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Global Status of India's Renewable Energy Policies

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Abstract: ***Today, India has significant potential for generation of power from renewable energy sources. India's search for renewable energy resources that would ensure sustainable development and energy security began in early 70's of the last century. Consequently, use of various renewable energy resources and efficient use of energy were identified as the two thrust areas of the sustainable development. This paper includes, India's Renewable Energy Policies i.e. Renewable Energy Certificate (REC), Electricity Act (2003), National Electricity Policy (2005), Tariff Policy (2006), National Action Plan of Climate Change, and Rural Electrification Policy (2006). Global status of India's renewable energy policies is also discussed. Along with that, the paper sums up with the path opted for India to become global renewable leader.***
Keywords: Climate Change, Renewable Energy, India's Renewable Energy Policies

I. INTRODUCTION

India cares for the planet and has taken a groundbreaking journey in renewable energy through the last 4 years. A dedicated ministry along with financial and technical institutions has helped India in the promotion of renewable energy and diversification of its energy mix. The country is engaged in expanding the use of clean energy sources and has already undertaken several large-scale sustainable energy projects to ensure a massive growth of green energy. In India, National Institution for Transforming India (NITI) Aayog, a non-statutory and advisory body, has taken the responsibility on the development of a comprehensive index to provide an integrated and combined view of the various socio-economic and substantial status of the country. It has also measured the progress of India and its state towards the accomplishment of the SDGs.

The energy demand in India is drastically increasing, and by 2030 India's total energy demand will be more than double while electricity demand will almost triple than today. Moreover, current conventional sources are responsible for climates as well as unlimited in capacity. Hence, an alternative form of the generation which is cleaner and unlimited will be indispensable. RE installed capacity accounts for 22.5% of India's total installed capacity for power production as of July 2019. India, the nation with abundant natural resources, has the immense potential for generating electricity through RE resources. The current day technologies have enabled for utilizing these renewable resources in a more efficient way of generating electricity. Fortunately, India is blessed with abundant natural resources for commercial production of electricity through renewables. The various renewable resources which are commercially available for generating electricity in India are wind, solar, small-hydel, biomass, tidal, geothermal energy. The reason for the discussion of renewable energy status and potential in India is its significant potential in the nation. India has witnessed a tremendous escalation in renewable energy generation in the past ten years. The rise in the total installed capacity of RE in the country is depicted in Figure 1.

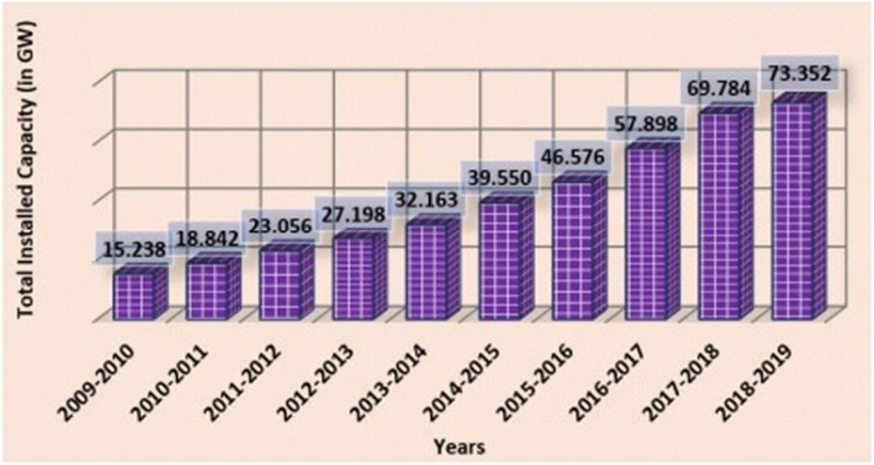


Figure 1: Growth of renewable energy over the past decade in India

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The Government of India has established the Ministry of New and Renewable Energy (MNRE) for developing and deploying alternative sources of energy generation and supplementing energy requirements of the country. Since its formation, it has implemented various programs to increase electricity generation from RE resources. Additionally, the generation of RE resources needs less maintenance cost compared to non-renewable resources. India's RE potential is about 900 GW from various sources, namely, Wind- 12%, Solar- 83% which includes the wastelands, Bioenergy- 3%, Small Hydro- 2.2%. India has committed to contribute to a healthier planet, and as per Paris Accord on climate change, it has pledged that by 2030, 40% of total power production will be from RE resources. If this ambitious target is achieved, India will become one of the largest RE producers in the world.

A. India has Ample, Untapped RE Resources which Include

1) The vast land area has the potential for solar energy generation. Moreover, solar exposure is also high in most of the areas of India.
2) There are many zones and areas where wind velocities are high, which can lead to a significant amount of wind energy generation by both offshore and land-based wind farms.
3) The decent amount of yearly biomass production.
4) India's precious asset of numerous rivers and waterways capable of a small hydel generation.

II. INDIA'S RENEWABLE ENERGY POLICIES

Country's three-fifths of power generation is based on fossil fuels, and the country faced hurdles due to the impacts of generation through fossil fuels which introduce global warming. In the last few decades, the regime has formulated many steps in cultivating the generation through renewable energy, thereby decreasing the use of fossil fuel-based energy. The Ministry of New and Renewable Energy (MNRE) is a department that takes charge of official matters and helps in uplifting the RE resources.

The State Electricity Regulatory Commissions (SERCs) specified better tariffs for purchasing renewable energy. There was no eminent cooperation from the private sector, but there existed some national actions to uplift the power generation through RE resources. In 1991, after the annunciation of the ''private power policy,'' the private sectors started to participate effectively. It paved the way for the enhancement of wind power generation capacity in India.

The Acts, Policies, and regulations have been codified by the ministry to promote RE. India has both states as well as central level policies that support RE and aims in achieving a clean development mechanism. Ten states have implemented the individual quotas for REs share of about 10 % out of 29, and low tariffs for electricity produced from renewable sources have been proposed. Some of the significant policies and acts are discussed here.

A. Renewable Energy Certificate (REC)

In 2010, the Central Electricity Regulatory Commission (CERC) had announced its regulations on the Renewable Energy Certificate mechanism. It is a green tradable certificate which was introduced to advocate renewable energy resources and marketing developments in electricity. Renewable energy certificate mechanism has facilitated the bound between the people to meet their Renewable Purchase Obligation (RPO) in those states that are deprived of renewable energy sources along with the open access consumers, captive power plants and distribution companies which have the option of purchasing the renewable energy certificate. RPO is a committee authorized by the State Electricity Regulatory Commission (SERC), to invest a meager level of RE out of total consumption in the area of distribution licensee.

The Central Commission designates the registration of renewable energy certificate through a central level agency, and; renewable energy can be sold at a tariff which has been established by the electricity regulatory commission. The renewable energy certificate mechanism has contributed an opportunity for all types of renewable energy generators to accept the benefits by not worrying about the agreement related to power purchase for the trade of renewable power.

B. Electricity Act (2003)

This act stands as a pillar for the upliftment of renewable energy in the country. This act was originated from three acts that were formed earlier, and these acts standardized electricity sectors-Indian Electricity Act (1910), the Electricity Act (1948) and the Electricity Regulatory Commission Act (1998). Few major regulations in the Electricity Act (2003) are: Section 3(1), Section 4, Section 61 (h), and Section 86 (1) (e), Section 86 (2) (i).

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C. National Electricity Policy (2005)

The policy specifies that the contribution of electricity from renewable energy should be increased, and distribution companies adopt the process of competitive bidding for the purchase of power. Some of the plans of the National Electricity Policy are:

1) In the next five years, all households will have access to electricity.
2) By the end of the year 2012, there will be no power demand and to increment the extra generating capacity, which can be done by increasing the output power of generators which are already connected through a power system.
3) To supply a standard quality of power in a well organized manner at a reasonable rate.
4) By 2012, the per capita availability of electricity has to be expanded to over 1000 units.
5) The electricity sector has to be supported financially and has to compete effectively to gain profit in the renewable energy sector.
6) To know the requirement of the consumers and to ensure protection to them.

D. Tariff Policy (2006)

The central government revises this policy under section 3(3) of the Electricity Act 2003. It has been evolved as a result of discussions between the State Governments, the Central Electricity Authority (CEA), the Central Electricity Regulatory Commission, and various stakeholders. The main objective of this protocol is fixing a minimum %age for purchasing energy, taking into consideration the presence of resources and its effects on retail tariffs and concerning the purchase by distribution companies. It also aims to provide a better service to consumers through robust electricity infrastructure. It also ensures in creating adequate capacity, which includes assets in generation, transmission and distribution to produce reliability in electricity supply to the consumers.

E. National Action Plan of Climate Change

This was formulated in the year 2008 to limit the emission of carbon concerning the protection and to accommodate the energy demand, and the government has launched a National Action Plan on Climate Change (NAPCC). The plan was started development through eight ‘‘National Missions’’ and to discuss the issues in climatic changes and about the steps to improve the utilization of Renewable Energy. The various ministries of the Government of India implement these missions, and the developments of every particular mission are constantly inspected by the Council on climate change which is governed by the Prime Minister of India.

The main aim is to utilize the local government and public-private partnerships effectively and gratify global companies for research and development. Through the United Nations Framework Convention on Climate Change (UNFCCC), the transfer of technologies and funding is made easy. Among the 8 national missions, the Jawaharlal Nehru National Solar Mission (JNNSM) is one of the major energy missions. It was launched in 2010 with an idea of increasing the generation through solar energy and by the end of 2022, it has targeted to set up 22000MW of power generation through off-grid and grid-connected plants.

F. Rural Electrification Policy (2006)

The main objective is to ensure the accessibility of electricity to all the remote villages by the end of 2009, either through off-grid or grid-connected techniques. It cannot be entirely achieved through conventional methods, which arose an opportunity for solar, micro-hydro, wind and biomass technologies. The government has launched Rajiv Gandhi Grameen Vidyutikaran Yojana in the year April 2005; this is a scheme to electrify 125000 villages and also gives access to rural households in 5 years. By the end of December 2006, a total of 19.758 villages have been supplied with electricity.

III. GLOBAL SCENARIO OF INDIA’S RENEWABLE ENERGY POLICIES

All United Nations SDGs act as guidelines and framework for countries to achieve a sustainable and better environment for everyone on the planet. The SDGs accelerate the steps to be addressed to overcome critical challenges and interconnects every goal for a better future, and the UN has fixed the deadline for every member nation to accomplish the goals by 2030. Goal 12 of the SDGs emphasis the motto ‘‘doing more and better with less,’’ energy efficiency, sustainable infrastructure, consumption, and production are the key areas that need to be addressed. While goal 7 stresses affordable and clean energy for all, but global nations are facing various blocks in executing this practically. More progress needs to be made, and more public and private investments should be made.

Moreover, innovative models and regulatory frameworks need to address to achieve this goal. About 17.5% of total final energy consumption comes from renewable energy while remaining came from conventional sources.

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It indicates that fossil fuels comprise a significant part of energy production, which leads to a chain reaction of GHG emissions, global warming, and climate change effects. One of the primary objectives of the Paris agreement is to keep the global temperature rise less than 2 degrees Celsius. It also aims to improve and aid nations in dealing with global climate change. The Agreement was different from its predecessors with its bottom-up approach; INDCs (Intended nationally determined contributions) for making it even more successful. With about 197 countries signed the Paris agreement as of November 2019, many of them have committed themselves towards the net-zero emission target. The Paris agreement acts as a catalyst in driving investments into cleaner energy and economy. India has also committed to reaching 40% of no-fossil fuel electricity by 2030. With 185 countries ratified the agreement; still, some are pending to ratify it. While the US intends to exit the accord by 2020, China has achieved its 2020 target in 2017 and countries like Sweden, Portugal, and France had made the most progress with 77%, 66%, 65% respectively. Therefore, the emerging interest today is to increase the share of renewables in global energy production to meet the ever-rising demand, reduce global warming and energy costs. Hence, significant initiatives are being taken to develop policies to increase renewable energy penetration into the energy mix, and over time, many countries have developed individual frameworks and policies

In recent years, many policies have adopted throughout the world in supporting renewable energy integration in the electricity sector such as 61 countries introducing a feed-in tariff (FIT) and the introduction of green certificates or auction systems with Europe leading implementation. By 2017, policies for renewable power had spread to 121 countries. Global production of renewable energy is increasing day by day and in 2018; 171 GW renewable energy is integrated into the energy mix with an annual increase of 7.9 % by new additions from solar and wind energy. Total RE installed capacity continent wise is shown in Figure 2 in which it is evident that Asia is the leading continent with a global share of 44%.

Among the Asian countries, China leads in renewable energy production followed by India and Japan. Figure 5 shows the Total RE Installed Capacities (in MW) of some of the leading Asian countries. From Figure 3, it is evident that China, the world's most populous nation and one of the largest renewable energy-producing nations achieving through its enormous potential in solar and installed capacity in hydroelectric and wind energy. As of 2018, it has a RE installed capacity of 695.86 GW, which was six times greater than India's total installed RE capacity. In the 13th Renewable energy five-year plan, China had set a target to achieve 680 GW of power generation from renewable.

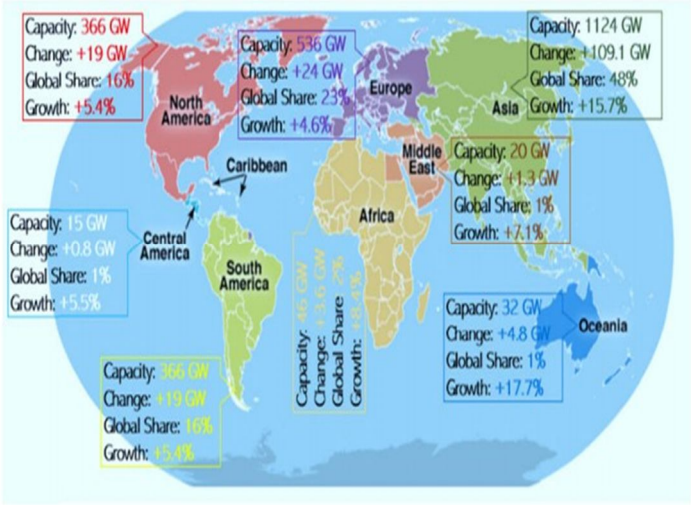


Figure 2: Renewable energy generation capacity at the regional level as on 2019

Energy sources by 2020, with wind energy accounting up to 210 GW. But China, at the end of 2018, achieved a total installed capacity of 728 GW, which is a 12% year on year increase in all forms of renewable. The Chinese government is also giving many incentives for local companies to support this development to reduce dependency on other countries.

Biomass capacity has considerably increased in recent years with total installed biomass capacity accounting for about 17.8 GW. Thus, China's new energy policy on self-security for energy takes proactive steps in developing cutting-edge technology in improving the efficiency of plants and delivering quality renewable energy and expansion of its various facilities across the nation. Renewable energy growth in the region from 2010-2018 is shown in Figure 4.

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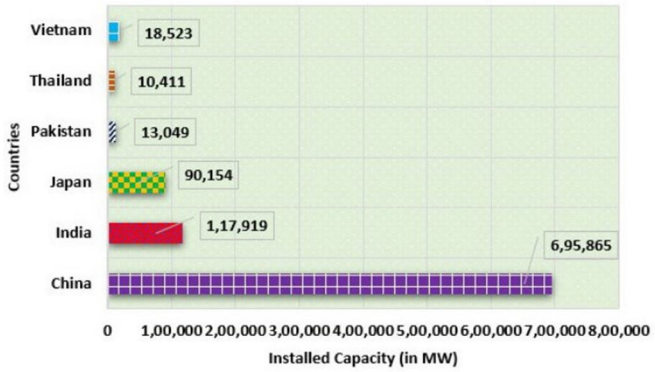


Figure 3: Total Installed Capacity of Leading RE producing Asian countries as of 2018

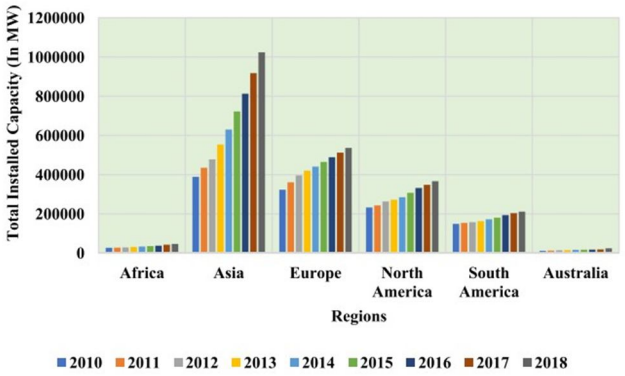


Figure 4: Total Renewable Energy Installed Capacity

Various sources of RE generation in these regions as of 2018 are shown in Figure 5. In the North American Continent, countries like the United States, Canada, Mexico lead in renewable energy production, with the United States pioneering in all fronts with an installed RE capacity of about 245.24 GW as of 2018. The United States of America stands as the second-highest polluter in the world, with 14.6% of overall carbon emissions in the world, but it also manages to lead in RE production in the world only behind China. The United States of America has abundant resources and mainly has a more significant potential of wind energy, and the government is likely to invest resources to increase its total capacity of wind energy to 314 GW.

In recent years, interest in solar energy adoption in small scale production has been in rising with the initiative of many private players like Solar City Corporation who tends to play a critical role in the wide-scale adoption of solar energy in US households. The share of renewable energy production through the solar, wind, geothermal and hydroelectric are projected to increase considerably in the next decades, with solar PV is projected to constitute about 48% of total renewable energy production followed by wind at 28% and hydroelectric at 18% by the end of 2050. The hydropower limited since there is a minor possibility of adding new structures. Renewable energy could also become the most abundant energy source contributing to about 50% by 2030.

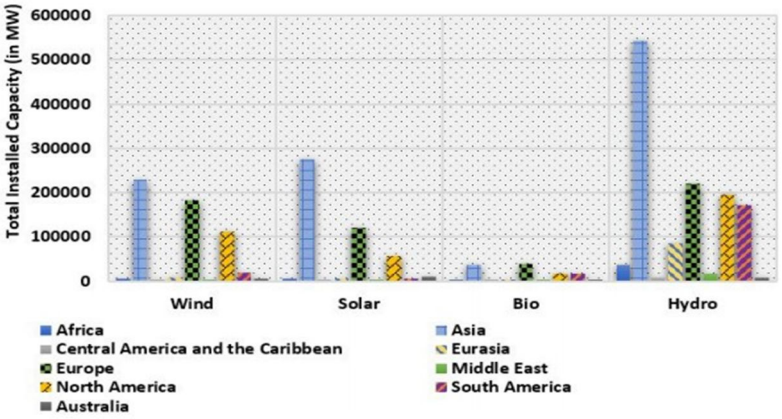


Figure 5: Resource-Wise Installed Capacity as of 2018

In Europe, among various countries like Sweden, Finland, Portugal, Denmark, Germany, and France leads the renewable energy production in the continent. Sweden is considered for discussion as it is one of the pioneering countries which lead towards a low-carbon economy with nearly 60% of energy coming from RE sources. It has an installed capacity of about 29.06 GW, according to a report by IRENA (International Renewable Energy Agency). It is a part of IEA (International Energy Agency) since 1974, and currently, the country has the second-lowest CO_2 emissions in the world and which is about 1/4th of the United States of America. The country was able to achieve this feat only because most of its energy comes from nuclear and hydroelectric power, which is nearly emission-free. Its energy sector underwent considerable changes in the production of energy in the last 30 years. Though nuclear and conventional sources make a large part of the country's energy production, hydropower contributes a considerable amount of about 68.6 TWh (Terawatt hour).

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It enjoys a massive amount of water resources, but still, hydropower expansion remains narrow as part of safeguarding the remaining large rivers. The country has already achieved 50% RE in total energy production way back in 2012, and now it is on track to achieve 100% RE production by 2040.

The total renewable energy installed capacity of the African continent stands at 46269 MW at the end of 2018. African countries like Ethiopia, Egypt, Morocco, South Africa leads the renewable energy production. RE installed capacities in some of the African countries are shown in Figure 8. South Africa is the pioneer regarding renewable energy production among the African countries, and the National Development Plan 2030 aims to make a decent investment in renewable energy capacity and generation. The White paper on renewable energy (2003) was vital in stressing the needs of RE and the need for diverse energy generation mix in the country. The nation has witnessed a rapid increase in recent years from a baseline zero RE capacity in 2010. South Africa Department of Energy (SADOE) has decided based on the new Integrated Resource Plan (IRP) focusing on increasing PV solar panels to reduce coal-fired plants and also not to install new nuclear power plants.

Under the Renewable Energy Independent Power Producer Procurement Program (REIPPP), 27 new renewable energy projects have signed, which will add about 19400 MW of new generation capacity by 2030. Many parts in South Africa on average, receives about 2500 hours of unobstructed sunshine throughout the year. The average solar radiation South Africa receives is about 4.5 and 6.5 kWh/m2. Currently, Rooftop solar PV installed capacity is about 250 MW. Wind energy generation is also considered from several wind farms like Metrowin Van Stadens (27 MW), Jeffreys Bay (138 MW), Kouga wind farms. It also has a higher potential for biogas production with an estimation potential of 2500 MW of power. Though renewable energy production is acute, the government aims to adopt various RE sources and to gradually reduce coal consumption with an ambitious target of 21.5 GW of RE capacities by 2030. It includes 9200 MW Wind, 8400 MW Solar PV, and 1200 MW of solar CSP (Concentrated Solar Power) capacity.

India has fast-tracked its approach in adopting renewable energy, gaining necessary experience from global countries regarding how to accommodate feed-in tariffs, net metering, attracting stakeholders to promote renewable energy, and have adopted national policies. Many states in India have also drafted separate policies for both grid-connected and off-grid renewable energy

IV. CONCLUSIONS

The India is currently home to one of the most significant clean energy expansions in the world. An increase in the Central Government and foreign investment drives the nation-wide green expansion. Still, the state governments can contribute a lot to fuel this transition. India is already among the top five global green energy producers in the world by the end of 2019. Newer technologies, steady influx of capital, falling prices of materials, and a highly conducive policy environment are among the most critical factors which determine the growth of new green energy projects. In order to emerge as a global leader in the renewable energy sector, India needs to aggressively rectify some prevalent issues, that are dampening the growth of RE in the country. Moreover, it can adapt and implement successful strategies of other forerunners like China, Japan, Germany and the US in the RE sector.

Renewable based power plants need more substantial blocks of lands for construction and easing the land acquisition norms will fasten current projects. About 31GW of renewable energy projects are in construction, and another 40 GW projects are out for tender in India. In 2005, China enforced the Renewable Energy Law (REL) to promote the development and utilization of RE and marked as the transition phase of RE development in the country. The law also fast-tracked the development projects and solved prominent barriers of RE generation in the country. Article 25 of REL promotes financial institutions to give preferential loans to renewable energy development projects. Article 26 insists the central government provide tax benefits for these projects. The Ministry of Finance (MOF) issued a national taxation policy to favour RE projects. Moreover, Customs duty exemption is provided to import RE power generation equipment. Now whereas in India, still lack the interest of financial institutions to fund RE projects prevails. Also, the safeguard duty on imported solar panels, ambiguity over goods and services tax (GST) on solar equipment hinders the adoption rate of newer projects.

The government can rationalize the GST on solar and wind power equipment using a fixed standard national rate to improve fluidity in the sector. The Indian government can relax its taxation policies on RE technologies and provide more incentives for RE projects in the coming years. The new programs like Pradhan Mantri Kisan Urja Suraksha Utthan Mahabhiyan (PM-KUSUM), development of Ultra Mega Renewable Energy Power Parks (UMREPPs) which was implemented in 2019 contributed significantly to the growth of renewable energy installed capacity in the country. The central government has been discussing the DISCOMs (Distribution Company) reform scheme for a long time, and it is yet to be implemented. The major highlight of the reform scheme is the privatization of debt-ridden DISCOMs to improve their performance.

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Moreover, modernization of current transmission networks and further expansion of it may fuel the large-scale connection needs of RE production hubs. There is a recent slowdown in addition to newer transmission capacity in the country with about only 10625 ckt km (Circuit kilometres) to be added in the current FY 2019/2020 whereas in previous FY 2018/19 and FY 2017/18 in was 25000 ckt km.

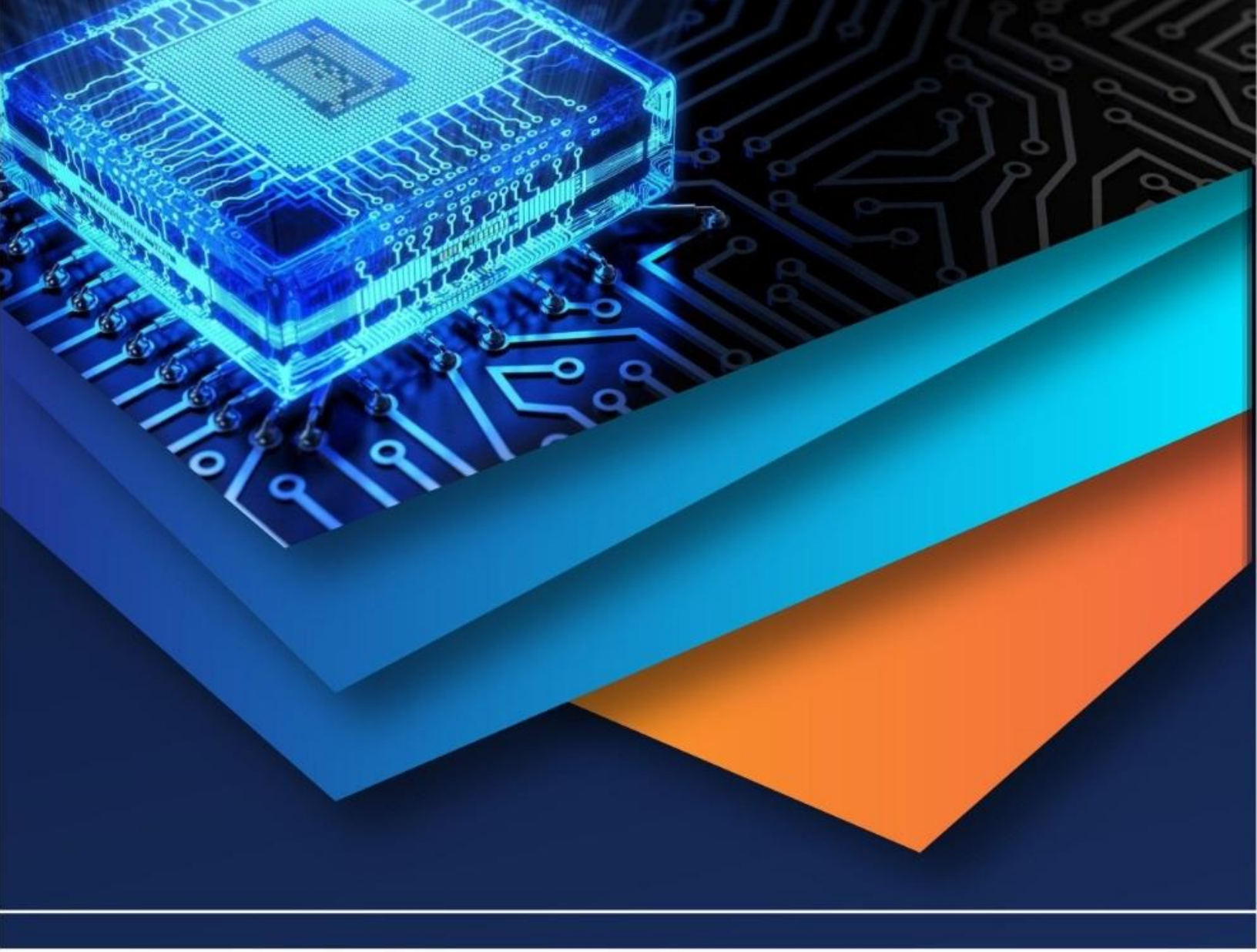
The lack of adequate transmission networks in key production hubs has kept the project developers from bidding for these RE projects. The Power Grid Corporation of India Limited (PGCIL) has recently shared proposals to set up large scale transmission networks in states of Maharashtra, Gujarat, and Rajasthan to support a combined 25 GW of renewable energy projects in these states.

The concentrating solar power, micro fuel cell and floating wind turbine technologies are the areas of prime focus to improve the efficiency of renewable energy generation. India should also incorporate the latest technologies through government-private partnerships to improve the efficiency of current installed capacity. More attention is needed on energy storage development projects and also energy transport on a more economical scale. There is a need to take special care of improved energy conservation techniques in heating, ventilation, and air conditioning (HVAC). These are the significant areas of concern to be focused on to improve the RE growth rate and efficiency in the country and to become one of the largest green energy producers in the world

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