Challenges of Environmental Protection and Green Energy Revolution

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Introduction

The increasing the public pressure on natural resources, economic progress and a materialistic lifestyle and approach are major causing of continuous instability in the environmental balance of the country. With a population of 1.42 billion(2023) and a growing demand for various necessities, India meets 89% of its energy needs from fossil fuels (coal, mineral oil and natural gas). Importantly, 82% of this fossil fuel dependency is on imported fuels. In order to achieve the goal of becoming a developed nation and with 17.76% of the world's population, according to the International Energy Agency India's energy consumption is projected to increase annually by 5.3% from 2023 to 2025. In 2025, Asia (with major players like India, China, and Japan) is expected to use half of the world's electricity. The rising demand and production of electricity in India, coupled with the burning of fossil fuels, result in significant carbon dioxide emissions and other greenhouse gases. This has led to global warming, climate change and widespread damage to the environment, affecting human health and economic progress in the short and long term. A revolution in green energy is essential for sustainable development. India's geographical and climatic conditions make it highly favourable for the development of renewable energy resources. The country spans from 8 degrees 4 minutes north latitude to 37 degrees 6 minutes north latitude and 68 degrees 7 minutes east longitude to 97 degrees 25 minutes east longitude,encompassing warm and subtropical regions. This makes India a rich source for solar energy, wind energy, water resources, and oceanic energy production.

To harness these possibilities, there is a need for the transformation of fossil fuels into renewable energy, extensive infrastructure development for green energy management, the development of indigenous advanced technology in the field of green energy, encouragement and prioritization of green energy in government policies and programs, and increased private sector participation in financial resources. Efforts by both the central and

state governments are crucial for increasing innovation in renewable energy production.

Objective

1. To underline the importance of green energy for sustainable development and clean environment.
2. To assess the potential for development of renewable energy as an alternative to fossil fuels in the country.
3. To review various programs being run in the field of green energy.
4. Expanding access to renewable energy to more people for sustainable development.

Developed India and energy availability

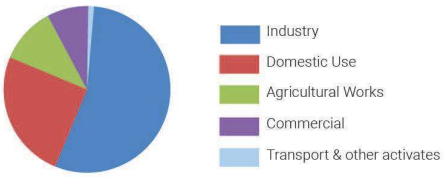
The demand for electricity in the country is increasing day by day due to urban and industrial development, expansion of residential areas, growing domestic needs, expanded commercial and professional requirements, the development of means of transport and transportation facilities, operation of advanced agricultural machinery etc. Currently, India is the third-largest consumer of electricity in the world. The per capita energy consumption in the country is 1100 kilowatt/hours, which is significantly lower than the global average of 2500 kilowatt/hours per capita. In recent years, various government schemes such as "Saubhagya" and "DeenDayalUpadhyaya Gram JyotiYojana" have led to the electrification of rural, backward, and remote regions. According to energy statistics surveys, electricity has reached 97% of households in the country. According to the latest report from the central government, 100% of rural areas in the country have been electrified. The electricity consumption in various sectors of the country is illustrated in table number 01.

Table Number -01

S.N.	Sectors	Electricity consumption in %
1	Industry	41
2	Domestic Use	26
3	Agricultural Works	18
4	Commercial	8
5	Transport & other activates	7

Source CFA (2021-22)

Electricity Consumption in %



The majority of the energy produced in our country is obtained from fossil fuels, accounting for 78% of the total energy produced in the country. A significant portion (86%) of this fossil fuel, particularly crude oil, and natural gas is dependent on imports from Gulf countries and other nations. According to data received from the Ministry of Finance of the Indian government, in the first half of the fiscal year 2022-23, crude oil imports amounted to $90.3 billion. This makes it clear that a large part of our budget is being spent on the import of mineral oil and natural gas. The requirement and supply of electricity in our country in the last 5 years is shown in Table No. 02.

Table Number -02

S.N.	Years	Requirement of Electricity (MU)	Supply of Electricity (MU)
1	2017-18	1212134	1204697
2	2018-19	1274594	1267526
3	2019-20	1291010	1284444
4	2020-21	1275534	1270663
5	2021-22	1379812	1374024
6	2022-23	1511847	1504264

Source- Ministry of Power, Government of India(2021-22)

Use of fossil fuels and its adverse effects on ecology

Traditionally, our energy needs has been dependent on coal, mineral oil (diesel, petrol, kerosene), and natural gas. Sixty percent of our country's energy requirement is fulfilled by the combustion of coal in thermal power plants for electricity production. The widespread burning of biomass fuels has serious environmental consequences, emitting greenhouse gases and pollutants that contribute to severe environmental damage.

This, in turn, leads to an increase in the frequency and intensity of cyclones, hurricanes, heatwaves, droughts, floods, etc. Research indicates that the combustion of coal releases 2249 pounds of carbon dioxide (CO_2) per megawatt-hour of electricity produced, while mineral oil results in 1672 pounds of CO_2 per megawatt- hour, and natural gas leads to the emission of 1135 pounds of CO_2 per megawatt-hour. India is the third-largest emitter of carbon dioxide globally, following the United States and China.

Various sources of power generation (2021-22)

S.N.	Sources	Production in %
1	Coal	60
2	Hydro power	17
3	Natural Gas	09
4	Nuclear energy	02
5	Renewable energy	12

Source- Ministry of Power, Government of India

Although the Indian government has set a challenging goal to achieve zero carbon emissions by 2050, the significant carbon footprint from biomass fuel combustion remains a substantial environmental concern.

Increasing demand for energy and the way to the future

For a cleaner environment and sustainable development on Earth, it is imperative that we reduce our dependence on biomass fuels and move towards renewable energy alternatives. Alongside this, there is a need to explore other energy options.

Estimated potential of renewable energy (green energy)

India is the fourth-largest producer of renewable energy in the world. India has vast potential for harnessing renewable energy sources. The geographical location of India presents immense possibilities in the fields of solar energy, wind energy, and oceanic energy. Although the share of renewable energy in the total energy produced in the country is currently only 12%, In the year 2022-23, India produced 175 Giga watts renewable energy.

Hydropower Generation

In the country, hydroelectric power generation activities began in the 19th century. Currently, there are more than 200 small and large hydroelectric projects operational in the country. This contributes to the production of 46,000 megawatts of hydroelectric power. Hydroelectric power contributes between17% to 22% of the country's total electricity generation. Although the available hydroelectric production capacity in our country is more than 84,000 megawatts, we can effectively utilize this by constructing small hydroelectric projects.

Solar energy production

Our country, situated in the tropical & sub tropical zone, is abundantly blessed with solar radiation throughout the year. The estimated solar energy capacity in the country is 5×10^{11} kilowatts per year. In the year 2021-22, the country achieved a solar energy production of 48 Giga watts. The Indian government has set a target of generating 750 Giga watts of solar energy by 2047.The southern and western parts of our country are comparatively rich in solar energy production. With the collaboration of government and non-government agencies, 47 solar parks have been established in various parts of the country. The National Solar Mission has an ambitious program to connect solar energy to the grid. Additionally, work is underway on solar-wind hybrid energy projects.

Under the Atal Jyoti Yojana, the installation of solar street lights in various sectors is proving to be beneficial on a large scale. The government is also providing subsidies under the Rooftop Solar Program to reach solar energy to as many people as possible. Under the PradhanMantri Kusum Yojana, subsidies are being provided to farmers for solar pumps to reduce their dependence on diesel. The first solar-powered village in the country, Modhera in Gujarat, has achieved round-the-clock electricity supply through renewable energy, setting an example for the rest of the nation. This model needs to be adopted in other areas of the country. In a significant development, the largest solar park in the country has been established in Bhadla, Jodhpur, Rajasthan, covering an area of 50,000 square kilometers, with a target of generating 2545 megawatts of solar energy. Solar energy production in different states of the country is shown in Table No. 03

Table No. 03

S.N.	State	Solar energy production in(GW)
1	Rajasthan	17.10
2	Gujarat	10.13
3	Karnataka	09.00
4	Tamil Nadu	06.80
5	Maharashtra	04.80
4	Telangana	04.70
5	Andhra Pradesh	04.00

Source- Ministry of New and Renewable Energy, Government of India(2021-22)

Wind Energy

Peninsular India and its coastal regions along with the arid climate of Western India, becomes prosperous in terms of wind energy production. India is the fourth-largest producer of wind energy in the world. By the year 2022-23, the country has established a capacity for producing 44.0089 Giga watts of wind energy.

Wind and solar energy hybrid technologies play a crucial role in the development of green energy.

Conclusion

Green energy is a crucial step towards sustainable development, contributing to clean and affordable energy availability. It plays a supportive role in meeting the diverse needs of the country's vast population and addressing global environmental challenges for sustained development. Along with this, it will prove useful in economic development, employment generation, improvement in public health and reducing environmental pollution.

The development of better research and new technologies in this direction will be helpful in the expansion of green energy. Additionally, financial support from government, private partnerships, and institutions like the Asian and World Bank will be instrumental in advancing new sources of green energy such as green hydrogen, battery manufacturing, geothermal energy, and more.

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