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Efficient Predictive Load Schedule Control of Hybrid Power System

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ABSTRACT

Autonomous operation of a microgrid system hinges on the efficient combination of varied energy resources to require care of self-sustainability of energy supply. Furthermore MPPT technique is implemented to reduce losses in Renewable energy. The existing is more complicated if these resources have intermittent characteristics like solar PV and wind turbines. This paper presents a hybrid solar PV/wind turbine system for voltage regulation in an exceedingly very microgrid. The singular use of solar PV and/or energy is used and compared with the hybrid case. Experiment is dispensed on an prototype model bus feeder to validate the effectiveness of the proposed system. it's shown that the coordination between the two variable renewable energy resources is far more practical in regulating the voltage throughout the microgrid.

KEYWORDS Wind, PV, DR, Microgrid.

INTRODUCTION

The global warming caused by the abundance of CO2 within the atmosphere and also the constraints of worldwide resources of fossil and fuel has necessitated an urgent explore for alternative sources of energy to satisfy the long term demand. It is also important to hunt out energy sources to scale back the negative environmental impact and to cover the continuously increasing demand of power supply. The projected availability of fossil and nuclear fuels, wind, solar and water energy which are non- pollution, free in their availability and renewable are considered as a promising power sources.However, because of their unpredictability and weather dependency, the blending of renewable energy sources to form a hybrid system could be a superb option for distributed energy production. A hybrid facility augments the photovoltaic (PV), turbine with a reversible energy storage system so as that the system can address the power demands. The chief merit of this architecture is that the power- capacity rating of the hybrid system is required to satisfy the standard demand only rather than the peak demand. This makes the hybrid facility more cost effective and energy-efficient than the alternative power sources in supplying the specified power.

NEED OF RENEWABLE ENERGY SYSTEM

With high increase and economic development within the globe, there is a really high demand for energy. Traditional fossil sources like oil, coal are costly and have a big pollution to the environment. To possess sustainable growth and social progress, it is necessary to meet the energy need by utilizing the renewable energy resources like wind, biomass, energy, co-generation, etc. In sustainable energy system, energy conservation and also

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the utilization of renewable source are the key paradigm. The proposed configurations of the hybrid i.e., wind/solar system could also be shown in Fig. 1.

During this method, renewable wind and solar resources are utilized as major energy sources, whereas battery is utilized as a tool. When the power generation from wind and scheme is excessive, the excessive power is delivered to the battery.

When battery becomes fully charged, then the extra power is sent to dump load. During the deficiency of power generated from wind and alternative energy system because of weather issues, the battery backup will supply power to satisfy the load demand. Through suitable interfacing circuits, various energy sources are additionally to the bus. The proposed hybrid system could also be extended easily when other energy generation resources are accessible.

SCOPE OF THE PROJECT

The target of this project is to require care of voltage stability and dispatching uninterrupted power to distribution system with cost efficient. System control for energy flow and management could be a necessary part in developing any hybrid facility. Have used conventional approaches for controlling standalone hybrid power systems, which have afterwards been proven it's instability in handling various changes in climate. The blending of wind- energy into existing facility presents a technical challenges which needs consideration of voltage regulation, stability, power quality problems.

.STEPS OF IMPLEMENTATION

Within this work, hybrid wind-solar system is utilized to understand load scheduling of facility by implementing genetic clustering algorithm with MPPT control method.

THE OBJECTIVES OF THIS PROJECT

- To maintain voltage stability constant.
- Unity power factor and power quality at the aim of common coupling bus
- Real and reactive power support from hybrid facility are controlled..
- Stand-alone operation in case of grid failure..
- Genetic clustering method is implemented.
- Power compensation through inverter is done.

EXISTING SYSTEM

In the existing paper, here reduce load demand by using hybrid compensation techniques by using PI controller, it isn't so adaptive control, so error solution won't be accurate. Also, interval for compensating load is high. When a voltage and/or current waveform is distorted, it causes abnormal operating conditions in an exceedingly very facility such as:

- Voltage fluctuations can cause additional heating in induction and synchronous motors and generators.
- Voltage varies with high values may damage insulation in cables and windings. Also in capacitors.
- Voltage Fluctuation can cause malfunction of assorted electronic components and circuits that utilize the voltage waveform for synchronization or timing.

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- Current Fluctuation in motor windings can create Electromagnetic Interference (EMI).

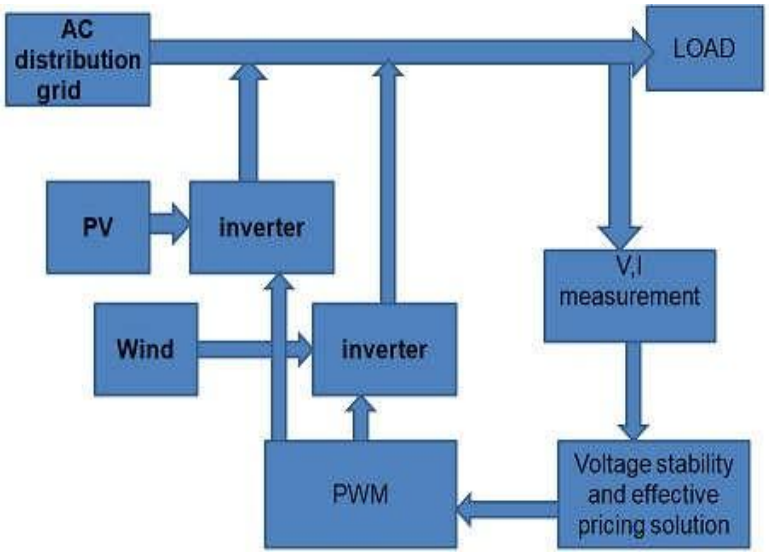

Fig.1 Existing Block diagram

DISADVANTAGES

- Here implement effective pricing technique for cost management.
- Voltage stability maintenance is slow.
- No power loss problem solution for renewable energy.

PROPOSED METHOD

Energy management is an essential method once it is designed and executed with suitable care for the load environment. The present project , manage the loads of a building that is using Hybrid Renewable Energy Systems (HRES) having solar PV plants, wind turbines and battery backup with grid connectivity.

The renewable energy generators were designed to have an installed capacity of 20% of the total load of the building. A set of 4 solar photovoltaic (PV) modules and wind turbine each of power rating 15 Wp, 1 wind turbines each of 5 W rated power output. A battery bank consisting of 2 units capacity of four amp hour were used.

The modeling of these components of the HRES was done as illustrated in. With the model in hand, hourly renewable energy availability was estimated considering forecasted solar irradiation and wind velocity data for a day under the assumption that these values would remain constant for a particular hour. This model forecast available in earlier with the off-line algorithm was created. It was built-in steps by prioritization of loads and later stage with tariff plans.

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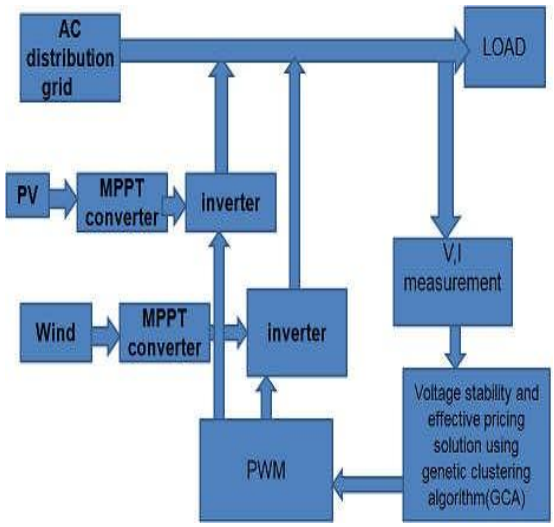

Fig.2 Proposed Block diagram

ADVANTAGES OF PROPOSED SYSTEM

- Here implement genetic clustering algorithm so cost efficient is more efficient than the existing method.
- Voltage stability maintenance is speed and accurate.
- Implemented MPPT-maximum power point tracking system so no power loss in renewable energy.

POWER DEMAND MANAGENET STATEGIES

The hybrid renewable power generation obtained under the weather conditions which should be capable of providing power for the electrical and hydraulic loads. Hence, the battery and the water tanks will be used to compensate or reduce both the electric energy and water deficits during the system operation in its environment.

Two approaches can be suggested to share the renewable source power between the electrical and hydraulic loads: Approach 1: "Uncoupled power management strategy." This approach is to meet the electrical and other loads following their demands (i.e. the electrical and water demands) and whatever the state of the intermittent power production. In this approach, the operation of electrical and hydraulic loads does not depend on the intermittent power production but only on their demands (i.e. electrical and water demands). In this case, to satisfy the water demand, the motor-pumps are operated with the nominal power following the tank filling levels (i.e. level L1 for motor pump 1 and level L2 for motor- pump 2). This is similar to a "flushing operation". And corresponds to the classical way of other load management: powering a pump to fill the tank only when its low limit is reached.

In reality, the energy availability is limited by the intermittence of PV and wind sources and the battery capacity. Later on two strategies are developed to manage the state of charge (SOC) of the battery according to the need of the loads. In strategy
1, the electrical load is privileged before the hydraulic loads and conversely for strategy 2 where the hydraulic load is privileged.

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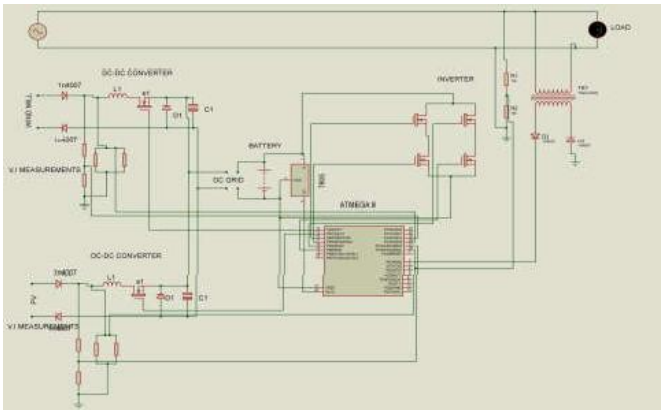
In other words, available power from sources and battery is used for electric loads then for hydraulic pumps in the strategy 1 and conversely for the strategy 2. In two strategies, the management of loads are not depend on the source of renewable energy. In this case, the battery must be sized in terms of power and energy to compensate the unbalance between the source and the required loads.

POWER QUALITY AND RELIABILITY

Reliability and quality of supply are equally important. Suppose, a consumer that is connected to the same bus and it supplies a large load may have to face a severe sag in the supply voltage every time the motor is switched on. In some worst cases even black outs and it is not acceptable one any consumer. Suppose some sensitive loads such as hospitals, processing units, air traffic management, financial institutions and data processing and network service providers need uninterrupted supply.

CIRCUIT OPERATION



- The appliance mainly based on the necessity of energy consumption at any point of time. The need and importance of an appliance over the others should be considered for an unique demand management. This can be assured by allocate importance to the devices considering their needs. This is useful only to the 2nd and 3rd category appliances as the 1st category must run quickly.

NEED FOR LOAD SCHEDULING

A hike in the purchase of electrical appliances following a rising standard of living causes a growing demand for energy in domestic buildings. Inadequate use of this equipment produces wastage of energy. One way to tackle this is to give feedback to the consumers on their behavior, which may lead to a reduction in this wastage. Next method of reduction of energy consumption is demand side power management.

The first method, eventhough makes the users realize their unhealthy trend of energy utilization, will not suggest any proper method for them to follow so that they could rectify the issue. Therefore, the best way to ensure the solution is to adopt the technique of DR. The implementation of DR through different methods. In order to accomplish this load management, loads have to be prioritize and heavily loads should not work during peak hours.

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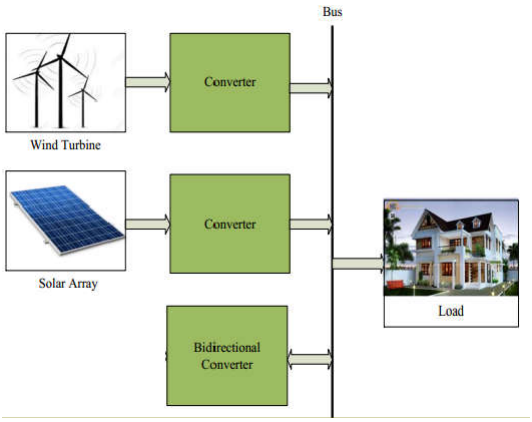

Fig.3 Model diagram of hybrid system

Fig.4 Hardware kit

RESULTS AND DISCUSSIONS PERFORMANCE ANALYSIS OF GRID POWER

A critical load is considered as a non-linear load for the simulation of the system. The performance of the system is noticed for the power quality management during critical load. condition. The inverter is switched "on" at 0.2 s. The grid current Ig, inverter current Iv, and load current I_L are measured with & without controller connection.

The dynamic performance of the system is monitored by operating the hybrid wind and solar inverter at 0.6 s. Under such condition the system performs load demand. The voltage sensor senses the condition and transfers the micro switches to generate the reference current in stand-alone hybrid wind-PV system.

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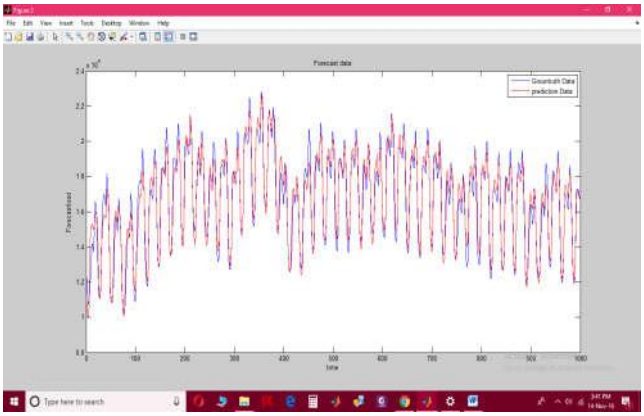

Fig 5. Simulated waveforms prediction of load demand

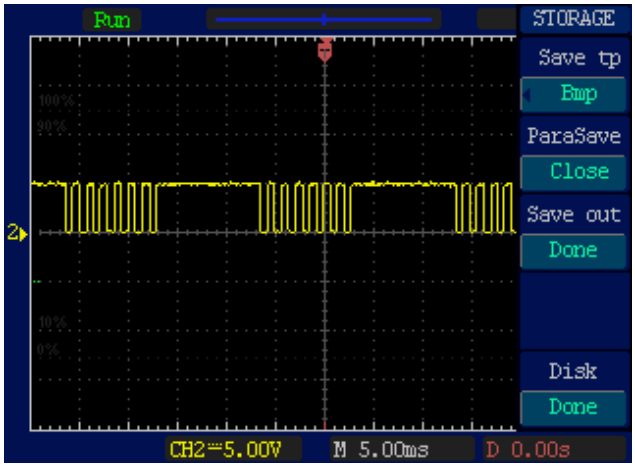

Fig 6. Hardware waveform of converter PWM

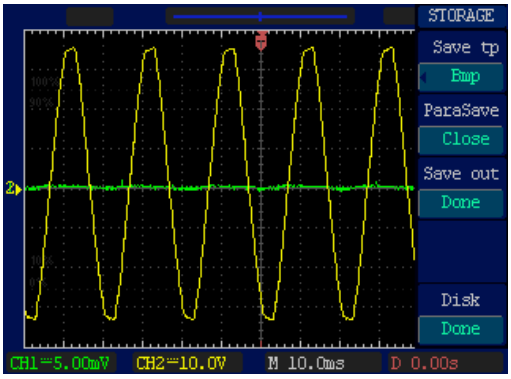

Fig 7. Micro grid output wave form

During this mode, the inverter will manage the critical load in the absence of grid voltage. Due to the unavailability of grid, the inverter will supply the full load current in this period. Fig 6.Shows the DC bus voltage and R phase load, converter and grid current before and after harmonic compensation.

CONCLUSION

This paper proposes a stand-alone hybrid wind/solar energy system. The HES configuration, system sizing,

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characteristics of system equipments, overall power management strategy of the standalone hybrid system is explained. The wind and solar energy sources are utilized as main power producing systems while battery is used as energy storing system. The battery stores surplus power during excessive power generation from wind and solar sources while it supplies power when there is a shortage of power generation to meet load requirement. Analytical studies are carried out to verify performance of a proposed system. This studies of the four seasons like winter, spring, summer & autumn, shows the feasible of a suggested stand alone hybrid wind and solar PV system. Through the experimental investigation, it is clearly observed that the Hybrid system can fulfill the demand of the consumer where yet no power.

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