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HACKATHON

MSME IDEA HACKATHON 4.0

Reference No. :- INC24DWB051614

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6. Problem Statements	Sustainable Development
7. Idea Sector	Power, Renewables, Electricals, Power Electronics, Energy Efficiency and any related sub-sector
8. Title of proposed idea/innovation	Hybrid Solar photovoltaic and vertical axis wind turbine system for higher capacity factor in domestic and commercial installations
9. Briefly explain newness/uniqueness of the innovation	Solar PV system individually achieve maximum 22 capacity factor and wind turbine power generation system also individually achieve capacity factor maximum upto 25. Integration of solar PV and wind turbine for generation of electricity surely improves capacity factor upto 60. Sunlight is at its peak during summers, thus solar PV system will produce ample electricity. The efficiency of solar PV system alone will drop in the winter season, in contrary wind flow increases. During winters, a single energy system cannot operate at its maximum efficiency. Hence, the better choice is to install a hybrid solar wind system. Modified vertical axis wind turbines can operate at low wind speeds and have good self-starting performance. It has low noise levels, independent of wind direction. The proposed hybrid system integrated with unique design of vertical axis wind turbine having reduced drag force. The proposed vertical axis wind turbine will allow passing through using tunnel effect thus reduce drag force. New micro-processor based charge controller will be integrated to the system for better management of fluctuation of generated power by wind turbines and SPV.
10. Concept & Objective	Growing energy demands, fluctuating reliability of fossil fuel sources, and the increasing awareness of environmental challenges like climate change have led to a strong focus on developing renewable energy solutions. A single solar or wind energy system often struggles to provide a stable electricity supply year-round. For instance, solar energy is highly effective during the summer when sunlight is abundant, but its efficiency drops significantly in the winter or on cloudy days. Similarly, wind turbines can generate power even in lower light conditions, but they may not always work optimally in areas with inconsistent wind patterns. Therefore, a hybrid solar-wind system provides a solution that overcomes these individual limitations. The hybrid system combining solar photovoltaic panels with a Savonius, helical wind turbine offers continuous power generation. The Savonius turbine, known for its ability to operate at low wind speeds and its good self-starting performance, complements the solar panels. This system ensures energy production during both sunny and cloudy days, making it a reliable choice for households and businesses that need uninterrupted electricity. The Savonius turbine also operates quietly and is less affected by changes in wind direction, making it suitable for urban and rural applications.

Specify the potential areas of application in industry/market in brief	The hybrid system is designed to provide a stable, continuous energy supply. It can be installed in households to meet daily electricity demands, especially in areas with unreliable grid connections or off-grid locations. In rural areas, this system can help power homes, farms, and small businesses, providing energy for lighting, heating, and other basic needs. In urban areas, the hybrid system can be used in offices, schools, and commercial buildings to reduce reliance on the electrical grid. For example, it can power air conditioning, lighting, and electronic devices in office spaces, reducing energy costs and contributing to environmental sustainability. Hotels, restaurants, and hospitals can also benefit by using the system to supply energy for lighting and small-scale operations. In the renewable energy market, the hybrid system holds significant potential as a solution for energy-efficient and eco-friendly power generation. Its ability to harness both solar and wind energy makes it particularly suitable for industries located in areas with varying weather conditions. Manufacturing plants and warehouses can use this system to reduce energy consumption, lowering operational costs and contributing to corporate sustainability goals.
12. Briefly provide the market potential of idea/innovation	From 2010 to 2020, the global adoption of hybrid solar-wind energy systems has seen significant growth, with installations increasing by approximately 30 each year. As of 2021, the global renewable energy market was valued at over 880 billion, with hybrid systems playing an increasingly prominent role. Countries like the United States, Germany, China, and India have seen widespread adoption of solar and wind technologies, and the hybrid energy market is expected to grow at a compound annual growth rate (CAGR) of 8.2 between 2022 and 2030. In India, the solar energy market alone is projected to reach 100 GW by 2025, while the wind energy market is expected to add 20 GW of new capacity by 2030. Despite these figures, standalone solar or wind systems face efficiency challenges due to seasonal variations. The hybrid solar-wind system addresses this gap by providing continuous power generation, making it highly attractive for both urban and rural applications.
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