Impact of Artificial Intelligence in Renewable Energy Management of Hybrid Systems

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Abstract- Companies are turning to AI to improve maintenance of renewable power-generation sites. Like reality capture platform Drone Deploy is using AI to evaluate solar farm layouts, maximize energy generated per site and automatically monitor the health of solar panels and other equipment in the field, AI systems would significantly improve the productivity of renewable systems by automation over the next 10 years. For solar and wind energy, this will become particularly prevalent. the use of artificial intelligence helps to improve the accuracy of operation to provide effective and accurate prediction control of the integrated system. Various optimization techniques are combined with To optimise the sizing of a system according to the loss of power supply probability(LPSP) and the levelized cost of energy (LCE) concepts. Applying this method, a PV/Wind hybrid system is assumed to be installed in various parts of India. This method also plays an important role in cost reduction as well as energy production.

Keywords: artificial intelligence, hybrid energy, renewable energy, hybrid system, etc.

I INTRODUCTION

Currently, the world is suffering from many problems caused by the use of traditional energy sources, one of the worst of these problems is global warming, which leads to many climate changes. Therefore, there is a trend currently to rely on renewable sources instead of using traditional sources as a result of the continued depletion of traditional energy resources and global worry about environmental pollution. RESs produce clean energy and do not cause any negative impact on the environment compared to traditional sources. But many problems have arisen as a result of the irregular production of energy from renewable sources as a result of their unstable nature and fluctuations. Therefore, researchers sought to integrate renewable sources together in isolated microgrids to feed remote areas far from the main electrical grid, or to integrate them with the grid to increase reliability and stability.

It is evident that India has a huge capacity of power generation but it has very poor infrastructure while in case of distribution to the people who actually need them. It has a great backup of fossil fuels particularly coal industry, which is generated three-fourth of the total electricity. According to a report, the total generation of renewable energy is about 220GW [1]. It states that a huge energy requirement can be fulfilled via this kind of renewable source. The total cost of PV-wind hybrid system setup tends to fall for the upcoming years, an evident growth of these renewable energy is realistic in this fast developing world. Many areas through the earth don't get electricity, so providing power to all these areas by increasing external equipment's would be a bit costly. Standalone PV/Wind system would be more cost effective in this case. PV/Wind system have no polluting and does not cause depletion and it is dependent on the site and is a source of alternative energy.

Smart grids are considered the future of electrical energy in the world. RESs such as the sun, wind and waves are integrated into these grids. These grids are based on hybrid renewable energy systems. To make smart grids more reliable, many sources are integrated together. An overview of smart grids is presented with some of the cases that have been studied. Based on these studies, the future requirements for smart grids were reviewed.

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Some of the challenges facing the integration of RESs in smart grids were discussed, such as voltage fluctuation, demand-side management, forecasting, storage systems, and systems flexibility and reliability (Failed 2010a). Artificial intelligence has been used in some studies to design a powerful monitoring network to constantly monitor the micro grid and predict the demand and energy produced in order to make the right decision. Data is collected and then analyzed to make the appropriate decision.

Hybrid system

Every hybrid system is a collection PV module, inverter, battery storage and many other components. Numerous systems of this kind are available, that are used to fulfil the demand offload. Till the resources are enough, the surplus power is then transferred to the battery for charging it totally. So the battery is used when the system is unable to fulfil the proper requirement of the user. The operation depends upon the individual element.

PV System (Hybrid)

As the Solar energy does not pollute, does not deplete, dependent of site source and available throughout, it is considered as a good source of energy its use reduces the dependency of fossil fuels. PV generation module consists of PV array, inverter, battery storage system. For maximum performance and better control, battery plays an important role. The suitable condition for the hybrid PV system for ultimate power efficiency in very hot temperature. This system works in the area where the power supply via grid is costly like remotely isolated areas. Several measures are carried out to increase the efficiency of this system by combining PV with a battery and without any sort of battery. For standalone system, analysis is carried out in terms of LOL probability. Several models are used to measuring Loss of Load probability calculation.

Wind turbine system (Hybrid)For a perfectly efficient wind system, it requires an appropriate location with highly efficient system along with reliable and cost efficient equipment. must have to derive the size of the system and optimum space to design the configuration. Several techniques like regression analysis, genetic algorithm can be taken into account. The price of energy that can be calculated using storage battery. When there is an excess of generated power, it is being used for charging the batteries for backup and it is further being used when the hybrid system is not in use.

Hybrid PV-wind System As the weather fluctuation in India is very random, so a hybrid system of this kind can be efficiently used. Gupta, Kumar, and Agnihotri et al. (16) successfully made model of a Matlab forthe evaluation procedure of economy and loss of power supply probability (LPSP) method which holds good for the reliability & NPC of the said system. Puig et al. (17) developed a system which is able to find the size of the overall system, which fulfills the local requirement of energy. Maleki et al. (18) carried various techniques for the optimization.

Renewable energy:

Renewable energy flows involve natural phenomena such as sunlight, wind, tides, plant growth, and geothermal heat, as the International Energy Agency explains: Renewable energy is derived from natural processes that are replenished constantly. Renewable resources are those resources that can be replenished or renewed naturally over time. Air, water, wind, solar energy etc are all renewable resources. Renewable resources can be easily renewed by nature. Renewables, including solar, wind, hydropower, biofuels and others, are at the center of the transition to less carbon-intensive and more sustainable energy systems.

SOLAR ENERGY.

Solar energy is the most abundant of all energy resources and can even be harnessed in cloudy weather...

- WIND ENERGY.
- GEOTHERMAL ENERGY.
- HYDROPOWER.
- OCEAN ENERGY.
- BIOENERGY.

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ARTIFICIAL INTELLIGENCE:

Artificial intelligence (AI) is the intelligence of machines or software, as opposed to the intelligence of humans or animals. It is a field of study in computer science which develops and studies intelligent machines. It may also refer to the intelligent machines themselves. Artificial intelligence is the simulation of human intelligence processes by machines, especially computer systems. Specific applications of AI include expert systems, natural language processing, speech recognition and machine vision.

AI software is a type of computer software that enables the adoption of Artificial Intelligence (AI) to process large amounts of data to solve tasks that otherwise require human intelligence. Such tasks include image recognition, video analytics, generative AI, voice recognition, text recognition, and NLP. Artificial Intelligence for Renewable Energy Systems addresses the energy industries remarkable move from traditional power generation to a cost-effective renewable energy system, and most importantly, the paradigm shift from a market-based cost of the commodity to market-based technological advancements.

Companies are turning to AI to improve maintenance of renewable power-generation sites. For example, reality capture platform Drone Deploy is using AI to evaluate solar farm layouts, maximize energy generated per site and automatically monitor the health of solar panels and other equipment in the field. The most common definition of hybrid AI is technology that combines symbolic AI (human intelligence) with nonsymbolic AI (machine intelligence) to deliver better outcomes. Advanced control algorithms based on AI and ML can help achieve effective control of a hybrid wind-PV power system. These algorithms can optimize the power output of the system by predicting the energy generation from both sources and adjusting the system parameters to ensure a stable and consistent power output.

AI needs bulk data for training, compared to humans, who need just a few cases. Hybrid artificial intelligence systems combine the analytics and automation capability of AI technology with human intellect, making it a powerful technology that is more than the sum of its parts.

The AI plays important role in every field and renewable energy systems.

The study reveals that AI-related technologies can effectively solve issues related to integrating renewable energy with power system, such as solar and wind forecasting, power system frequency analysis and control, and transient stability assessment. In addition, future research trends are discussed. Companies are turning to AI to improve maintenance of renewable power-generation sites. For example, reality capture platform Drone Deploy is using AI to evaluate solar farm layouts, maximize energy generated per site and automatically monitor the health of solar panels and other equipment in the field. Forecasting and analyzing solar system performance.

AI can identify patterns that may indicate future performance based on solar conditions, environmental data, and past maintenance records, as well as anticipate future challenges, repair needs, or likely upgrades Predictive Maintenance and Optimization: Additionally, AI algorithms can continuously optimise the performance of renewable energy systems by adjusting operational parameters in response to changing conditions, ultimately leading to increased energy generation and improved overall system efficiency.

Merei et al.1.have proposed cost and low energy emissions of remote sites and applications are important considerations when considering future energy concepts. This article describes the process and optimization of hybrid systems. The system includes renewable energy sources such as PV panels, air conditioners, generators and batteries. For storage, the dissolution rate of lithium ion, organic acid, vanadium or mixtures was calculated.

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Mascio et al. 2He recommended improving legal services. As a result of these approaches, there is a growing body of research and new technologies needed to reduce the energy consumption required to reduce greenhouse gas emissions based on fossil fuels. The best solution to meet the requirements of a new system is a hybrid system. The term refers to the integration of a number of technologies into a single system, including air, solar, and power plants.

Hazem et al. [03have proposed significant issues such as increased power consumption, increased electricity bills, increased renewable energy consumption, and traditional energy restrictions to link power generation, climate change, global warming, and environmental. All this has caused a serious political and economic crisis in the world. As a result, all states around the world are working on clean energy development. Renewable energy generation helps countries achieve their sustainable development goals by preventing access to safe, affordable, clean and safe energy.

Paulitschke et al. [04] proposed the efficient photovoltaic installations, battery systems and hydrogen storage is much higher than the efficiency of a well-established operating system. For this purpose, they considered number of issues related to different services including installation, maintenance, and timing. For this reason, the response of performance enhancement considers as a function of parameter and rate with performance management.

In Saul et al. 05New energy: energy, electricity, air conditioning, fine, natural gas, photovoltaic power, wind energy, biofuel, gas, reliability, operating time. DG, CEE, Air Quality Control, Algorithms and Time-varying features for GA systems, you can achieve great results using PSO. This indicates how the output of each function unlocks the battery charger.

Shadmand et al. [06]have proposed optimization of production and storage, taking into account investment costs and reducing variability, is critical to the economic viability of DC micro-grid systems. The output times of photovoltaic and wind energy are dependent and variable, but strongly correlated, which makes them ideal for a hybrid system with two sources. This article presents an optimization method based on the Multipurpose Genetic Algorithm (MOGA). This method uses a feasibility study to determine an optimized system design based on several criteria, including size, cost, and availability.

Shi et al. [07] proposed stand-alone photoelectric/ wind/diesel (HPG) batteries that store and run other systems. Power Management System (I-PMS) improves battery usage and prevents power outage. Multiple Ecosystems for HPGs (EEMSO) have been successfully implemented using advanced technologies to optimize battery capacity, efficiency and quality.

Singh et al. [08] proposed Battery operated (BESS) and discontinuous source (NIS) storage. Final excess energy (FEE), energy production coefficient (EGR), energy cost (COE), current net cost (NPC), and constraints that optimize the share of energy are taken into account to optimize a renewable system (REF). This optimization is performed for discrete loads, including daily consumption of 84.5 kWh. With the successful implementation of Resca with various restrictions with the optimal energy resource size for HRES varies depending on the selected restrictions.

Ioan et al. [09] proposed PV-Wind using lithium batteries and analyzed the behavior of the systems. This series focuses on the Danish market with a good time and growth profile, which is a site-specific feature in Denmark. For this purpose, models for photovoltaic modules have been developed that are easy to use and comfortable with small air and battery lithium ion batteries. Performance forecast combined for two different conditions: Energy Sensitivity, Power Module Usage: 3.75 day cycle and maximum 1.75 day Li-ion battery. Winters and winters.

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Sue et al. [10] indicates that the demand for quality of life in developing countries is growing slowly. He emphasized on environmental pollution. Renewables such as Pure As Energy can replace non-oil ones, which can be harmful and harmful. Global use of renewable energy sources presents a tremendous potential for increasing electricity demand to meet all theneeds of daily life and social development. The photovoltaic and wind turbines are 514 GW and 397 GW respectively.

Proposed problem:

proposed a grasshopper optimization algorithm (GOA) for micro-grid system sizing design problem. Energy Determine the best strategies to increase energy. Electronic Power Management (EMS) proposes to add electrical energy between components and microgrid systems. Added GAA and EMS sections used to create fast microgrid and hybrid materials. PV panels, turbines, battery systems, and fuel cells grow into microgrid. Analyze the performance of the proposed GAA to solve the optimization problem and compare it with PSO and CS optimization algorithm. Due to differences in application parameters, the reusable version is not compatible with different operating systems. For this reason, users should ensure that the supply of batteries or other supplies is included. We all know that PV-Wind energy storage is an important source of energy. All operating systems are expensive because of the high cost of storing battery power. However, the high cost of grid systems and the availability of different methods have received much attention in this study.

Our contribution, to overcome these problems, we propose the optimal size and efficiency of a hybrid PV-Wind energy storage system using the MPPT algorithm. The proposed method used for obtaining a high-cost hybrid power system configuration. The total cost of operating system used is control cost, PV capacity, wind capacity, battery capacity, system stability and fluctuations applied on the grid. In addition, various sensing and optimization parameters are available for RE resources, local load demand, grid energy cost, nominal discount rate, wind turbine life, wind turbine capacity, and PV. Arrays, converters, and batteries are used for decision making. The proposed algorithm is implemented using the Matlab simulation package, which compares the performance of existing sophisticated algorithms along with AI modules

Objective: The objective of this study is to provide statistics for modeling hybrid, model, source, hybrid systems and software for optimization. Along with AI modules

Conclusion work

Artificial Intelligent (AI) approaches have surged into the energy sector as a potentially viable option to make optimal use of distributed energy resources and assist real-time and rapid demand response. AI methods are capable of providing far more reliable, efficient solutions to deal with the grid system's limitations and effectively manage the system and make timely decisions. This hybrid system optimization sources uses for AI application on the basis of renewable energy management system.

The AI is played important role in renewable energy management system with wind energy system, solar energy application, solar plant optimization. The better software solution is provided by AI application suing simulation tool for prediction and forecasting application

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