International Engineering Journal For Research & Development

Vol.4
Issue 6

E-ISSN NO:-2349-0721

Impact factor : 6.03

ARTIFICIAL INTELLIGENCE IN INTEGRATED MICRO GRID WITH WIND POWER GENERATION SYSTEM

Mohd Wajahatullah Naseem
Assistant Professor
Dept of Electrical Engineering
Prof Ram Meghe College of Engineering & Management, Badnera
Amravati, India
mw.nasim@gmail.com

Dr. Mir Sadique Ali
Principal,
Prof Ram Meghe College of Engineering & Management, Badnera
Amravati, India
softalis@hotmail.com
Assistant Professor

Krunal Panpaliya
Dept of Electrical Engineering
Prof Ram Meghe College of Engineering & Management, Badnera
Amravati, India
krunalpanpaliya@gmail.com

Abstract-

The micro grid is basically an upgraded conventional grid that has two-way communication. By using micro grids and the technologies related to it, transmission and distribution losses can be minimized, efficiency can be improved and the overall power system becomes capable of responding power in more optimal ways in comparatively wide range. Besides these advantages, it is also helpful in minimizing demand-supply gap, theft reduction, and load shedding. Artificial intelligence (AI) techniques, have brought an advancing frontier in power electronics and power engineering. These techniques provide powerful tools for design, simulation, control, estimation, fault diagnostics, and fault-tolerant control in modern micro grid (MG) and renewable energy systems (RESs). To change and control the energy flow variations, we need to shift today's grid to integrate and AI automated substations. This paper is basically an outline of the micro grid power system connected with several small wind turbines to recapture wind energy from vehicles on the highway and the same generated energy can be used as an unlimited power source for various public amenities especially for providing energy in rural areas where load shedding is a major issue these days.

Keywords—Micro grid, PV system, Wind Energy, Solar Energy, Energy Storage System

INTRODUCTION

Presently the government is motivating to increase the utilization of non-conventional energy sources in comparison to conventional energy sources because the conventional energy sources are reducing day by day. In India, there are 28% of the renewable power plants and 72% of non-renewable power plants [1-5]. To fulfil the power supply demand, it is important to either increase the energy sources or minimizes the power losses. The fixed number of power generation plants can never cope up with increasing population and their discrete demands of power supply.

The traditional electrical power grid is unidirectional in nature, where the electricity flows from power generation facilities to end users. This system has served well for the last hundred years. The micro grid offers digital control appliances, micro monitoring systems, and various micro electric networks.

By using micro grid technologies electricity is delivered from producers to consumers, losses are reduced,

TABLE I

FEATURES	TRADITIONAL GRID	SMART GRID
Communication Technology	None or One-Way	Two-Way
Generation	Centralized	Centralized And Distributed
Power Flow Control	Limited	Comprehensive
Consumer Interaction	Limited	Extensive
Type of Meter	Electromechanical	Digital
Maintenance	Maintenance, IOT	Remote, Monitoring, Predictive, Condition-Based Maintenance
Topology	Radial	Network

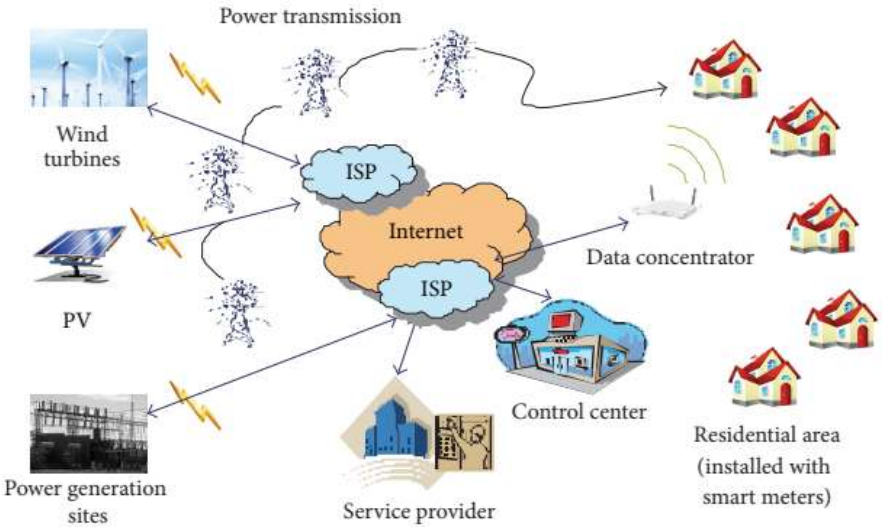

FIG. 1. MICRO GRID

energy flow is controlled and the performance is improved with higher efficiency. And when a micro system is

arranged with the renewable sources, then the problem of voltage collapse, and other power failures will be reduced.[6-9]

The micro grid as in Fig. 1 is started with low voltage substation, ground up, automatic micro meters. Once this micro equipment is rearranged to form a micro grid, we can easily control, detect these components and their losses and leakages and perform various actions on it. One of the most important elements of SG is the supply–demand interactive energy management with the help of micro meters that will shape the demand curve, reduce the bulk storage requirement, and provide economical dynamic tariff rate to the consumers. In an SG, when demands are established at different grid points, optimum generation of the resources and electricity flow paths can be programmed for the most economical and efficient supply of electricity to the consumers maintaining the desired system frequency and bus voltages at different points and preventing overloading any elements.

PROBLEM FORMULATION

An automated, widely distributed energy delivery network, the Smart Grid will be characterized by a two-way flow of electricity and information and will be capable of monitoring everything from power plants to customer preferences to individual appliances. It incorporates into the grid the benefits of distributed computing and communications to deliver real-time information and enable the near instantaneous balance of supply and demand at the device level. it brings all elements of the electricity system production, delivery and consumption closer together to improve overall system operation for the benefit of consumers and the environment.

Moreover, it by adding several wind turbines to micro grid which is environmentally cleaner as compared to the fossil fuels used in many bulk electric power generation facilities or conventional energy resources. Wind energy is the fastest growing source of clean energy worldwide. A major issue with the technology is fluctuation in the source of wind. There is a near constant source of wind power on the highways due to rapidly moving vehicles and also in the city area. The idea is to contribute to the global trend towards clean energy in a feasible way. Each vehicle on the highway offers an intermittent and uncontrolled source of wind power. The design of the wind turbine must include storage of power and a system to distribute the generated power effectively.

Wind turbines are traditionally used in remote locations. This offers the additional challenge of having to transport the power generated to the location wherein it will be utilized. Fortunately, the wind turbine in this project is designed for use in high traffic areas where the demand for power is high and also the same generated power can be transported to the rural areas which will help in minimizing load shedding in rural areas.

Furthermore, by adding the Artificial Intelligence in the micro grid, power generated by different wind turbines situated at different areas in the urban region can fulfill power requirement in different rural areas connected to the micro grid more effectively. Also, when the demand at rural areas are less, the generated energy can be stored in batteries using power converters. The energy stored in the batteries can compensate the each of these new power generating systems can be relatively small and can be distributed around the load centers to increase the reliability and reduce the transmission loss, which adds another degree of flexibility while also increase the complexity to the current power system.

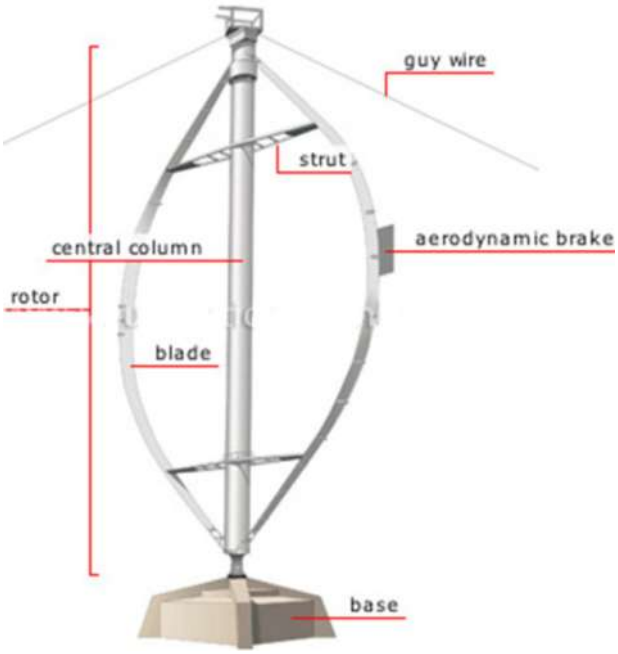

FIG. 2. WIND TURBINE TO BE INSTALLED ON DIVIDERS ON ROADWAYS AND HIGHWAYS

IMPACT ON SOCIETY

The circumstances when the power demands cannot be fulfilled by the service provider can eventually lead to power system collapse. By using microgrid system we can maintain or compensate the power requirement in small rural areas. Energy storage is a very important part in power system that is in electricity generation, transmission and distribution systems. Traditionally, energy storage needs have been met by the physical storage of fuel for fossil-fueled power plants, bykeeping some capacity in reserve and through large scale pumped hydro storage plants. However, it also makes delivering power Energy storage is a very important part in power system that is in electricity generation, transmission and distribution systems.. However, it also makes delivering power reliably where and when it's needed a bigger challenge than ever before. Since there is no fuel to store, the grid must adapt to store electrical energy efficiently after it is generated.

DESIGN APPROACH AND NOVELTY

The wind turbines as shown in Fig.2 are to be installed on dividers between the roadways and highways. These wind turbines are connected to the micro grid. An ANFIS controller is used for making decisions depending upon some predefined rules. The rule base of this controller has rules defined depending upon input parameters of wind mills and load dispatching depending upon the requirement by the areas connected to the micro grid.

The Fig. 3 shows that the microgrid is integrated with AI. the sources are connected to the adaptive neuro-fuzzy inference system (ANFIS). ANFIS modify those power fetching from generation sources and compensate them according to load. ANFIS is basically a decision-making block.

If X=A1, Y=A2 then Z=B1

A1 is the load consumption is at the peak point, A2 is the generating power at the power plant which is lesser than that of requirements then B1 is then adjusting microgrid and fetching power according to situation.

If X=A3, Y=A4 then Z=B2

In this rule, A3 is the fault occur in power station and A4 is the requirement of power urgently at any place then B2 is the shifting from the power station to the microgrid.

CONCLUSION

As we know that wind energy system is proved to be sustainable and environment friendly and these systems give the best environment benefits such as greenhouse gas emission etc. Separately, their efficiencies are quite low. But due to their ecological benefits we are using them. The AI techniques are extremely powerful tools for application in Microgrid and RES. When these different technologies are combined to form a hybrid system then its efficiency and reliability increases at a very high rate. In addition, advanced hybrid micro grid improves the

total energy production along with its environmental benefits. Also by installing the small wind mills in the high density traffic areas, load shedding problems can be minimized to some extent.

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