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An economic analysis of recent initiatives and policies on renewable energy in India

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Abstract
Renewable energy is the most reliant energy sector nowadays to conserve sustainability. Also, government plays an indispensable role in implementing policies and developing activities to enlist deeply in more advancement of renewable energy technologies. In India, both central, state authorities and other government regulatory take the development of renewable energy sectors through implementing different plans and policies. In reaction to the issue, a far higher quantity of public money dedicated to helping India's economy and people via monetary and fiscal policies may also assist many parts of the energy industry. In the meantime, the database in the article covers other policies, initiatives, and laws that can help manufacturers and users of various energy kinds. This review paper aims at describing the policy implications and initiations taken by the government of India in respect to developing renewable energy sectors in India during 2020-21.

Keywords: renewable energy, policies, initiatives, energy sustainability

Introduction

India's power demand is growing at a higher range, and the country's power production capacity is restricted. As a result, India has been pursuing research, advancement, manufacturing, and reassertion with zeal for the past several decades to find a solution to the country's longstanding power shortage. India has gained access to numerous renewable energy knowledges that are in a variety of industries. Concerns about energy supplies and emissions are promoting many global governments to embrace renewable energy resources in large numbers. Sustainable growth with minimum environmental impact is only possible through a large-scale shift away from limited fossil fuels and toward renewable energy sources that are practically infinitely accessible. The government's arrangements and tactics perform a critical part in the extensive importance of renewable energy sources. The government's operational and economic/financial assistance, provided through its different agencies, supports the development of these technologies. To act as a nodal agency for the progress of renewable energy sources, the Indian government established a unique Bureau of Non-Conventional Energy Sources in 1982, which was then amplified to a distinct Ministry in 1992 and redesignated Ministry of New and Renewable Energy (MNRE) in 2006.

Many independent organizations, such as the National Institute of Solar Energy (NISE), the National Institute of Wind Energy (NIWE), the Sardar Swaran Singh National Institute of Bio-Energy (SSS-NIBE), the Solar Energy Corporation of India (SECI), and the Indian Renewable Development Agency Ltd, assist the Government (IREDA). The government issued a 'National Action Plan on Climate Change (NAPCC)' in 2008, which established the following eight national objectives to endorse renewable sources of energy, saving energy, and support sustainable development: Solar mission, Mission for Boosted Energy Effectiveness, Mission on Sustainable Habitat, Water mission, Mission for Sustaining the Himalayan Ecosystem, Mission for a Green India, and Mission for Sustainable Farming.

India may be pleased to report it is one of the major players in the manufacturing and use of renewable energy among many other emerging countries. India, the world's second-most populated country with 1.353 billion people, is one of the worlds the greatest users of fossil fuels, causing climate change. Population expansion is expected to continue until 2050, and as a result, energy consumption will be exacerbated by strong industrialization in future generations. With the help of the National Institution for Transforming India (NITI) Aayog, the Ministry of New and Renewable Energy (MNRE) is trying to meet the Indian government's goal of 175 GW of renewable energy resources. In command to mollify energy necessities, several Indian states are presently developing their renewable energy production. This study aims at reviewing the overall scenario of policy implications and initiatives taken by the Indian government in promoting/developing the renewable energy sectors in India (2020/21). This study covers the recent initiatives and policy implications of the government of India in regards to the development during the year 2020/21. Based on the literature survey on initiatives and policies on the renewable energy sectors in India, the researcher collected data based on published

sources (secondary data) collected from different articles, journals, research papers, books, government websites, and online sources.

Review of Literature

Many research publications on sustainable energy industries were published, and it suggested the belief that India still has a tremendous amount of potential for upgrading and maximizing its resources. Even though India has experienced rapid and impressive economic expansion, energy is still in short supply. India's robust economic development is driving increased demand for power, but an alternative of energy supplies is urgently needed to meet this need. Hence renewable energy is the better source of energy to build a strong energy enrichment in the energy sectors; however, India is now taking a lot of initiatives to create a broader renewable sector from many actions. (Mitra, 2021) [9] The causes of challenges are due to the regulatory, political, geographical, and socioeconomic elements. And now India has initiated many implications to avoid the obstacles such as public awareness programs, human resource training and development, skill up-gradation, price of installation, and other initiatives taking place. And many other e-office and e-portals are initiated under project development schemes and awareness programs. (Subhojit Dawn, 2019) Wind energy would be the most dominating alternative of energy in the future generation because of its potentials in India also a better tool for curtailing the cost and exploiting energy safety by increasing the energy supply and reducing energy importation. And government initiatives on the wind energy regulatory acts such as the electricity act 2003, National electricity policy 2005, national tariff policy 2006, national rural electrification policies (NREP) 2006, Central electricity regulatory commission (CERC), and other supervisory acts are imposed to developing the wind energy sector. (S.S. Chandel, 2016) [4] Discussed the various implications under the National Action Plan for Climate Change in renewable energy sectors in India. And under National Action Plan on Climate Change (NAPCC) program initiated with eight “National Missions” to endorse the growth in the country- National Solar Mission, National Mission for Enhanced Energy Efficiency, National Mission on Sustainable Habitat, National Water Mission, National Mission for Sustaining the Himalayan Ecosystem, Green India Mission, National Mission for Sustainable Agriculture, National Mission on Strategic Knowledge for Climate Change.

The industrial need for power is driven by the rising demand in infrastructure building, primary industries, and the execution of socio-economic schemes. India's energy independence has vastly improved significantly with an initiative of a unified national power grid and significant investments in the utilization of renewable energy capability. (S. A. Khaparde, 2010) [1] India has initiated many programs and policies to achieve in the renewable sectors like implementing "Jawaharlal Nehru Solar Mission" Regulatory measures programs, implementing Renewable Purchase Obligations (RPO), and issuing renewable energy certificates (REC). (Meena, 2017) [6] Researchers frame a question: Could India meet all the required energy demands? And examined the scenario and found the solution as it can meet energy demand and through implications of research & development programs and coordination from individual and cooperative efforts can make the effective utilization of the gap between renewable potentials and capacity of the installation.

Governments are expected to respond quickly to the energy crises and environmental difficulties. Indeed, governments throughout the world have been hesitant to react to this crisis. (Fortu ´nski, 2020) The Paris Climate Accord, signed in 2015, is a hopeful project, with the United States and China pledging to comply with the deal. The issues of rising energy consumption and pollution necessitate energy resource regulations and management. (Naveen Kumar Sharma, 2012) Many acts/regulators to regulate the activities and policies of solar energy such as Electricity act 2003, National electricity policy 2005, National tariff policy 2005, National rural electrification policies 2006, Initiatives to promote solar PV in India, Semiconductor policy 2007, Solar PV generation-based incentives, State-level initiatives, and Research & development initiatives. By imposing in research activities like Innovation of new materials, process system and application, field evaluation process, infrastructural development, performance evaluation, and other programs can utilize the maximum availability. (Upadhyay, 2014) [3] Many regulatory acts are formulated to initiate the development of renewable energy sectors are the National Electricity Policy 2005, the Tariff Policy 2006, the National Action Plan on Climate Change (NAPCC), State Electricity Regulatory Commission (SERCS), and Renewable Purchase Obligation (RPO). And author mentioned that higher potential states in India should transmit to each other state and co-ordination is helpful for project development and policy implications.

Government Policy Implications and Initiatives (2020/21)

The government Policy implications and Initiatives of renewable sources collected from the official websites of the government of India are mentioned below in references. The below discussion made on the undertaking institutions and authorities to implement the needed actions on renewable sectors in India.

The allocated ministry, the Ministry of New and Renewable Energy (MNRE), is now in charge of developing sustainable energy laws in India for power, transportation, and heating. The National Institute of Solar Energy (NISE) and the National Institute of Wind Energy (NIWE) are part of the MNRE, responsible for testing, certification, standardization, skills enhancement, upgrading programs, and public awareness. Bioenergy for electricity, including Energy from Waste (EfW) and biogas, are maintained by the MNRE. The Indian Renewable Energy Development Agency (IREDA) functions as a non-banking financial agency under the auspices of MNRE, distributing funds for qualified Renewable energy and feasible energy efficiency initiatives. Furthermore, the Solar Energy Corporation (SECI), the Power Ministry (MOP). Authorities such as the Indian

Renewable Energy Development Agency (IREDA) under the Ministry of New and Renewable Energy (MNRE). Commissions such as the Central Electricity Regulatory Commission (CERC), the Petroleum and Natural Gas Ministry (MOPNG), and the Science and Technology Ministry (Central DST & DBT) have all been responsible for the advancement and have a clear emphasis on bioenergy research and technology.

The Ministry of New and Renewable Energy (MNRE) has implemented many policies under the rooftop installation program, such as financial assistance for residential, institutional, social, and government buildings; Gross/net metering Regulation and Tariff; expert appointment in rooftop project departments; PPA (power purchase agreement), MOU (Memorandum of understandings), and CAPEX (Capital Expenditure model) Agreements. The Ministry of Power (MOP) has initiated the National Electricity Policy (NEP) 2021 to take suggestions from stakeholders. Frame an expert committee that includes the members of state government, NITI Aayog, Central Electricity Authority (CEA), and Ministry of New & Renewable Energy (MNRE). The stakeholders include the Central Public Sector undertakings, HDFC Bank, ICICI Bank, Solar Energy Corporation of India, Power transmission companies, Industries, solar and wind associations, etc. The European Union (EU) has joined the Coalition Disaster Resilient Infrastructure (CDRS), launched by Prime Minister Narendra Modi in 2019 at the climate change Summit. And CDRS included both the public and private sectors with the object of stretching with the help of Sustainable developments to form new and existing infrastructure systems to climate and disaster risk.

The Ministry of Power (MOP) and the Government of India aims to provide rural electrification implemented Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY). Under this program, the government aims to provide decentralized distributions of electricity in the rural areas through Off-Grid (mini-grid) plant installation with an investment of Rs 756 billion. Under the Scheme of Production-Linked Incentives (PLI), Rs 4500 crore was approved by the Union Cabinet; to promote the domestic manufacturing of high-efficiency solar PV modules. And the main aim of this scheme is to generate around 10000 MW with a direct investment of 17,500 crore, direct employment of around 30,000 persons, and indirect employment of about 1.2 lakh persons. Set a targeted plan of producing 5 GW Solar Park with a cost of Rs 25000 crore in Gujarat, announced by the National Thermal Power Corporation Ltd. (NTPC), and this plan to produce 5 GW capacity of Renewable energy through solar, wind, hydro and biomass. With the aim of research & study on energy modeling in India, the Government set up an inter-ministerial committee under the NITI Aayog. The committee consists of the Ministry of Petroleum and Natural Gas, Ministry of New and Renewable Energy (MNRE), Coal Ministry, Ministry of Environment, Forest & Climate Change, and Department of Science and Technology.

The Delhi government decided to shut down the Rajghat Thermal Power Plant and use its 45 acres of land to develop a solar park and with the potential to produce 5000 KW of Electricity. In the budget of 2021, the Finance Minister Nirmala Sitaraman initiated to raise customs duty on solar investors from 5% to 20% and also 5% to 15% on solar lanterns to promote domestic production and encourage the theme of "Made in India" among the domestic manufacturers. Under the Atal Jyoti Yojana, the government implemented financing a project of 3 million solar street lights in specific regions. The Power and New & Renewable Energy Minister R.K. Singh in Bihar launched the scheme Gram Ujala; under this program, the government initiated around 15 million LED bulbs to the villages in Bihar, Uttar Pradesh, Andhra Pradesh, Maharashtra, and Western Gujarat. Maharashtra State Electricity Distribution Company Ltd. (MSEDCL), under Mukhyamantri Saur Krushi Vahini Yojana in Maharashtra, issued 1300 MW of wind-solar hybrid tender. Under the project development program in Pan India, Solar Energy Corporation of India Ltd has issued 1200 MW of wind-solar tender. And the NTPL issued a tender of about 5724 MW and 2800 MW. Honorable Prime Minister Narendra Modi has informed the signing of the Memorandum of Understanding (MOU) between India and the French Republic for mutual co-operation in new and renewable energy, equality, and reciprocity. And it consists the technologies relating to solar, wind, biomass, and hydropower energy.

As per the guidelines of the Ministry of New and Renewable Energy (MNRE) regarding the Dakshin Haryana Bijli Vitaran Nigam; allowed 40% of the subsidy for three-kilowatt plants and another 20% for a three to ten kilowatt for installing a solar system from various listed firms. The Central Electricity Authority (CEA) and Council on Energy Environment and Water (CREW); together established the Indian renewable dashboard, a center for providing all operational information on Renewable energy projects in India. Under Pradhan Mantri - Kisan Urja Suraksha Evam Utthaan Mahabhiyan (PM-Kusum) Scheme initiated with providing financial and water facility to the farmers with the solar energy capacity of 25,750 MW by 2022. Under the Akshay Urja Portal (AUP) and India Renewable Idea Exchange (IRIX) Portal issued by /announced by the Ministry of New and Renewable Energy (MNRE) to promote mutual idea sharing between India and around the Globe. Under the scheme National Renewable Energy Internship scheme (NREI); aim to provide the internship to the students to study UG, Graduation, Post-graduation degrees, and Research scholars to join in recognized institutions or universities. National Institute of Wind Energy (NIWE) provides Online training courses on wind turbine technology for the employees working in M/S Adani Green Energy ltd, Ahmadabad. And Gail India Ltd, Noida; to promote a better understanding of Renewable energy technologies. During COVID-19 Pandemic, to support the unemployment issues due to lockdown, the National Institute of Wind Energy (NIWE) provided a Virtual Private Network (VPN) facility to make it easier to work from home as per the approval of IT policy.

The ministry has codified the Acts, Policies, and Regulations to facilitate RE. India has policies at the state and national levels that encourage RE and strive to achieve a clean development mechanism. Out of states, ten have

enacted individual mandates for a renewable energy contribution of roughly 10%, and low prices for renewable energy have been suggested. Here are amongst the most important laws and policies.

A. Electricity Act (2003)

This legislation is a cornerstone for the nation's renewable energy development. The Indian Electricity Act (1910), the Electricity Act (1948), and the Electricity Regulatory Commission Act were all derived from three previous acts that standardized the power sector: the Indian Electricity Act (1910), the Electricity Act (1948), and the Electricity Regulatory Commission Act (1998). Section 3(1), Section 4, Section 61 (h), Section 86 (1) (e), and Section 86 (2) (i) of the Electricity Act (2003) are just few significant rules.

B. National Electricity Policy (2005)

The section defines that the share of renewable energy to electrical energy should be raised, and transmission firms should use an open tender method for power purchases. And under this act aim to access all families will have access to power over the next five years (according to the National Electricity Policy). There will be no energy requirement by the end of 2012 thus, the excess production capacity may be increased by boosting the electrical output of machines that are already connected through a power system and also to providing a consistent level of electricity in a well-organized and cost-effective approach, Electricity supply per capita must be increased to around 1000 units by 2012.

C. Tariff Policy (2006)

Section 3(3) of the Electricity Act of 2003 allows the central government to change this regulation. It is the product of consultations with state governments, the Central Electricity Authority (CEA), the Central Electricity Regulatory Commission, and other stakeholders. The protocol's goal is to establish a minimum proportion for acquiring energy into the availability of resources and their impact on retail rates and the purchase by distribution businesses. It also aspires to improve consumer service by constructing a more reliable electrical infrastructure. It also oversees the creation of enough capacity, which comprises assets in production, transfer, and distribution, to provide customers with a reliable energy supply.

D. Rural electrification policy (2006)

The goal is to ensure that all distant communities have access to power by the end of 2009, whether through off-grid or grid-connected methods. It is impossible to accomplish it wholly using traditional methods, which have created an opportunity for solar, micro-hydro, wind, and biomass technologies. In April 2005, the government started the Rajiv Gandhi Grameen Vidyut Karan Yojana, which aims to electrify 125000 villages and provide services to rural families within five years. By the end of December 2006, the power has provided about 19,758 communities.

E. National action plan of climate change

The government has created a National Action Plan on Climate Change (NAPCC), which was formulated in the year 2008 to control carbon emissions for environmental protection and to satisfy the energy requirements of the country. The strategy was developed through eight National Missions, which met to address climate change challenges and to boost renewable energy consumption. These initiatives are carried out by several agencies of the Indian government and the progress of each mission is continually monitored by the Council on Climate Change, which is chaired by India's Prime Minister. The goal is to make good/effective use of local government and public-private collaborations and satisfy global firms' research and innovation needs.

F. Renewable Energy Certificates

The Renewable Energy Certificate method was first introduced by the Central Electricity Regulatory Commission (CERC) in 2010. It is a green marketable certificate created to promote renewable energy resources and electricity marketing advances. The renewable energy certificate mechanism has made it easier for people in states to fulfill their Renewable Purchase Obligation (RPO), freely accessible buyers, captive power stations, and channel partners who have the option of purchasing the renewable energy certificate. The State Electricity Regulatory Commission (SERC) has enabled the RPO to spend a small percentage of overall utilization in renewable energy in the allocation licensee's region. Renewable energy certificates are registered through the Central level agency designated by the Central Commission. And Renewable Energy can be sold at a rate set by the electrical regulatory commission. The renewable energy certificate method has made it possible for all sorts of renewable energy producers to acquire benefits without worrying about power purchase agreements (PPA) to trade in sustainable power.

International Alliance

The International Solar Alliance (ISA) was established in November 2015 as a consequence of an Indian proposal to address significant shared obstacles in solar energy scaling up. On 6th December 2017, the ISA Framework Agreement was signed and ratified by 15 nations, making it the first international inter-governmental body in India. On the 3rd of October 2018, the ISA's First Assembly approved a resolution amending the Framework Agreement to include all regions of members of the United Nations in the ISA's membership (UN).

The ISA Framework Agreement has been signed by 88 nations so far. And 70 nations have also approved the agreement. A vast number of institutions, including the World Bank, the United Nations Development Programme, the European Investment Bank, and the Green Climate Fund have signed Joint Proclamations with ISA to work collaboratively for the enhancement & implementation of solar energy across the world. The World Solar Technology Summit was started by the Hon'ble Prime Minister of India on September 8, 2020. Almost 26,000 people from 149 countries took part in the meeting. The ISA Standing Committee, led by the President of the ISA and the Minister of New and Renewable Energy and Power, met twice this year, the most recent meeting being on September 10, 2020. In addition, the ISA's third Assembly was convened on October 14, 2020. In response to the solar alliances' many initiatives, including seven programs that the ISA has initiated so far like Scaling Solar Implementations for Agribusiness Need, Affordable Funding at Scale, Growth of large Grid-connected Solar projects, Scaling Solar Mini-Grids, Scaling Solar Rooftop, Scaling Solar e-mobility and Storage, and Solarizing Heating and Cooling Systems. These programs contribute to the ISA member nations' general objective of increasing solar energy deployment to achieve universal resource efficiency and accelerate economic growth.

Reommendations

Create a dependable and trusted database system for policy analysis. Typically, a new energy strategy is developed based on existing technologies and database management systems. It is also critical to guarantee that the database's integrity and reliability are not endangered to avoid inaccurate data input. A very trustworthy database can help future electricity policies and building rehabilitation programs. National and local governments can use the database system to determine when and how strategy execution be tweaked. Providing monitory assistance for the refurbishment of a structure. Retrofitting the existing building stock for energy efficiency is a primary concern.

However, two significant factors prevent property owners from carrying out renovations: increased prices for energy-saving techniques and a lack of understanding of the financial benefits of remodeling. The rehabilitation comprises improving the thermal performance of the building exterior and replacing the existing heat pumps. Incentives are offered to the buildings that achieve a specified energy level following refurbishment, reducing the perceived risks of investing in energy-efficiency technologies. Increase information openness and make recommendations for energy-saving strategies in buildings. Building type, year of construction, floor space, heated floor area, annual electricity usage, energy label, carbon emission, energy-saving suggestions, and details about the energy assessors should all be included in the database. To develop a user-friendly information network for regulators, research institutions, residents, potential owners, and tenants; some features of the databases should be made public. It can help them compare findings to those of another representative residence in the same block to raise public awareness about energy conservation.

Conclusion

The study discoveries have crucial policy considerations for Indian authorities to address. In order to increase the use of renewable energy sources, incentives should be provided to innovative megaprojects in renewable energy systems. And also consider the factors like Poor management, a lack of lengthy finance, high starting CAPEX, a cost of borrowing, poor returns, grid connections, site characteristics, and other issues confront the renewable energy business. The authorities are continually working to create a climate that is attractive to investors by providing essential fiscal and monetary benefits. Large renewable energy projects, such as the development of Solar City, Solar Park, Large Scale Solar Power Plants, Solar Rooftop, repowering of existing wind farms, and many more, have been taken to enhance the percentage of renewable energy. To maintain the industry appealing to producers, the government must continue to give generation-based incentives and capital subsidy schemes. Creating customer knowledge, interest, desire, and action for green goods, on the other hand, should be considered equal.

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