# SHREE VENKATESHWARA
## Hi-Tech Engineering College

(AUTONOMOUS)

Othakuthirai, Gobi – 638 455, Erode District, Tamilnadu

Web: http://www.svhec.com

# DEPARTMENT OF MECHANICAL ENGINEERING

# MECHITECH MAGAZINES

# 2024

**SHREE VENKATESHWARA HI-TECH ENGINEERING COLLEGE**

**DEPARTMENT OF MECHANICAL ENGINEERING**

**B.E. MECHANICAL ENGINEERING**

## VISION

- Produce competent Mechanical Engineering professionals with scientific temper, values, ethics, team spirit and capabilities to face new challenges.

## MISSION

- Provide conducing learning environment with state-of-the-art infrastructure facilities, laboratories and teaching learning systems.
- Produce skilled Mechanical Engineers with skills towards employability, leadership, communication skills with social responsibilities and ethical values.
- Inculcate Professional skills to function as proficient engineers and designers capable of building sustainable equipment and infrastructure for the society.
- Promote research and development activities in the rapidly changing technologies related to Mechanical Engineering and allied areas.

**Editor - in - Chief**

Dr.S.Prakasam
HOD / MECHANICAL

**Sub Editors**
Mr.V.Prabaharan, AP/MECH

# DEPARTMENT OF MECHANICAL ENGINEERING

# TYRE KINGDOM

# MAGAZINE 2024

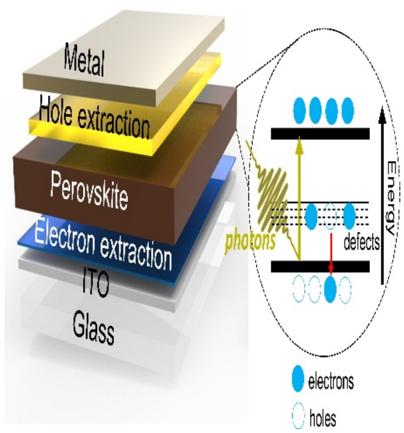
## MESSAGE FROM HOD

Mechanical Engineering is evergreen, dynamic, skill as well as knowledge-oriented Department. Students of this department always show their revolutionary attitude through activities. Department technical magazine, “TYRE KINGDOM” will be effective platform to show case the research and other academic thought of the students and faculties as individual sand team. We also welcome articles form from our alumni, academicians from other institute and industries to enrich our academic end eavors.

# CONTENT

## 1.PEROVSKITE-INTEGRATED SOLAR CELL (PIASUC) TECHNOLOGY

Perovskite-Integrated Solar Cell (PIASuC) technology represents a significant advancement in photovoltaic systems, combining perovskite materials with traditional silicon-based solar cells to enhance efficiency and reduce costs. Perovskites are a class of materials with a unique crystal structure that exhibit excellent light absorption properties, making them highly efficient for solar energy conversion.

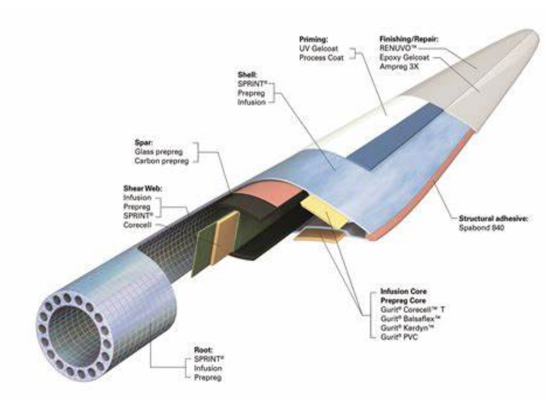


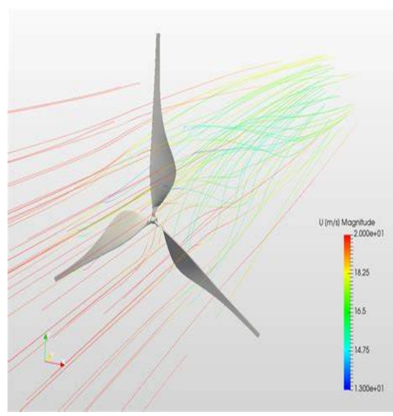

One of the primary advantages of PIASuC technology is its potential for low-cost production. Perovskite materials are cheaper to manufacture than silicon, and they can be processed using solution-based methods, making the technology scalable and potentially reducing the cost of solar panels. Additionally, perovskite layers are lightweight and flexible, opening up new applications in areas where traditional rigid solar panels cannot be used.

Challenges to the widespread adoption of PIASuC technology include stability and durability issues, as perovskite materials are sensitive to moisture, oxygen, and UV light. However, research is ongoing to improve the longevity and environmental resilience of perovskite materials, and recent developments in encapsulation techniques and material engineering are showing promise.

## 2.ADVANCED WIND TURBINE BLADE MATERIALS AND DESIGN

The efficiency of wind energy generation heavily relies on the design of the turbine blades, which capture kinetic energy from wind. Advances in material science and blade design are crucial for improving performance. New composite materials like carbon fiber and fiberglass are being used to create lighter and stronger blades, increasing the durability and energy output of wind turbines. Innovations in blade aerodynamics, such as adaptive and flexible blades that change shape in response to wind conditions, are improving the efficiency of turbines in low-wind environments. Additionally, the development of quieter and less invasive blades helps address environmental concerns related to noise pollution and wildlife disruption.

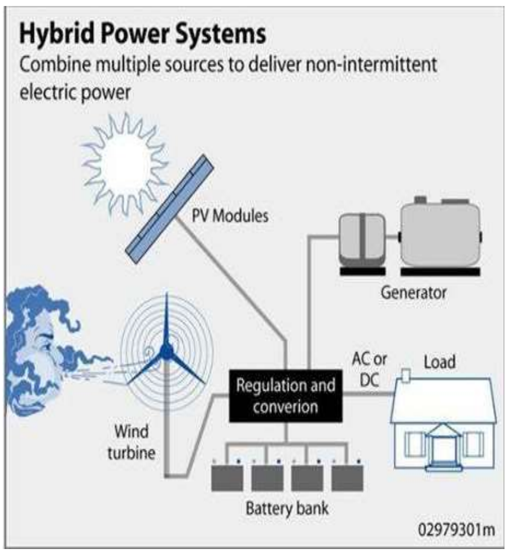


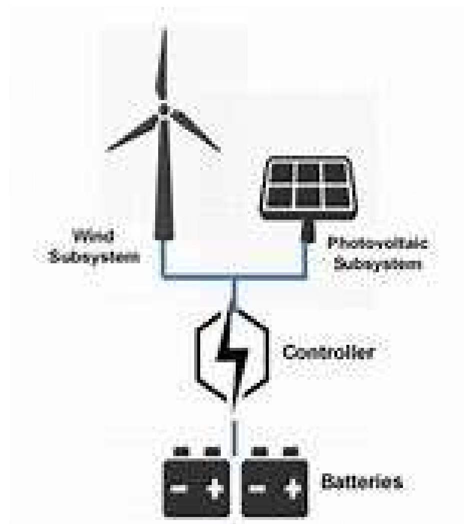




The development of advanced materials for wind turbine blades is crucial for improving efficiency and performance in wind energy generation. Traditional turbine blades are primarily made from fiberglass and epoxy composites, but newer materials, such as carbon fiber and lighter, more durable composites, are being explored to reduce weight and increase strength

# 3.HYBRID SOLAR-WIND ENERGY SYSTEMS

Hybrid solar-wind energy systems combine the benefits of both solar and wind power to create a more reliable and efficient renewable energy solution. By integrating these two complementary sources, such systems reduce intermittency, ensuring consistent energy generation throughout the day and night. Solar energy is often strongest during daylight hours, while wind energy can peak at night or during stormy weather, making their combination ideal for balancing power supply. This dual-source approach increases.



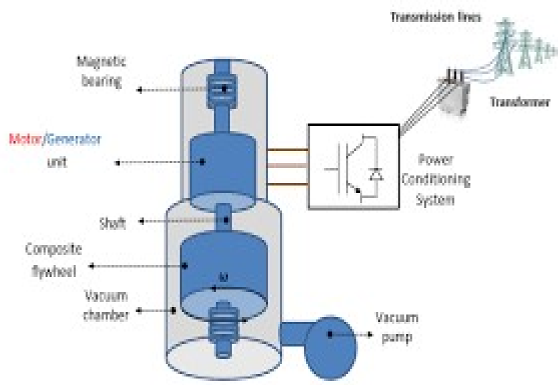



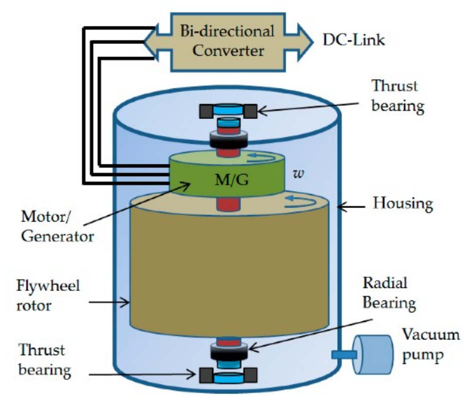

reduces dependence on fossil fuels, and offers a sustainable way to meet electricity demand in both grid-connected and off-grid scenarios. Hybrid systems also optimize land use by allowing both technologies to operate together, making them suitable for remote areas or large commercial installations. Additionally, the system's ability to reduce reliance on costly energy storage and provide backup during periods of low generation is a significant advantage. Despite their higher initial installation costs and more complex system design, hybrid systems often result in long-term savings and enhanced grid stability.

# 4.MECHANICAL ENERGY STORAGE SOLUTIONS (FLYWHEELS AND CAES)

Flywheels and Compressed Air Energy Storage (CAES) are two key mechanical energy storage solutions that help stabilize power grids by storing energy in physical forms. Flywheels store energy as rotational kinetic energy, rapidly releasing it when needed, making them ideal for short-duration, high-power applications like frequency regulation.

CAES, on the other hand, stores energy by compressing air and storing it in underground caverns or pressure vessels, releasing it to drive turbines when demand rises. CAES is more suited for large-scale, long-duration energy storage, though it faces challenges like geographical limitations and higher capital costs.

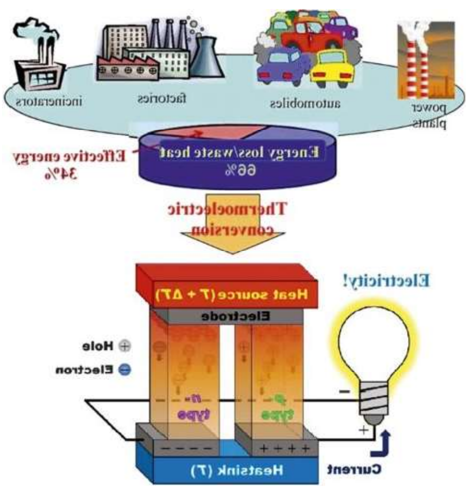


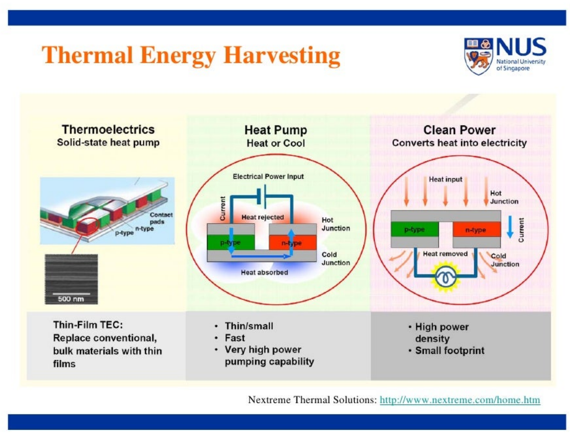




Mechanical energy storage solutions like Flywheels and Compressed Air Energy Storage (CAES) offer efficient ways to store and release energy. Flywheels store rotational kinetic energy using a spinning rotor, providing high efficiency (85–95%) and rapid response times, making them ideal for grid balancing and regenerative braking.

## 5.THERMAL ENERGY HARVESTING VIA HEAT PUMPS

Thermal energy harvesting via heat pumps is a cutting-edge, sustainable solution for capturing and utilizing ambient heat from renewable sources such as air, water, or ground, to efficiently meet heating and cooling demands. These systems operate by transferring heat against its natural flow using a refrigeration cycle powered by electricity. In heating mode, heat pumps absorb low-grade thermal energy from the environment, compress it to a higher temperature, and release it indoors, while in cooling mode, they reverse the process to remove heat from indoor spaces.



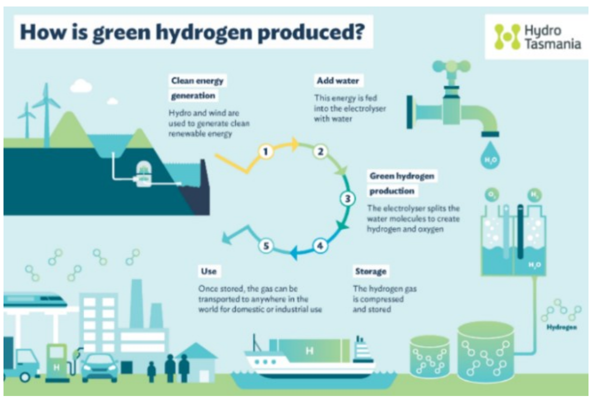


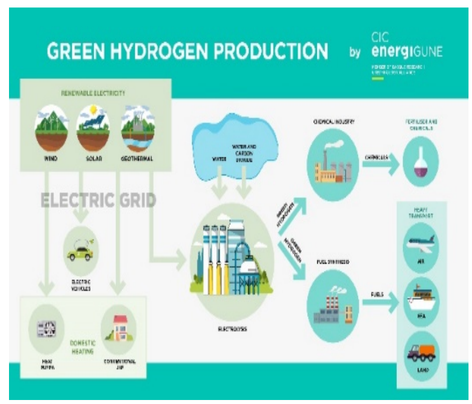

Their ability to integrate with renewable energy sources, such as solar or wind power, further amplifies their role in achieving energy efficiency and reducing greenhouse gas emissions. As key enablers of sustainable energy systems, heat pumps support global efforts to combat climate change by reducing fossil fuel dependency and transitioning toward low-carbon, energy-efficient technologies, making them indispensable in modern energy strategies.

# 6.GREEN HYDROGEN PRODUCTION TECHNOLOGIES

Green hydrogen production technologies focus on generating hydrogen using renewable energy sources, ensuring minimal carbon emissions and a sustainable energy pathway. The primary method is water electrolysis, where electricity from renewable sources like wind, solar, or hydropower splits water into hydrogen and oxygen.

.




Emerging methods, such as photocatalysis and biological processes using algae or microbes, explore direct hydrogen generation from sunlight or biomass. Advancements in these technologies aim to reduce costs, increase scalability, and improve efficiency.

Green hydrogen is pivotal for decarbonizing hard-to-abate sectors, such as heavy industry and long-haul transport, and serves as a key enabler for energy storage and grid balancing in renewable energy systems. Its production aligns with global efforts to achieve net-zero emissions, making it a cornerstone of the clean energy transition.

## 7.SUSTAINABLE BUILDING MATERIALS FOR ENERGY EFFICIENCY

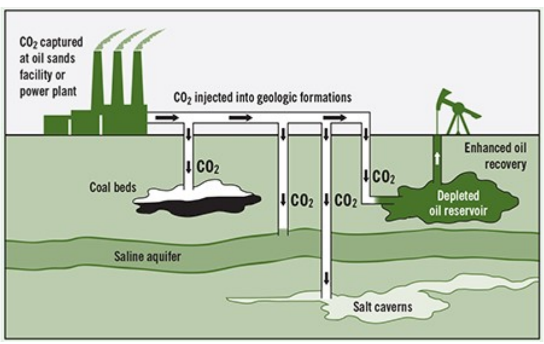
Sustainable building materials are essential for improving the energy efficiency of buildings while minimizing their environmental impact. These materials are sourced and produced with a focus on reducing carbon emissions, conserving natural resources, and enhancing the overall performance of structures. For instance, insulation materials like cellulose, cotton, and hempcrete have low environmental footprints and provide excellent thermal resistance, reducing the need for heating and cooling. In addition, materials like recycled steel and reclaimed wood help

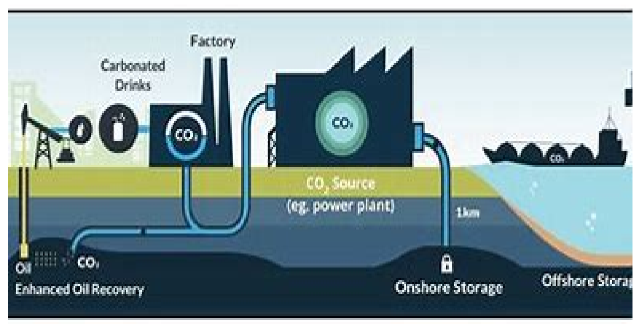

Incorporating these materials into building design leads to long-term energy savings and helps lower the overall carbon footprint of a structure. High-performance glazing and energy-efficient windows can reduce heat loss and gain, making heating and cooling systems more effective. Reflective or green roofing materials can reduce the urban heat island effect and decrease the need for air conditioning, further lowering energy costs. Furthermore, natural, renewable materials such as bamboo and rammed earth not only reduce reliance on energy-intensive materials but also offer durability and resilience. By focusing on energy-efficient, sustainable materials, buildings can significantly reduce energy consumption, improve occupant comfort, and contribute to a more sustainable, low-carbon future.

# 8.CARBON CAPTURE, UTILIZATION, AND STORAGE (CCUS) SYSTEMS

Carbon Capture, Utilization, and Storage (CCUS) systems are vital technologies for mitigating climate change by capturing carbon dioxide ($CO_2$) emissions from industrial processes, power generation, or directly from the atmosphere. These systems prevent $CO_2$ from entering the atmosphere and repurpose or store it safely.

The process involves three key stages: capture, transport, and storage/utilization. $CO_2$ capture is achieved through methods like post-combustion, pre-combustion, and oxy-fuel combustion, using advanced solvents, membranes, or sorbents.

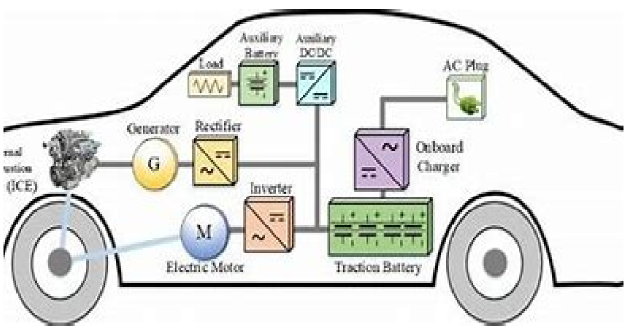


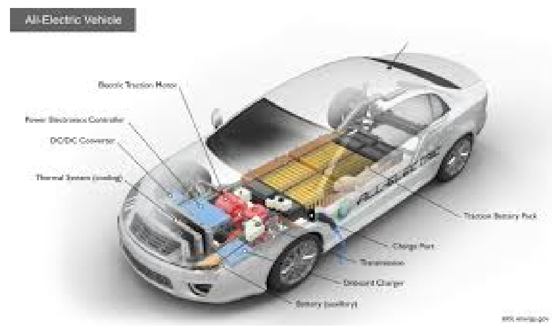




CCUS technologies are crucial for decarbonizing energy-intensive industries like cement, steel, and chemicals, which are challenging to electrify. They also complement renewable energy by addressing emissions from fossil fuel plants and enabling carbon-negative solutions when paired with bioenergy (BECCS). Despite challenges like high costs, energy demands, and regulatory hurdles, ongoing advancements in technology, policy incentives, and public-private partnerships are accelerating CCUS deployment. By reducing atmospheric $CO_2$ levels, CCUS systems are indispensable for achieving global climate targets and supporting a sustainable energy transition.

# 9.LOW-CARBON TRANSPORT: ELECTRIC VEHICLE (EV) POWERTRAIN DESIGN

Low-carbon transport through electric vehicle (EV) powertrain design is revolutionizing mobility by reducing greenhouse gas emissions and reliance on fossil fuels. An EV powertrain replaces the internal combustion engine (ICE) with an electric motor, powered by energy stored in a battery pack. The key components include the electric motor, inverter, battery pack, and transmission system, all orchestrated by an advanced control system for optimal efficiency and performance.



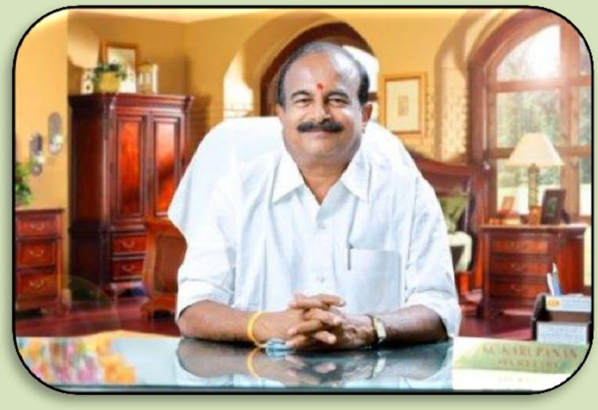




Innovations in powertrain design focus on improving energy efficiency, reducing weight, and enhancing regenerative braking systems to recapture energy during deceleration. Integration with smart energy systems, such as vehicle-to-grid (V2G) technology, extends EV utility by allowing energy feedback to power grids. Lightweight materials, optimized aerodynamics, and modular architectures further enhance performance and range. EV powertrains are pivotal in reducing transportation emissions, with widespread adoption supported by advancements in charging infrastructure, renewable energy integration, and policy incentives. As technology evolves, EV powertrain design will continue to lead the transition to a sustainable and low-carbon transportation future.

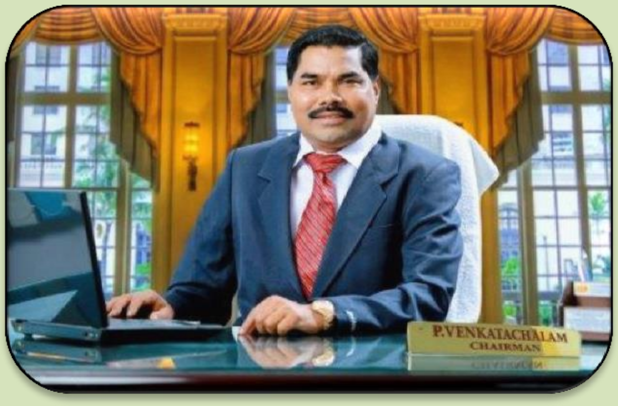
## About the Institution

Shree Venkateshwara Hi-tech Engineering College, gifted with a serene atmosphere is located at Othakuthirai, near Gobichettipalayam, Erode. The College was founded by Shree Venkateshwara Educational and Charitable Trust in the year 2008 with the divine aim of educating the students of rural background. The College inculcates in students technical and innovative skills catering to the dire need of the present scenario. It imparts professionalism and critical thinking in them for a dynamic engineering career. It also sensitizes students to uphold academic excellence and become technically competent.

**PATRON**



***Thiru K.C .Karuppanan***
***Chairman/ Bhavani Municipality***
***Secretary / SVHEC***




***Thiru.P.Venkatachalam, MPHF***
***Chairman / SVHEC***


***Dr. P.Thangavel, ME ,MBA ,PhD.***
***Principal / SVHEC***

I feel it a privilege to launch the seventh and eighth edition of News Letter. I appreciate everyone who has taken sustained efforts in bringing out this edition successfully.