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AN ANALYTICAL STUDY ON CONSTRUCTION OF A POWER MANAGEMENT SYSTEM USING AN EXTERNAL CONTROLLER FOR MANY RENEWABLE ENERGY SOURCES

[1] Y.V. Niranjan Kumar, [2] N. Sudarshan Rao, [3] G.Vasundhara, [4] Varikuti Vishnu Vardhan
[1,2,3,4] Dept of Electrical and Electronics Engineering, Sree Venkateswara College Of Engineering, Nellore (Dt), Andhra Pradesh, India.

ABSTRACT
The system cost and service quality issues with hybrid micro-grid architecture. In this study, we address these issues by preserving State of Charge (SOC) in batteries and making best use of renewable resources. The suggested solution also specifies the minimum rate at which electricity can be transferred across AC/DC microgrids. The main energy sources in the system are solar and wind power. Additionally, both microgrids are connected to storage banks, and the fuel cell serves as the backup assets to increase the reliability of the production method. A superior controller manages the transfer of electricity across micro-grids while ensuring that resources are used to their full potential. This study examines the optimization of power management in an AC/DC microgrid. This algorithm, called MOPSO (Multi-Objective Particle Swarm Optimisation), was used. The outcome demonstrates that MOPSO produces positive presentation, and the suggested solution is advised as the foremost replacement to increase the use of electric energy in rural environment.
Keywords: circuit breaker, ESS and BESS, switch off phase, microgrid, SOC, optimization

1. INTRODUCTION

By 2040, the populace is expected to increase by 2 billion due to the population explosion. This population growth is mostly concentrated in parts of Africa, India, and numerous increasing nations. It has a significant impact on the demand for energy. In 2040, the demand for energy is expected to increase by 30%. The population's fast increase in energy demand has been seen in developing nations. Nuclear energy, hydroelectricity, coal, and unsurprising energy sources like oil and common gas are insufficient to supply the demand. Additionally, more people are switching to alternate energy sources. Technology for harvesting renewable energy sources has advanced quickly. Countries are sensing for construction to use the natural resources at their disposal to satisfy the requests, which are being driven by economic development and the corresponding rise in energy demand. The primary energy source in India, photovoltaic (PV) energy generation, is the subject of our study [1]. For the year 2016, the harmonizing nature of wind and PV resource accessibility is clearly stated [1]. It demonstrates the urgent need to enhance energy resources systematic to accelerate the widespread use of renewable energy sources. Consequently, this research work suggests PV/Wind integration. The traditional electricity system requires more adaptability, which will change the financial and regulatory environment. Energy resources and ecological conflicts are driving the development of micro grids, that is anticipated to show a significant role in future power structures. The micro-grid is an innovative method of grid that combines power electronics and distributed production. It is our opinion that the usage of micro-grids with enhanced presentation might meet the Indian population's critical need for energy. The following is how the paper is set up: After a brief overview of pertinent literature in the following part, part 3 presents the proposed methodology in full. We describe the MOPSO-based optimization technique for HMG in Section 4. Section 5 provides a full analysis of the experiment assessments that were done to sustain the validity of the suggested scheme. The publication concludes with recommendations for additional study.

1.1 Overview

The organization of various electricity sources using micro-grid technology enables improved power supply solutions for projects in India that are based on the smart-grid. Sophisticated control method Guerrero et al. [2] The control systems of grid-connected mode and island-xbased micro-grids are dispersed, scattered, and classified in the suggested architectures for hybrid micro-grids. In their investigation, the issues with droopbased control approaches are resolved. The frequency and magnitude are restored by the another auxiliary controller, which is installed in the microgrid's central control. A dynamic scheming and control method for a microgrid that mostly uses solar and wind energy was given by Sungwoo and Alexis [3].The primary DC bus system uses a current-fed multi-input source DC-DC type converter to combining the renewable energy sources [3]. A thorough investigation of the application of multi-agent method for micro grid control has been conducted by Kantamneni et al. [4]. As bit-by-bit frameworks for the micro-grids, they have provided and addressed the circumstance of multi-agent method pattern study. Derksen et al. [5] unveiled a novel energy agent in 2015 in anticipation of the development of hybrid energy systems. In order to modify the energy factor for the extensive reproduce in the test beds and on-site real devices, they provided a pattern pattern. Dibangoye et al. [6] have calculated the necessary amount of power to be create and the best schedules to meet the request for power. Here recommended a cutting-edge dispersed approach to deal with the unit commitment issues while taking into account the ambiguity of privacy-preserving limitations and supply and demand.

2. RELATED STUDY

They approached the issue from a dual-objective perspective, optimizing both flow time and create span. Later, they accessible two versions of enhanced evidence that the effectiveness and capabilities of GAs in the difficulty of computational grid scheduling. The standard RST structure for 2DOF technique was created by Madiouni et al. [8], who also successfully implemented it using the MOPSO approach. They tested the proposed MOPSObased method using a variety of benchmark functions. Through the Pareto dominance of the MOPSO approach, they have demonstrated the superior capability of their experiments' results. To prevent the classic PSO algorithm's early convergence, El Dor et al. [9] combined the Four-cluster and Fitness to propose the dynamic topology known as DC lustre. Their test tests revealed that early meeting in PSO have extremely low probabilities and that DC lustre outperforms all other examined classical topologies for all tested tasks. A multiobjective biological process design of dependable grid controllers was produced in a manner similar to this by Shenfield and Fleming [10] and evaluated using computer representation. A two-step enhanced droop control system was put forth by Eghtedarpour and Farjah [11] for the bi-directional power flow of the hybrid type AC/DC micro-grid. The electric power control techniques can generate the power reference by calculation the AC source micro-grid functioning frequency (f) and the DC source micro-grid operating voltage (V dc). The built power reserve, which also permits a small amount of reserve power for each microgrid, may regularly support both microgrids. The usage of smart grid technologies is expanding in India thanks to a number of ongoing projects that make use of new smart technology and range in size from kW to MW, serving all kinds of customers. One of the main subjects of the investigations already mentioned is the DC or AC micro-grid. The crossed AC/DC micro-grid idea is fresh from a technical standpoint [14]. It combines both AC and DC sources with both types of loads. It should be emphasized that changes in the created power may be more or bring down than the existent power requirement because the output power of the resources is unknown. The amount of DC bus voltage varies as a result of the erratic output power that is produced, which should be considered as a problematic component for power imbalance [15]. By exploitation a controller to regulate the DC bus voltage in the power generation system, this significant issue can be fixed. The suggested approach is designed to be sufficiently resilient to issues with generation prediction inaccuracy and resource output power uncertainty. While limiting the transmission of power among micro-grids can enhance the efficiency of the power, it won't allow for the full utilization of the accessible wind or solar energy.

The present study proposes a trade-off among quality of power and system efficacy to prevent a conflict. A minimal value for the power divergence among the micro grids is established by the suggested trade-off.

3. PROPOSED SYSTEM

The elimination of unnecessary multiple modification processes, that lowers transmission loss, and the emission of embedded rectifiers for DC loads from current AC source grids, which makes equipment easier to use and lowers the price of power electronic converters, are the two main advantages of the hybrid system AC/DC source micro-grid. Regardless of the advantages of all of the above, a superintendent control approach is necessary for the hybrid micro-grid to function properly in order to satisfy the power demand and split it between different sources of energy. In addition, a fuzzy logic-based control system is required to modulate the charge and discharge currents of the battery. The hybrid micro-grid's (HMG)design, operation, and power governance strategies are covered in the sections that follow.

An AC/DC hybrid micro-grid and its energy management are suggested by this work. Generated power is shifted among the AC and DC edges utilizing a bidirectional mode converter in order to separate DC resources using DC heaps and AC resources by AC heaps. Either an AC-DC conversion or a DC-AC conversion is employed, according to the desired power transfer. A wind turbine generator and a solar array serve as the system's primary energy sources. So as to optimism the reliability of the power presentation system, retention banks are also connected to both AC and DC source micro-grids, and the fuel cell has been taken into consideration as a hold-up resource. Whenever the utility network system needs power, the inverter operates to shift power from a DC source to an AC source sub-grid system by the output power of the input DC sources exceeds the DC demand. The inverter functions as a converter and introduces power generated by the AC subgrid system and utilities grid system to the DC side when the total generation of electricity is less than the total heap consumption at the DC source side. The DC source bus voltage stability is simultaneously managed by a PI controller. scattered renewable energy sources, DC and AC piles, and battery-like storage systems make up micro-grids. A hybrid microgrid's development will lessen the number of reverse conversions required by separate AC and DC grids. For the micro-grid concept to function successfully, a power management system must be used to regulate the electric power stream. To be able to address the power problems on the load side, it is essential that the electrical power stream defines the power output of the manufacturing services. It ought to be highlighted that takes into consideration all restrictions on power conversion from AC to DC, micro-grid plans may encounter problems with the standard of the electricity and are unable to concentrate on the current wind or solar power's highest rates of consumption. As a result, this study shows a connection between the efficiency of the generation plans overall and the standard of the electric power system. A wind turbine, a generator with a permanent magnet (PMSG), a diode rectifier for AC-DC conversion, and a DC-DC boost converter make up the wind generating system that was on display. As shown in the schematic representation in Figure 1, a potent DC-DC boost converter controls the power generated by the wind system. Utilizing a DC-DC boost converter mode, the photovoltaic system is attached to the DC bus. The state of charging of the storage banks is determined by the current addition approach (coulomb counting) in both AC and DC microgrids.

4. SIMULATION RESULTS

According to the information gathered for all of the micro-grid modules, the electricity management system (PMS) has a sizeable processing unit that assists in the development of effective plans for the transfer of electricity among renewable resources. Real-time measurements should be used to determine the storage tank's smallest and highest charge/discharge mode energy along with the lowest authorised power exchange among the AC source and the DC source micro-grids. Comparable to manufacturing machines, the output instructions of the PMS serve as a reference for the amount of power sources that need to be switched between microgrids and the charge/discharge source power of the storage tank. According to the delivery directions, the micro-grid system components are

anticipated to adhere to the controllers' specified reference points. Figure 1 illustrates the power transfer among AC and DC grids utilizing a bi-directional converter when only wind energy is considered. Figure 1 illustrates the power transfer among AC and DC grids by utilizing a bi-directional converter when only wind energy is considered. The aforementioned tactic is used, and it produces excellent outcomes. These include (i) utilizing renewable resources to their fullest potential to meet both AC and DC load demands in microgrid systems, (ii) maintaining battery SOC in tandem with microgrids, and (iii) keeping an eye on the transfer of power between microgrids using AC and DC source energy.

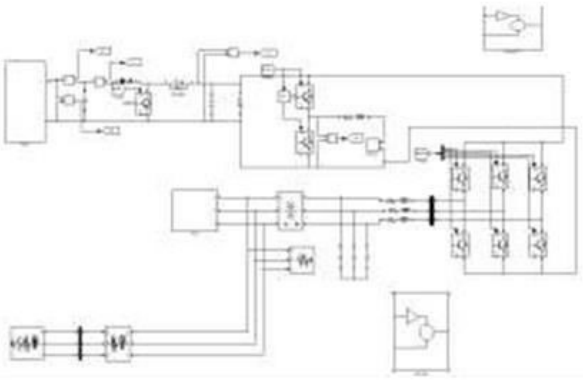

Fig.1. Simulation circuit.

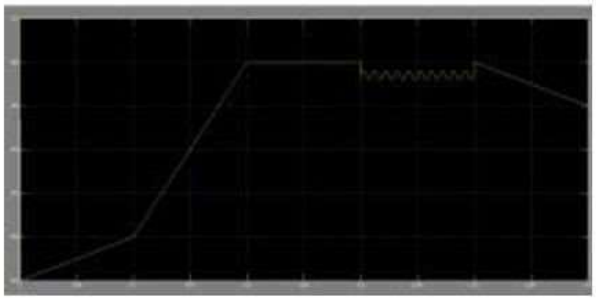

Fig.2. Voltage across the PV system.

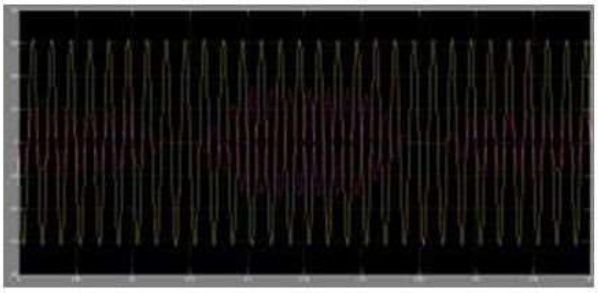

Fig.3. Output power.

CONCLUSION

The deployment of a micro-grid is thought to be the most viable option for rural electrification since it lowers implementation costs while improving the quality of the supply. This study provides a power approach for an HMG setup that will supply constant power to customers' needs across fifteen distinct procedure modes. Programmable parameters are used for analyzing the sequence of PV, fuel cells, wind, and battery storage. The supervising controller sets reference values for the producing subsystems utilizing the state machine approach to correspond with a specified scheme. By considering the disparity among the make and requested power in addition to SOC, the fuzzy controller decides when to charge and discharge battery banks. In order to enhance constituent

sizes and optimize the system's configuration, By developing function objectives for the cost of energy and power loss chance, we have applied the MOPSO method. The simulation's results show how rising energy prices greatly increase the usage of HMG depending on renewable resources. Consequently, employing cutting-edge information and communication technologies to make energy power in India's rural areas is an attractive derivative to creating a more information and communication technologies (ICT), the methodology that has been provided can be expanded. A more effective, dependable, and sustainable method of producing and distributing power could result from using ICT for analyzing customer and supplier behaviors using automation and artificial intelligence.

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