Green Technology: Innovation Status and Challenges in India

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ABSTRACT: *Green Technology Innovation is a manner of innovation where environment friendly innovations are introduced and developed, so that any type of destruction towards environment can be restricted as well as natural resources can be conserved. Green Technology is usually referred to clean technology or environment technology. The goal of green technology innovation is to reach the desires, needs and comforts of the society in way wherein depletion of natural resources can be restricted and thereby socials needs are met in an environment friendly manner. It comprises an idea of innovation where the main focus while developing any product is on in-future repetitive reusability of the product. Another goal of green technology provide a way to recover the damage that occurred due to climate change. In this paper, our main focus is presenting the situation of green technology innovation in developing nations and use a lens towards India in order to describe the situation of green innovation in other developing countries. Furthermore this paper highlights green innovation, its need as well as challenges faced by the innovation within developing countries. The summary described within the paper can be used in future in order to understand the challenges faced by the green innovation and proper policies can be introduced using the same.*

KEYWORDS: *Development, Environment Green Technology, Innovation, Technology.*

INTRODUCTION

Green technology is the creation and application of products, systems, and frameworks that aim to protect the natural environment and its properties by mitigating and reducing the negative consequences of human activities. The term "green technology" refers to devices, services, or processes that follow those criteria. i.e., it emits no or very few greenhouse gases (GHGs), is safe to use, and encourages a healthy and better climate for all forms of life; It has negligible or minimal greenhouse gas (GHG) emissions, is safe for using, and encourages a healthy and better climate for all habits; It reduces electricity and natural resource consumption; and It encourages the use of natural energy. Green technology is technology that is built and used in a manner that preserves the atmosphere and conserves natural resources. The value of green technology, which is part of the clean energy division of the sustainable technology revolution, cannot be overstated. We've reached a point where we need to take a step back and consider that green technology is becoming increasingly important to mankind. With so many arguments for the value of green technologies, volumes may be written and spoken on the topic. If it's the increasing value of green technologies in business or at home, one thing is certain, things must be achieved quickly[1]. It does not take a rocket scientist to realize that humanity must take action to protect the atmosphere and save energy supplies. Going green can just help us get out of our current dilemma. Before things get out of hand, we must recognize the role of green technologies in resolving this problem.

1. *Four Pillars of Green Technology Policy*

1.1.*Environmental Pillar:*

Both human actions have an effect on the environment, according to the Environmental Pillar. The scope and size of operations in the other pillar areas of this program, such as fiscal, cultural, and social, would be determined and influenced by the relative health of the environment. Climate change, nonrenewable resource degradation, diminishing natural habitats, decreasing biodiversity, ocean acidification, and increasing human demographic stresses are some of the main global environmental challenges we discussed previously in this document. Obviously, there is a financial, social, and religious aspect to both of these subjects[2].

1.2.Social Pillar:

The Social Development Pillar will help social care agencies and residents raise knowledge of global concerns and involve people and neighbors in coordinating and contributing to these requirements. The collective quality of life of the population will rise as a result. We'd cooperate to build social infrastructure in the region, encouraging individuals and organizations to work with us on initiatives that are mutually beneficial. We highlight the significance of individual and community well-being and security, which requires total access to proper health care, housing, food, and educational amenities of that are essential for full participation in social, ecological, and financial environment.

1.3.Economic Pillar:

Its primary goal is to bring new industries and people to India. This is important for the city's long-term growth and viability, as well as for the development of a healthy and diverse local community. The hiring of talented people in India's public, corporate, and non-profit sectors is critical to achieving this goal. Businesses today, as well as the jobs they make, are critical components of a healthy, long-term economy. We will achieve and be the difference that makes a difference if we work together.

1.4.Energy Harvesting:

Energy harvesting is an important cornerstone of green technology, as it tries out modern and creative ways to derive usable energy from potentially worthless waste by-products, as well as developing new solutions to optimize energy harnessing. By reducing the amount of electricity consumed, energy consumption has proved to be a cost-effective strategy for developing economies. Figure 1, represents some un-resistible objectives of the green technology:
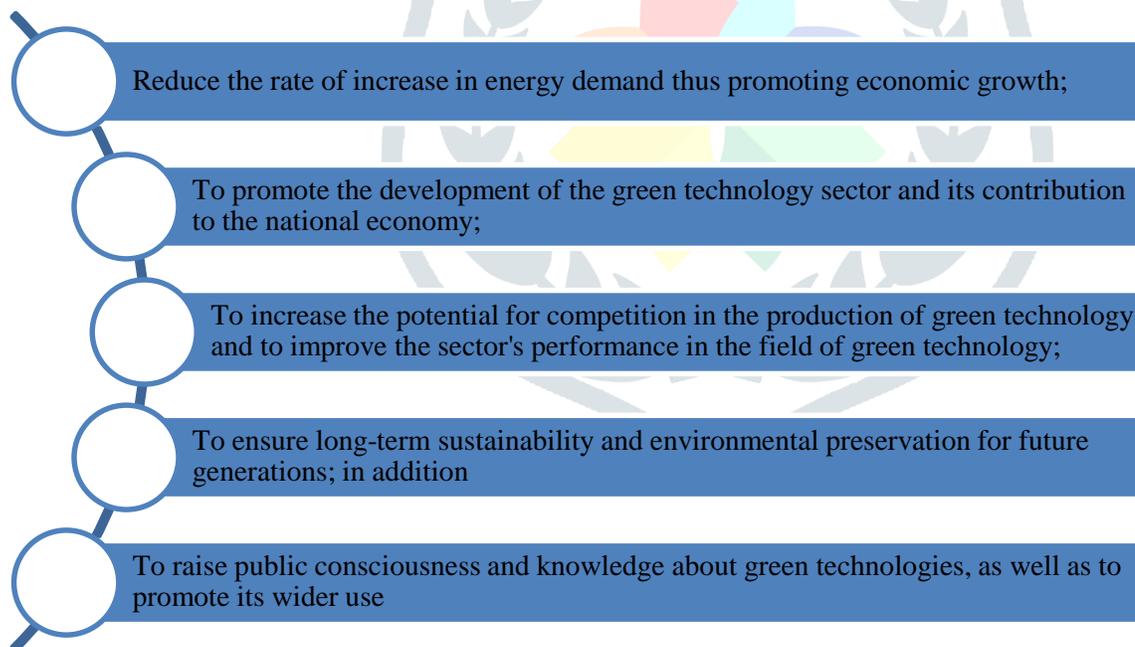
- Reduce the rate of increase in energy demand thus promoting economic growth;
- To promote the development of the green technology sector and its contribution to the national economy;
- To increase the potential for competition in the production of green technology and to improve the sector's performance in the field of green technology;
- To ensure long-term sustainability and environmental preservation for future generations; in addition
- To raise public consciousness and knowledge about green technologies, as well as to promote its wider use

Figure 1: Objectives of Green Technology Innovation Sustainable way of Development.

2. *Goals of Green Technology:*

Green technology has a diverse set of goals. The primary aim of green technologies is to meet societal needs without damaging or depleting the planet's natural capital. The aim is to satisfy current demands without compromising on quality. You've arrived at the right place if you want to learn everything there is to know about green technology's ambitions. The focus is now on creating materials that can be fully recycled or re-used. As one of the major priorities of green technology, efforts are being taken to minimize waste and emissions by shifting manufacturing and usage habits. Alternative technologies must be developed in order to avoid more

harm to human health and the environment. Accelerating their adoption would be beneficial to our climate and will help to truly preserve the world. Investigate the aims of green technologies, including the introduction of sustainable living, the development of clean energies, and the reduction of waste[3].

3. *Major Sector:*

3.1. *Energy Sector:*

Green Technology in electricity generation and energy resource management, including co-generation (co-generation) in the manufacturing and commercial sectors, and Green Technology in all sectors of energy use and energy demand control systems.

3.2. *Building Sector:*

Green technology is being used in the design, administration, repair, and demolition of houses.

3.3. *Water and Waste Management Sector:*

Green technology use of water supply control and usage, wastewater disposal, and solid waste landfills.

3.4. *Transport Sector:*

Green technology integration into transportation infrastructure and automobiles, including bio-fuels and public transportation[4].

4. *Green Technology and Administration:*

The Indian Prime Minister declared on April 9 that the Ministry of Energy, Green Technology, & Water will be formed to replace the Energy Ministry, Water, and Communications. I assume that focusing on "green technology" is the best way to address environmental issues while still promoting economic development. It also aligns with the global agenda of governments currently prioritizing environmental challenges, including the phenomena of climate change. As global citizens, we all take responsibility for working together to make the planet a safer place to live.

The greatest advantage of using green technologies is that it improves people's quality of living by making the climate more sustainable. If pollution of the air, water, and noise continues, it would have an effect on people's quality of life. The negative effect on the climate is minimized as we use green technologies. Green technology has a lot of promise for propelling the nation forward. Industries that use or produce goods based on green technologies may help the local population find work. We should also look at exporting "green" goods that we've developed.

Green technologies and products have a sizable demand, especially in the clean energy or renewable energy sector. For instance, our country's solar photovoltaic industry has been described as a new source of economic development. According to our projections, the PV industry will contribute four percentage of the Gross Domestic Product (GDP) by 2020. Green technologies will be promoted by the government by supportive policies. To develop and commercialize green technology, the private sector, experts, and academics can collaborate[5].

5. *Initiatives by Government for Green Technology:*

After 2003, the government has launched numerous tax incentives for companies that produce electricity from renewable energy bases, or Renewable Energy, as well as companies that implement energy-saving practices, or Energy Conservation, which are eligible for tax exemption investments (Investment Tax Allowance). Machines, machinery, components, and spare parts manufactured specifically used in the production of energy from

Renewable Energy bases and operations, and Energy Conservation may be excluded from import tariff and sales tariff for a term of a year. The 2009 Budget increased these benefits, and an exception could be given for:

- Importers, like photovoltaic service providers licensed by the European Commission(EC), should be granted duty and sale charge exemptions for solar systems services used by 3rd parties;

- Purchases of solar heating device products from local suppliers are excluded from sale taxes;

- Importers, including permitted agents licensed by the EC, are excluded from import duties and sales taxes on Energy Conservative appliances such as power efficient motors (high performance motors) and insulation products (insulation material).

- The EC must approve the retail tax exclusion for manufactured products relating to energy preservation, like insulating fabrics, domestic freezers, light bulbs, ballasts, household fans, bulbs, and AC (air conditioning)[1].

6. *Program Held to Bring Awareness to the Community:*

Furthermore, the Ministry of Energy has created an annual National Month to promote renewable energy and facilitate public and private sector energy efficiency activities. Any of the activities carried out during the program Energy Month include holding conversations on energy conservation, releasing guidebooks Energy Quality at Home, and producing a series of articles in journals and the internet to promote power efficiency.

In the future, the Ministry will launch a Green Technology initiative that will include all key stakeholders, including the general public, the Ministry / Department of the Government, NGOs, and other credible organizations, with the aim of educating and increasing understanding and knowledge of all parties on the role of green technology in our lives. This is to ensure that the government's policies for supporting and improving local Green Technology are successful and well-received by all segments of society.

7. *Four Steps of Green Technology Sample:*

The Indian Prime Minister outlined four strategic measures for the National Green Technology Policy's success:

- According to the Prime Minister, the first phase is to strengthen institutional structures, particularly among officials, while the secondary is to foster an environment conducive to green energy growth.

- He stated that the third step would help in the development of human capital by creating opportunities for education and training.

- "The third step is to promote science and invention through the commercialization of Green Technology."

- "The final move is to bolster campaigns to encourage and raise public consciousness of green technologies," he said today at the announcement of the National Green Technology Policy[1][6].

8. *Advantages of Green Technology:*

- Does not release any toxic substances into the atmosphere.

- Will help some regions economically.

- It needs less upkeep, which means you won't have to spend a lot more money to keep it running.

- We would never run out of resources because they are renewable.

- By reducing CO_2 emissions, it is possible to mitigate the impacts of global warming.

9. *Disadvantages to Adopting Green Technologies:*

- There are no known substitute chemical or raw material inputs.

- Implementation costs are high.

- No alternate process technology is known.

- Uncertainty about the effects on results.

- A scarcity of human capital and expertise[1]

10. *Green Growth in Indian Context:*

The 2030 Sustainable Development Agenda enacted in September 2015 and consisting of 17 sustainable growth goals and one hundred sixty nine targets, shows the depth and involvement of member countries in the new universal agenda. Environmental protection and change was specifically addressed in the Indian Constitution. As per Article 48-A of a Constitution, "the government shall aim to guard and improvise the environment, as well as to protect the country's habitats and wild lifetime." The 2030 Sustainable Development Agenda enacted in September 2015 and consisting of 17 sustainable growth targets and 169 targets, shows the depth and involvement of member countries in the new universal initiative. Environmental protection and change was specifically addressed in the Constitution of India. As per Article 48-A of a Constitution, "the government shall aim to guard and progress the atmosphere, and also to protect the country's habitats and wild lifetime."

The National Action Plan on Climate Change (NAPCC) & also the State Action Plan on Climate Change (SAPCC) are notable landmarks in the incorporation of climate change into federal and regional planning systems. The NAPCC has eight federal missions that outline climate change reduction and adaptation targets. The present eight missions are solar power, energy efficacy, supportable ecosystem, sustainable farming, Green India, climate, Himalayan wildlife, and strategic understanding. The administration aims to reorganize the National Water Project and the National Assignment on Maintainable Agriculture, as well as develop new projects for green energy, health, waste-to-energy, and coastal regions. Under the Framework Agreement, India stated its intention to decrease the carbon intensity of its GDP by 20–25 percent by 2020, relative to 2005 levels. In its Envisioned Nationally Determined Contributions (INDCs), India recently stated that it aims to cut the emission rate of its GDP by thirty three to thirty five percentage by 2030, comparative to 2005 levels.

Green Growth is a concept that refers to sustainable growth which is both socially beneficial and environmentally responsible. It goes above climate innovation and transformation. Green growth is acknowledged in the sight of the Ministry of Environment, Forestry, and Climate Change, which prioritizes poverty elimination alongside sustainable development. According to India's Finance Commission, "rethinking growth policies in respect of their aspect(s) on environmental conservation and the ecological resources obtainable to deprived and deprived populations" is a key component of green creation. Inclusion is crucial to India's environmental sustainability, according to the Finance Commission and the Ministry of Environment, Forests, and global climate variation. The Fourteenth Finance Commission has put in place the forward expectation grant that recognizes states that have high-quality ground cover, as measured by moderate and highly dense forest cover. By 2022, India's government has set an objective of one hundred seventy five Giga Watt of renewable energy potential. During last fifteen months, the administration is increasing the coal cess from fifty dollar per ton to two hundred dollar per ton, with the revenues going to the National Clean Energy Fund. By adopting "smart" strategies, the Indian government hopes to cultivate cities which provide benefit not just to infrastructure and services but also a reasonable quality of life for their citizens, as well as a clean and stable environment[1].

DISCUSSION

1. *India's Green Growth Challenges*

Figure 2 shows that India is among the world's highest growing markets and it is actually Asia's third biggest market in terms of GDP1. India's gross domestic product per capita for 2014 and 15 was 10527E100 trillion, along with an yearly growth rate of 74E10 percent as per the Economic Report 2014–15. 2 The services industry accounts for the majority of India's GDP (57 percent in 2013), led by manufacturing (25 percent), and cultivation (14 percent) (the remaining 18 percent). 3 India's overall population was 1.29 billion in 2014, with a 17.84 percent share of the global population. Globally, economic activity seems to have picked up in the last year, and 2015–16 is predicted to be much better.

India's economy must continue to thrive in order for it to meet its growth goals. However still, for a nation like India, where expansion is a necessity the environmental significances can be serious, as severe restraints on usual assets like minerals, fossil fuel, or land water extraction are imposed, driving up food and energy prices. The potential of a country's economy to "go green" is measured by its capability to decrease the amount of capital obligatory to support long-term development that clues to increased societal equity and employment creation.

Green development has the potential to help balance these goals. Managing fiscal deficits and public debts, on the other hand, are two major problems for national policymakers, which could make technical progress necessary for green growth more challenging. The trade deficit and fiscal policy will continue to be important considerations in deciding India's macroeconomic policy. As a result, it's important to think about and maximize the benefits of green growth interventions in all major markets, such as employment, energy supply, and trade[7].

Countries with a higher level of economic growth have a larger ecological footprint, according to studies. As a consequence, as India speeds up its progress to lift millions of citizens out of homelessness. the challenge it faces is to improve the standard of living for its citizens while being environmentally conscious—and the fault points on key environmental growth indicators are already visible, as seen below:
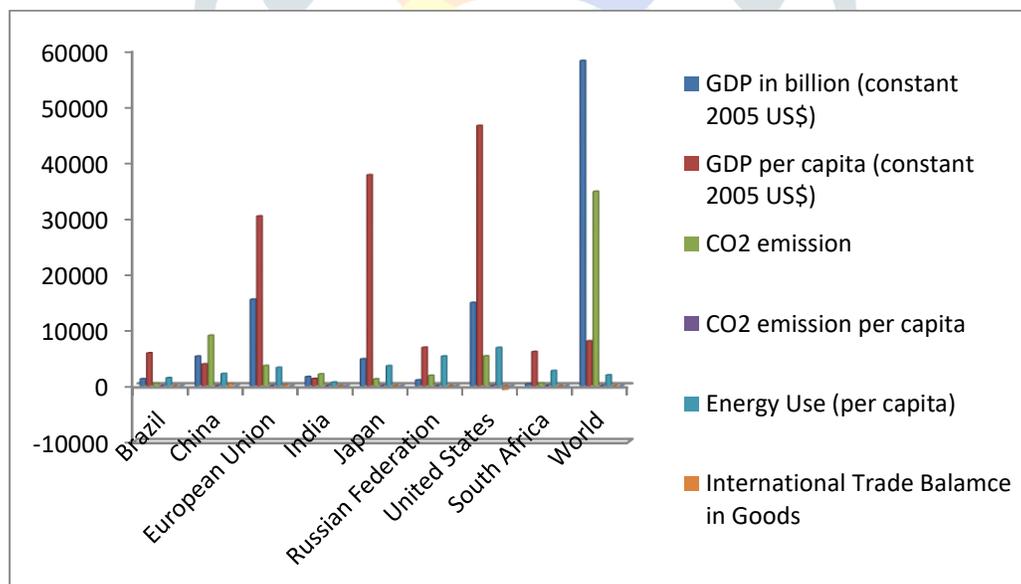

Figure 2: A Graphical Representation of key Expansion Pointers for India and Select Nations.

1.1. *Air and Water Pollution:*

Reparable residual particulate matter concentrations in most cities exceed the National Ambient Air Quality Standards, according to the emissions tracked. According to the Central Contamination Control Panel, the country's Class one and Class two cities produce about thirty eight thousand two hundred fifty four million liters per day (MLD) of manure, of which only 1,787 MLD (31%) is preserved and the rest is released unprocessed[3].

1.2.Forests:

Plant and tree shelter occupies 78.92 million hectares, or 24.01 percent of the nation 's total field area as per the Forest Census of India. Land cover has risen by 5,871 sq km since the Forest Survey of India's 2011 evaluation; however, there's been a modest decline in relatively dense forest and a growth in accessible forest Despite an aggregate rise in woodland and leaf cover, the nation's expanding stock dropped by 389 cubic. m between 2011 and 2013, suggesting a reduction in forest productivity.

1.3.Bio-Diversity:

India is a giant country with a vast number of recorded animals while occupying just 2.4 percent of the world's ground arena Four of India's 34 main ecological hotspots are the Western Ghats, Himalayas, Andaman and Nicobar Islands, and the Northeast. India had 1,039 critically vulnerable species in 2015, as per the Universal Union for Preservation of Wildlife's Red List.

1.4.Water:

India is on the verge of experiencing a permanent water shortage. As per the National Institute of Hydrology, India's fresh water availability is nine hundred thirty eight cubic meters per capita per year. A nation with lesser than seventeen hundred cubic meters per capita a year is reflected to be under water stress. Cultivation is currently the primary consumer of land aqua, and it will remain so in 2025 & 2050. The water request will be boosted by the residential and manufacturing segments. Water efficiency initiatives are urgently needed in all industries, but particularly irrigation.

1.5.Climate Change:

According to previous measurements, India's average mean temperature has shown a strong warming pattern of 0.51°C every 100 years from 1901 to 2007, with accelerated warming from 1971 to 2007. The Indian subcontinent is also expected to warm by 2030, according to projections. Just 2°C of warming is expected to have significant ecological consequences, and the situation could get much worse if temperatures climb even further.

1.6.Energy:

India's energy supply is largely reliant on vestige fuels, through coal and petroleum goods secretarial for around eighty-eight percent of the country's overall principal energy supply. The nation imports the majority of its crude, creating significant challenges to long-term energy stability. According to the International Energy Agency, more than three hundred million people in India were without power in 2012, and more than eight hundred million people relied on compact biomass for food preparation. Conferring to Census 2011, kerosene was the main energy source for illumination in 43% of rural households. Since energy access has such a significant impact on sustainability, it is a severe problem that the administration is currently attempting to solve[3].

1.7.Urbanization:

Cities account for nearly two-thirds of India's Gross Domestic Product and will play an even bigger role as the country accelerates its economic development. At the identical interval, Indian towns face major challenges in terms of infrastructure quality and affordability, such as electricity, telecom, highways, water stream, and public conveyance, which, if not tackled, could stifle economic development.

Table 1 depicts the status of important environmental and energy-related issues. The study examines India's long-term sustainability issues and concludes that green growth policies deliver many development benefits but necessitate coordinated policy action and interventions. To promote green evolution and expansion in India, the following main strategies are recommended:

2. Mainstreaming in Decision Making Processes:

Climate resilient green development policies must be seen as a irritated wounding topic that necessitates policy consistency and cross-departmental cooperation. The administration should familiarize green costing for India in order to further mainstream environmental sustainability in decision making procedures, in which all departments can formulate environmental budget declarations delineating core "green" initiatives accompanied in their particular departments.

3. Addressing Data Gaps:

To promote the planning of policies as well as the review of current policy proposals, existing and new data must be collected and synthesized. Other criteria can be gathered with the help of current management information systems.

4. Mobilizing Finance:

The ability to finance climate-resilient green growth interventions is crucial. The private sector, financial institutions, and development agencies, in addition to public finance, become increasingly relevant.

Table 1: Tabular Overview of Growth on Features Connected To Atmosphere and Energy

	Progress	**Data**	**Policy**
Air Quality	Insufficient	Needs Improvement	Present
Waste Management	Insufficient	Insufficient	Present
Water	Insufficient	Insufficient	Present
Forests	Needs Improvement	Present	Present
Biodiversity	Insufficient	Insufficient	Present
Climate Change	Insufficient	Needs Improvement	Present
Energy Access	Insufficient	Present	Present
Renewable Energy Supply	Needs Improvement	Insufficient	Present

5. Commissioning Pilots and Technology Demonstration:

In places where there are opportunities, pilots should be commissioned. Technology demonstrations in the fields of renewable energy, leftover control, and renewable energy aimed at cold packing systems, as well as natural resource management, should be welcomed. Upscaling of technology will be aided as a result of this.

6. Capacity Building:

The government's financial, scientific, and structural capacities, as well as the voluntary sectors, must be strengthened in order to adopt climate resilient green development approaches. A thorough review of capability building requirements, segment by segment, becomes indispensable. To support adoption, further collaboration among government, science and academic world, nonprofit administrations, and the reserved segment is required.

CONCLUSION

The green investments will improve new segments and machineries that will be the chief sources of economic expansion and evolution of the upcoming future: renewable energy machineries, resource and energy effectual structures and apparatus, low carbon public conveyance systems, substructure for fuel effectual and sanitary energy. As per the paper's analysis, the green technology emphasizes the requirement to better consider and prepare for approaching socio-economic transformations, such as development and shifts in the economy's structure. To generate jobs in key green growth-related industries, such as renewable energy, buildings, and manufacturing, skill creation and technical education must be prioritized. The paper's analysis of green technology in the future can be used as a reference in order to understand the present state of the green technology along with its feasibility terms. The paper describes various green technologies and its innovation to help other researched to recognize the root and depth of the issues associated with green technologies, and therefore the presented overview can be used to enact effective policies.

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