

**GENERIC ELECTIVE**

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
<b>GREEN ENERGY SOLUTIONS</b>	<b>4</b>	<b>2</b>	<b>0</b>	<b>2</b>	<b>12<sup>th</sup> Class: Physics, Chemistry, Mathematics</b>	<b>-</b>

**Course Objectives:**

- Introduce core concepts in renewable and non-renewable energy
- Explain the science behind clean energy technologies
- Provide insight into India's current green energy initiatives
- Familiarize students with practical tools, energy efficiency, and storage systems
- Create awareness about policy, innovation, and future career opportunities in energy

**Learning Outcomes:**

Students will be able to:

- Identify major renewable energy systems and their underlying science
- Estimate solar potential using simulation tools
- Understand India's energy policies, electric mobility plans, and startup innovations
- Apply basic energy audit and comparative assessment techniques
- Participate in group-based exploration and communication of green energy ideas

**THEORY:**

**Unit 1: Energy and the Environment**

**(6 Hours)**

- Forms of energy; renewable vs non-renewable
- Fossil fuels: sources, use, and environmental impact
- India's energy consumption profile
- Environmental consequences: air pollution, greenhouse gases, climate change
- Traditional Indian energy practices and their sustainability insights

**Unit 2: Solar and Hydrogen Energy**

**(8 Hours)**

- Basics of solar energy: photovoltaic effect, solar thermal systems
- Types of solar panels: monocrystalline, polycrystalline (basic comparison)
- Components and layout of a small solar system, perovskite solar cells
- Hydrogen as a fuel: green hydrogen electrolysis, properties, use cases, safety
- Fuel cells: basic working principle and relevance in transportation
- India's solar programs and National Green Hydrogen Mission

**Unit 3: Biofuels, Batteries, and Energy Storage**

**(8 Hours)**

- Types of biofuels: ethanol, biodiesel, biogas – preparation, chemistry, benefits
- Battery technologies: lead-acid, lithium-ion – structure, function, and applications
- Importance of grid-level storage and stability
- Energy storage methods: pumped hydro, BESS, and battery-integrated solar setups
- Electric Vehicles as mobile storage; Battery swapping and EV charging ecosystem

- India's FAME scheme and emerging EV landscape

**Unit 4: Energy Efficiency, Policy, and Innovation (8 Hours)**

- Energy-efficient appliances, conservation practices, behavioral changes
- Carbon footprint: meaning, impact, and mitigation
- Life Cycle Analysis (LCA): basic concept and real-life examples
- Key Indian government programs: UJALA, PM-KUSUM, FAME, Green Hydrogen Mission
- Carbon markets and energy pricing (simplified overview)
- Indian startups and innovations in green energy: ReNew, Ather, Log9, Ola Electric

**PRACTICALS**

Any 8 Activities + 1 Group Project optional

1. Compare visible smoke and residue from different fuel types (wood, kerosene, LPG – demo)
2. Create and test a fruit or salt-water battery
3. Prepare simple biodiesel from vegetable oil (under supervision)
3. Estimate rooftop solar output using MNRE Solar Calculator or RETScreen (guided worksheet)
4. Conduct a home/college room energy audit (appliances, lighting, fan usage)
5. Compare energy-efficient vs conventional appliances (e.g., LED vs CFL)
6. Poster/model or infographic on one major Indian energy initiative or clean-tech startup
7. Survey-based project: public awareness of solar/EVs in your locality
8. Group project + viva presentation on a selected green energy theme

**Suggested Readings**

- *Energy Resources and Utilization* – K. S. Ramaswamy (Narosa Publishing)
- *Environmental Chemistry and Pollution Control* – S. S. Dara (S. Chand)
- *Renewable Energy and Environment* – Mukesh Khare & R. K. Anand (Narendra Publishing)
- Selected articles from *Down to Earth* – Centre for Science and Environment (CSE)
- Government PDFs and online documents from MNRE, FAME India, and UJALA portals

**Note:** Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.