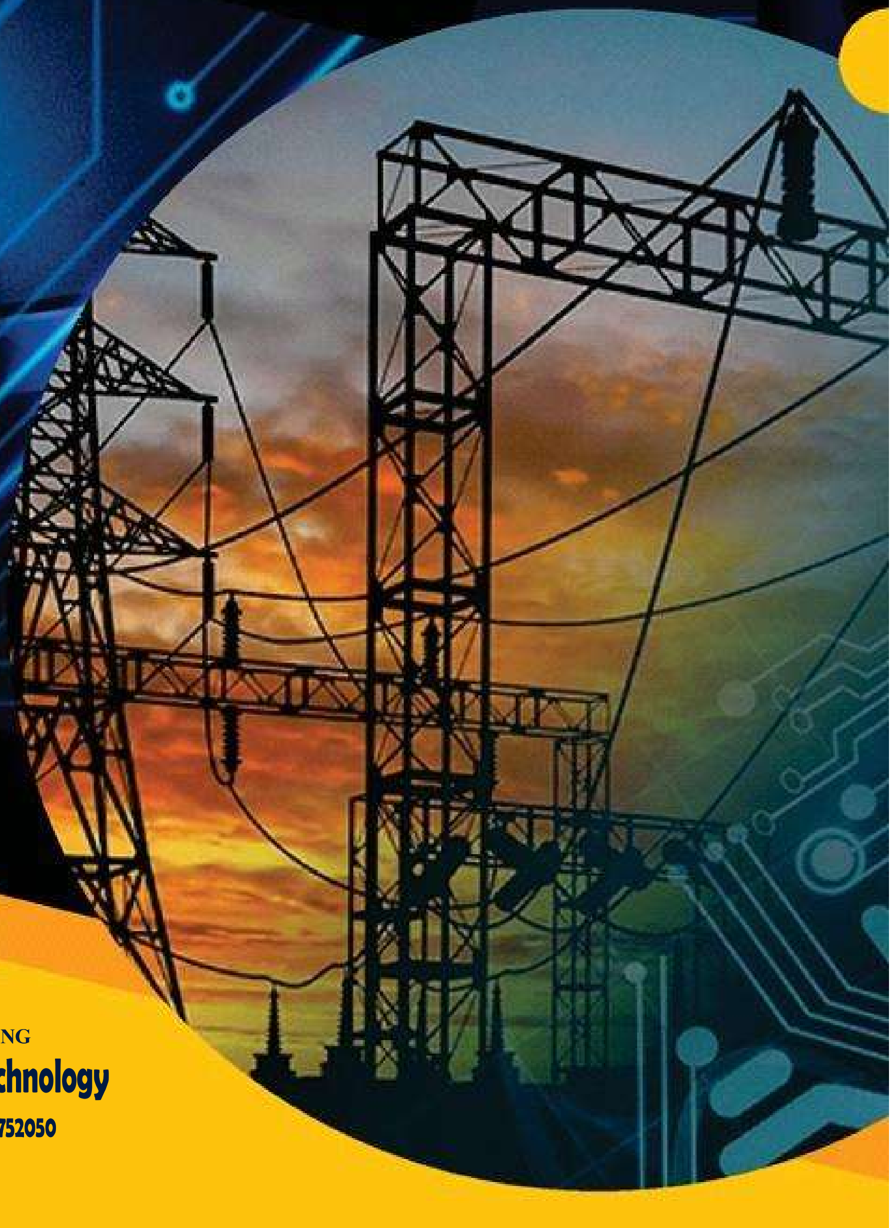

DEPARTMENT OF ELECTRICAL ENGINEERING
Aryan Institute of Engineering and Technology
Arya Vihar Colony, Bhubaneswar, Barakuda, Odisha 752050

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About the Institute

Established in the year 2009, Aryan Institute of Engineering and Technology (AIET) is one of the premier engineering colleges in the self-financing category of engineering education in eastern India. It is situated at temple city Bhubaneswar, Odisha and is a constituent member of Aryan Educational Trust. The institute is approved by the All India Council for Technical Education (AICTE) under the Ministry of Human Resource Development, Government of India; recognized by the Government of Odisha; and affiliated with Biju Patnaik University of Technology (BPUT), Rourkela, Odisha..

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AIET aims to create disciplined and trained young citizens in the field of engineering and technology for holistic and national growth. The college is committed towards enabling secure employment for its students at the end of their four-year engineering degree course. (The NAAC accreditation in the year 2018 vouches for the college's determination and dedication for a sustainable learning environment). The academic fraternity of AIET is a unique blend of faculty with industry and academic experience. This group of facilitators work with a purpose of importing quality education in the field of technical education to the aspiring students. Affordable fee structure along with approachable location in the smart city of Bhubaneswar makes it a preferred destination for aspiring students and parents.

AIET serves as a deep of knowledge for students pursuing program ranging from diploma to B.Tech courses equipped with an excellent infrastructure for academics, co-curricular and extracurricular activities. AIET secured its compliance certificate for ISO 9001:2015 QMS standards from the prestigious INNOVATIVE SYSTEMCERT PVT. LTD Accredited by EGAC, a member of International Accreditation Forum, Ghaziabad, Up, India

VISION AND MISSION OF THE INSTITUTE

Vision

- To become a leading engineering institution of the state by impacting quality technical education at affordable costs to create skilled and motivated engineers to serve the technological requirements of society in different ways.

Mission

AIET will strive continuously to

- To impart contemporary technical education and skills to students of different socio-economic background.
- To equip students with analytical learning and real life problem solving.
- To make learning a continuous endeavour compatible with market needs.
- To promote the spirit of leadership, entrepreneurship, innovation and ethics

About the Department

The Department of Electrical was established in the year 2009. It aims at producing qualified engineers in the areas of electrical machine, power electronics, control system, power system, and instrumentation. The field of Electrical and Electronics is advancing at a very rapid pace. Power electronics has taken the centre stage in every area be it power systems, control systems, power quality, etc. The department is well equipped with a group of highly qualified and dynamic teachers. It boasts of laboratory facility to be one of the best in the state. The students are encouraged and motivated to take up challenging projects. Summer training, industrial visit and projects are carefully planned for the students to remain updated with the technology trend. Seminars and short courses are regularly organized to update the students with the latest in the education and industry trends.

Vision

- To be a leader in the field of electrical engineering education and training by creating graduates who are globally competent, successful in their chosen fields of endeavour, engaged in innovative research and entrepreneurship, and deeply committed to social advancement.

Mission

- **M1:** To impart the fundamentals of electrical engineering so that students may develop new products and solutions to solve issues in the real world
- **M1:** To enable students to pursue a prosperous career in the cognitive electrical engineering professions and to become ethical technologists
- **M1:** Through continuous improvement of faculty and lab facilities, to strive for excellence in academics and research works by developing a rich electrical engineering based research centre for industrial growth of the nation.

ELECTRICA

Chairperson's Message

Dr. Madhumita Parida
Chairperson
AIET, Bhubaneswar

Today's technical world is expanding at the speed of thought and has opened numerous options of excellence. Perfection and quality in educational field enhances one's ability to formulate new ideas & look beyond the obvious which is necessary to succeed in today's technical era. I am gratified to know that the Department of Electrical Engineering is bringing out the first issue of their technical magazine "ELECTRICA" of this academic year (2023-2024). This magazine is providing great space for the faculty and students to pen down their innovative ideas, imagination and perceptions to show case their creativity. So, I take the opportunity to congratulate the Department of EE and its editorial team to successful release of this issue.

Director's Message

Mrs. Sasmita Parida
Director
AIET, Bhubaneswar

It is a noble task on the part of the Department of Electrical Engineering to once again make it with their frequent issue "ELECTRICA". I wish that this technical magazine establishes to be a flint to fire the enthusiasm and excite their minds for many intrusive innovations among the students and inspire passion among the members of the faculty of Electrical Engineering committee. My greeting to the editorial board and department of EE.

Principal's Message

Prof. (Dr.) Bimal Sarangi
Principal
AIET, Bhubaneswar

It gives me immense pleasure to note that, department of EE has been publishing their bi-annual magazine "ELECTRICA" and I am sure this will provide an opportunity for the faculty and students to share their knowledge and beacon the information about various issues and activities that are being taking place in the department. I look forward for more activities and achievements for the department to march towards excellence in the future. I would like to thank all teaching, supporting staff and our beloved students for their active participation in publishing this magazine. My special compliments and congratulation to the editorial team of the department for their consistent effort in publishing this magazine

Dean Academic's Message

I am glad to know that the Department of Electrical Engineering is bringing out its technical magazine “ELECTRICA” which will mount creativity in the minds of the students as well as the staff members. The release of this spectacular first issue of ELECTRICA has added value to their constant efforts. Through this message, I wish them “All the very Best” for their future endeavors to and hope the students of EE bring more achievements to the college on the whole.

Prof. (Dr.) P K Swain
Dean Academics
AIET, Bhubaneswar

Vice Principal's Message

I am glad to pen for this wonderful magazine “ELECTRICA” as an appreciation of the commendable efforts put forth by the team of Electrical Engineering department for its first issue in the academic year 2023-24. The efforts taken to bring about innovative content is appreciable. I wish all the students who have involved in bringing out the magazine for their greater success and career ahead.

Prof. (Dr.) A K Sahoo
Vice Principal
AIET, Bhubaneswar

HOD's Message

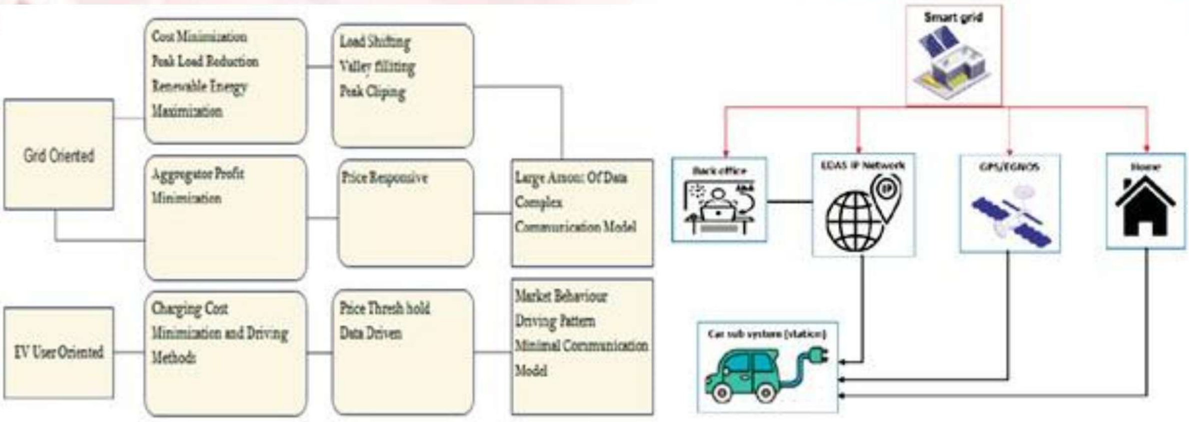
I feel privileged in presenting the first issue of departmental magazine “ELECTRICA” once again successful for this academic year 2023-24. This magazine is intended to bring out the unseen fictitious talents among the students and the faculty and also to inculcate leadership skills among them. I'm confident that it will inspire the students who aspire to be poets and writers and push their imaginations to explore new avenues. I acknowledge my gratitude to our principal for their continuous support to prepare these issues of magazine. I extend my sincere thanks to the editorial team for their constant effort and support in bringing out the magazine in the present form.

Prof. (Dr.) P C Nayak
HOD EE
AIET, Bhubaneswar

Contents

FACULTY CORNER

ELECTRIC VEHICLE CHARGING SYSTEM IN THE SMART GRID



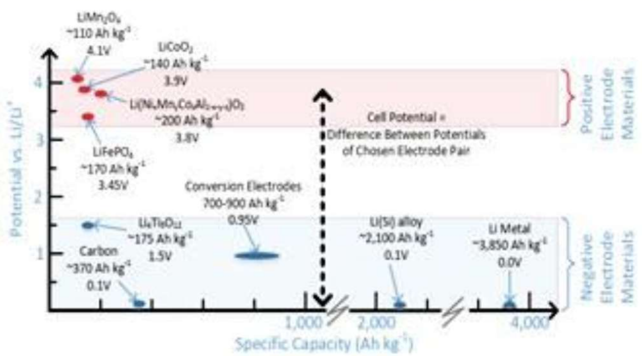
Smart cities require the development of information and communication technology to become a reality (ICT). A “smart city” is built on top of a “smart grid”. In order to improve the reliability and sustainability of the transportation system, changes are being made to the way electric vehicles (EVs) are used. EV sales will reach 2.1 million in 2019, a 40% annual growth rate. Electric vehicle (EV) chargers are now an essential part of the world's infrastructure, with 7.3 million chargers installed globally in 2019 and a 60% increase in the number of public charging stations installed in 2019. Additionally, 43 million electric vehicles are expected to have been sold globally by 2030, accounting for 30% of all vehicles. Fast-changing technologies, like DC-DC converters with improved performance, have greatly contributed to this. As new driving techniques are developed to help drivers lower their operating costs, demand for these vehicles is also anticipated to rise. More electricity is needed to power their charging stations as more electric vehicles are on the road.

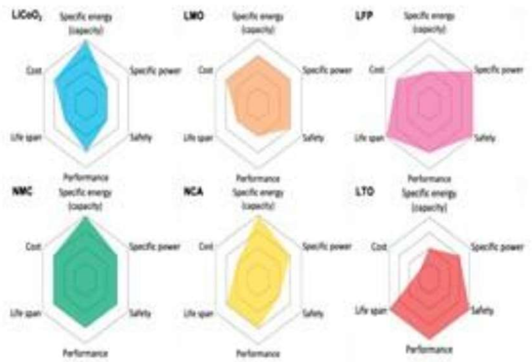
As EV use has increased, several problems have arisen, including the requirement to build a charging infrastructure, and forecast peak loads. Management must consider how challenging the situation is. A machine-learning (ML)-based charge management system considers conventional charging, rapid charging, and vehicle-to-grid (V2G) technologies while guiding electric cars (EVs) to charging stations. This operation reduces the expenses associated with charging, high voltages, load fluctuation, and power loss. The effectiveness of various machine learning (ML) approaches is evaluated and compared. These techniques include Deep Neural Networks (DNN), K-Nearest Neighbors (KNN), Long Short-Term Memory (LSTM), Random Forest (RF), Support Vector Machine (SVM), and Decision Tree (DT) (DNN). According to the results, LSTM might be used to give EV control in certain circumstances. The LSTM model's peak voltage, power losses, and voltage stability may all be improved by compressing the load curve. In addition, we keep our billing costs to a minimum, as well. Electric vehicles (EVs) have grown in importance as the auto industry has developed.

Dr. Amruta Abhishek
Professor, EE
AIET, Bhubaneswar

GREEN ENERGY INNOVATIONS IN ELECTRICAL ENGINEERING

(Li-Ion Batteries for Evs)





Electric Vehicles (EVs) are a major pillar of the global transition to green transportation, reducing reliance on fossil fuels and lowering carbon emissions. At the heart of EV technology are lithium-ion (Li-ion) batteries, which serve as the primary energy storage systems powering modern electric cars, buses, and two-wheelers. These batteries have gained widespread acceptance due to their high energy density, long cycle life, fast charging capability, and improved efficiency compared with earlier battery technologies.

A Li-ion battery consists of a cathode, an anode, an electrolyte, and a separator that enables the movement of lithium ions during charging and discharging. Electrical engineers focus on optimizing electrode materials and cell architecture to achieve a balance between energy capacity, power output, safety, and thermal stability. The Battery Management System (BMS) is a critical component that continuously monitors voltage, current, temperature, and state of charge. It ensures safe operation, prevents overcharging or deep discharging, and extends battery lifespan.

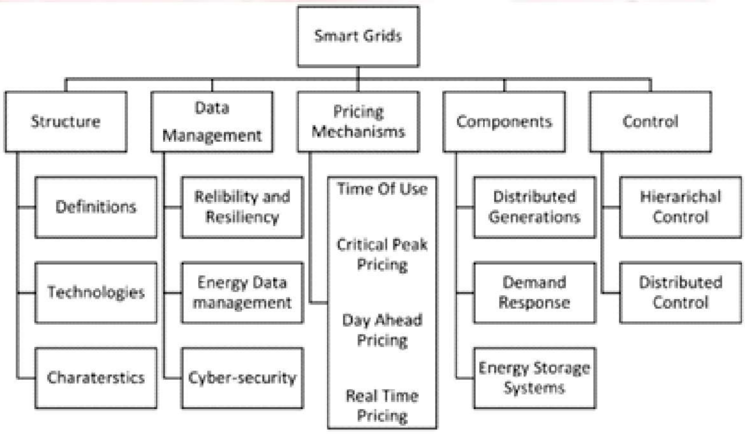
Recent innovations highlighted in research focus on advanced cathode materials, improved electrolytes, and better thermal management techniques. High-nickel cathodes and solid-state electrolytes are being explored to increase energy density while improving safety. These developments aim to reduce battery weight, enhance vehicle range, and lower overall system costs. Additionally, fast-changing technologies and intelligent control algorithms are being developed to minimize charging time without accelerating battery degradation.

Another important advancement is the reuse and recycling of EV batteries. After their automotive life, batteries can be repurposed for stationary energy storage applications such as solar and wind power systems. This "second-life" use improves sustainability by maximizing resource utilization and reducing environmental impact. Recycling technologies also help recover valuable materials like lithium, cobalt, and nickel, supporting a circular economy.

Li-ion battery innovation represents a major contribution of electrical engineering to green energy and sustainable transportation. Continuous research and technological advancement in battery materials, management systems, and lifecycle optimization are essential for enabling clean mobility and achieving long-term energy sustainability.

Er. Ajit Kumar Panda
Assistant Professor
AIET, Bhubaneswar

GREEN ENERGY INNOVATIONS IN ELECTRICAL ENGINEERING



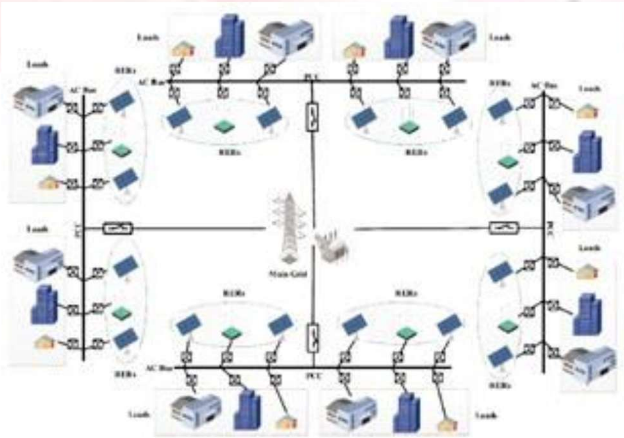
The transformation of conventional electrical grids into smart grids represents one of the most impactful innovations in the field of electrical engineering, especially in the context of green energy and sustainable power systems. Smart grid technology fundamentally redefines how electricity is generated, transmitted, distributed, and consumed by integrating advanced digital communication, automation, and intelligent control systems into traditional power networks.

A smart grid enables bi-directional flows of both energy and information, unlike conventional grids which only support one-way energy transmission from centralized generation plants to end users. This interactive capability enhances system efficiency, reliability, and responsiveness while promoting greater integration of distributed renewable energy resources such as solar, wind, and energy storage systems. One of the crucial innovations highlighted in recent research is the integration of Demand Response (DR) with distributed renewable generation. Demand Response systems allow end users to adjust their energy usage in response to supply conditions, price signals, or grid reliability needs. When combined with renewables, DR enhances grid flexibility by balancing supply and demand in real time, which reduces the reliance on fossil fuel-based peaking plants and minimizes wastage. Network reliability and resilience are further enhanced through advanced technologies such as automated fault detection, isolation, and restoration. These systems help maintain stability in the face of disturbances, whether due to renewable variability, equipment failures, or extreme weather events.

Emerging innovations in pricing mechanisms and energy markets support economic incentives for renewable adoption. Dynamic pricing frameworks and bidding strategies encourage consumers and distributed generators to operate in harmony with grid needs, aligning financial benefits with sustainability goals. By enabling intelligent energy management, supporting high renewable integration, and enhancing system resilience and security, electrical engineers are playing a pivotal role in shaping a sustainable and efficient energy future.

Er. Sangram Keshari Nayak
Assistant Professor
AIET, Bhubaneswar

SMART GRID, DEMAND RESPONSE, AND OPTIMIZATION



The rapid expansion of renewable energy sources and the increasing complexity of modern power systems have created new challenges for electrical engineers and grid operators. Traditional grids were not designed to handle highly variable electricity generation from renewables such as solar and wind or the dynamic patterns of modern consumption. To manage this transition effectively, advanced strategies such as smart grids, demand response (DR), and optimization algorithms are increasingly important in energy management and sustainability. Smart grids represent the next generation of electrical networks, incorporating digital communication, automation, and real-time control to efficiently balance supply and demand. Unlike conventional grids, smart grids allow two-way communication between utilities and consumers, enabling better visibility and control over energy flows. These systems are designed to integrate distributed energy resources (DERs), including rooftop solar, micro-grids, and electric vehicles, while maintaining high levels of reliability and stability.

A key component of modern smart grids is demand response (DR). DR strategies encourage consumers to adjust their electricity usage during peak periods or in response to price signals. By aligning demand with supply - especially when intermittent renewable sources are generating excess power - DR helps reduce the need for expensive peaked plants and decreases stress on the grid. Proper implementation of DR requires sophisticated computational methods that can predict consumption behavior, optimize load profiles, and coordinate responses across large populations of users. These include scalability issues, slow convergence, and difficulty managing the high dimensionality of real world data. The review highlights the importance of choosing the right algorithms and optimization strategies that balance accuracy with computational efficiency.

Quantum algorithms have the potential to process large datasets and complex optimization problems much faster than classical methods, which could significantly improve DR performance and overall grid efficiency. Continued research into computational methods will advance demand response capabilities, support large-scale renewable integration, and lay the groundwork for more resilient, efficient, and sustainable electricity networks.

Er. Krushna Keshab Baral
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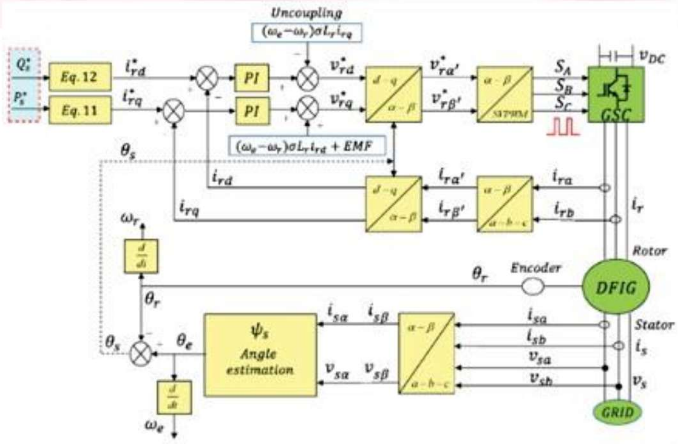
GREEN ENERGY INNOVATIONS IN ELECTRICAL ENGINEERING: A MATHEMATICAL PERSPECTIVE



Green energy has become a central pillar of sustainable development, and electrical engineering plays a crucial role in advancing renewable power technologies. In recent years, innovations in green energy systems have increasingly relied on mathematical modeling, optimization, and analytical techniques to improve efficiency, reliability, and large-scale integration of renewable resources. These innovations help engineers design intelligent, cost-effective, and environmentally responsible power systems. These models consider factors such as energy demand, weather variability, equipment capacity, and grid constraints. By applying optimization techniques, engineers can maximize energy output while minimizing losses, operational costs, and environmental impact.

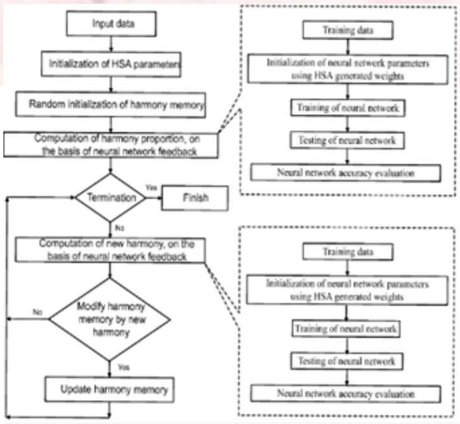
Energy storage systems are essential for overcoming the variability of renewable energy sources. Mathematical models help engineers design effective energy management strategies that determine when energy should be stored and when it should be released. By analyzing charging and discharging cycles, efficiency losses, and battery lifespan, engineers can enhance the performance and durability of storage systems. This leads to improved reliability and reduced dependency on fossil-fuel-based backup generation.

Electric vehicles and charging infrastructure also benefit from mathematical innovations in electrical engineering. Load forecasting and scheduling algorithms help manage charging demand, preventing grid overload and reducing peak-time stress. These strategies ensure efficient utilization of renewable energy while supporting the growing adoption of electric mobility. Vehicle-to-grid concepts further demonstrate how mathematical control methods can transform electric vehicles into active components of the power system.

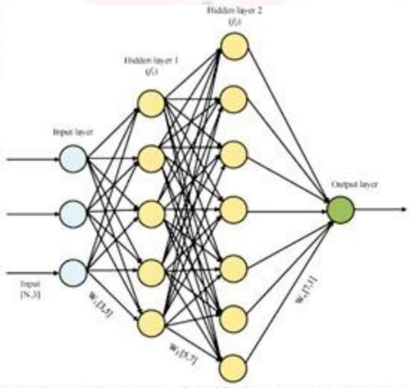
Emerging trends in green energy innovation include the use of advanced algorithms, artificial intelligence, and multi-objective optimization techniques. These approaches enable engineers to simultaneously address economic, environmental, and technical goals. By managing uncertainty in renewable generation and demand, mathematical models contribute to more resilient and adaptive energy systems. The green energy innovations in electrical engineering are strongly supported by mathematical methods that enhance system efficiency, reliability, and sustainability. Through optimized renewable integration, smart grids, energy storage, and electric mobility, electrical engineers are shaping a cleaner and smarter energy future for society.

Er. Chinmayi Choudhury
Assistant Professor
AIET, Bhubaneswar

HYBRID SOLAR–WIND FORECASTING



Proposed solar and wind energy forecasting model.



Basic architecture of artificial neural network.

Green energy sources such as solar and wind play a fundamental role in addressing the environmental and economic challenges posed by fossil fuel dependence. These renewable energy sources are widely available and emit significantly fewer pollutants compared to traditional energy generation methods. However, the integration of solar and wind energy into power grids has long been hindered by their intermittent and unpredictable nature. Fluctuating weather conditions lead to variability in solar irradiance and wind speed, making accurate forecasting essential for efficient energy management, grid stability, and cost reduction.

In recent research, experts have developed advanced forecasting models that combine machine learning with optimization techniques to improve the accuracy of solar and wind energy predictions. Conventional forecasting models, including those based on artificial neural networks (ANN), often struggle with inconsistent input data. This is primarily because random initialization of parameters in ANN can lead to unreliable results under highly variable environmental conditions. To overcome these limitations, electrical engineers have turned to hybrid approaches that integrate evolutionary optimization algorithms with neural network frameworks to enhance forecasting performance. One such innovation involves using the harmony search algorithm (HSA) to optimize the initial weights of ANN models dedicated to predicting solar irradiance and wind speed. By assigning optimized weights instead of random values, the ANN structure becomes more effective in learning complex patterns in renewable energy data. This hybrid model harnesses the strengths of both machine learning and meta-heuristic optimization, resulting in faster convergence and higher precision in forecasting outcomes compared to traditional methods.

The improved forecasting capabilities contribute significantly to the efficient integration of renewable energy into power systems. Accurate predictions enable grid operators to plan better for energy demand, balance supply fluctuations, and reduce dependency on fossil fuel-based generation during low renewable output periods. Additionally, reliable forecasting supports effective scheduling of backup resources, enhances load management strategies, and minimizes energy costs. From a broader perspective, innovations in forecasting methodologies represent a critical component of smart grid development. As the global energy infrastructure evolves, electrical engineers continue to focus on predictive modeling, data analytics, and advanced control algorithms to support sustainable and resilient power networks.

These advances not only improve the operational efficiency of renewable energy systems but also help accelerate the transition toward low-carbon and environmentally friendly power generation. By combining innovative forecasting techniques with renewable energy deployment, electrical engineering is contributing to a future where sustainable energy systems can reliably meet growing global demand while reducing environmental impact and enhancing grid reliability.

Er. Divya Das
Assistant Professor
AIET, Bhubaneswar

STUDENTS CORNER

CYBERSECURITY IN SMART GRIDS

Smart grids represent the future of power systems — they blend digital communication, sensing, and automation with traditional electricity networks to improve efficiency, reliability, and sustainability. However, this digital transformation brings with it significant cybersecurity challenges. Smart grid cybersecurity isn't just a technical concern; it's a socio-economic imperative. Imagine a power grid where millions of data points are flowing every second — from smart meters in homes to sensors across transmission lines. Each of these connected devices is a potential pathway for cyberattacks, and the consequences could range from localized blackouts to widespread infrastructure failures.

Below is a chart that highlights the types of cyber threats smart grids commonly face:

CYBER THREATS IN SMART GRIDS

Threat Type	% of Incidents (2025 data)
Malware & Ransomware	35%
Unauthorized Access	25%
Denial of Service (DoS)	15%
Data Manipulation	15%
Supply Chain Attacks	10%

Common Smart Grid Cyber Threats

The art and diagrams above illustrate how smart grid networks are interconnected and can be exposed to cyber risks if left unprotected. From the high-level network map to the focused "attack pathways", these visuals help readers quickly grasp why cybersecurity is not just an add-on but a foundational requirement.

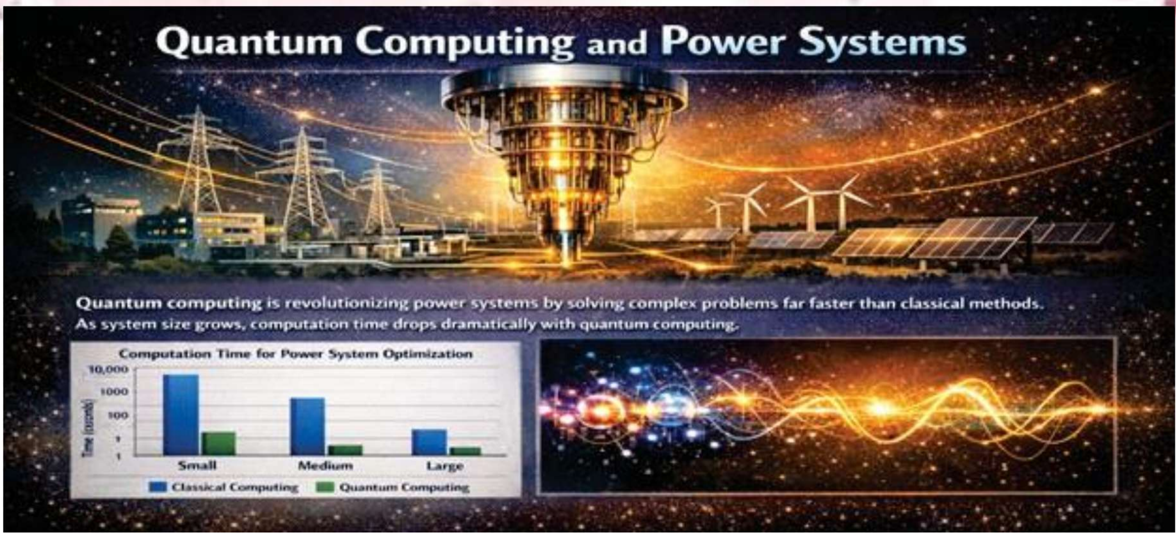
In essence, cybersecurity in smart grids is about protecting data integrity, ensuring the availability of services, and safeguarding the privacy of end users. As grids become more automated and reliant on Internet of Things (IoT) sensors, the attack surface expands — meaning more opportunities for adversaries. Smart meters, for example, communicate usage data back to utilities. If this data is intercepted or manipulated, consumers could face billing errors, and operators might make incorrect grid-management decisions. Similarly, if a critical control signal is hijacked, it could mislead operators or trigger equipment failures.

To counter these risks, engineers and cybersecurity professionals use a layered defense strategy. This includes encryption to protect data in transit, authentication mechanisms to verify legitimate users and devices, and intrusion detection systems (IDS) that monitor network traffic for anomalies. Additionally, regular security audits and firmware updates are essential — outdated software is one of the easiest entry points for attackers. International standards and collaborative information sharing between utilities also enhance resilience by spreading best practices and early warnings about emerging threats.

In conclusion, the smart grid revolution promises a more efficient, sustainable, and responsive power system — but its success depends on robust cybersecurity. For students and future professionals, understanding these challenges isn't optional; it's essential for building the secure electrical infrastructure of tomorrow.

ASHISH KUMAR MALLICK
Regd. No. : 2101320120
4th Year, EE
AIET, BBSR

QUANTUM COMPUTING AND POWER SYSTEMS



Quantum computing is emerging as a transformative technology with the potential to redefine the way modern power systems are analyzed, controlled, and optimized. Unlike classical computers that process information in binary bits, quantum computers use qubits, enabling them to handle multiple states simultaneously. This unique capability is particularly valuable for power systems, which involve highly complex networks, nonlinear equations, and massive datasets. [Image 1: Artistic illustration of a quantum computer connected to a smart power grid with transmission lines and substations] shows how quantum processors could act as the brain of future grids. Quantum algorithms can solve load flow analysis, unit commitment, and economic dispatch problems far faster than traditional methods. [Chart 1: Comparison bar chart showing computation time of classical computing vs quantum computing for large-scale power system optimization] highlights the dramatic reduction in computation time as system size increases. Additionally, quantum-inspired optimization can enhance renewable energy integration by managing uncertainty in solar and wind generation. [Art Sketch: Fusion of glowing qubits transforming into electric waveforms] symbolically represents the convergence of quantum physics and electrical engineering. As grids evolve into smart and cyber-physical systems, quantum computing promises superior forecasting, fault detection, and grid resilience, making it a powerful tool for next-generation power engineers.

The application of quantum computing in power systems extends beyond optimization into security, planning, and sustainability. Modern power grids are increasingly vulnerable to cyber threats due to extensive digitalization. Quantum computing introduces both challenges and solutions in this domain. While quantum algorithms could potentially break conventional encryption, they also enable quantum-safe cryptography, ensuring secure communication between grid components. From a planning perspective, quantum computing can analyze millions of grid expansion scenarios simultaneously, helping utilities design cost-effective and reliable networks for future demand growth. It also supports advanced energy storage management and electric vehicle charging coordination by solving complex scheduling problems in real time. For a country like India, where renewable penetration and grid complexity are rapidly increasing, quantum-enabled power system tools could play a vital role in achieving sustainability goals. Although large-scale practical quantum computers are still under development, research progress suggests that their integration with power systems is inevitable. For electrical engineering students, understanding quantum computing opens new interdisciplinary career paths that blend physics, computation, and power engineering. In the coming decades, the synergy between quantum computing and power systems will not only enhance efficiency and reliability but also accelerate the global transition toward clean, intelligent, and resilient energy infrastructures.

NIKHIL BARIK
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4th Year, EE
AIET, BBSR

POWER ELECTRONICS IN RENEWABLE ENERGY SYSTEMS

Power electronics plays a vital role in the effective utilization of renewable energy resources. Solar panels, wind turbines, and fuel cells generate power in forms that cannot be directly used by conventional electrical loads. Power electronic converters enable efficient energy conversion, control, and integration into modern power systems.In solar photovoltaic systems, DC-DC converters regulate output voltage, while inverters convert DC into AC for grid compatibility. Advanced inverter technologies ensure high efficiency, low harmonic distortion, and improved power quality. Maximum Power Point Tracking (MPPT) algorithms optimize energy extraction from solar panels under varying environmental conditions.

Wind energy systems rely on power electronic converters to regulate frequency and voltage generated by variable-speed turbines. These converters enable smooth grid synchronization and efficient energy transfer. In modern wind farms, back-to-back converters and multilevel inverters improve system reliability and power quality. Energy storage systems also depend on power electronics. Bidirectional converters manage battery charging and discharging processes, ensuring safety and long battery life. In microgrids, these converters help balance load demand and renewable generation. Power electronics enhances overall system efficiency, reduces losses, and improves reliability. Emerging technologies such as wide bandgap semiconductors (SiC and GaN) allow higher switching frequencies, compact designs, and superior thermal performance.

In conclusion, power electronics forms the backbone of renewable energy systems. Continuous advancements in converter technology will further accelerate the global transition toward clean and sustainable power generation.

RAJIB PRADHAN

Regd. No. : 2201320168

3rd Year, EE

AIET, BBSR

ENERGY STORAGE TECHNOLOGIES FOR FUTURE POWER SYSTEMS

Energy storage systems are becoming indispensable in modern power networks due to increasing renewable energy penetration and fluctuating load demand. They store excess energy and release it when required, ensuring reliability and grid stability.Battery energy storage systems (BESS) are widely used due to their flexibility and scalability. Lithium-ion batteries dominate the market because of high energy density, long life, and fast response. Flow batteries and sodium-ion batteries are emerging alternatives with improved safety and environmental benefits.

Pumped hydro storage remains the largest energy storage method globally. It stores energy by pumping water to a higher reservoir during low demand and generating electricity during peak hours. Though highly efficient, it requires specific geographical conditions.Supercapacitors and flywheels provide rapid energy delivery and are suitable for short-duration applications such as voltage stabilization and frequency control. Hydrogen-based storage systems also offer long-term energy storage potential.Energy storage supports renewable integration, peak shaving, frequency regulation, and backup power supply. It enhances power quality and reduces dependency on fossil fuel-based peaking plants.

In conclusion, energy storage technologies will define the future of power systems. Continuous innovation in storage solutions will enable reliable, sustainable, and flexible energy networks.

SUBHANKAR SAHOO
Regd. No. : 2201320173
3rd Year, EE
AIET, BBSR

DIGITAL TWINS IN ELECTRICAL ENGINEERING DESIGN

Digital twins are virtual replicas of physical electrical systems that simulate real-time behavior using data-driven models. This technology enables engineers to analyze performance, predict failures, and optimize designs before actual implementation. In power systems, digital twins model substations, transmission networks, and generation units. Engineers can simulate load variations, fault conditions, and system upgrades without risking physical infrastructure. In industrial automation, digital twins allow predictive maintenance by identifying abnormal operational patterns. This reduces downtime and improves productivity. In renewable energy plants, digital twins enhance performance forecasting and fault diagnosis. For students, digital twins provide interactive learning experiences. Virtual laboratories allow experimentation with complex systems without expensive hardware. This improves conceptual understanding and practical exposure. Digital twin development requires expertise in simulation tools, data analytics, IoT, and machine learning. Engineers use real-time sensor data to continuously update virtual models, ensuring accurate system representation. Despite benefits, challenges include high computational demand, data integration complexity, and cybersecurity concerns. In conclusion, digital twins are transforming electrical engineering design and operation. Mastering this technology will empower future engineers to develop safer, smarter, and more efficient systems.

PRASAD SWAIN
Regd. No. : 2101320130
4th Year, EE
AIET, BBSR

STORY

LETTERS TO MYSELF

Ananya wrote letters to herself every month. In them, she poured fear, dreams, anger, and hope. They were her therapy. When college pressure increased, she wrote. When homesickness hurt, she wrote. When heartbreak struck, she wrote. One day, during a cultural fest, she performed spoken poetry using lines from those letters. The audience fell silent, then emotional. Her words reflected every struggling student That day, Ananya realized pain, when expressed, becomes power. She started a student writing club. Hundreds joined. Stories flowed. Healing began.

Sometimes, the strongest voice begins in silent letters.

SHUBHAM PRADHAN
Regd. No. : 2101320135
4th Year, EE
AIET, BBSR

THE BROKEN BICYCLE

Every morning, Vikram rode a broken bicycle to college. The chain slipped, brakes failed, and pedals creaked. But he rode proudly. Because it was his father's last gift. Vikram repaired it himself, learning mechanics from online videos. Slowly, he became skilled. By final year, he started repairing bicycles for classmates. Soon, he opened a small campus repair stall. Today, Vikram runs a successful eco-friendly transport startup. A broken bicycle taught him the power of small beginnings.

BIKASH BEHERA
Regd. No. : 2301320251
2nd Year, EE
AIET, BBSR

LEARN FROM MISTAKES

Thomas Edison tried two thousand different materials in search of a filament for the light bulb. When none worked satisfactorily, his assistant complained, "All our work is in vain. We have learned nothing." Edison replied very confidently, "Oh, we have come a long way and we have learned a lot. We now know that there are two thousand elements which we cannot use to make a good light bulb."

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THE PEN THAT SPOKE

Aditi loved writing. Her words flowed like rivers, but her confidence was dry. She filled notebooks with poems, yet never shared them. One day, her professor announced a poetry competition. Friends pushed her to participate. Fear tried to stop her, but courage whispered louder.On stage, her hands trembled. But her words stood firm. Her poem about loneliness, dreams, and survival moved the audience to silence — then thunderous applause. She won first prize. That pen, once silent, became her voice. And she learned: When you let your heart speak, the world listens.

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POEM

GROUP PHOTO

We stand shoulder to shoulder,
smiling on command.
Behind every smile, different
war.
One is scared of returning home. One fears
being forgotten.
One pretends confidence professionally.
The camera captures unity.
It misses individuality.
Years later,
this photo will hurt gently— like
proof
that we were once together before
life scattered us deliberately.

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NOTES WRITTEN AT 3 AM

The best understanding
arrives when the world sleeps
At 3 AM,
truth stops pretending.
Notes are messier,
thoughts more honest.
Dreams leak into margins.
No one is watching.
No one is judging.
Learning finally feels like discovery,
not competition.
If education listened more at night,
it would sound kinder.

SANJAYA KISAN
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THE FIRST FAILURE

Failure doesn't shout. It arrives politely,

disguised as surprise. Marks lower than hope.
Silence louder than disappointment. I

stared at the paper,

waiting for mercy.

Instead, failure taught me something

success never did—

humility. From that day,

I stopped chasing perfection and started

respecting effort.

ASHISH RANJAN MOHANTA
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THE STUDENT WHO DOUBTS EVERYTHING

I doubt lectures.

I doubt leaders.

I doubt myself the most.

They call it confusion.

I call it honesty.

Certainty feels borrowed.

Doubt feels earned.

Questioning makes me unpopular.

Understanding makes me patient.

If thinking deeply is rebellion,

then I accept the charge.

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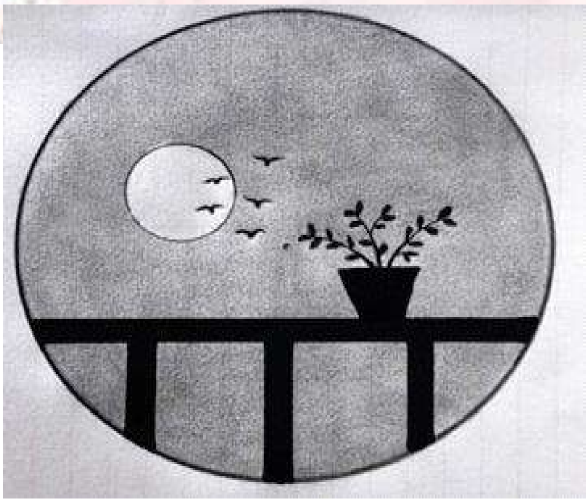
PHOTO GALLERY



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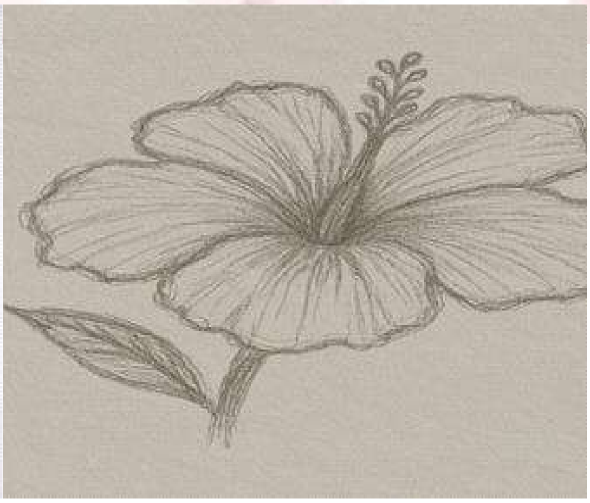

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Freshers welcome function 2024-25

Organization Of Kisan Divas Day 2024-25

International Day Against Corruption 2024-25

INDEPENDENCE DAY CELEBRATION 2024-25


PRACHITES