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Theoretical Investigation Of Renewable Energy Data For Northern Parts India

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Abstract: There will be substantial gains in energy stability, environmental alleviation, and financial rewards as a result of the rapid expansion of renewable energy sources and energy conservation. In order to deal with the gap and change in solar and wind energy supply, several different types of hybrid energy systems (PV-Biomass) are being deployed worldwide to generate electricity. This article examines the data that details the three regions' energy sources and the current renewable program in each. The study of secondary data and original sources is a necessary part of every research project. When doing preliminary research and optimizing hardware model prototypes or a real industrial setup, secondary data is quite helpful. As secondary data for renewable energy research, the areas of Uttarakhand, Haryana, and Rajasthan have been chosen for this work. To lessen the people's reliance on the grid and take some modest steps toward reducing greenhouse gas emissions, governments at all levels are exploring the feasibility of making solar and other energy sources available to the general population.

Key Word: Renewable Energy, Uttarakhand, Haryana, and Rajasthan.

I. Introduction

Percentages of renewable energy use in different Indian states vary widely. Tamil Nadu, Karnataka, Gujarat, and Rajasthan make up more than half of India's ten most renewable-rich states, each with a higher solar and wind proportion than the national average of 8.2 percent. Roughly 29% of Karnataka's annual power production capacity comes from renewable energy sources like solar and wind. As a result, there are problems with system integration across a number of countries. The use of renewable energy is on the rise in India as a means to decrease reliance on fossil fuels, increase energy availability, and help the country transition to a low-carbon economic model. The government of India has set a target of having 40% of the country's electricity come from sources other than fossil fuels by the year 2030. The INDC promises that by 2030, India will have lowered its GHG emissions intensity as a percentage of GDP by 33–35 percent below 2005 levels, and that it would have developed a new carbon sink of 2.5–3 billion tonnes via increased forest cover. In the previous several decades, India has made great strides in creating a climate conducive to the growth of renewable energy technologies including solar, wind, biofuels, and waste-to-energy conversion. Using decentralized distributed renewable energy solutions, rural communities can meet their lighting, cooking, and productive energy needs. 1.3 In January of 2010, as part of the NAPCC's first operational mission, the National Solar Mission (NSM) was launched (NAPCC). The mission's overarching objective is to elevate India to the forefront of the solar energy industry by creating the enabling regulatory environment for widespread adoption of solar technology throughout the country as soon as possible. As part of the first phase of the mission, project developers participated in a "reverse bidding procedure" in which they were invited to propose discounts from the baseline rates set by the Central Electricity Regulatory Commission (CERC). Solar water heaters and rooftop solar systems have been promoted via the application of building bylaws and the National Building

Code. Incentives provided by the federal government have boosted the popularity of solar panels for use on rooftops and in off-the-grid settings. The Ministry has also approved R&D projects and established Centres of Excellence to promote research and development. As a consequence of these initiatives, the price of solar energy in India has dropped dramatically. For the most part, NSM is on schedule to achieve its objectives. In this year's efforts, addressing the issues of land availability and affordable finance, two major roadblocks to the broad adoption of solar energy, was a priority. There is still a lot of work to be done in the areas of architecture, processes, and the power grid infrastructure required for the evacuation of renewable energy.

II. Background

Dawn et al. (2019), Wind power has demonstrated enormous capacity development potential and broad use throughout the world in the last several decades. Since the final decade of the 1990s, wind energy has emerged as a major source of renewable power generation. During the last several decades, the world's installed wind power capacity has increased by a factor of three every three years. According to this article, a look at the Indian government's attempts to improve the country's energy security by using current renewable energy sources is provided. It is widely accepted in India that wind power may be both a source of energy generation and a cost-effective method of transporting that energy. Data on India's total electrical production and consumption, as well as the contributions of various renewable sources, is included in this study. Wind power potential of India has been compared to that of other major countries across the globe.

Kumar et al. (2019), Many rural Indians lack access to clean energy sources like LPG and electricity since grid construction is difficult or impossible in these areas. As a result, countries like India must turn to renewable energy sources in place of more traditional ones. In this article, the potential of several renewable energy sources in India is evaluated. Additionally, it reveals patterns in the expansion of the renewable energy industry, but it also illustrates that India's rural electrification requires a hybrid renewable energy model. Agricultural waste may be used as a biofuel, which can reduce pollution while also posing health risks. The paper also describes a number of technologies still in the demonstration stage, such as tidal, OTEC, and solar thermal power plants. The availability of sun rays throughout the year is one barrier that has placed progress in the solar and wind sectors on hold. All conceivable renewable energy solutions are evaluated in this study so that a major portion of the rural population may have access to power and satisfy their basic energy demands.

Mathur & Singh (2019), Energy production and consumption in India are the world's 3rd and 4th biggest, respectively. An estimated 2800 TWh of additional power would be required in India by 2030, up from the current total of 1913 TWh in 2015. By 2030, India plans to use non-fossil fuels to cover 40% of its energy needs, as outlined in the NDC document. For this purpose, India intends to raise its renewable energy installed capacity to 500 GW. There are 350 GW of solar electricity, 140 GW of wind power, and the rest from nuclear, hydro, and biomass. Here, we assess whether India is on pace to accomplish these lofty objectives in this article." Roughly 10% of India's total installed power production capacity and about 4% of the total energy are generated by wind power. Currently, there are 36.625 GW of wind turbines in operation, and another 5 GW of additional capacity is under development. A total of 28.18 GW of solar capacity has been built in India, of which 10 GW has been added in the past year alone. Currently, nuclear has an installed capacity of 6.78 GW and is expected to achieve a total of 20 GW by 2030. The cost of new wind and solar electricity is currently 20% lower than the cost of coal-fired power. Managing the increasing use of renewable energy in the grid is becoming a serious issue. The construction of new coal-fired power plants has slowed significantly

since many are running at low capacity factors. To achieve its stated objectives, India must continue to make significant investments in renewable energy and grid upgrading.

Mohanty et al. (2017), Provided information on A major portion of future global energy supply will come from solar power. As a result of economic and other climatic factors, it has already started to acquire momentum in emerging countries like India. Forecasting or estimating future solar energy output is an essential aspect of integrating high-insolation solar energy into the nation's electricity grid. By depending on accurate predictions and the availability of solar energy at various time and geographic scale, it is possible to make the best use of solar energy. Solar radiation projections and their usage in the rapidly developing Indian economy demand an evaluation of the country's rapid expansion. This may be done either empirically, via the use of soft computing, or through the use of simulations.

Panwar & Srivastava (2017), Uttarakhand, a Himalayan state, is the focus of the current inquiry. The current state of renewable energy production in Uttarakhand and the potential for further production and the acceptance of additional renewable energy sources are the subject of this article. Studying government publications on energy statistics and conducting a survey in the Himalayas are two of the methods used in the current study's methodology. Uttarakhand's current electricity production capacity is 1.86 GW, which is 0.76 percent of India's total power capacity of 245 GW. Similarly, 0.21 GW of India's total renewable energy capacity is shared by Uttarakhand, making up 0.66 percent of the state's total capacity. Small Hydro Projects (SHP) generate 0.175 GW of electricity in Uttarakhand at the moment, which accounts for the majority of the state's renewable energy sources. In the Himalayan state of Uttarakhand, the largest source of renewable energy (83 percent) is small-scale hydropower (SHP), with just a minor percentage coming from other forms of renewable energy. 0.005 GW is the amount of solar energy generated. The state of Uttarakhand has a theoretical wind energy capacity of 0.534 gigawatts (GW), but none exists as of right now. Hot water springs in Uttarakhand may provide thermal energy or generate electricity, depending on how they're used. Another source of renewable energy is the vast volume of readily accessible biomass.

Sangroya & Nayak (2015), The Indian wind energy business has been shown to be the fastest-growing renewable energy sector. Energy is vital for the country's economy to grow and for its population to enjoy a higher standard of living. Since gaining its independence, India has made significant financial investments to increase its energy production. This has resulted in an increase in producing capacity. Using conventional energy sources such as coal, gas, and the like in order to meet expanding energy needs, on the other hand, leads to environmental problems. Because of this, the government started exploring into alternate and ecologically beneficial sources of energy. " New and renewable energy sources such as wind, solar, and biomass have gained considerable attention in India despite coal and natural gas being the country's principal power sources. Numerous easily expandable, sustainable, and renewable energy technologies have seen an increase in their use. In India, wind power is becoming more important as a supplementary energy source for ensuring a clean and sustainable future. An overview of wind energy in India and its future is provided in this article.

Sharma (2019), It was projected in their report that the population of India totals more than 1250 million people. It needs a lot of power, and the energy sources we have now can't provide it. The world's principal source of energy is coal, gasoline, and other fossil fuels. By generating power from these sources, our environment gets contaminated. Pollution in the environment is causing a wide range of health problems for most people. They must rely on renewable sources of energy like solar, wind, and hydropower to satisfy the

needs of contemporary society. A growing number of countries are turning to alternative energy sources including geothermal and tidal power. Solar power is a renewable and ecologically benign source of energy. Unlike other sources of energy, it's untainted and plentiful. No pollutants are created by solar energy. Since solar energy is both safe and abundant, India is well situated to take advantage of its abundant sunshine all year round. India's government has chosen to concentrate on solar power production and the creation of multiple solar cities and solar parks in view of the present circumstances.

Singh & Singh (2016), The Indians are shown to have a lot of potential for solar power generating. Because of its geographical location, the nation is well-suited to harness the power of the sun. Indians live in a subtropical climate, which means the country receives an average of 3,000 hours of sunshine every year. The equivalent here is more than 5,000 trillion kWh. In India, you'll get anything from 4 to 7 kWh of solar radiation per square meter. Estimates range from 2,300 to 3,200 hours of sunshine each year. As a result of their location, the states of Andhra Pradesh (Bihar), Gujarat (Haryana), Madhya Pradesh (Maharashtra), Orissa (Punjab), Punjab (Rajasthan), and West Bengal (West Bengal) have a great amount of potential for harnessing solar energy. Rural areas, where the majority of the population resides, are ideal locations for promoting solar energy. Solar lighting, street lights, and solar water pumps are all powered by 66 MW in rural regions. To fulfill the country's energy demands and contribute to the global effort to battle climate change, India has a large strategy for the generation of solar energy.

Sharma et al. (2015), The NAPCC (National Action Plan on Climate Change) calls for the promotion of alternative forms of renewable energy. A number of actions have been suggested, including promoting renewable energy deployment, innovation, and basic research; removing obstacles to the development and commercial deployment of biomass, hydropower, solar and wind technologies; promoting direct biomass combustion and direct biomass gasification technologies; promoting the development and manufacture of small wind electric generators; and improving regulatory and tariff frameworks for these renewable energy sources and technologies. By 2032, renewable power is expected to account for roughly 5% of the country's total energy consumption, according to a recent report. Foreign investment in India's green energy revolution should be encouraged by highlighting the country's enormous renewable energy potential. Energy security and sustainable development in India rely heavily on the capacity to tap into alternative sources of energy. There are plans to gradually replace diesel and petrol in transportation vehicles with alternative fuels, mostly biofuels. Last but not least, renewable energy delivers huge advantages and contributes considerably to the national energy mix, and it is projected that the percentage of renewable energy in total generating capacity will grow in the future.

Sharma et al. (2014), As the climate of Rajasthan is suitable for catching the sun's energy, the state has a great lot of potential for solar power. 66.66 percent of Rajasthan's land area is covered by the Thar Desert, a semi-arid climate. There are nearly 300 to 325 bright days in a year, which is the second largest quantity of solar radiation in the globe, thanks to these climatic features. In the summer, the average temperature in the western towns of Rajasthan rises beyond 45 degrees Fahrenheit. In Rajasthan, solar energy is available at a density of 6 to 7 kilowatts per square kilometer, with an annual output potential of 100,000 megawatts (MW), of which only 442,25 MW are now generated. I can't think of a better way to describe the current scenario. The potential, status, goals, and constraints of solar energy in Rajasthan are discussed in this research.

Khare et al. (2013), The development of solar and wind energy systems in India is hindered by certain restrictions. India, on the other hand, has a steady supply of sunlight and moderate breezes. Because of this,

there is a bigger possibility to expand solar and wind energy systems in India, and there is adequate future potential for these renewable sources via "Grid Parity." The purpose of this study is to describe the primary obstacles to the growth of renewable energy in India in a logical and comprehensive manner.

III. Regional Analysis of Energy resources

3.1 Uttarakhand: The state of Uttarakhand has an abundance of renewable energy resources. A wide range of microclimates may exist in Uttarakhand. A vast part of the Himalayan region is classified as "cold and overcast," whereas other locations, such as Dehradun, have a more moderate temperature. Haridwar, Kashipur, Roorkee, and Rudrapur are part of the composite climatic zone, which includes the state's plains. Between 4.5 to 5.55 kWh/m2 of sunlight fall on the state. It is a key goal for the state government of Uttarakhand to promote solar energy. Create an environment that supports public and private investment in solar energy projects is the goal of Policy Endeavour. All aspects of the Uttarakhand Solar Energy Policy 2013 are addressed in this comprehensive plan.

3.3.1 Policy-Eligible Solar Energy Projects in Uttarakhand

Type I As stated by the UERC from time to time, Uttarakhand DISCOM's RPO Obligation, competitive bidding is utilized to choose projects that fulfill the RPO Obligation.

Type II - Captive usage or sale to a third party of renewable energy certificates (RECs) generated by projects built on private property.

Type III - Construction of renewable energy facilities on public land with the intent of either providing power for government use or selling electricity to customers in other parts of the state or beyond.

Type IV - The Jawaharlal Nehru National Solar Mission is a program that finances solar power initiatives on behalf of the Indian government.

3.2 Rajasthan: With an installed capacity of 7,737.95 MW, according to statistics from the MNRE, Rajasthan is now the largest solar power producing state in India, surpassing Karnataka in the process (MW). Following Gujarat with a capacity of 5708 MW is Karnataka, with a total of 7469 MW. In Rajasthan, solar energy production can supply national demand for 325 out of every 365 days. Every day, the wind power plant generates 150 MW, while the solar power plant generates 225 MW. Officials believe that a new solar energy initiative implemented by the state government of Rajasthan in 2019 might make the state the largest solar energy generator in the world. In addition, the solar energy sector was given a huge boost by the Rajasthan Investment Promotion Scheme-2019 (RIPS). A record 10,000 crores ($1.6 billion) have been invested in Rajasthan's solar energy industry in only the last eight months. By 2021, the state of Rajasthan will have achieved substantial progress in solar energy, including ground mounts, roof tops, and off-grid installations. The aim of 30 GW of solar electricity generation by 2024-25 has been set. In light of current procedures, the Renewable Energy Corporation predicts that Rajasthan will remain a frontrunner for the foreseeable future. With a target of 30,000 MW of solar power production by 2030 in mind, the state is continually expanding its network of solar parks to satisfy this need.

3.3 Haryana: Modern solar systems have helped make India a household name there. Solar panel and solar system firms have been founded by more than a few enterprising people. The Haryana Government has launched the Haryana Solar System Subsidy 2021 initiative for farmers in our state. This ordinance mandates the use of solar cells to power inverter chargers for all farms in the state. The government has provided the farmer with a 40% subsidy and solar inverters with capacities of 300 or 500 watts. Thus, under this

arrangement, they will be eligible for a subsidy to purchase an inverter charger. When the whole cost of this subsidy is calculated, however, farmers stand to save a significant amount. There is a potential solution to the high price of solar energy systems, and it is called the Solar Inverter Charger Scheme 2021. Growing crops has always been a labour-intensive endeavour for farmers. Although climate and the environment have hindered agricultural output. Our farmers' efforts to cultivate wheat were often thwarted by untimely downpours. There hasn't been any government help for farmers in Haryana for quite some time. Therefore, in order for farmers to reap the benefits of the program of their choice, they must first register in this program.

IV. Conclusion

This article delves into the present renewable energy program in this field by analysing statistics on energy sources in three distinct locations. Primary analysis of existing literature and secondary data are prerequisites for every research endeavour. Utilizing secondary data for preliminary research and optimising proposed hardware model or actual industrial setup is highly useful. In the framework of studying renewable energy, the states of Uttarakhand, Haryana, and Rajasthan have been selected for investigation. To lessen the public's financial investment in power and to take a modest step toward lowering the nation's greenhouse gas emissions, local governments are working hand in hand with the federal government to expand access to solar and other energy sources. In addition to discussing the policies that have been implemented to promote the use of renewable energy, this study also provides a regional analysis of three different regions.

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