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Availability of Renewable Energy Resources in India: An Exemplary Resolution to Energy Crisis & its Future Prospective for Rural Areas

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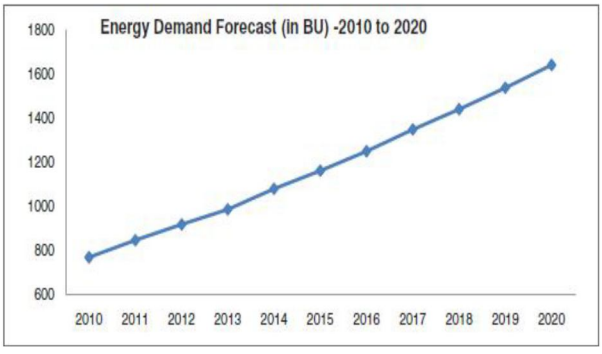
Abstract: ***The world is moving very fast towards development of civilization now a day. Industries, factories, power plants, various government organisations, growing up based on available instinctive energy sources. However, these sources are limited and expensive. So renewable energy will be the finest solution. Developing countries like India are also trying to utilize different renewable energy sources to fulfil their growing demand. As India is a big country with a vast population, to meet the energy challenges, different government proposals have been implemented to promote renewable sources. In this paper, it has been focused to identify different renewable sources of the country along with their effective utilization and getting their benefits. This paper also belongs to subject that how far renewable energy can be treated as an ideal solution of economic development in rural areas.***

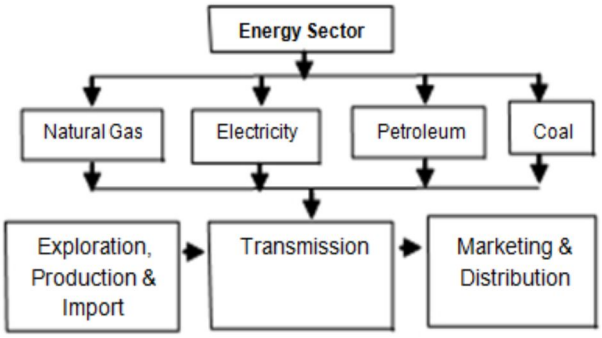
Keywords: ***Energy crisis, future prospective, Renewable Energy, Biomass, Tidal Energy.***

I. INTRODUCTION

India is the fourth largest energy consumer in the world after the United States, China, and Russia. In recent, India's energy consumption has increased relatively fast due to explosion in population and economic development. Rapid urbanization and improving standards of living for millions of Indian households, the demand is likely to grow significantly. To sustain the production, industries have gone for inefficient diesel-fuelled back-up power. India's energy planning, which is based on the twin objectives of high economic growth and providing electricity to all, is failing to meet either. The domestic power demand of India was 918 billion units in 2012. It is expected that at 9.8% annual growth the demand will reach 1,640 billion units (BU) by 2020. At this pace, India will require 390 GW in the next eight years which is almost double its current installed capacity of 210 giga watts (GW). There is growing energy inequity between rural and urban areas and between the developed and developing states. There are millions who are yet to be benefited from electricity in rural India. The scarcity of electricity in rural areas in comparison to urban areas seems to be biased in delivery through the centralized system. While the urban-rural difference in energy supply could be reduced through renewable energy, it is more complex to overcome the widening gap between developed and not so developed states. Current centralized energy planning of India is dependent on coal and fossil fuel sources. The main concern arises on how to protect the fossil fuel for our coming generation with simultaneously utilizing the different resources of energy for high and sustained economic growth. Pressure to increase its energy supplies and the consequent negative environmental impact of fossil fuels has led India to a conscious policy toward renewable sources. Current scenario of energy demand and supply demands the research and development activities in exploration ofnew reserves. There is huge amount of potential available in the renewable energy system which can be explored and harnessed to meet the energy demand.



[Fig 1: Energy demand forecast in Billion Unit]



[Fig 2: Energy Sectors of India]

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II. IMPORTANCE OF RENEWABLE ENERGY

A. Environmental Benefits

Renewable energy technologies are clean sources of energy that have a much lower environmental impact than conventional energy technologies.

B. Energy for Our next generation (Sustainability)

Renewable energy will not run out. Ever, other sources of energy are finite, and will someday be depleted.

C. Jobs and the Economy

Most renewable energy investments are spent on materials and workmanship to build and maintain the facilities, rather than on costly energy imports. Renewable energy investments are usually spent within the United States, frequently in the same state, and often in the same town. This means your energy dollars stay home to create jobs and fuel local economies, rather than going overseas. Meanwhile, renewable energy technologies developed and built in the United States are being sold overseas, providing a boost to the U.S. trade deficit.

D. Energy Security

After the oil supply disruptions of the early 1970s, our nation has increased its dependence on foreign oil supplies instead of decreasing it. This increased dependence impacts more than just our national energy policy.

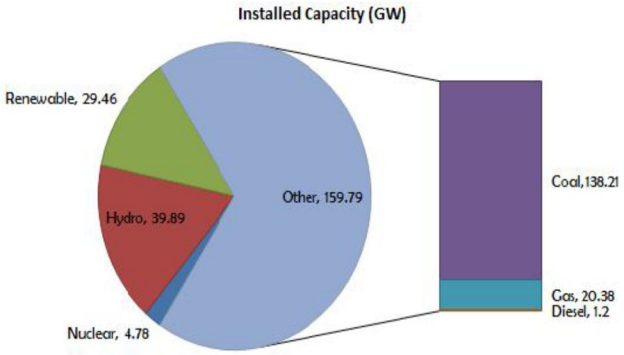
III. CURRENT ENERGY STATUS OF INDIA

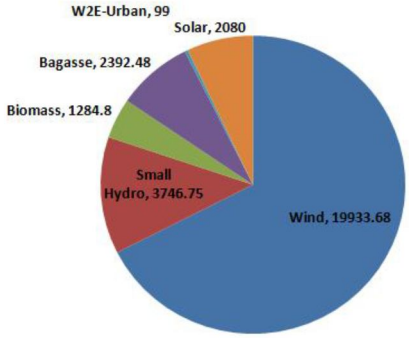
India has transitioned from being the world's seventh-largest energy consumer in 2000 to fourth-largest one within a decade. The country has the fifth-largest power generation portfolio worldwide. India's energy basket has a mix of all the resources available including renewables. The dominance of coal in the energy mix is likely to continue in near future. At present India's coal dependence is borne out from the fact that ~58 % of the total installed electricity generation capacity is coal based. Out of total thermal installed capacity 86% capacity is coal based. Other renewables such as wind, geothermal, solar, and hydroelectricity represent 2% share of the Indian fuel mix. Nuclear power holds a2% present share.

Total installed capacity in the country stands at ~234 GW of which

Thermal power accounts for 67 %

Renewable energy accounts for 13%





[Fig 3: All India Installed Capacity on Dec, 2013] [Fig 4: Break up of renewable energy sources in MW on Oct, 2013]

Renewable Energy sources are not depleted, and it is distributed over a wide geographical area, these resources are quickly renewed through natural process. It won't create any environmental pollution problems. The main advantage of using renewable resource is it is available throughout the year. By a onetime investment we can drew energy for many decades without affecting the environment.

A. Solar Energy

Solar Energy has the greatest potential for providing clean, safe, and reliable power in rural areas. The solar energy falling onthe Earths continents is more than 200 times the total annual commercial energy currently being used by humans. The government started solar power adoption with subsidies. A consumer who installs a solar panel array on a house can sell surplus energy to the local utilities. The solar panel cost, reduced to 50%, which would make solar Powered Electricity cost comparable with other types

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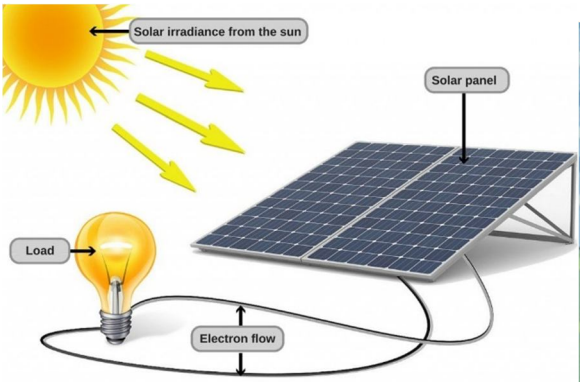
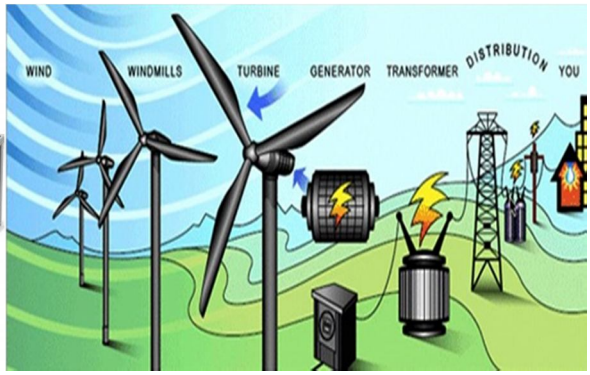
of fuel, is possible within the next decade. Solar Energy can be classified as two types Passive solar & Active solar. Passive solar energy is making direct and indirect use of thermal energies from the sun. Indirect use of Energy is possible only in building. A southern exposure of a building guarantees the maximum exposure of the sun's rays. Special metal leaf covering over windows and roofs can block out the sun during the summer months. Special thermal solar collectors can circulate water through the collection unit that collect the sun's thermal energy to heating the water for use. Active Solar Energy is the use of the sun's Electromagnetic radiation in generating Electrical Energy. Generally, semiconductor silicon Boron solar chips are used for this. The problem of these chips one that they have low Efficiency ratio and can only be used in supplying Energy needs of small devices i.e. calculators, watches, radio etc.

B. Wind Energy

Wind, ultimately driven by atmospheric air, is just another way of collecting Energy. Sun also heats the atmosphere, which produces wind. It works on cloudy days and Rainy season also. The location of wind turbines is a very important factor, which influences the performance of the machine. The windmills are generally located at the topof a tower to heights approximately 30 m. To avoid turbulence from one turbine affecting the wind flow at others it is located at 5-15 times blades diameter. Windmills are working both in horizontal axis and vertical axis. The basic mechanics of the two systems are similar. Wind passing over the blades is converted in to mechanical power, which is fed through transmission to an electrical generator. Wind turbines will not work in winds below 13km an hour. They work best where the wind speed averages22 km an hour. Most of wind turbines produced now are horizontal axis turbine with three blades,15-30 m diameter, producing 50-350 KW of Electricity. Wind energy produces no air or water pollution, involves no toxic or hazardous substances, and poses no threat to public safety.



[Fig 5: Solar energy at small unit]



[Fig 6: Schematic view of wind energy generation]

C. Biomass Energy

Biomass is the most important source for energy productions supplied by agriculture. Effective harnessing of bio-energy can energize entire rural milieu in a country like India where nature offers various types of biomass. This energy is also available in the form of biodegradable waste, which is the rejected component of available biomass. Biomass energy refers to fuels made from plants and animal wastes. The Biomass resource is, organic matter in which the energy of sunlight is stored in
chemical bonds. When the bonds between carbon, hydrogen and oxygen molecules are broken by digestion, combustion (or) decomposition these substances release stored energy. Biomass energy is generated when organic matter is converted to Energy. In this process, the facultative bacteria breakdown the organic material in the absence of oxygen and produce methane and carbon dioxide. Bioconversion is a non-polluting, environmentally feasible and cost-effective process. The effluent and digester residues are rich innitrogen and phosphorus, which can be recycled back to the soil as a fertilizer. By using this method, we can derive70% of the energy. The biomass is mixed with water and stored in an airtight tank. The gas comprises 65% of CH_4 and 35% of CO_2, and other common gasses. The gas produced may be used as cooking gas, fuel for automobiles and electricity generations depending upon its bulk rate of production.

D. Tidal Power

Oceans cover Two Thirds of the Earth's surface. This water is vast reservoir of renewable energy. India is naturally located in seashore side and covered 3 sides by sea. The movement of the water at the coastal front in kinetic energy that can be converted into Electrical energy. The energy spread out along the thousands of km of coasts, in favourable location, the energy density can average

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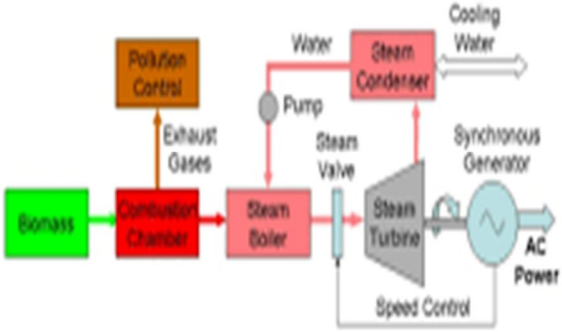
65MW/mile of coastline an amount which can lead to economical wave generated Electricity. The cheapest method to draw tidal power is that the oscillating water columns use the force of waves entering a fixed device to generate Electricity. The waves entering the anchored compress air in a vertical pipe. This compressed air cans be used to simply derive a turbine generator producing Electricity. The main problem of wave power plants is cyclone and severe storms. During this period the plant does not work.



[Fig 9: Generation of electricity from biomass]

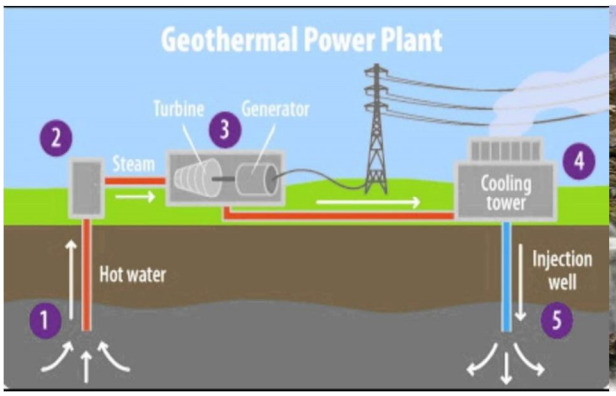
[Fig 10: Generation of power from tidal waves]

E. Geothermal Energy

Geothermal energy is the heat from the Earth. It's clean and sustainable. Resources of geothermal energy range from the shallow ground to hot water and hot rock found a few miles beneath the Earth's surface, and down even deeper to the extremely high temperatures of molten rock called magma. Almost everywhere, the shallow ground or upper 10 feet of the Earth's surface maintains a nearly constant temperature between 50° and 60°F (10° and 16°C).Geothermal heat pumps can tap into this resource to heat and cool buildings. A geothermal heat pump system consists of a heat pump, an air delivery system (ductwork), and a heat exchanger-a system of pipes buried in the shallow ground near the building. In the winter, the heat pump removes heat from the heat exchanger and pumps it into the indoor air delivery system. In the summer, the process is reversed, and the heat pump moves heat from the indoor air into the heat exchanger. The heat removed from the indoor air during the summer can also be used to provide a free source of hot water.

F. Small Hydro Power (SHP)

Hydro projects in India, which are under 25 MW in capacity, are classified as “small hydropower” and considered as a “renewable” energy source. The use of small hydro power (SHP) in India goes way back in history, with the country’s first SHP plant having come up in 1897. The sector has been growing rapidly for the last decade. The Number of SHP plants has doubled. SHP is by far the oldest renewable energy technology used to generate electricity in India. The total installed capacity of SHP projects in India was 3,632 MW in March 2013. This is spread over 950 projects; hence, the average SHP project capacity is 3.8 MW. This does not include micro-hydel plants. The draft 12th Five Year Plan (2012-17) has, as its target, 2,100MW of SHP capacity. The total potential country-wide capacity is estimated at19,749 MW, of which about 1,250 MW is under development. The current total installed capacity of small hydropower plants is 3746.75 MW.



[Fig 11: Schematic view of Geothermal Power Plant]

[Fig 12: Power production through SHP Plant]

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G. Use Of Renewable Energy In Different Sectors

1) Transport Sector
2) Agricultural Sector
3) Industrial Sector
4) Domestic Sector
5) Energy Sector

H. Economical Benefits

Problems with renewable energy sources are not available at a reasonable cost, limited supplies and lack of cost Effective means for capturing and concentrating the renewable Energy. The production cost of renewable source is reduced by subsidies. For some years, the World Bank has been sold Electricity in developing countries at an average only 40% of the cost of its production. Predicted estimation about the rate of utilization of energy resources shows that the coal deposits will deplete within the next 200 to 300 years and petroleum deposits will deplete in next few decades. Now, the world is looking for alternate energy resources. Hence, it is necessary to encourage and emphasize the research and development activities covering abroad spectrum of possible renewable resources, as their contributions are substantial. Renewable Energy sources are not depleted. These resources are quickly renewed through natural process. It won't create any environmental pollution problems. The main advantage of using renewable resource is it is available throughout the year. By a onetime investment we can drew energy for many decades without affecting the environment. Successful implementation of renewable energy sources our country economy is increased.

[Table 1: Renewable Energy Potential as on 2013]

Resources	Estimated Potential (MW)
Solar Power (30-50 MW/sq. km)	100000
Wind Power (At 80m height)	100000
Small Hydro Power (Up to 25 MW)	20,000
Bio Power (Argo-Residues)	17,000
Bio-Power (Co-generation-Bagasse)	5000
Waste to Energy (MSW-Municipal Solid Waste to Energy)	2600
Waste to Energy (Industrial Waste to Energy)	1280
Total	2,45,880

I. The Future Sources Of Energy

Proper use of energy is very vital in catering the need for energy demand. Experts all over the world are of the opinion to utilize renewable energy sources for power generation. Gone are the days when fuel prices were low and power companies resorted to fossil fuels for meeting energy demand. The sustainable nature of wind, hydropower, geothermal, solar and biomass highly encourage the energy supply companies to utilize them. Moreover, people can setup small solar panels over their homes to tackle their own load demands. These sources of energy are not hazardous to the environment since they do not require any sort of mining and drilling and produce nearly no pollution. Most importantly, they are much more economical than fossil fuels and do not cause adverse mishaps. Conservation of energy and utilizing renewable sources is the ultimate destination of energy. Many vehicles run on gasoline (which is a fossil fuel). Gasoline will deplete one day, and vehicle industry must resort to some new sort of energy such as hybrid systems to continue its business. Energy can be conserved in many ways. Many a times, we take for granted the lights being switched on. When not in the room, the lights do not need to be switched on. This practice will certainly save a lot of cash on electricity bill. Incandescent lamps can be replaced with Compact Fluorescent Lamps (CFLs). They consume very less power and give much more light using the same amount of current. This not only saves money, but it also conserves an energy source for others. Air conditioning and heating are responsible for a large percentage of electricity bills in various countries. Consider adjusting the thermostat ofair conditioner and heater by a few degrees, but while still maintaining soothe. For example, if the heater is typically setto 71^0 Fahrenheit in the peak winter, set it to, for instance, 69 and if the air conditioner is at 73 in the peak summer,

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set it to, for instance, 75. Just a couple of degrees can make a considerable indentation in the amount of energy consumed while this also reduces the electricity bill.

IV. CONCLUSION

The renewable sources are cost effective, user-friendly, so that they can easily beat the fossil fuels. By promoting renewable energy sources, we can avoid, Air pollution, soil pollution and water pollution. Country's Economy will increase. Throughout the year these sources are available without affecting the Environment. There is need to increase total domestic energy production to reduce import dependence, combined with the need to move away from fossil fuels in the longer run in view of climate change considerations and it points to the need for stronger efforts to increase the supply of energy from renewables.

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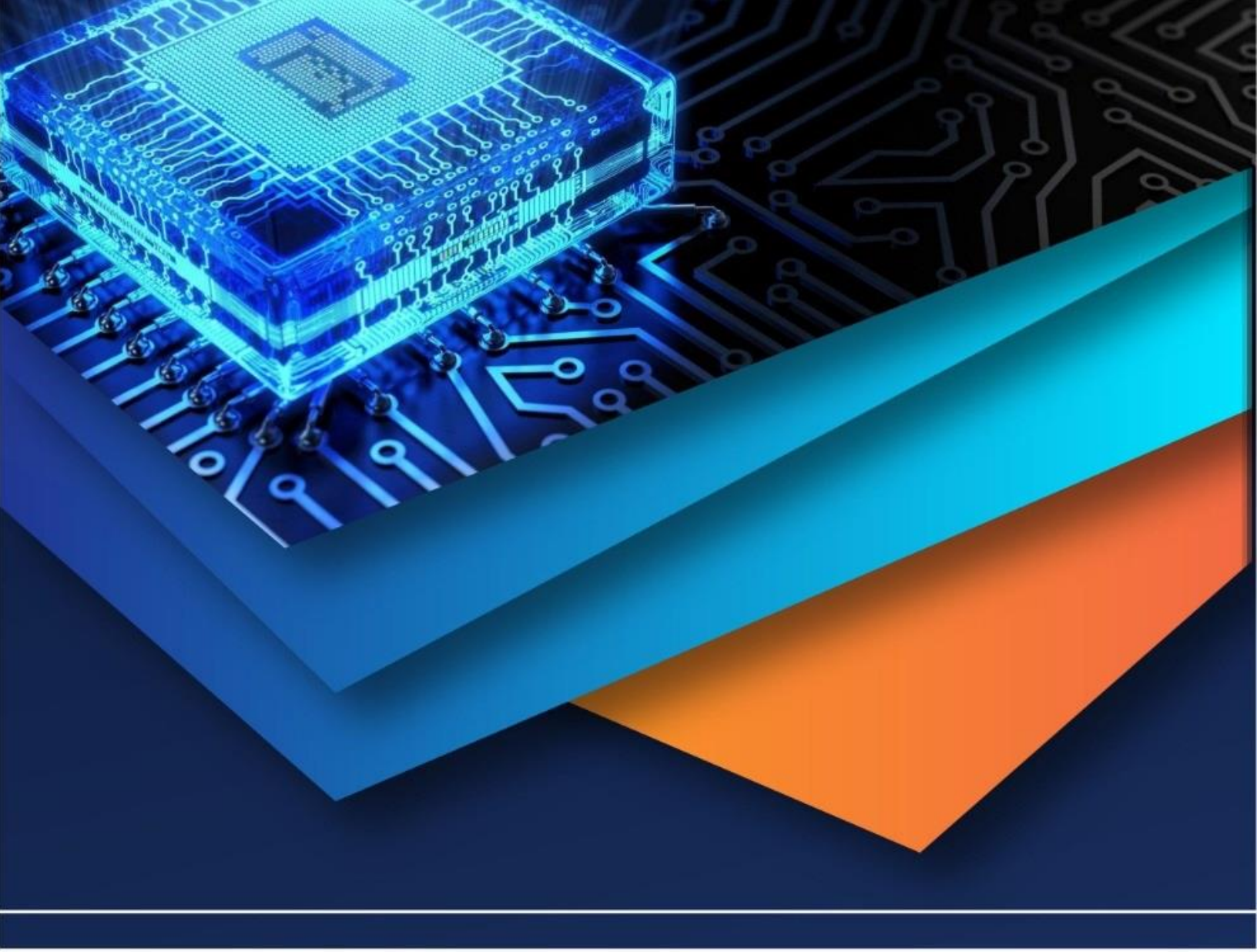

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