



Vel Tech
Rangarajan Dr. Sagunthala
R&D Institute of Science and Technology
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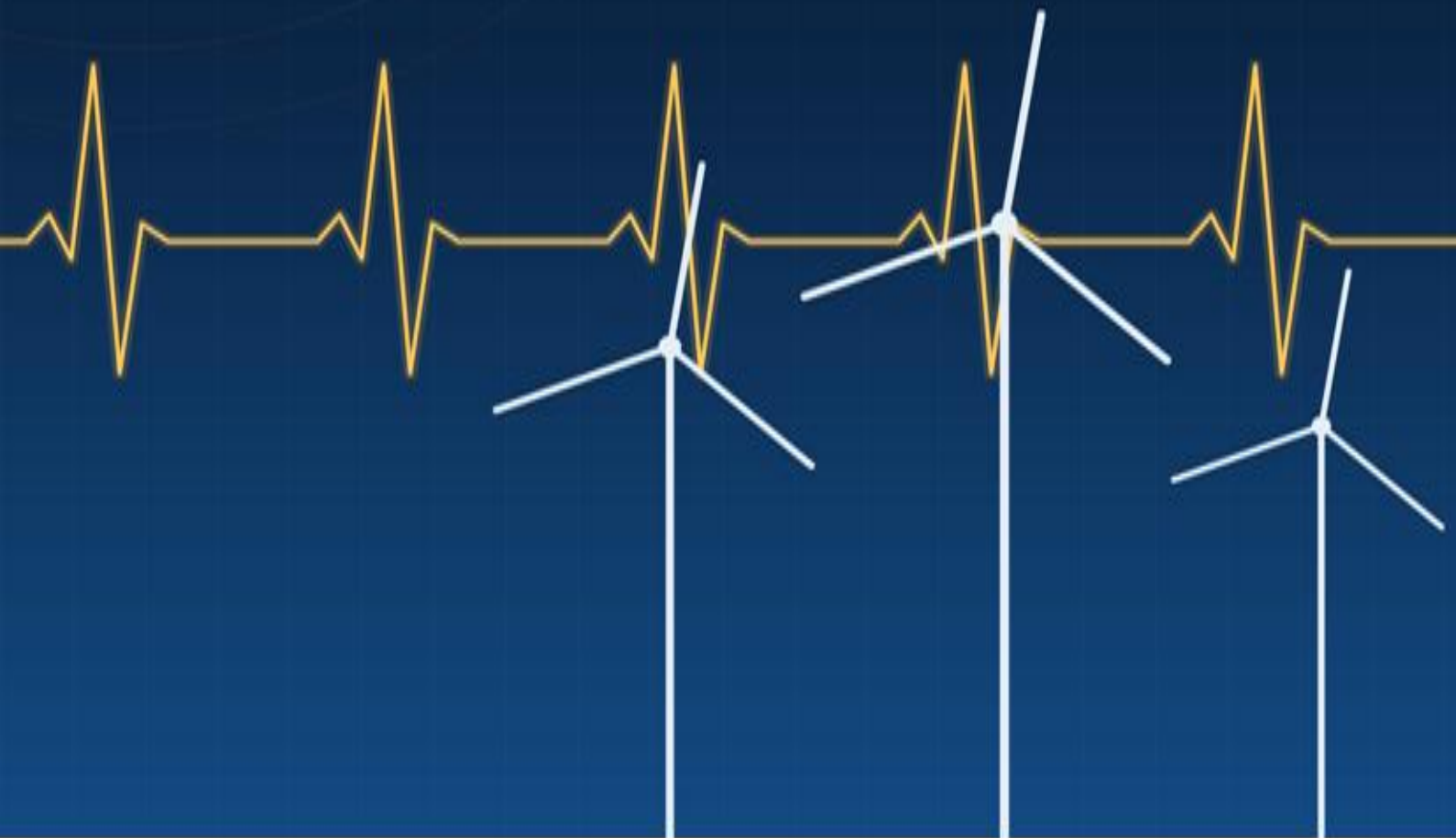
SCHOOL OF ELECTRICAL AND COMMUNICATION

**DEPARTMENT OF
ELECTRICAL AND ELECTRONICS ENGINEERING**

Spark Magazine

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Foreword



Col. Prof. Vel. Dr. R. Rangarajan
Founder President & Chancellor



Dr. Mrs. Sagunthala Rangarajan
Foundress President

We remain committed to building an educational environment that nurtures knowledge, character, innovation, and excellence. Our institution continues to encourage students and faculty to pursue meaningful academic, research, and technological endeavors, supported by modern infrastructure, well-equipped laboratories, and a dedicated faculty. The Department of Electrical and Electronics Engineering reflects this vision through its academic achievements, research initiatives, funded projects, industry collaborations, and the accomplishments of its students and faculty.

LEADERSHIP



Dr. Rangarajan Mahalakshmi Kishore
Chairperson & Managing Trustee

I am delighted to present this vibrant edition of SPARK, the magazine of the Department of Electrical and Electronics Engineering. This magazine reflects the department's academic excellence, student contributions, innovative initiatives, and technical achievements. As technology continues to evolve, I encourage students and faculty to embrace lifelong learning, explore emerging technologies, and apply their knowledge to address real-world challenges. I congratulate the editorial team and the entire EEE department for their dedicated efforts in bringing out this edition and showcasing the department's accomplishments and vision.

Wishing SPARK continued success in inspiring innovation, creativity, and excellence!



LEADERSHIP



Prof. S. Salivahanan
Vice Chancellor

I am delighted to present the latest edition of Spark, the flagship magazine of the EEE Department. This magazine reflects our continuous pursuit of research excellence, creativity, co-curricular activity and technical learning of our students. Kudos to the editorial team, faculty, and brilliant students whose hard work and contributions made this edition possible.



Prof. Dr. E. Kannan
Registrar

I warmly congratulate the EEE Department on launching this vibrant edition of Spark. This platform beautifully captures the dynamic activities, student achievements, and academic excellence of the department. I wish the EEE team continued success in inspiring our community through such creative and meaningful initiatives.



Message from Dean and Head of the Department

Dr. R. S. Valarmathi

Professor & Dean
School Of Electrical and Communication



The School continues to make remarkable progress, driven by the achievements of our faculty, students and staff in cutting-edge research, academic excellence, and industry collaboration. Spark, the magazine of EEE department serves as a wonderful window into this journey—reflecting our focus on innovation, hands-on learning, and community impact. I commend the entire team for shaping our students into future-ready professionals and bringing these milestones to light.

Dr. S. Ramesh

Professor & Head
Department of Electrical and Electronics Engineering



It is with great pleasure and a deep sense of pride that to present the SPARK-Magazine of the Department of EEE. I encourage you to delve into the pages of this magazine to gain a deeper understanding of the remarkable work that has taken place within our department. Together, we can look forward to an even brighter future filled with groundbreaking research, transformative education, and meaningful contributions to the field of electrical and Electronics engineering.

VISION OF THE DEPARTMENT

To provide intellectual curiosity in the field of Electrical and Electronics engineering that produces skilled interdisciplinary engineers to serve the society.

MISSION OF THE DEPARTMENT

M1: To inculcate knowledge among the students through comprehensive curriculum.

M2: To enrich the academic experience in terms of flexibility, teamwork, design skills, practice and industrial trainings.

M3: To produce competent graduates suitable for a successful career in Industry and Research.

PROGRAMME EDUCATIONAL OBJECTIVE

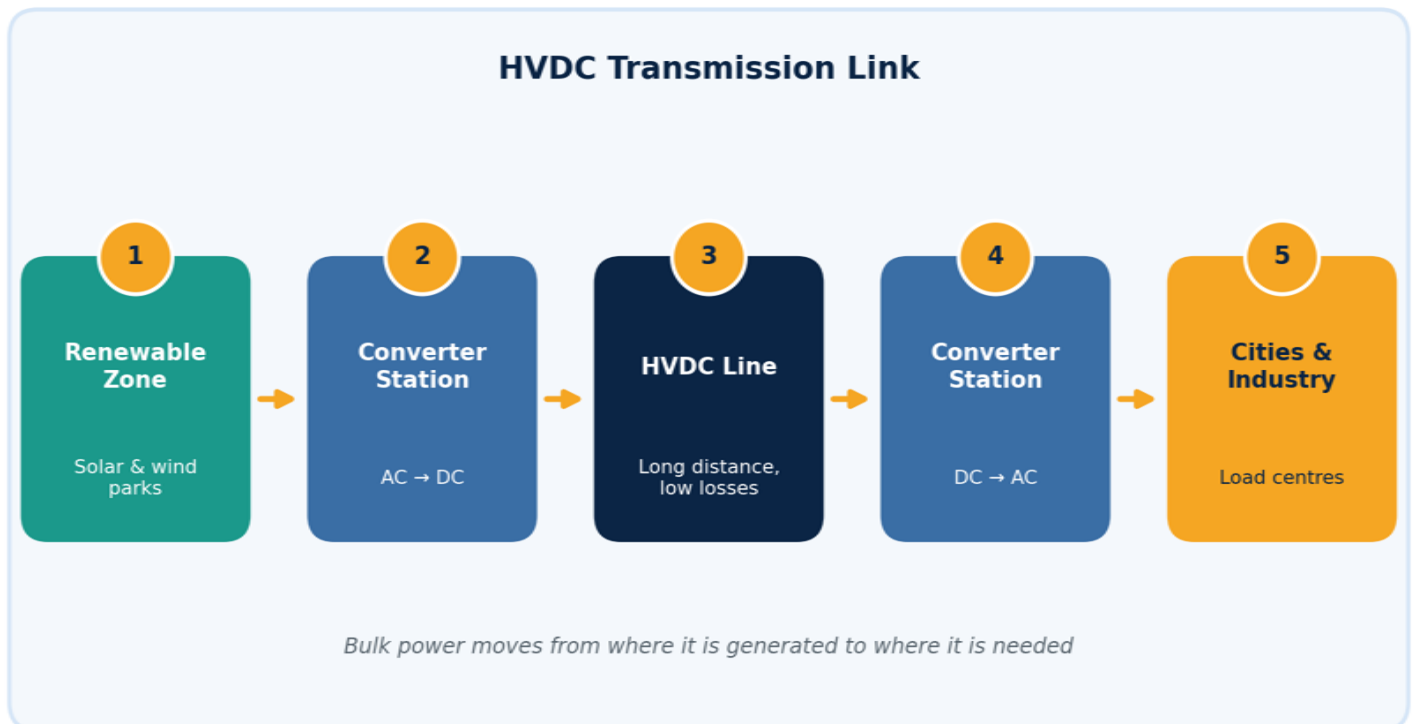
PEO1: Design and analyse electrical and electronic systems by applying the knowledge of mathematics and engineering.

PEO2: Provide practical solution to multidisciplinary societal problems through innovative ideas.

PEO3: Secure positions and continue as valued, creative and proficient employees in a wide variety of fields and industries for a rewarding career.



HVDC and Green Energy Corridors

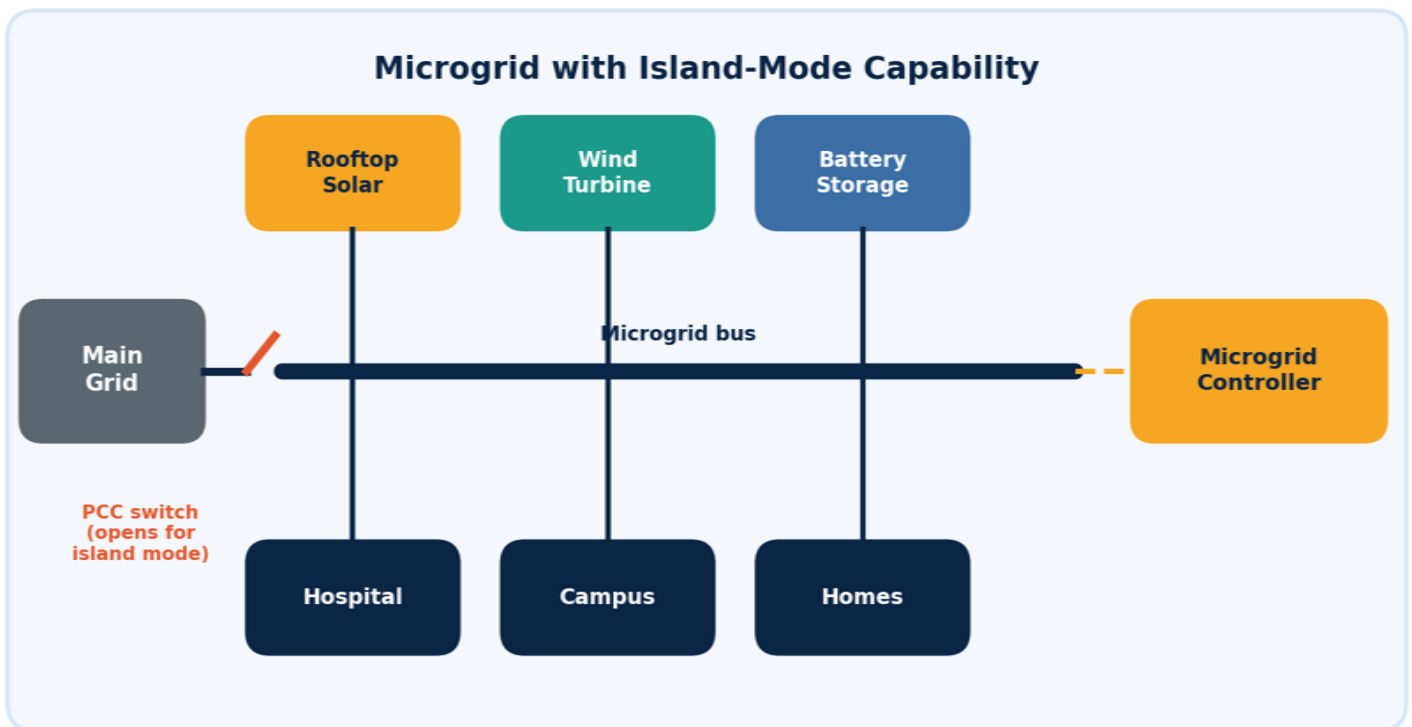


India's best solar and wind resources lie in states such as Rajasthan, Gujarat and Tamil Nadu, while the biggest demand is in distant cities and industrial regions. High-voltage direct current (HVDC) transmission carries bulk power over very long distances with lower losses than AC, and it can connect grids that are not synchronised with each other.

An HVDC link uses a converter station to change AC to DC at the sending end and another to change DC back to AC at the receiving end. Voltage-source-converter (VSC) technology can also support weak grids and offshore wind farms. The Green Energy Corridor programme is strengthening transmission to carry renewable power, in support of India's target of 500 GW of non-fossil capacity by 2030. Engineers in power electronics, protection and high-voltage design will be in high demand.

VTU21361 Gurunathan

Microgrids: Local, Reliable Power



A microgrid is a small local electrical network with its own sources, such as rooftop solar and batteries, and its own loads. It normally works connected to the main grid but can disconnect and run in island mode during a blackout. Hospitals, campuses, industrial parks and remote villages are ideal places for microgrids.

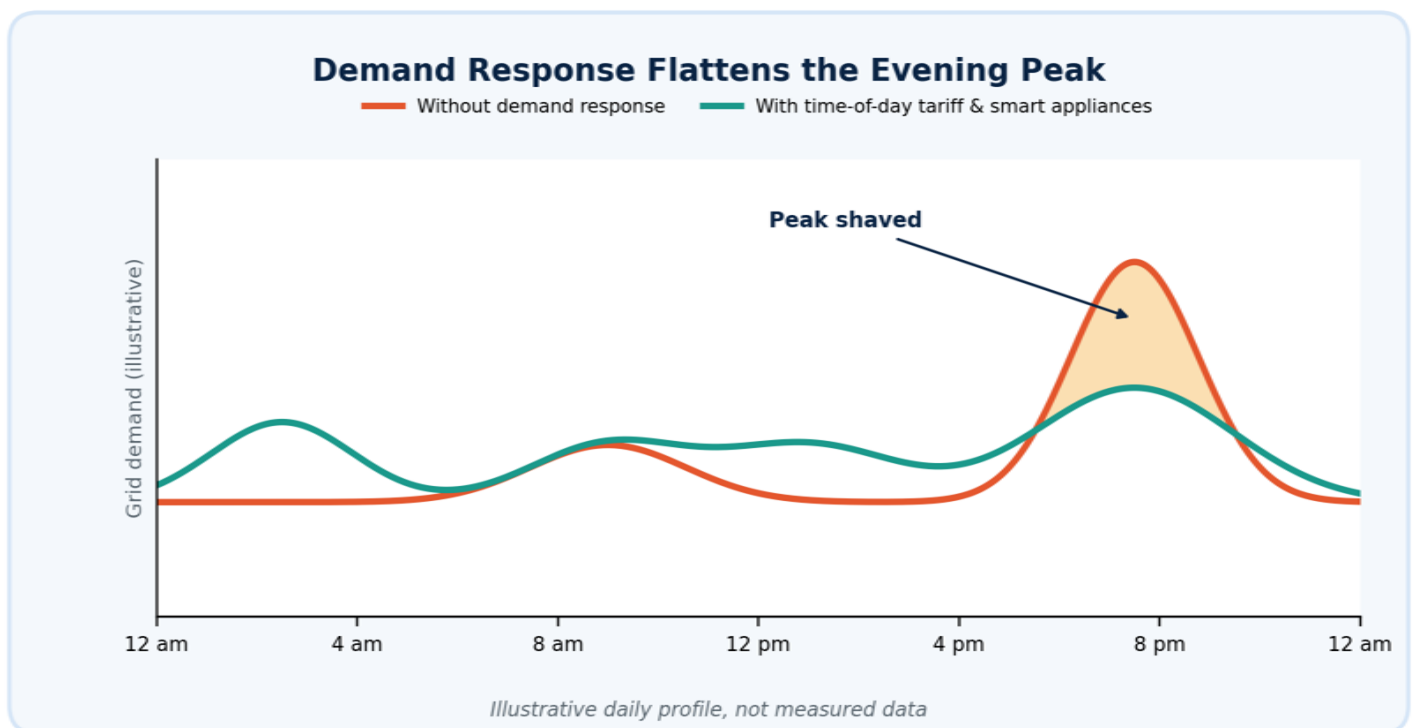
A microgrid controller continuously matches generation, storage and demand, decides when to buy or sell power from the main grid, and keeps voltage and frequency within limits. DC microgrids are growing because solar panels, batteries, LED lighting and EV chargers all work naturally on DC. In future, neighbours may trade solar power through peer-to-peer platforms, making local energy cheaper and more resilient.

VTU19723 Adesh

Smart Meters and Demand Response

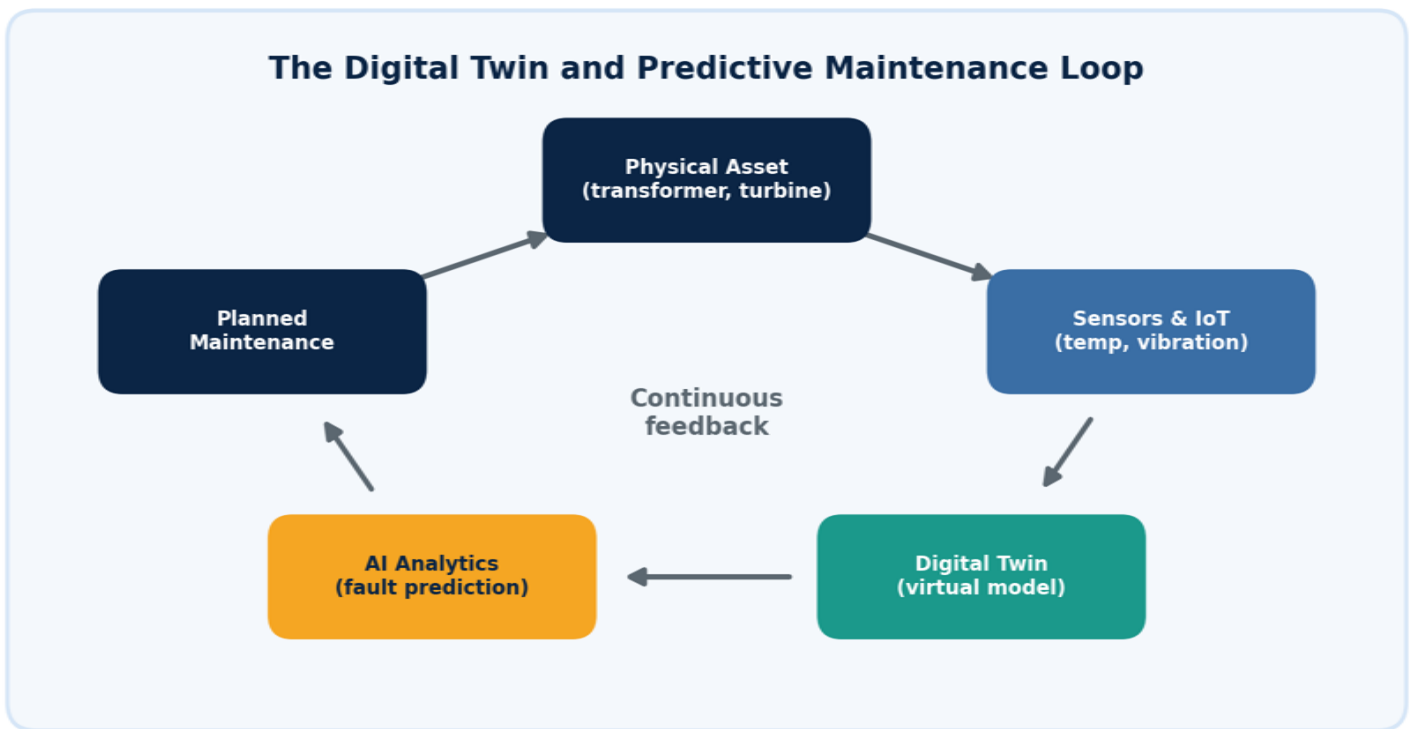
Smart meters record electricity use at short intervals and send the data automatically to the utility, removing manual reading and giving consumers detailed information. With time-of-day tariffs, electricity costs less when demand is low, which encourages people to run washing machines, water heaters and EV chargers at off-peak hours.

This is called demand response: instead of building more power plants for a few peak hours, the grid reduces or shifts demand. Smart appliances and home energy management systems can respond automatically to price or grid signals. India's Revamped Distribution Sector Scheme promotes smart prepaid metering to reduce losses and improve billing. Flattening the demand curve lowers costs and lets more renewable energy be used.



VTU19723 Adesh

Digital Twins and AI in Power Systems



A digital twin is a virtual model of a real asset, such as a transformer, wind turbine or substation, that is continuously updated with data from sensors. Operators can use the twin to test what-if scenarios, such as an overload or a fault, without risking the real equipment.

Artificial intelligence analyses temperature, vibration, dissolved-gas and loading data to detect early signs of ageing and recommend maintenance before a failure occurs. This predictive maintenance reduces outages, extends equipment life and cuts costs compared with fixed-interval maintenance. Drones, thermal cameras and robots are also being used to inspect power lines and solar plants. For the future engineer, data skills will be as important as circuit theory.

Sensors

real-time data from every asset

AI

early detection of faults and ageing

Fewer outages

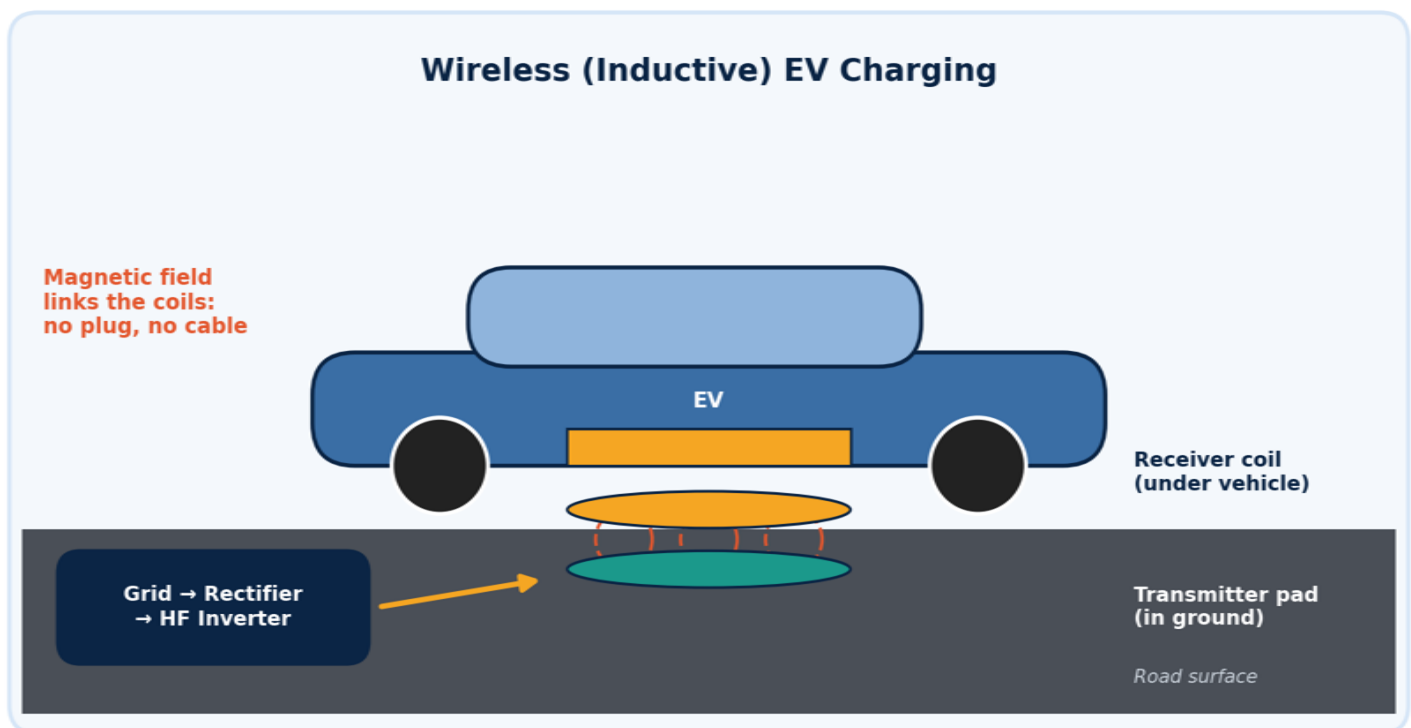
predictive instead of reactive maintenance

VTU22378 Varshini

Wireless EV Charging

Wireless charging transfers power between a coil in the ground and a coil under the vehicle through a magnetic field, with no plug or cable. It works on resonant inductive coupling, the principle behind wireless phone chargers but at much higher power. The driver simply parks over the pad and charging starts automatically.

Static wireless charging suits homes, parking lots and bus depots. Dynamic charging, still at pilot stage, embeds coils in the road so vehicles charge while moving, which could allow smaller batteries. Good systems already reach efficiencies above 90 percent, but alignment, cost and electromagnetic safety remain challenges. Driverless fleets and warehouse robots are likely early users.



90%+

efficiency of good wireless charging systems

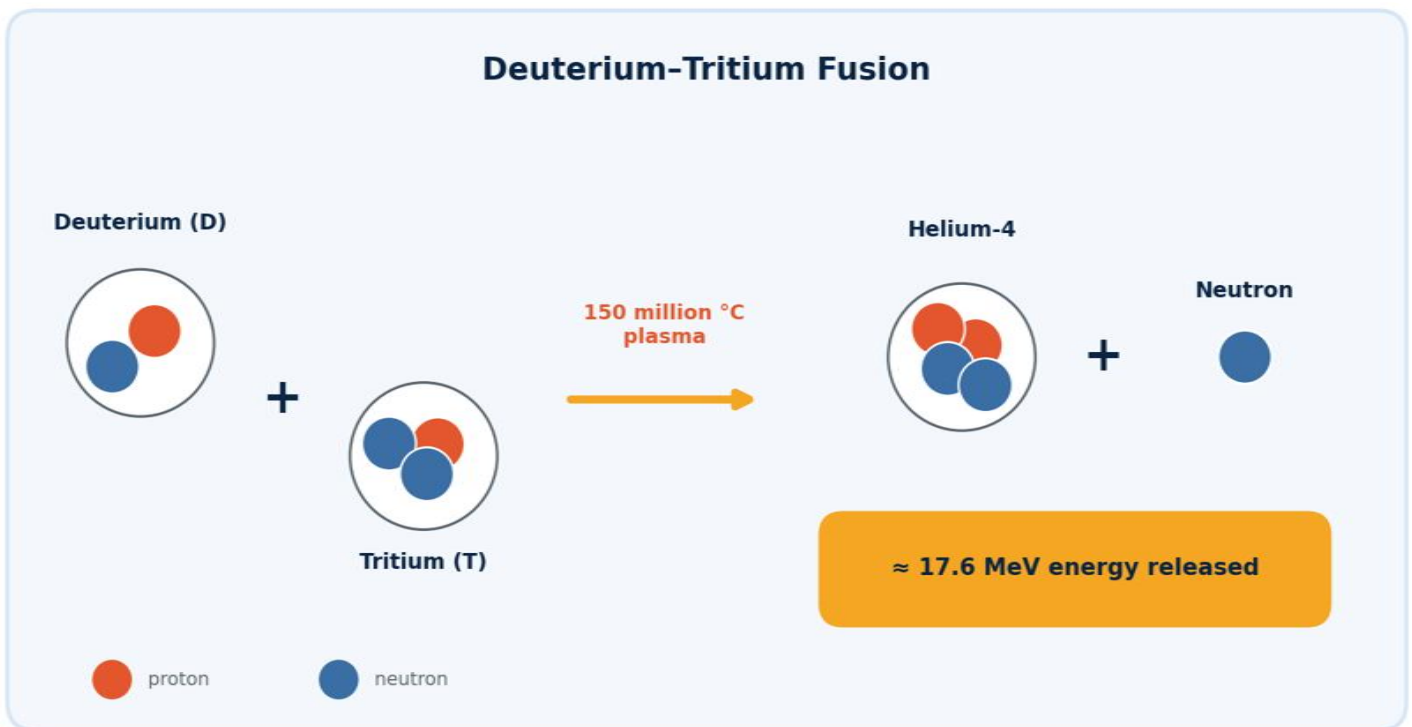
Resonant

inductive coupling between two coils

Dynamic

charging while driving (pilot stage)

Nuclear Fusion: Power of the Stars



Fusion is the process that powers the Sun. Light nuclei such as deuterium and tritium join to form helium and a neutron, releasing a large amount of energy. Deuterium can be extracted from seawater, a fusion plant produces no greenhouse gases in operation, and a runaway chain reaction is not possible.

The challenge is to heat the fuel to over 100 million degrees Celsius and hold the plasma using powerful magnetic fields, as in tokamaks, or to compress it with lasers. The ITER project in France, in which India is a partner, is building the world's largest tokamak, and in 2022 a US laser facility achieved fusion ignition. Commercial fusion is still decades away, but magnet, power-supply and control engineering already offer opportunities.

150M °C

plasma temperature targeted in
ITER

D + T

deuterium–tritium fuel mix

ITER

global project with India as a
partner

Rangoli: Dots, Dust, Delight...

Rangolis'



VTU22378 Varshini

Brain Teasers: Circuit Puzzles

Puzzle 1: The Resistor Riddle

A 10 V battery feeds a $5\ \Omega$ resistor in series with two $10\ \Omega$ resistors connected in parallel. What is the total resistance of the circuit?

Puzzle 2: Who Am I?

I have a core and windings, I hum day and night, and I change voltage without a single moving part. What am I?

Puzzle 3: The Three Switches

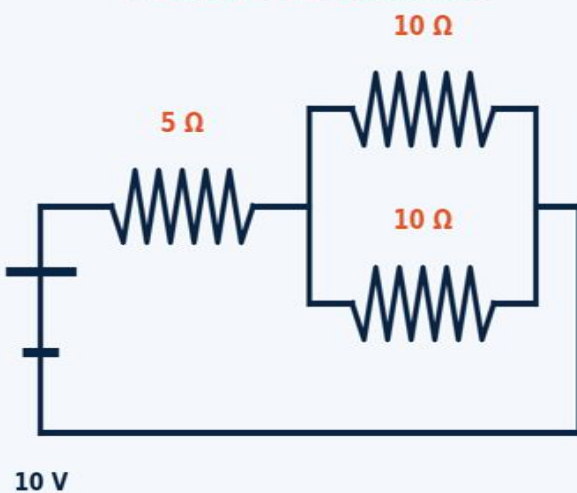
Three switches outside a closed room control one bulb inside. You may enter the room only once. How can you find which switch controls the bulb?

Puzzle 4: Count the Units

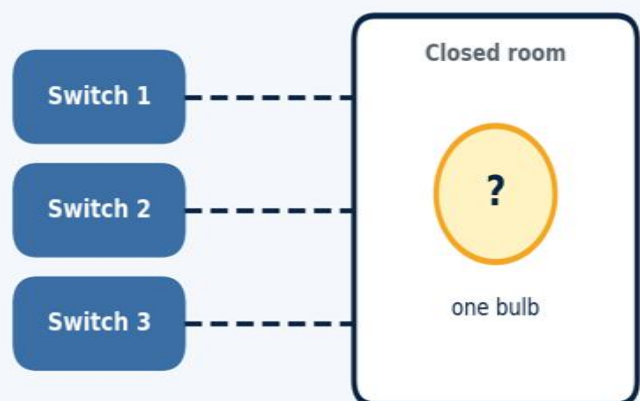
A 100 W bulb is left on for 10 hours. How many units (kWh) of electricity does it use?

Puzzle Corner: Circuit and Switch Teasers

Puzzle 1: total resistance?



Puzzle 2: which switch?



Answers

- 1) $10\ \Omega$ (two $10\ \Omega$ in parallel give $5\ \Omega$, plus $5\ \Omega$).
- 2) A transformer.
- 3) Turn switch 1 on for a few minutes, then off. Turn switch 2 on and enter: lit bulb = switch 2, warm but off = switch 1, cold and off = switch 3.
- 4) 1 unit ($0.1\ \text{kW} \times 10\ \text{h}$).

Quiz Challenge:

•I am the semiconductor device that permits current to flow in only one direction, widely used in rectifiers. What am I?

Answer: Diode

•I am the fully controllable, three-terminal semiconductor switch that combines high speed and high power handling, widely used in modern inverters. What am I?

Answer: IGBT (or MOSFET)

•I am the power electronic converter circuit that transforms a Direct Current (DC) voltage into an Alternating Current (AC) voltage. What am I?

Answer: Inverter

•I am the power electronic converter that takes an unregulated AC input voltage and converts it into a regulated or fixed DC output voltage. What am I?

Answer: Rectifier

•I am the control technique that varies the duty cycle of a pulse train to regulate output voltage in DC-DC converters. What am I?

Answer: PWM (Pulse-Width-Modulation)

•I am the reactive component placed at the output of power converters to store energy and smooth out current ripples. What am I?

Answer: Inductor (or Capacitor)

•I am the DC-DC converter configuration specifically designed to step an input DC voltage down to a lower average output level. What am I?

Answer: Buck

•I am the power semiconductor switch known for its high-frequency switching capability, historically recognized as a latching thyristor with a control gate. What am I?

Answer: Thyristor (or SCR)

Quiz Challenge:

1. Which material is most commonly used for overhead electrical transmission lines due to its high conductivity, lightweight nature, and cost-effectiveness?

- A) Iron B) Aluminum C) Carbon D) Wood

Answer: B) Aluminum

2. What is the primary purpose of a fuse in a domestic electrical circuit?

- A) To step up supply voltage B) To measure total electrical power C) To automatically break the circuit during excess current D) To store electrical energy for backup

Answer: C) To automatically break the circuit during excess current

3. In a standard domestic parallel electrical circuit, what happens to the remaining appliances if one lamp stops working or is switched off?

- A) All other appliances stop working B) All other appliances continue to work normally C) The main supply voltage doubles D) The total current in the circuit drops to zero

Answer: B) All other appliances continue to work normally

4. What does a very low power factor in an industrial electrical installation typically indicate?

- A) Highly efficient power usage B) Excessive inductive loads such as heavy motors C) Purely resistive heating loads D) Zero current consumption

Answer: B) Excessive inductive loads such as heavy motors

5. Which scientist discovered the principle of electromagnetic induction, which forms the fundamental operational basis for generators and transformers?

- A) Thomas Edison B) Michael Faraday C) Alessandro Volta D) James Prescott Joule

Answer: B) Michael Faraday

6. Why are soft iron cores commonly used inside transformers and electrical machines?

- A) They can easily magnetize and demagnetize with minimal energy loss B) They act as permanent magnets C) They block all magnetic flux from escaping D) They conduct electricity better than copper windings

Answer: A) They can easily magnetize and demagnetize with minimal energy loss

◆ CREDITS

Editorial Team & Acknowledgements**ACKNOWLEDGEMENTS**

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