

**A REVIEW ON SOLAR AND WIND ENERGY HYBRID SYSTEM**

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**ABSTRACT**

With the usage of traditional energy sources, the world is currently expanding rather quickly. Today, electricity is the most essential resource for people. Every conventional energy source is running out every day, and using them has the drawback of causing environmental degradation. Therefore, we must switch from using traditional to non-conventional energy sources. Electricity can be generated using a wide variety of green and renewable energy sources. This idea combines the use of wind and solar energy, two different energy sources. This approach despises renewable energy sources without endangering the environment. Using a hybrid energy system, we can provide uninterrupted power. Two energy systems that provide continuous electricity are integrated into this system. Solar panels and wind turbines are used to convert solar and wind energy, respectively, into electrical energy. There are many uses for this electrical power. At a reasonable price, power will be produced. The goal of this project is to generate electricity from two sources simultaneously at a low cost without upsetting the delicate balance of nature. In addition to the hybrid system, we are producing electricity from the wind utilizing the maglev technology. In terms of producing electricity from renewable energy sources, INDIA is currently ranked fourth worldwide.

**Keywords:**

Renewable, Hybrid, Solar energy, Wind energy, Maglev principle

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**INTRODUCTION**

Our daily lives most certainly require electricity. Electricity can be produced in one of two ways: using traditional energy sources or unconventional energy sources. Demand for electrical energy is rising globally, so we must produce electrical energy to meet this demand. Nowadays, traditional energy sources like coal, diesel, nuclear power, etc. are used to produce electrical energy. The main disadvantage of these sources is that it generates waste, including nuclear waste in nuclear power plants and ash in coal power plants, and that taking care of this waste is quite expensive. Additionally, it harms nature. Humans are also greatly harmed by nuclear waste. The supply of conventional energy is running out every day. We must develop another way to produce power because it will soon completely disappear from the planet. The new supply needs to be trustworthy, clean, and affordable. Alternative energy sources to traditional energy sources like non-conventional energy sources ought to be good. There are numerous non-conventional energy sources, including solar, wind, tidal, and geothermal. Tidal energy has limitations because it can only be used on seashores. In contrast, geothermal energy requires a much longer process to draw heat from the earth. In any circumstance, solar and wind power are readily available. Alternative energy sources like solar and wind are available and can be good. We can employ two energy resources to ensure that even if one of them fails, another will continue to create electricity. Solar energy has the downside of being unable to produce electrical energy in foggy or rainy seasons. Additionally, we can combine both sources when the weather is favorable.

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### Hybrid Energy System

A hybrid energy system combines two energy sources to supply the load with power. In other words, it can be said that "A hybrid energy system is one that is created or designed to extract power by utilizing two energy sources." A hybrid energy system is more cost-effective, efficient, and reliable. In the suggested system, power is produced using solar and wind energy. Compared to other non-conventional energy sources, solar and wind have a number of advantages. Both energy sources are more widely available everywhere. It requires less money. To deploy this system, no special site is required.

### Solar Energy

Solar energy is that which is obtained by the sun's rays. The world is constantly and abundantly covered in solar energy. Solar power is a free resource. It is pollution-free because it doesn't produce any gases. It is reasonably priced. It requires little upkeep. The solar system's one drawback is that it cannot create electricity in inclement weather. But compared to other energy sources, it is more efficient. Only the first investment is required. It lasts a very long time and emits fewer pollutants.

### Wind Energy

The energy that is drawn from the wind is known as wind energy. Our extraction method involves a windmill. It is a renewable source of energy. For the generation of power, wind energy is more cost-effective. A wind energy system also has lower maintenance costs. There is wind energy virtually every single day. It emits fewer pollutants. The system has a lower startup cost as well. The speed of the wind has an impact on how much electricity it can produce. The main drawback of adopting independent renewable energy sources is that power is not always available. We combine solar and wind energy to overcome this. As a result, the generation will be maintained if one source of power fails. We can combine both sources in the system that is being presented. Another option is to use one source while keeping a backup source on hand. This will ensure generational continuity. As a result, the system will be dependable. The biggest drawback of this technology is the hefty initial investment required. In addition to being dependable, it produces fewer emissions. Maintenance expenses are lower. This system has a longer lifespan. There is more efficiency.

### Faraday Law of Electromagnetic Induction

The power is produced by using Faraday's first law of induction, which states that "Wherever a conductor is placed in a varying magnetic field, emf is induced, which is called induced emf, and if the conductor circuit is closed, a current is also induced, which is called induced current." This is the general schematic diagram of a magnetic levitation vertical axis wind turbine. The magnetic flux of these magnets links with the coil that is positioned on the base of the maglev wind mill, and the wind energy rotates the wind turbine blades that are fastened to the disc and to which magnets are fixed.

### Magnetic levitation

An object is suspended using only magnetic fields in a process known as magnetic levitation, often known as maglev or magnetic suspension. The effects of gravitational acceleration and any other acceleration are resisted by magnetic force. Mechanical contact reduces friction that would otherwise exist.

### LITERATURE SURVEY

Shruti Sharma et al. reviewed a progressive development in solar cell research from one generation to another, and discussed their future trends and aspects. They try to emphasize the various practices and methods to promote the benefits of solar energy. First generation (wafer based) cells include Monocrystalline and Polycrystalline solar cells, second generation (thin film) include amorphous silicon, CdTe, CIGS(copper indium gallium diselenide) ,third generation cells include nanocrystal-based cells, polymer solar cells, dye sensitized cells, concentrated solar cells ,perovskite based cells. An overview of the comparison of various types of cells has also been presented.

Mohd Rizwan Sirajuddin Shaikh ,et.al. have studied solar energy produced by sunlight and spoke about their potential future trends and features. They also talked about how different types of solar panels function and how to best promote the advantages of solar energy. sun cells directly transform sun energy into electricity. When a solar-powered cell

absorbs photons, silicon atoms' electrons are broken loose and dragged away by a grid of metal conductors, which forces an electric current to flow. Also reviewed are photovoltaic modules, panels, and arrays. They also explore several solar energy concentrate collection techniques, such as parabolic trough reflectors, Fresnels, parabolic dishes, and central receivers. The drawbacks of solar energy include the inability to produce electricity at night, high initial costs, the necessity for a vast amount of space, and the need for storage.

Manoj L, et.al. designed a windmill that doesn't require a generator or ball bearings and produces the most power possible. To maximize performance, a vertical axis wind turbine is added using magnetic levitation. They talked about wind energy, the invention of maglev wind turbines, and their use. With the help of only magnetic fields, an object is suspended using the maglev technique. The generated magnetic force is utilized to elevate the object and offset the effects of gravity. When calculating the turbine's performance, different wind speeds and their related voltage and current output are taken into account. Utilizing magnets makes it possible for the turbine to spin quickly and efficiently while reducing friction and stress on the turbine shaft.

Rahul Jangam, et.al. have created a magnetic levitation-based frictionless wind turbine. The key benefit of this prototype is that it may be used in a variety of working environments with little wind. The size of the assembly, which comprises the number of blades, magnets, and coils, directly affects the amount of power generated. The page provides a brief description of the turbine's construction, workings, and component specifications. Voltage, current, and power are computed based on the turbine's speed to determine the performance of the turbine.

Deepak A R, et.al. studied about hybrid power generation. A windmill must be levitated, therefore choosing the right magnet is crucial. The design of the turbine and rotor determines the magnetic forces needed to levitate the wind turbine. This project shows how effectively a renewable resource (wind energy) may be used. Whereas conventional power supplies are unprofitable, this sort of generating can be employed in remote locations. By increasing the number of coil turns proportionally to the magnetic lines of force obtained from the permanent magnet, the voltage generated by the maglev wind turbine can be raised. The article also discusses the benefits and uses of the maglev wind turbine.

Ogunoh Chika C , et.al. analyzed the different wind turbine design factors, such as the swept area, wind power and power coefficient, tip speed ratio, and number of blades. The vertical axis wind turbine was created, built, and tested to address the issues of environmental pollution and low operating costs due to the lack of fuel costs. The turbine is primarily used for small-scale operation, maintenance, and use. The test's findings indicate that the turbine has an efficiency of 80%. The turbine's capacity is sufficient for the job at hand, and its ability to generate current has been demonstrated to be effective.

Mayur Patel, et.al. examined that an object can be suspended using only magnetic fields through a process called magnetic levitation. The main distinction between a maglev windmill and a traditional one is that the rotor of the former is suspended in the air thanks to levitation, which eliminates mechanical friction. The innovative approach to enhancing the performance of wind turbines makes rotation possible in extremely low wind speeds. In this project, wind turbines that are magnetically levitated (maglev) are designed and developed. Wind turbines are machinery that transform the kinetic energy of the wind into electricity. The smallest turbines are utilized for uses like battery charging, supplemental power for boats, or traffic warning signs. They are manufactured in a variety of vertical and horizontal axis varieties. To examine the impact of air flow on the turbine blade, Finite Element Analysis is utilized in conjunction with Solidworks 2015 software for 3D design. An axial flux generator, which consists of coils and permanent magnets, produces power. DC voltage is transformed into AC voltage using an inverter circuit. The need for renewable energy is growing as more traditional power producing techniques run out of steam. Although one of the energy sources with the quickest growth is wind, wind speeds in Asian nations are too low to operate wind turbines. Shozab Hasnain Rizvi et.al. conducted a case study on the application of magnetic levitation in wind turbines to produce electricity. Using magnetic fields, a technology known as "maglev levitation" allows an object to be suspended freely. A key element that must be created is energy, which needs to come from a sustainable source. Using magnetic fields, a technology known as "maglev levitation" allows an object to be suspended freely. This study focuses on a vertical axis wind turbine that generates axial flow by magnetic levitation.

The elimination of frictional losses, low starting wind speeds, and operation at greater wind speeds are advantages of the Maglev Windmill. Utilizing ANSYS 20 and SolidWorks, respectively, the prototype's fluid analysis and modeling were completed. Renewable energy is electricity produced by renewable resources such wind, sun, geothermal, hydropower, and biomass. Wind energy in India has a potential of 20,000 MW, or around 9.87% of the country's

existing capacity for power generation. The goal of this project is to develop and put into operation a magnetically levitated vertical axis wind turbine system that can function in both high and low wind speed environments.

Maglev (magnetic levitation), an effective substitute for the ball bearings used in conventional wind turbines, is utilized to elevate the design vertically on a rotor shaft. The turbine blades will be spiral-shaped, and an effective size and shape for a turbine blade suitable for the project will be determined. The necessary wind will be captured using an axial flux generator.

Shaffic Ssenyimba, et.al. conducted a case study on the use of a hybrid system for localized irrigation. They started by learning about the irrigation needs and agricultural practices of the village. Data on the village's wind and solar irradiation conditions were gathered. The article provides a basic description of irrigation system design, including crop water requirements, in-line drip lateral and irrigation time calculations, pump design and pump discharge, and power requirements calculations. The article also discusses how to choose solar and wind power systems based on electricity requirements. The suggested hybrid system has also undergone finite element analysis and cost analysis.

Nema Parveen, et.al. have researched that combining the two energy sources of solar and wind can improve dependability and make their hybrid system more cost-effective to operate because the shortcomings of each system can be made up for by the advantages of the other. A more affordable option for stand-alone type is the integration of renewable energy generation with battery storage and diesel generator backup systems. The wind battery-diesel hybrid combination has the capacity to handle peak system loads. great system reliability, low cost, and great system efficiency should all be guaranteed by energy management systems. The impact of intermittent energy can be lessened by careful planning and accurate forecasts of weather patterns, sun radiation, and wind speed.

K.Balaji, et.al. performed a case study on a hybrid power generation system that uses wind and solar energy, which is a crucial resource for any nation looking to grow economically. By the year 2250, it is predicted that all fossil fuel reserves will have been used up. PVC (Poly Vinyl Chloride) pipes, which are widely available, are used in the design of wind turbine blades. By paying attention to design factors, it is simple to get them into the desired size and shape. The utilization of solar panels, DC generators, voltage regulators, and anemometers to increase the pole efficiency for conventional methods are the most crucial features in this article. Over 650 million years ago, buried dead organisms under the earth's surface underwent anaerobic decomposition, creating fossil fuels. Today, the globe consumes 8,400,000 barrels of oil daily, 16,761,120 tonnes of coal daily, and 2,963 cubic meters of natural gas daily.

Due to the industrial revolution, the demand for fossil fuels skyrocketed after World War II, and the rate of annual energy consumption growth is 2.3%. With the world population anticipated to reach 7 billion people by the year 2000 A.D., fossil fuel output from 1800 to 2300 A.D. is likely to grow significantly. By the end of this century or the start of the next, conventional energy sources may have run out. While fossil fuels will be the primary fuels for thermal power, renewable energy sources can be created or replenished at the same rate as they are consumed.

Ashish S. Ingole et.al. discussed about hybrid power producing system that combined sun and wind power. Two energy systems that will provide constant power must be integrated. Solar panels and wind turbines are used to convert solar and wind energy, respectively, into electricity. This electrical energy is produced at a reasonable cost and without endangering the delicate balance of nature. It can be used for a variety of things. In order to generate power at a reasonable cost without endangering the balance of nature, this study discusses the creation of electricity using two sources together.

We need to find another means to produce electricity because the conventional energy sources, including coal, diesel, and nuclear power, are running out. Although unconventional energy sources like geothermal, tidal, wind, and solar can be utilized to produce electricity, they have limitations including only being usable near the coast and requiring a more involved process to extract heat from the earth. In any circumstance, solar and wind power are readily available. One disadvantage of solar energy is that it cannot generate electricity during overcast or wet weather. A hybrid energy system produces power by combining two different energy sources.

It is more affordable, more efficient, reliable, and produces fewer emissions. Solar and wind energy have benefits like greater accessibility in all locations, lower costs, and no need for grid maintenance.

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### CONCLUSION

In this research, investigations on solar energy, wind energy, maglev wind turbines, and combining solar PV and wind energy for power generation have been reviewed. The intermittent nature of solar PV and wind sources presents the stand-alone system with its biggest hurdle. Even in less-than-ideal siting conditions, wind turbines and solar energy conversion systems can be useful and potentially very helpful in producing clean, renewable electricity from the wind. The impact of the fluctuating nature of the solar and wind resources can be partially mitigated by combining the two resources into an ideal combination, and the total system becomes more dependable and cost-effective to operate. It should be economical, dependable, and efficient, which are the main obstacles when combining the energy sources. The impact of intermittent energy can be lessened by careful planning and accurate forecasts of weather patterns, sun radiation, and wind speed. The study provides an overview of several studies on solar technology, the design of maglev wind turbines, and the analysis needed to construct hybrid systems.

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