

THE GREEN TECH REVOLUTION: BRIDGING INNOVATION WITH SUSTAINABILITY

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Abstract- This paper discusses the impact of the Green Tech Revolution on combating the climate changes which is a full-spectrum disruptor not only affecting various aspect of human life, health, society, environment but also other economic business industries like banking, agriculture etc. In order to understand the aspect Green Tech Revolution, we need to understand the terms like renewable energy and clean technology solution. Renewable energy is energy that is generated from natural processes that are continuously replenished. This includes sunlight, geothermal heat, wind, tides, water, and various forms of biomass. This energy cannot be exhausted and is constantly renewed. It promotes eco-friendly practices, combining technological innovation, improved operations, and changing customer behavior to achieve environmental sustainability. Green technology or Clean

technology solution refers to products, services and processes that utilise renewable materials and energy sources. The significance of clean technology lies in its potential to decarbonise the energy system. By deploying solutions for the storage and applications of renewable energy, clean technology can help mitigate climate risks and advance sustainable development. Clean technology is crucial for India for energy security and maintaining high economic growth rates while ensuring ecological sustainability. It promises new industries and jobs creating green GDP, and energising programs like Make in India through renewed manufacturing.

The Green technology or Clean technology promotes eco-friendly practices, combining technological innovation, improved operations, and changing

customer behaviour to achieve environmental sustainability.

Through this paper, the researcher wants to highlight and discuss on how we not only move towards modernism without affecting our climate but also work towards those Innovation with Sustainability.

Keywords: Green technology Revolution, Renewable energy, Clean technology solution, Sustainability, Innovation, Sustainability.

I. INTRODUCTION

As the global consciousness and awareness has shifted towards sustainability, the 21st century has witnessed revolutionary developments in green technology. With the climate change, environmental degradation, resource depletion, green technologies are stepping into the spotlight to drive sustainable growth . From renewable energy and electric vehicles to smart agriculture and eco-friendly construction, the Green Technology, also called clean or sustainable tech, focuses on creating solutions that reduce environmental impact, conserve natural resources, and foster a healthier planet. From renewable energy to waste management innovations, green tech is transforming social behaviours of

consumers, ie., how we live, work and consume.

The rise of Green tech is not just about machines or gadgets- its about global shift towards sustainability. By integrating innovative solutions into our industries, cities and homes, we can combat pollution, slow climate change, and create a more resilient planet.

According to Global Climate Record, the last decade (2015-2024) has been the warmest on records, with the average global temperature rising to about 1.29—1.55 °C above pre industrial levels. With the rising concern like climate change, environmental degradation and the overconsumption of natural resources are no longer distant threats- they are pressing the challenges that impact daily life across the globe. Therefore the rising temperatures, melting glaciers, extreme weather events and declining biodiversity are clear reminders that humanity must adopt sustainable solutions to survive and thrive. Amid these challenges, green technology, often referred to as “green tech”, has emerged as a beacon of hope, providing innovative ways to reduce environmental impact while promoting sustainable development.

The Green Tech Revolution aligns with the growing emphasis on renewable energy to

reduce environmental impact and promote clean, sustainable development globally. It is a broad movement focused on developing and adopting eco-friendly technologies across sectors. Renewable energy is a cornerstone of modern engineering, representing a shift towards sustainable and environmentally friendly power generation.

Thus we can move towards modernism without affecting our climate and also work towards those Innovation with Sustainability

II. MEANING AND TYPES OF RENEWABLE ENERGY

Renewable energy is a cornerstone of modern engineering, representing a shift towards sustainable and environmentally friendly power generation. As the world grapples with the adverse effects of climate change and the depletion of fossil fuels, renewable energy sources such as solar, wind, hydro, and geothermal have become increasingly important.

Basic Principles and Concepts

Renewable energy refers to energy derived from natural processes that are replenished constantly. Unlike fossil fuels, which are finite and emit greenhouse gases, renewable energy sources are sustainable and have a minimal environmental impact.

The primary types of renewable energy include:

- **Solar Energy:** Energy harnessed from the sun using photovoltaic cells or solar thermal systems.
- **Wind Energy:** Energy generated by converting wind currents into electricity using wind turbines.
- **Hydropower:** Energy produced from the movement of water, typically through dams or hydroelectric plants.
- **Geothermal Energy:** Energy obtained from the Earth's internal heat, often used for electricity generation and direct heating applications.
- **Biomass Energy:** Energy derived from organic materials, such as plant and animal waste, which can be converted into biofuels.

Examples of Renewable Energy

1. **Solar Panels on Homes** Solar panels installed on residential rooftops capture sunlight and convert it into electricity. These panels use photovoltaic cells to harness solar energy, providing a sustainable and eco-friendly power source for households. Solar power can reduce electricity bills and decrease reliance on fossil fuels.

2. Wind Farms Wind farms consist of multiple wind turbines located in areas with strong, consistent winds. These turbines convert wind energy into electricity. Wind farms can be found on land or offshore and provide a significant amount of renewable energy to the power grid, reducing greenhouse gas emissions.

3. Hydroelectric Dams Hydroelectric dams generate electricity by using the flow of water from rivers or reservoirs to spin turbines. This kinetic energy is then converted into electrical power. Hydropower is one of the oldest and most reliable forms of renewable energy, providing a stable and continuous power supply.

4. Biogas Plants Biogas plants produce energy from organic materials such as agricultural waste, manure, and food scraps. These materials are broken down through anaerobic digestion, producing methane gas that can be used for heating, electricity generation, or as a vehicle fuel. Biogas plants help reduce waste and provide a renewable energy source.

5. Geothermal Heating Systems Geothermal heating systems tap into the Earth's internal heat to provide heating and cooling for buildings. These systems use geothermal heat pumps to transfer heat

from the ground into buildings during winter and extract heat from buildings back into the ground during summer. Geothermal energy is a sustainable and efficient way to regulate indoor temperatures.

6. Tidal Barrages Tidal barrages harness the energy from tidal movements to generate electricity. These structures are built across estuaries and use the rise and fall of tides to drive turbines. Tidal energy is highly predictable and can provide a steady, reliable source of renewable energy.

7. Wave Energy Converters Wave energy converters capture the energy from ocean waves and convert it into electricity. These devices are typically placed on the surface of the sea and move with the waves, generating power through their motion. Wave energy is a promising renewable resource with the potential to contribute significantly to the global energy supply.

III. BENEFITS OF RENEWABLE ENERGY

As the global energy sector evolves, renewable energy has become a central pillar of long-term strategy for governments, investors, and industries. Once considered expensive and niche, renewable sources like solar, wind, and

hydroelectric power are now recognized as essential for economic stability, climate action, and energy security. This listicle outlines five of the most significant benefits of renewable energy today, using the latest data and expert insights .

a. Environmental Benefits:

Renewable energy supports environmental sustainability by reducing greenhouse gas emissions and dependence on fossil fuels :

- Reduction in Greenhouse Gas Emissions : One of the primary environmental benefits of renewable energy is the substantial reduction in greenhouse gas emissions. Unlike fossil fuels, renewable sources such as solar, wind, and hydroelectric power generate electricity with little to no emissions of harmful gases. This transition to cleaner energy helps to combat climate change and promotes a healthier atmosphere.

- Mitigation of Air Pollution: Renewable energy also contributes to significant reductions in air pollution. Traditional energy generation methods emit pollutants that can lead to respiratory problems and other health issues. By shifting to renewable energy sources, the levels of harmful particulates, sulphur dioxide, and nitrogen oxides can be significantly decreased.

- Conservation of Water Resources: Water conservation is another important environmental benefit of renewable energy. Conventional power generation, especially fossil fuels and nuclear energies, requires significant quantities of water for cooling and processing. In contrast, many renewable energy technologies, particularly solar and wind, require minimal water usage. This conservation helps to preserve vital freshwater resources and reduces the strain on ecosystems.

- These environmental benefits highlight the importance of transitioning to renewable energy sources. By reducing greenhouse gas emissions, mitigating air pollution, and conserving water resources, the shift towards clean energy supports a healthier planet for future generations.

- Advantages for Ecosystems: Renewable energy sources offer significant advantages for ecosystems. By minimizing environmental impacts, they help maintain the delicate balance of our natural world. Two key areas of focus are the preservation of biodiversity and the reduced impact on land and habitats.

- Preservation of Biodiversity: The shift towards renewable energy plays a critical role in preserving biodiversity. Traditional energy sources, particularly fossil fuels, often lead to habitat

destruction, pollution, and climate change, all of which threaten various species. In contrast, renewable energy systems such as wind, solar and hydroelectric power, generally have a much lower ecological footprint.

- Reduced Impact on Land and Habitats: The deployment of renewable energy technologies often results in a reduced impact on land and habitats compared to conventional energy production. Renewable installations can be designed to coexist with existing ecosystems. For example, solar panels can be installed on buildings or in agricultural areas, reducing the need for large tracts of land to be cleared.

b. Climate Benefits: Significant reduction in carbon emissions can be observed while promoting cleaner air and water, conserves natural resources, and helps combat climate change. The single most important environmental benefit of renewable energy is the reduction of greenhouse gas emissions. Fossil fuels are the largest source of global carbon dioxide emissions, contributing around 75 percent of total emissions. Renewable energy sources, by contrast, emit little or no carbon during operation.

Shifting electricity generation from coal and gas to renewables is one of the fastest

ways to reduce emissions at scale. Replacing fossil fuels with renewables also reduces other forms of pollution. Solar, wind, and hydroelectric plants do not emit sulphur dioxide, nitrogen oxides, or particulate matter, all of which contribute to smog and acid rain. Renewables are also key to meeting international climate targets, including those set under the Paris Agreement. Without a rapid transition to clean power, global warming cannot be kept below 1.5°C. The climate impact of renewables is not theoretical, it is measurable, immediate, and scalable.

c. Health and Social Impact: Cleaner air and water lead to fewer respiratory and cardiovascular issues. Burning fossil fuels releases a wide range of pollutants that harm human health. These include fine particulate matter (PM2.5), nitrogen oxides, and sulphur dioxide, all of which are linked to respiratory and cardiovascular disease. According to the World Health Organization, air pollution causes over seven million premature deaths each year.

Renewable energy, by contrast, produces clean electricity without releasing harmful emissions. Wind, solar, and hydropower generate no air pollution at the point of use. This results in cleaner cities, better respiratory health, and fewer hospital visits.

Water quality also improves with the adoption of renewables. Fossil fuel power stations often discharge heated water and chemical byproducts into rivers and lakes. Hydroelectric, wind, and solar facilities avoid these impacts and use significantly less water .

Beyond direct health benefits, the reduced environmental damage from renewables also supports better food systems, safer water supplies, and healthier ecosystems. Cleaner energy is a public health investment that reduces both human suffering and long-term healthcare costs.

d. Economic Benefits: These energy sources also drive economic growth through green job creation and energy security while fostering resilience in communities. Renewable energy is now the most cost-effective form of electricity generation in many markets. According to the International Renewable Energy Agency (IRENA), over 90 percent of new renewable power capacity added globally in 2024 was cheaper than electricity from fossil fuels. Thus resulting Lower energy costs and long-term savings. The renewable energy sector is now a major source of employment, supporting millions of jobs worldwide. In 2024, the industry accounted for more than 13 million jobs.

e. Reliability and Accessibility: Renewable energy are naturally replenished and widely available. It can bring electricity to remote and underserved communities. Renewable energy can empower communities and reduce energy poverty supporting equitable development.

Renewable energy enhances national energy security by reducing reliance on imported fossil fuels. Countries that invest in domestic wind, solar, and hydro resources are less exposed to fuel supply shocks, price spikes, and geopolitical instability. Decentralised renewables, such as rooftop solar and community-owned wind projects, also strengthen resilience. These systems provide backup during emergencies and reduce pressure on central grids. In regions vulnerable to storms or supply interruptions, local renewable systems have proven to be more reliable than traditional power plants .

Energy independence is not just a national security issue. It also supports economic stability by shielding countries from fluctuating fuel prices and supply chain bottlenecks. By developing homegrown energy resources, governments can chart a more predictable and autonomous energy future.

IV. MEANING OF GREEN TECH REVOLUTION

Green Technology refers to the development and implementation of sustainable solutions that reduce environmental harm. This includes innovations in energy efficiency, renewable energy, waste management, and eco-friendly production processes.

The Green Tech Revolution is about using innovation in energy efficiency, electric vehicles, sustainable manufacturing, and smart grids to solve environmental and climate challenges.

The Green Tech Revolution is a transformative global movement that integrates technological innovation with environmental sustainability. It's not just about using cleaner energy—it's about rethinking how we build, power, and live in our world.

Green Tech Revolution is humanity's response to urgent environmental challenges, blending cutting-edge science with a renewed focus on planetary health.

It encompasses a wide range of technologies and practices designed to:

- Minimize pollution
- Conserve natural resources
- Reduce carbon emissions

- Promote renewable energy and circular economies

The key characteristics of Green Technology :

- a. Environmental Sustainability: Focuses on reducing carbon emissions and conserving natural resources.
- b. Renewable Energy Integration: Uses solar, wind, hydro, and geothermal energy sources to replace fossil fuels.
- c. Energy Efficiency: Optimizes processes to consume less energy while maintaining performance.
- d. Circular Economy Practices: Emphasizes recycling, reusing, and reducing waste throughout the production cycle.

V. OBJECTIVES OF GREEN TECH REVOLUTION

India's Green Tech Revolution aims to transform its energy landscape by 2025 through ambitious renewable targets, rural electrification, and urban solar adoption—while advancing broader sustainability goals like carbon reduction, ecosystem protection, and community empowerment.

1. Ambitious National Goals

India's 2025 target is to achieve 200 GW of renewable energy capacity, including:

130 GW from solar power

40 GW from wind

30 GW from biomass and hydro sources

2. Electrifying Remote Communities

The plan prioritizes rural electrification using decentralized solar solutions such as mini-grids and stand-alone solar panel systems. This supports inclusive development, improves education and healthcare access, and reduces reliance on diesel generators

3. Boosting Urban Rooftop Solar

Urban India will see increased adoption of rooftop solar technology supported by easier net-metering processes and government subsidies .

VI. IMPACT OF GREEN TECH ON ENVIRONMENT ETC

Impact on Environmental:

Green technology is transforming environmental sustainability by cutting carbon emissions, improving air and water quality, and protecting ecosystems

Green tech revolution have also resulted in reduction in carbon emissions . India's renewable energy shift in 2024 led to the elimination of around 180 million tons of CO2 emissions. The 2025 vision targets a reduction of over 250 million tons . Cities such as Delhi and Bengaluru recorded noticeable air quality improvements thanks

to broader reliance on solar energy and clean fuels .

Economic Impact:

The green tech revolution is reshaping global economies by creating new industries, jobs, and investment opportunities while reducing long-term environmental costs. It's a catalyst for sustainable economic growth

Renewable energy sectors (solar, wind, bioenergy) are among the fastest-growing job markets globally. Green construction, electric vehicles, and sustainable agriculture are spawning new roles in engineering, design, and maintenance. According to the International Renewable Energy Agency (IRENA), renewable energy employed over 13.7 million people worldwide in 2022, with projections to reach 38 million by 2030 .

Social and Global Impact

The green tech revolution is reshaping societies and global dynamics by promoting equity, resilience, and cooperation while addressing climate challenges. It empowers communities, fosters inclusive development, and strengthens international collaboration . It has also resulted into improved public health.

Green tech enables countries to meet climate targets through renewable energy, carbon capture, and sustainable infrastructure. Global partnerships in clean energy R&D, carbon trading, and green finance are fostering shared innovation and policy alignment. Developing nations are leveraging green tech to reduce reliance on fossil fuels and build new industries, enhancing global competitiveness. Technologies like early warning systems and climate modeling help vulnerable regions prepare for and recover from environmental disasters. Thus green tech revolution empowers through sustainability.

Impact on Agriculture:

Green technology is revolutionizing agriculture by boosting crop yields, enhancing food security, and introducing modern farming techniques that are more sustainable and efficient.

High-yield crop varieties developed through biotechnology and genetic engineering produce more food per acre. Precision agriculture uses GPS, drones, and sensors to optimize planting, irrigation, and fertilization, reducing waste and increasing productivity. Climate-resilient farming techniques help maintain yields despite changing weather patterns

Smart irrigation systems and drought-resistant crops ensure consistent food production even in water-scarce regions. Vertical farming and hydroponics allow food to be grown in urban areas, reducing dependency on rural supply chains. Blockchain and AI improve supply chain transparency, reducing food loss and ensuring timely delivery.

Automation and robotics streamline harvesting, planting, and monitoring, reducing labor costs and human error. Soil health monitoring through sensors and AI helps farmers apply nutrients precisely, preserving long-term fertility. Data-driven decision-making enables farmers to predict yields, manage pests, and plan crop rotations more effectively.

VII. ACHIEVEMENTS OF GREEN TECH REVOLUTION

The Green Tech Revolution has ushered in transformative achievements across energy, innovation, and sustainability—especially in India, where bold policies and technologies are reshaping the future. India is undergoing a profound transformation in the field of renewable energy/ Clean Energy, marking a global move toward sustainability. With rising environmental concerns and a growing energy demand, India has positioned itself as a pioneer in renewable technologies,

especially solar power. In 2024, the nation recorded exceptional achievements, driven by strategic efforts from the Ministry of New & Renewable Energy (MNRE).

Here's a detailed look at the most impactful achievements, backed by recent articles:

Key Achievements of the Green Tech Revolution

b. Massive Growth in Renewable Energy Capacity

- India recorded rapid expansion in solar and wind power in 2024, driven by strategic initiatives from the Ministry of New & Renewable Energy (MNRE).
- Solar panel efficiency and deployment surged, making India a global leader in clean energy adoption.

c. Breakthrough in Electricity-Free Cooling

- A revolutionary cooling technology using reflective coatings—requiring no electricity—was developed to combat extreme heat and reduce grid pressure.
- This innovation offers thermal comfort without power, potentially saving billions in energy costs and preventing blackouts.

d. Green Tech Market Explosion

- India's green technology and sustainability market hit \$837.2 million in 2024, with projections to reach \$8.6 billion by 2033.

- This represents a 27.4% annual growth rate, the fastest eco-sector expansion in the country's history.

e. Government-Led Bold Moves

- In 2023, India invested \$68 billion in energy infrastructure, with a strong focus on renewables and green innovation.
- The government's aggressive push includes subsidies, R&D support, and international partnerships.

f. Innovation and Patent Leadership

- Organizations like CSIR and DRDO led the charge with hundreds of patents in green technologies.
- Despite gaps in innovation, India's research ecosystem is evolving rapidly to meet global sustainability goals.

g. Global Momentum and Future Breakthroughs

- China and other nations are accelerating green tech development, with expectations of major breakthroughs in the next five years across digital economy, sustainability, and strategic technologies.

VIII. ROLE OF INNOVATION IN SUSTAINABLE DEVELOPMENT

Innovation drives continuous improvement in energy systems, enabling reduced costs, enhanced performance, and broader adoption of sustainability solutions. It fosters resilience, supports circular economies, and aligns industry growth with environmental stewardship.

a. Technological Advancement

- These are the clean energy technologies like solar, wind, and hydrogen reduce carbon emissions and dependence on fossil fuels.
- Smart infrastructure (e.g., IoT-enabled buildings, smart grids) enhances resource efficiency and minimizes waste.
- Green manufacturing uses automation and AI to optimize production while reducing environmental impact .

b. Sustainable Product Design

- Eco-design principles prioritize recyclability, energy efficiency, and minimal resource use throughout a product's lifecycle.
- Circular economy models encourage reuse, remanufacturing, and upcycling to extend product life and reduce waste.
- Biodegradable materials and low-impact packaging reduce pollution and landfill burden.

c. Data-Driven Decision Making

- Big data and analytics help monitor environmental indicators, predict climate risks, and optimize resource allocation.
- AI and machine learning support precision agriculture, smart transportation, and energy forecasting.
- Open data platforms foster transparency and collaboration among governments, businesses, and citizens.

d. Social and Economic Inclusion

- Inclusive innovation ensures marginalized communities benefit from sustainable technologies and services.
- Digital access and education empower underserved populations to participate in the green economy.
- Microfinance and social enterprises promote local entrepreneurship and equitable development .

e. Policy and Governance Innovation

- Adaptive regulations encourage experimentation with green technologies and sustainable business models.
- Public-private partnerships accelerate innovation through shared investment and risk.

- Participatory governance engages citizens in co-creating solutions and holding institutions accountable.

IX. INTERNATIONAL AGREEMENTS AND PROTOCOLS

Several Global agreements endeavour for reducing emissions and encouraging renewable energy adoption.

These protocols unify countries under shared climate goals, promoting cooperation and accountability in transitioning to cleaner energy sources worldwide.

Global Agreements Driving the Green Tech Revolution:

a. Paris Agreement (2015)

The goal of Paris Agreement is to limit global warming to well below 2°C, ideally 1.5°C. Over 190 countries committed to Nationally Determined Contributions (NDCs), spurring investments in renewables, energy efficiency, and carbon markets . Thus resulting into:

- o Accelerated global shift to solar and wind energy.
- o Boosted climate finance and green innovation.
- o Inspired net-zero targets from major economies like the EU, US, China, and India.

b. United Nations Sustainable Development Goals (SDGs)

The SDG 7 (Affordable and Clean Energy), SDG 13 (Climate Action). Integrated sustainability into national policies and corporate strategies.

This resulted into:

- o Expanded access to electricity in developing nations.
- o Promoted clean cooking technologies and off-grid solar solutions.

c. International Renewable Energy Agency (IRENA) Frameworks

The role of this framework is to provides data, policy advice, and technical support to accelerate renewable energy adoption.

This resulted into :

- o Helped countries design renewable energy roadmaps.
- o Facilitated knowledge-sharing and capacity-building across 160+ member states.

d. Clean Energy Ministerial (CEM)

The purpose of global forum to promote policies and share best practices for clean energy.

- This resulted into :

- o Launched initiatives like EV30@30 (30% electric vehicle sales by 2030).
- o Supported smart grids, energy storage, and industrial decarbonization.

e. Mission Innovation

It was Launched by 20 countries and the EU in 2015. The goal is to Double clean energy R&D investments.

This resulted into:

- o Catalyzed public-private partnerships for breakthrough technologies.
- o Supported innovations in hydrogen, carbon capture, and next-gen solar.

f. EU Renewable Energy Directive

It was mandatory to set binding renewable energy targets for EU member states.

This resulted into:

- o Helped the EU reach over 22% renewable energy share by 2020.
- o Strengthened the market for bioenergy, offshore wind, and solar PV.

X. NATIONAL RENEWABLE ENERGY POLICIES

Many countries implement tailored policies to support renewable energy development, including mandates,

subsidies, and grid integration plans. These frameworks aim to boost investments, increase renewable capacity, and align energy sectors with sustainability objectives.

India's national renewable energy policies form a comprehensive framework to achieve energy security, sustainability, and economic growth. These initiatives aim to reach 500 GW of non-fossil fuel capacity by 2030 and position India as a global leader in clean energy.

Following are the detailed overview of each major policy:

1. National Green Hydrogen Mission

The goal of National Green Hydrogen Mission is to make India a global hub for green hydrogen production, usage, and export. It targets to produce 5 million metric tonnes of green hydrogen annually by 2030. The mission supported by allocating an amount of Rs.19,744 crore for electrolyzer manufacturing and pilot projects. The impact can be seen in reduction of dependence on fossil fuels and supports decarbonization of hard-to-abate sectors like steel and shipping .

2. PM Surya Ghar Muft Bijli Yojana

The objective of the PM Surya Ghar Muft Bijli Yojana is to provide free electricity (up to 300 units/month) to 10 million

households via rooftop solar. The budget of the Yojana was ₹75,000 crore. The capital subsidies, net metering, and income from surplus power fed to the grid. It empowered the citizens, reduces grid load, and promotes energy self-reliance and a powerful impact.

3. Production-Linked Incentive (PLI) Schemes

The PLI Scheme targets the Domestic manufacturing of solar PV modules and advanced batteries. The manufacturers receive direct financial rewards based on production output and efficiency. The impact was that it reduced import dependency and boosts green tech manufacturing

4. PM-KUSUM Scheme

The focus of the scheme is solarization of agriculture.

The scheme has following components:

- Installation of solar pumps
- Grid-connected solar power plants on barren land
- Solarization of existing grid-connected pumps

The scheme aims to reduce diesel use and provide reliable daytime power to farmers.

The scheme supports up to 60% subsidy on solar pump installations

XI. INCENTIVES AND REGULATIONS SUPPORTING ADOPTION

India's green energy transition is powered by a robust mix of financial incentives and regulatory frameworks that make renewable technologies more accessible and economically viable for individuals and businesses. Financial incentives such as tax credits, grants, and feed-in tariffs encourage businesses and consumers to adopt renewable technologies. Regulatory measures ensure standards and facilitate market growth, balancing innovation with environmental protection.

Here are the few Financial Incentives mentioned below:

a) PM Surya Ghar Muft Bijli Yojana :

The Objective of PM Surya Ghar Muft Bijli Yojana is to promote rooftop solar adoption among residential consumers. The Benefits of this yojana is that the Households receive capital subsidies and monthly savings on electricity bills. Surplus power can be sold back to the grid, generating income. Many of the citizens have installed 3kW solar systems, significantly reducing their bills and becoming energy self-reliant

b) Production-Linked Incentive (PLI) Schemes

The PLI Scheme targets the Domestic manufacturing of high-efficiency solar PV modules and other green tech components. The manufacturers receive direct financial rewards based on production output and efficiency. The goal was to reduce import dependency and boost India's green manufacturing base .

c) Accelerated Depreciation

The businesses investing in renewable energy assets can claim higher depreciation rates (up to 40%) in the first year. It reduces taxable income, making green investments more financially attractive.

d) Viability Gap Funding (VGF)

The Purpose of VGF was to Bridge the gap between project cost and expected returns for large-scale renewable projects. The Government provides capital grants to make projects bankable, especially in solar parks and offshore wind.

e) Capital Subsidies

It offered for solar pumps, microgrids, and rooftop systems. It direct upfront financial assistance to reduce installation costs, especially in rural and agricultural sectors.

f) Renewable Energy Certificates (RECs)

Tradable certificates representing 1 MWh of renewable electricity. It enables obligated entities (like DISCOMs) to meet Renewable Purchase Obligations (RPOs) by buying RECs. The developers earn additional revenue by selling RECs in power exchanges.

XII. CONCLUSIONS

The Green Revolution's legacy along with renewable energy establishes a strong foundation for sustainable progress. Strong legal frameworks and green technology innovations are key drivers for achieving global sustainability goals. Support and continuous collaboration with governments, industries, and civil societies and investment will ensure lasting environmental benefits and economic growth in a balanced, sustainable future.

The tapestry of our future is being woven with threads of green technology and renewable energy. As we've journeyed through this exploration, it's evident that this isn't just about harnessing the sun or the wind; it's about reshaping the very paradigms of how we live, work, and educate in the society. From the heart of our homes to the sprawling policies of nations, green technology's influence is pervasive and profound. Therefore it's a

tale of transformative solutions that drive both environmental and economic value, reshaping the tapestry of our global narrative.

While challenges exist, the combined might of innovation, education, and policy directives are not only addressing these obstacles but are turning them into stepping stones toward a brighter, sustainable future. It's a collaborative endeavour, involving governments, industries, academic institutions, and crucially, individuals like you and me.

As we stand at this pivotal juncture in human history, it's heartening to witness the myriad ways in which we're recalibrating our trajectory. With each solar panel installed, every student educated on sustainability, and every policy crafted with the environment in mind, we're crafting a legacy of responsibility, innovation, and hope. The age of green technology isn't just upon us; it's here to shape, guide, and illuminate our path forward.

REFERENCES

- [1] The Evolution and Impact of Green Technology in the 21st Century - The Renewables
- [2] With PM Surya Ghar: Muft Bijli Yojana, resident of Chhattisgarh's Kondagaon gets relief from monthly electricity bill
- [3] PM Surya Ghar: Muft Bijli Yojana Benefits Resident in Chhattisgarh's Kondagaon, ETEnergyworld
- [4] India's renewable energy milestone: A step towards sustainability
- [5] India's Renewable Energy Revolution
- [6] Sustainable Development Through Technological Innovations and Data Analytics | Information Systems Frontiers
- [7] THE ROLE OF INNOVATION IN SUSTAINABLE DEVELOPMENT – NGM COLLEGE LIBRARY
- [8] Green technologies: Coherent policy action needed for developing countries to reap the benefits | UN Trade and Development (UNCTAD)
- [9] How Green Technology is Driving Social Impact - FasterCapital
- [10] IJCRT25A5568.pdf
- [11] Green Revolution in India, History, Impact, Advantages
- [12] ch8.pdf
- [13] The Impact of the Green Revolution on Modern Agriculture and Food Security
- [14] Paper12122.pdf
- [15] The impact of clean technology adoption on carbon emissions: A global perspective | Clean Technologies and Environmental Policy

- [16] Green Technology and Innovation: Carbon Emission Reduction
- [17] India's Innovation Journey: Unveiling Green Technology Trends and Gaps, ETGovernment
- [18] greenmatch.co.uk/blog/2020/03/the-economic-benefits-of-green-technology
- [19] The Evolution and Impact of Green Technology in the 21st Century - The Renewables
- [20] IJCRT25A5568.pdf
- [21] doc2025122487901.pdf
- [22] India's Renewable Energy Revolution: Key Achievements
- [23] What is Renewable Energy?
- [24] Clean Technology, Meaning, Importance, Adoption, Limitations
- [25] Introduction to Renewable Energy
- [26] Introduction to Renewable Energy | Understand Energy Learning Hub
- [27] Renewable Energy - 15+ Examples, Types, Importance