



SDG 7: AFFORDABLE AND CLEAN ENERGY

Progress Report 2023-2024

MANAV RACHNA UNIVERSITY

Established wide Haryana state Legislature Act
No 26 of 2014 & under section 2(f) of UGC 1956



Ensure access to affordable, reliable, sustainable, and modern energy for all.



PREAMBLE

WE, THE FACULTY, STAFF, AND STUDENTS OF MANAV RACHNA UNIVERSITY, recognizing that universal access to affordable, reliable, sustainable, and modern energy services is paramount for economic growth, public health, and mitigating climate change, hereby affirm our strategic commitment to the objectives of the United Nations Sustainable Development Goal 7: Ensure access to affordable, reliable, sustainable and modern energy for all.

WHEREAS the transition to sustainable energy systems requires both campus-wide efficiency measures and robust academic efforts in research and development of renewable technologies;

WHEREAS the university has made significant investments in energy transition through the implementation of clean energy sources, notably the installation of Solar Photovoltaic (PV) systems on campus infrastructure to generate electricity and reduce reliance on conventional grids, thereby lowering operational costs and carbon emissions;

WHEREAS our academic centers, including the Smart Energy Centre and the School of Engineering, are actively engaged in cutting-edge research—such as projects focused on enhancing the efficiency and stability of next-generation Perovskite Solar Cells—to advance scalable, reliable, and cost-effective energy solutions for both urban and rural environments;

WHEREAS our commitment extends to promoting energy literacy and conservation among the community and local villages, ensuring that knowledge of efficient energy usage and the benefits of modern technologies are accessible to all;

NOW, THEREFORE, BE IT RESOLVED that Manav Rachna University shall continue to aggressively pursue energy-use efficiency across all operations, significantly increase the share of renewable energy utilized on campus, and dedicate its research and teaching expertise to innovate and deploy sustainable, affordable, and clean energy technologies for the long-term benefit of the region and the nation.

Affordable and Clean Energy

1. Global Context

The global context of SDG 7 reflects the fact that **energy is central to development**—it drives economic growth, enables education and healthcare, supports communication, powers industry, and is critical to combating climate change. Yet, major disparities remain worldwide.

1.1.1 Access to Energy

- Around the world, **hundreds of millions of people (mainly in Sub-Saharan Africa and South Asia)** still lack access to electricity.
- Nearly **2.3 billion people** continue to rely on biomass (wood, charcoal, dung) for cooking, causing health issues due to indoor air pollution.

1.1.2 Renewable Energy Transition

- Fossil fuels dominate the global energy mix, contributing to greenhouse gas emissions and climate change.
- To meet SDG 7, the world must **rapidly scale up renewables** (solar, wind, hydropower, bioenergy, geothermal) and **phase down coal and oil dependence**.
- Progress is uneven: advanced economies and some developing countries are adopting renewables quickly, while many low-income nations struggle due to financial and technological gaps.

1.1.3 Affordability and Equity

- The energy crisis triggered by geopolitical conflicts (e.g., Russia–Ukraine war) caused price volatility in oil, gas, and electricity markets.
- This exposed global inequalities: many developing nations face energy poverty, while richer nations adapt with subsidies and alternatives.

1.1.4 Climate Change Link

- **Achieving SDG 7 is essential for meeting the** Paris Agreement goals.
- A clean energy transition directly reduces emissions from power generation, industry, and transport.

1.1.5 Global Cooperation

- International frameworks like UN Energy, IRENA, and the SDG 7 Technical Advisory Group push for cross-border collaboration.
- Financing remains a challenge: the world needs trillions in investment for renewables, grids, and clean cooking solutions

1.2 Relevance to Higher Education & Manav Rachna University’s Mission

1.2.1 “To impart outcome-based holistic education.”

- Relevance: HEIs can integrate **sustainable energy, renewable technologies, and energy management** into their curriculum, ensuring graduates are not only academically strong but also skilled in applying knowledge to solve real-world energy challenges.
- Outcome: Students graduate with **practical skills** to contribute to clean energy transitions.

1.2.2 “To disseminate education in frontier areas.”

- Relevance: Frontier areas include **renewable energy systems (solar, wind, bioenergy, hydrogen), smart grids, energy storage, and energy efficiency technologies.**
- Outcome: By teaching and researching in these domains, the university contributes directly to **SDG 7 innovation and knowledge advancement.**

1.2.3 “To produce globally competitive, ethical and socially responsible human resources.”

- Relevance: The energy sector needs professionals who can balance **technological progress with ethics**, ensuring energy projects are inclusive, affordable, and environmentally responsible.
- Outcome: Graduates become leaders who champion **energy equity and sustainability** in global and local contexts.

1.2.4 “To produce human resources sensitive to issues of Environment and Sustainable Development.”

- Relevance: Clean and affordable energy is at the **heart of sustainable development**—reducing emissions, improving air quality, and ensuring energy justice.
- Outcome: Students and researchers understand the **interlinkages between energy, environment, and human well-being**, making them sensitive to the broader goals of SDG 7.

1.2.5 “To develop the Environment and Sustainable Development as a thrust area of research and development.”

- Relevance: R&D in renewable energy technologies, energy-efficient systems, and sustainable campus practices can position the university as a **hub for SDG 7 innovation**.
- Outcome: The university can develop **pilot projects, patents, and partnerships** that advance global progress toward clean energy.

1.3 MRU’s Strategic Commitment to the Goal

- Curriculum innovation can integrate **renewable energy, energy efficiency, and sustainable technology modules**. Outcome-based learning ensures graduates can apply knowledge to **real-world clean energy challenges**.

- A strong research culture encourages **interdisciplinary studies in energy, environment, and technology**, leading to innovations such as **bioenergy, waste-to-energy, smart grids, and solar applications**.
- Quality education involves **hands-on training, energy labs, green campus practices, and exposure to sustainable technologies**.
- Developing a sustainable campus with **solar energy installations, energy-efficient buildings, smart classrooms, and eco-friendly infrastructure** reflects direct application of SDG 7 principles.

1.4 Policy Alignment and Institutional Values

1.4.1 Policy E-Governance

Manav Rachna University's E-Governance policy aligns with SDG 7 by promoting energy-efficient digital systems, minimizing paper and resource consumption, streamlining data management, and fostering modern infrastructure that reduces overall energy demand. These measures contribute to creating an **affordable, reliable, and sustainable energy ecosystem** within the university's academic and administrative framework.

1.4.2 Quality Policy

Manav Rachna University's Quality Policy, though broad in scope, is deeply aligned with SDG 7 as it embeds sustainability into curriculum design, promotes digitalization for energy efficiency, fosters research and innovation in renewable technologies, and ensures resource-efficient infrastructure development. By emphasizing inclusivity, ethical governance, and continuous improvement, the policy framework creates an enabling environment where the university contributes both directly and indirectly to the global agenda of ensuring access to affordable, reliable, sustainable, and modern energy for all.

1.4.3 Policy of Usage and Maintenance

The policy promoted the responsible and optimal use of resources to reduce the waste generation in campus. Thus shared use of facilities not only help in the conservation of energy resources but also promote the greener environment.

1.4.4 Key Administrative/Academic Units Involved

Manav Rachna Centre for Peace & Sustainability (MRCPS)

Drives awareness, research and community outreach on clean energy and environment. It can shape institutional policies, student activities, and research that promote SDG 7.

2. Key Initiatives and Achievements

(a) Research & Development

(2.1) Research Publications

(2.1.1) India's renewable energy research and policies to phase down coal: Success after Paris Agreement and possibilities post-Glasgow Climate Pact; Journal & Year of Publication: Biomass & Bioenergy, 2023

Alignment with SDG 7: this research paper aligns with **SDG 7** by **addressing access, efficiency, renewable share, technology, and policy frameworks** to ensure India's transition to affordable and clean energy systems in line with global commitments.

(2.1.2) Biodiesel production from waste cooking oil using heterogeneous catalysts; Journal & Year of Publication: Energy Nexus, 2023

Alignment with SDG 7 : The study emphasizes **waste cooking oil (WCO)** as a low-cost, widely available feedstock. Using waste instead of edible oils reduces production cost and avoids the **food vs. fuel conflict**, making biodiesel more affordable. Development of reusable heterogeneous catalysts reduces operational costs by minimizing catalyst loss and simplifying separation.

(2.1.3) Ion implantation in multifunctional materials; Journal & Year of Publication: Materials Letters, 2023

Alignment with SDG 7: This modifies its **surface, structure, and functional properties** (e.g., electrical, optical, catalytic, or mechanical). When applied to *multifunctional materials*, this

technique is used to tailor materials for advanced technologies — including **energy conversion, storage, and efficiency applications**.

(2.1.4) Excitation of the Laser Wakefield by asymmetric chirped laser pulse in under dense plasma; Journal & Year of Publication: Journal of Optics, 2023

Alignment with SDG 7: The study aligns with **SDG 7** because it contributes to **energy-efficient particle acceleration**, which underpins research and technologies for **clean energy generation, energy-efficient experimental systems, and advanced renewable energy applications**. It emphasizes optimizing **energy use**, a critical element of sustainable modern energy.

(2.1.5) Carbon dioxide sequestration by Chlorella pyrenoidosa toward biomass and lipid production: An integrated multi-optimized management. Journal and Year of Publication: Biomass Conversion and Biorefinery, 2024

Alignment with SDG 7: It directly contributes to *developing renewable bioenergy sources* via lipids/biomass. It contributes to *technology/research advancement* in clean energy (again SDG 7.a). Through CO₂ sequestration, it helps address climate change, which is part of the context of “clean energy” transitions.

(2.1.6) Challenges and opportunities using Ni-rich layered oxide cathodes in Li-ion rechargeable batteries: the case of nickel cobalt manganese oxides. Journal & Year of Publication: Energy Advances, 2024

Alignment with SDG 7: The review aligns with **SDG 7** because it focuses on **developing high-performance, safe, and sustainable lithium-ion batteries**, which are crucial for **energy storage, renewable energy integration, and affordable clean energy technologies**. It addresses both **technical innovation** and **material sustainability**, key components of modern energy solutions.

(2.1.7) An Improved Hottel-Whiller-Bliss Equation for the Nth Photo-Voltaic Thermal-Thermo-Electric Cooler Air Collectors Connected in Series: Exergy Analysis

Prashant Bhardwaj, Sujata Nayak, Arvind Tiwari & G N Tiwari	An Improved Hottel-Whiller-Bliss Equation for the Nth Photo-Voltaic Thermal-Thermo-Electric Cooler Air Collectors Connected in Series: Exergy Analysis
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Develops an enhanced thermodynamic model for hybrid PV/T-TEC collectors. Incorporates exergy analysis for multi-stage connected systems. Improves prediction accuracy of energy and exergy efficiencies. Guides design of advanced solar air collector arrays.

(2.1.8) Digital Consumer and Legal Compliances in Sustainable Ecosystem: Issues, Challenges and Road Ahead

Prof.(Dr) SK Bose	Digital Consumer and Legal Compliances in Sustainable Ecosystem: Issues, Challenges and Road Ahead
Dr. Aditi Chaudhary	
Dr. Ghazala Abidin	
Dr. Manisha Narula	
Dr. Yamini Atreya	
Ms. Simran Singh	

Examines legal frameworks protecting digital consumers in sustainable ecosystems. Identifies challenges in e-commerce, data privacy, and regulatory compliance. Highlights gaps in enforcement and consumer awareness. Proposes policy measures for a secure and sustainable digital marketplace.

(b) Conference & Workshop

(2.2) International Conference on "Energy Materials and Rechargeable Batteries-2023.

The International Conference on Energy Materials and Rechargeable Batteries (ICEMRB-2023) was organized collaboratively by the Department of Sciences (Physics) and the University Instrumentation Center (UIC) at MRU. The primary aim was to foster engagement among students and the research community within the field of energy materials. The conference aimed to open up possibilities for future collaborations in research, particularly focusing on rechargeable batteries and related technologies.



(c) Student engagement in sustainable energy promotion through competitions and events.

Event Name: Poster Presentation

Date: 24th July 2023

Alignment with SDG 7:

(2.3) Awareness through Poster Presentation

- The poster-making activity on **SDGs** directly encouraged students to explore and represent themes related to sustainability, including **SDG 7: Affordable and Clean Energy**.
- By engaging creatively, students learned about renewable energy, energy efficiency, and the importance of access to clean energy, thus fostering awareness and responsibility.



3. INNOVATION & INCUBATION CENTRE - Initiatives

Report on ATVC

Under MRU-IIC a team of nine students from a university participated in the Aravalli Terrain Vehicle Championship (ATVC) from 1st March to 5th March 2024. The team designed and fabricated a vehicle in the Fabrication Centre, which was funded with Rs. 5,70,000 from the university. The team was led by Mr. Mohit Sanju and Mr. Rajveer Singh Bedi, under the guidance of Dr. J P Sharma and Dr. Prashant Bhardwaj.

The team designed and fabricated a rugged off-road vehicle that was capable of navigating rough terrain. The vehicle was designed to be lightweight yet durable, with a powerful engine and high ground clearance. The team utilized the latest CAD/CAM software to design the vehicle and utilized various fabrication techniques to build the chassis, suspension, and other components. The team also designed and fabricated the steering, braking, and other systems, ensuring that they were safe and reliable.

The team extensively tested the vehicle in various conditions to ensure that it was capable of handling any challenge that came its way. The team tested the vehicle's acceleration, braking, steering, and suspension, making adjustments and improvements where necessary. The team also tested the vehicle's stability and safety, ensuring that it was safe for the driver and passengers.

The team participated in the Aravalli Terrain Vehicle Championship, where they competed against other teams from different universities. The competition was held over five days, with various events such as acceleration, endurance, and maneuverability. The team performed well in all the events, demonstrating the vehicle's capabilities and the team's skills. Team acquire 9th position in the initial round at National Level hosted by Nutan Maharashtra Institute of Engineering and Technology, Talegoan and Orison Education India Ltd. This is a National Level Education and Innovation Festival to promote Skill India, Startup India, Go Green and Make In India. In this event, more than 100 teams participated with over 3500 participants with

an ensemble of engineering undergraduates and diploma holders from various recognized institutes.

Overall, the team of nine students from the university performed exceptionally well in the Aravalli Terrain Vehicle Championship. The vehicle designed and fabricated by the team was rugged, reliable, and capable of navigating rough terrain. The team's performance in the competition demonstrated their skills and expertise in design, fabrication, and testing. The team's mentors, Dr. J P Sharma and Dr. Prashant Bhardwaj, provided valuable guidance and support throughout the project, ensuring that the team was successful in their endeavor.



4- PATENTS

i) Lightning Protection System for Rooftop Solar PV Panels

Dinesh kumar sharma, Ananna Bardhan, Raj Kumari, Prashant Kumar	202311060466A
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A safety mechanism that shields solar panels from lightning damage. Incorporates conductive pathways and surge protection components.

Automatically redirects lightning energy to ground safely.
Prevents costly damage and ensures continuous solar operation.

ii) Synthesis and Utilization of Graphene Sheet with Periodic Vacancy for Hydrogen Storage

Jaiparkash, Deepti Maihuri, Shiv Kumar Dixit, Haider Abbas	202311064446A
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Develops graphene structures engineered with periodic atomic vacancies.
Increases hydrogen adsorption capacity and stability.
Supports energy storage for clean hydrogen-based technologies.
Provides a step toward sustainable fuel alternatives.

iii) Erosion Protection System for Solar PV Panels

Dinesh Kumar Sharma	202311072581
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A surface protection system to prevent erosion and wear on panels.
Uses nanocoating and sensor-based feedback for early detection.
Extends panel lifespan under harsh environmental conditions.
Maintains solar efficiency and reduces maintenance costs.

iv) Analysis and Management of Overload Protection of EV Batteries

Dr. Anthati Sreenivasulu Dr. M Pala Prasad Reddy Dr. Piyush Charan Prof Dr. Jyoti Prasad Patra Dr. Manasi V. Ghamande M Rambabu Roshan Kisan Bonde V.S.B. Engineering College Dr.P.ARULKUMAR Rashi Goswami Anand Goswami Dr.Maaz Allah Khan	202341036797
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A system ensuring safe energy distribution in electric vehicle batteries. Detects overloads, temperature spikes, and voltage imbalance. Applies AI algorithms for preventive

maintenance and balancing. Improves battery life, safety, and eco-friendly transport performance.

v) IoT Driven Sensor Network Alert System for Detection of Hydrogen Gas Leakage

Dr. Charu Pathak	202311039870
Dr. Piyush Charan	
Dr. Joginder Singh	

Smart IoT-based sensor grid for detecting hydrogen gas leaks.

Continuously monitors pipelines or storage areas for leakage.

Sends instant alerts to prevent accidents or explosions.

Enhances industrial safety and environmental protection.

PLEDGE TO SUPPORT MANAV RACHNA INITIATIVES FOR PROMOTION OF RENEWABLE ENERGY

I pledge to actively support and champion the shift towards 100% renewable energy at Manav Rachna University. Recognizing that clean energy is essential for a sustainable and resilient future, I commit to the following actions to promote its adoption and integration:

1. Learning and Awareness:

I will deepen my understanding of renewable energy technologies and their benefits for the environment, society, and the economy. I will share insights through workshops, seminars, campus initiatives, social media, and community engagement to inspire others to embrace sustainable energy solutions.

2. Advocacy and Policy Engagement:

I will participate in discussions with university leadership, local authorities, and relevant stakeholders to support policies and programs that advance renewable energy implementation. I will encourage initiatives that reduce reliance on fossil fuels and incentivize green energy innovation.

3. Responsible Energy Choices:

I will make conscious choices to use renewable energy in my personal and professional life, such as opting for solar or wind-powered solutions wherever feasible. I will also motivate peers and the broader community to consider sustainable energy options and highlight their long-term benefits.

4. Collaboration and Action:

I will work together with fellow students, faculty, staff, organizations, and the wider community to accelerate the transition to renewable energy. By sharing knowledge, best practices, and supporting joint projects, we can strengthen the university's role in shaping a cleaner and healthier energy future.

By taking this pledge, I dedicate myself to advancing the adoption of renewable energy at Manav Rachna University. Through collective effort, we can reduce greenhouse gas emissions, combat climate change, and contribute to a greener, healthier planet for generations to come. Manav Rachna University (MRU), Faridabad

Policy on Divesting Investments from Carbon-Intensive Energy Industries

Purpose

This policy establishes Manav Rachna University's commitment to divesting financial investments from carbon-intensive energy industries, particularly those involved in coal, oil, and other fossil fuel extraction or processing. The Policy aligns with MRU's strategic sustainability goals, the National Education Policy (NEP) 2020 focus on environmental responsibility, and the United Nations Sustainable Development Goals (SDG 7 – Affordable and Clean Energy, SDG 12 – Responsible Consumption and Production, and SDG 13 – Climate Action).

Policy Statement

Manav Rachna University commits to:

1. Phasing out direct investments in companies primarily engaged in the extraction, refining, or distribution of coal, crude oil, or natural gas within five (5) years of this policy's adoption.
2. Avoiding new investments in fossil-fuel-based industries from the date of this policy's enforcement.
3. Encouraging investments in renewable and low-carbon sectors such as solar, wind, biomass, and clean-tech innovation.
4. Supporting sustainable financial institutions that uphold environmental, social, and governance (ESG) standards.

Energy Consumption Analysis and Energy Conservation Plan

Manav Rachna University is committed for optimal use of energy in its overall operation. University has already identified areas with high energy consumption and analysed the ways to reduce the energy consumption in the campus.

At Manav Rachna University, there is a strong commitment to responsible energy usage and optimization through the adoption of energy-efficient equipment and sustainable operational practices. Each year, the university management sets clear energy conservation goals, and progress against these targets is continuously monitored and documented in periodic reports.

Cross-functional teams comprising faculty, administrative staff, non-teaching personnel, and students actively collaborate to identify opportunities for energy optimization. Numerous initiatives Energy Smart Challenges, are planned and implemented to achieve measurable energy savings. The university also undertakes technological and process upgrades, such as replacing high-energy equipment with low-energy alternatives, to meet the established goals. Additionally, strategic projects supported by university leadership focus on transitioning to clean and renewable energy sources, thereby reducing reliance on fossil fuels and fostering sustainable energy generation across the campus.