RESEARCH ARTICLE OPEN ACCESS

Hybrid Renewable Efficient Model for Future

Ankit Kumar [1]Er.Bimal Kumar[2]

[1]Student B Tech in Electrical Engineering, Amritsar Group of Colleges, Amritsar

[2]Associate Prof. Department of Electrical Engineering, Amritsar Group of Colleges, Amritsar

Abstract-

The paper reviews a hybrid system which is a combination of different but complementary energy generation systems based on renewable energies. This project is designed as a hybrid power system having WIND energy and SOLAR power sources.In present, people are facing major problems due to non-renewablesources of energy. Continuous use of non-renewable sources like petrol and diesel has broughttheseon the edge of extinction. As a result these resources have become so expensive.Therefore, this project is to showcase an idea of using alternate sources of fuel which are environment-friendly, renewable, cost-efficient and can be used for both purposes domestic and commercial.Embedded technology anddifferenttypes ofenergysources have been used.

Keywords-Micro grid,Hybrid generation, Solar, Wind ,PV Cell, Renewable Energy Resources.

Introduction

Operational controls are outlined to back the integration of wind and sun powered control inside micro grids. An amassed show of renewable wind and sun powered control era estimate is proposed to back the measurement of the operational save for day-ahead and real-time planning. At that point, a hang control for control electronic converters associated to battery capacity is created and tried compared with the existing hang controls.It is recognized in the project (MICRO DC GRID) hang bends are set to work as the capacity state-of-charge (SOC) and can be deviated. The adjustment of the slants guarantees that the control yield underpins the terminal voltage at the same time keeping the SOC inside a target run of craved operational save, usually appeared to preserve the balance of the micro grid's real-time supply and request. The controls are executed for the uncommon case of a DCmicro grid that is vertically coordinates inside a high-rise building of an urban region. Already undiscovered wind and sun based controls are gathered on the roof and sides of atower, additionally supporting conveyance to electric vehicles on the ground. The micro grid is vertically coordinating with highbuildings without making a expansive impression.

Literature Review

Operational controls are outlined to bolster the integration of wind and sun based control within micro grids. An totaled demonstrate of renewable wind and sun powered control era figure is proposed to bolster the evaluation of the operational save for day-ahead and real-time scheduling Technology[1].

The quick consumption of fossil fuel assets and natural concerns has given awareness on era of renewable vitality assets. Among the different renewable assets, hybrid solar and wind vitality appears to be promising arrangements to supply dependable control supply with improved framework effectiveness and diminished capacity necessities for standalone applications This paper presents a feasibility assessment and optimum size of photovoltaic (PV) array, wind turbine and battery bank for a standalone hybrid Solar/Wind Power system (HSWPS)[2]

The paper explains the innovative field of hybrid energy storage systems (HESS). An HESS mainly is a beneficial coupling of two or more energy storage technologies with supplementary operating characteristics like energy and power density, self-discharge rate, efficiency and life-timeetc. The paper discusses typical HESS,applications, energy storage coupling architectures, basic energy management concepts and a core approach for the power flow decomposition based on peak saving and double low pass filtering. Four HESS-configurations, suitable for the application in decentralized PVsystem.[3]

The paper presents the optimal hybrid power system design including various configurations of renewable energy generation. To decide the optimal configuration of parameters, a new multi-objective function with six separate objectives of hybrid renewable system is presented using GA, PSO, BFPSO and TLBO optimization techniques.[4]

Problem Formulation

Non renewable energyis primarily extracted from fossilsfuels.Fossil fuels release greenhouse gases like carbon monoxide, carbon dioxide and nitrous oxidein the extraction process.These byproduct gases can cause serious respiratory diseases and otherproblemsforhuman beings. The ozone layer is also depleting as a result of these substances.

On the other hand renewable energy sources mainly solar and wind are offering a better option for our energy needs. Since renewable energy is not so reliable, therefore the aim is to create a hybrid system to use renewable and non renewable energies in an efficient way. This project uses renewable energy as a primary source for uses. Thus the challenge liesinsynchronizing renewable sourceswith non renewable sources.

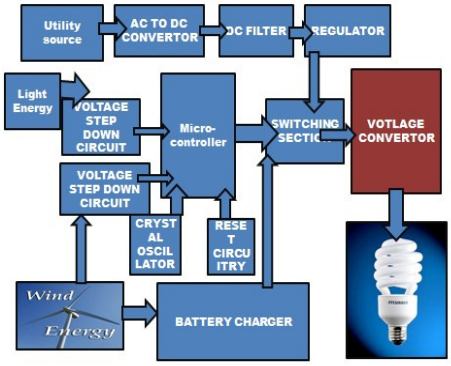
Methodology

It is essential to have a well-defined and standardized framework taken for hybrid system based power generation in industry. These steps are as follows:

a. **Demand Assessment:-** Using accurate load forecasting of industry the load demand can be fetched. Load assessment can also be done by interviewing industry engineer workers etc.
During load survey, following factors may be considered: Demand for street lighting, Number of houses, commercial establishment and their energy requirement, number of small scale industries and their energy demand and Miscellaneous demand.
b. **Resource Assessment:** Resource assessment can be done by calculating potential available in wind and solar, renewable energy resources using meteorological data available.

c. **Barriers/Constraints:** Annual electricity demand, Reliability, PV array AC/DC converter DC/AC converter Charge controller AC load Diesel generator Battery Bank Wind Turbine DC/DC converter Hybrid Renewable Energy System: Net Present cost, Environmental factors, Employment.

Demand is fulfilled by Hybrid renewable energy system. To do this, one or more renewable energy sources can be combined with conventional energy sources. Some Hybrid renewable system configurations are as follows: solar+wind, main supply+wind,solar+main supply, solar+ main supply +wind and above configuration will be selected by the microcontroller on the basis of availability and load will be connected by relay.



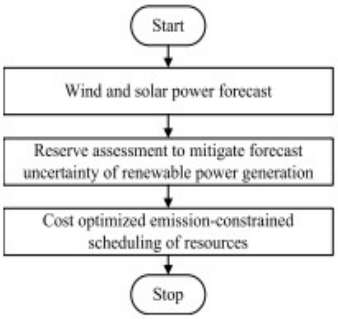


Figure 1-Block Diagram of Project

In this project hybrid energy system consists of three source of energy that is main power supply from power system grid available ,solar energy system, wind mill.

a. During day time solar energy is available so whole load will be shifted on solar system.
b. During night time wind energy is available so whole load will be shifted on wind energy system.
c. If both solar energy and wind energy not available then load will be shifted on main supply.

Most preferred sources of energy will be renewable energy sources that is solar and wind .

Model description

This section offers a description of an optimization technique developed for the design of a hybrid energy system. The design considers the unit cost of different resources based on life cycle costs. The problem is formulated as a mixed integer linear programming . The
mathematical approach is presented in a simple and useful form to make it directly applicable for the modelling of stand-alone hybrid energy system for use in the remote rural areas. The input data required, assumptions involved, and the design procedure are clearly explained for easy use. The approach includes the minimization of a cost function subjected to a set of equality and inequality constraints.

Model assumptions

To state a model which is both sufficiently general and accurate for describing all types of energy flow, following assumptions and simplifications have been made:
The system is considered in steady state.

It is considered to have steady state power, efficiency, and energy only, any other values are not used for the system description.
The model incorporates conservation laws (e.g. Conservation of flow) but no constitutional laws (e.g. relation between voltage and current).

Since the electrification process is continuous, it is assumed that the hybrid generation system operates on a 24 hour a day and thus equipment breakdowns and planned maintenance etc. are not explicitly considered.

It is assumed that the costs are additive and there are no perceptional changes in other factors such as plant capacity, unit cost of different energy sources, configuration of energy system etc.

It is assumed that AC appliances only are being used and are connected to the load bus.

The hybrid energy system optimization model is divided into two parts:

A simulation-performance component and an economic-assessment component. The simulation is actually based on a steady state model which uses different renewable generators, diesel generator, battery storage and thus allows for a static model (based on hourly energy balance) to be used in place of an instantaneous operational dynamic model. The simulation-performance model, integrated in a C program, takes description of the model.

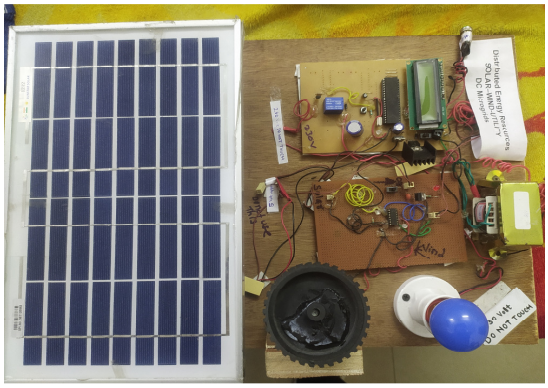


Fig 2- Model

It consists of two PCB boards one PCB consist consists of solar and wind circuit.

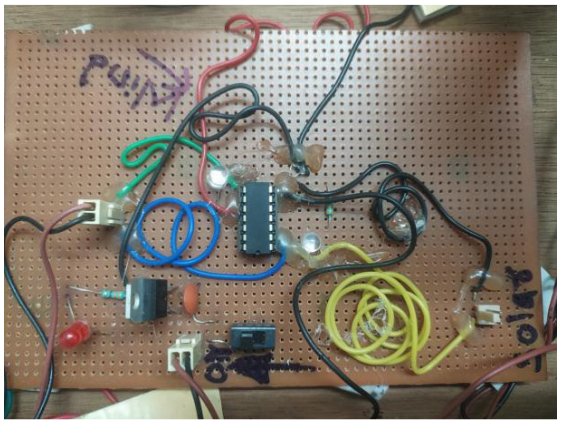


Fig 3- windand solar circuit

Other PCB board consists of microcontroller,LCD,Relaymainly.

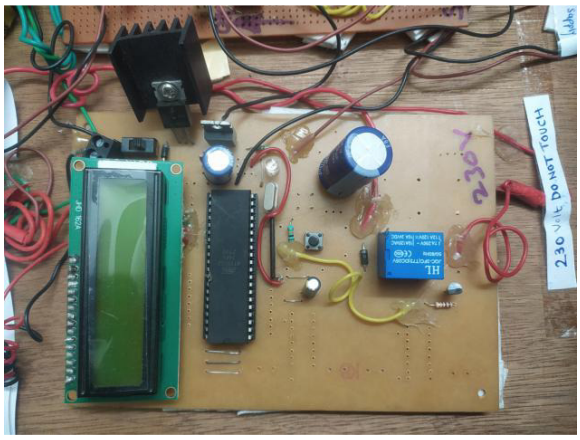


Figure 4-Controller Circuit

Microcontroller works on zerology. Itshifts load withavailable power supply according to its voltagemagnitude.

It consists two batteries, one which manually can be charged and another battery can be charged by vehicle motion of wind energy. Comparator always compares the both battery voltage.Microcontroller determine whether battery one or free energy battery is fully charged and connected to dc motor via microcontroller. Dc motor shaft is connected to the shaft of alternator which converts motion energy into electrical energy and charge the battery via a battery charger.It is combination of mechanical engine power and electric motor power to propel the vehicle (HEV driving).

Efficiency, indicated as fuel economy, must be affected by the electric system performance, which strongly depends on the characteristics of the Energy Storage System (ESS).Typically mild HEV calls for an improved energy storage system because of a rather high current operation at a low operating voltage range. In particular, the idle stop & start function significantly

increases the number of engine starting, which involves frequent high current discharge. Sometimes the starting current reaches the 10C to 15C rate and it causes a decrease in performance and cycle life. The regenerative braking function is another major factor compromising performance, because a rather high charging current is applied to the energy storage device ina short period of time when kinetic energy is changed into electrical energy while braking. The algorithm for optimized scheduling of the micro grid is depicted. In first stage, wind and solar power generation are forecast. The uncertainty of the wind and solar power is presented by a three-state model. An example of such a forecast is thatapower forecast lower than the average power forecast. State 2 depicts a power forecast higher than the average power forecast. Then, in state 3 wind and solar power forecasts are combined to produce the total renewable power forecast model. This aggregation method is formulated. The aggregated power generation data are used to assign hourly positive and negative energy reserves to the BESS for the micro grid operation. The positive energy reserve of the BESS provides the energy (stored)that can be immediately injected into the dc bus on demand. The negative energy reserve allows the part of the BESS to remain uncharged to capture excess power on demand. Energy reserve assessment is performed on the basis of the aggregated renewable power generation forecast. In order to compensate for the uncertainty of the forecast, a method is devised to assess positive and negative energy reserves. Finally, the emissionconstrained cost optimization is formulated to schedule the micro grid resources for the day-ahead dispatch. The optimized scheduling is formulated. Wind and solar power generation forecast uncertainty data are made available for the urban micro grid. Specifically, as shown the output power state and the probability assigned to that state are available. A sample of forecast data of the wind and solar power generation is provided for 1 hour. For example, at a probability of 50% the wind power will be 50 kW . The aggregation of output power states of wind and solar power is formed as follows.The combined states in the forecast uncertainty model of wind and solar power are depicted in Fig. 5. In each combined state, the power of those individual states is aggregated , and the probability of a combined state is the product of the probabilities in individual states assuming that the individual states are not correlated. For the wind and PV power forecast shown in nine combined states are defined.

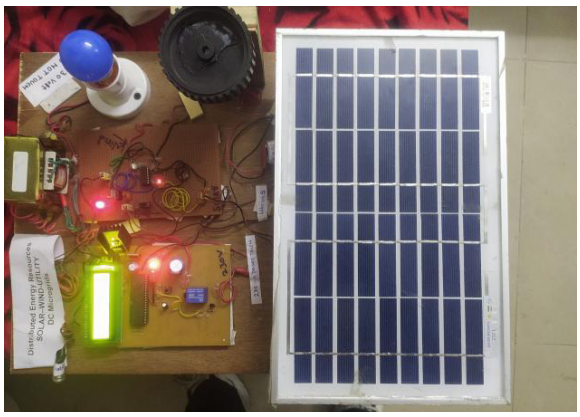


Figure 5-DC Micro grid

Component description

1. Solar panel-Solar Panel is considered to be a heart of project known as micro gridwhich is beneficial to charge the lithium ion battery. Solar panel used in project is poly crystalline with 15 watt 18V as power and current rating.Whensunlight of particular intensity falls on solar panel then photons of sunlight together with electrons of cells produce Direct Current at output.

Figure 6-Solar Panel

2. **Plywood-**Plywood is a material which has high mechanical strength and is widely used in various applications like furniture, home decors and in much more areas. In project known as DC micro grid, plywood is used as supporting material which supports various components like micro controller, battery, solar panel and solar charge controller.

Figure 7-Plywood

3. Relay- A relay is a switch that is controlled by electricity. A set of input terminals for a single or multiple control signals, as well as a set of functioning contact terminals, make up the device. The switch can have any number of contacts in any contact form, including make contacts,break contacts, and combinations of the two.

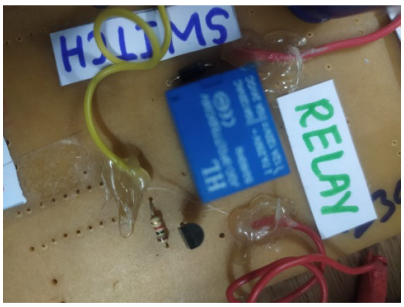


Figure 8-Relay

4.LCD- LCD 20 x 2 Parallel LCD Display that provides a simple and cost-effective solution for adding a 20 x 2 Black on RGB Liquid Crystal Display into project. The display is 20 characters by 2 line display that has a very clear and high contrast black text upon a yellow background/backlight.

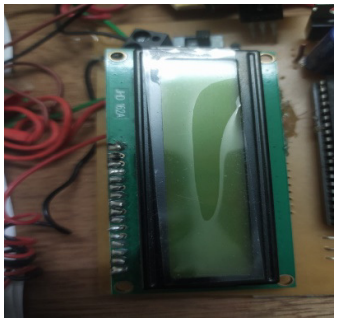


Figure 9-LCD

5. 7805 Transistor- A prominent voltage regulator integrated circuit (IC) is the 7805 transistor, which is part of the 78xx series of fixed linear voltage regulators used to maintain such variations.

7V-35V input voltage range

1A is the current rating.

Mix=5.2V, VMin=4.8V

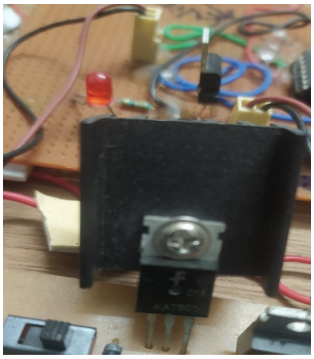


Figure 10- Transistor

6. **Microcontroller (AT89S52) -**The **AT89S52** comes from the popular 8051 family of Microcontrollers. It is an 8-bit microcontroller with 8K as Flash memory and 256 bytes of RAM. Consideringits similarity to the trust worthy 8051 architecture these microcontrollers are as per industry standards. It consists 32 I/O pins comprising of three 16-bit timers, external interrupts, full-duplex serial port, on-chip oscillator and clock circuitry.

The Microcontroller has Operating mode, Idle Mode and Power down mode to makeit suitable for battery operated applications. Atmel microcontroller can be programmed with different software's that is available in the market. Kielvision is the most used platforms to name a few. UPS battery is recommended in DC micro grid Project.

Figure 11-MicroController

Results andDiscussion

A DCmicro grid for renewable power integration has been proposed in the paper. The operational optimization and a voltage–power droop controlbased on power-electronics was developed, and the functioning was demonstrated through simulation. Interaction with the main grid was controlled as a result of an operational optimization whichaims to minimize cost and emissions. A method to quantify the uncertainty associated with the forecast of aggregated wind and PV-based power generation was created and used to quantify the energy reserve of the battery (energy storage system). The battery is parallel-connected with a super capacitor to form multilevel energy storage. The latter plays a critical role in compensating renewable power fluctuations and providing the power required when EVs stop by for fast charging. In accordance with the micro grid paradigm, operation is also supported in autonomous mode to support UPS whenever the connection to the main grid is unavailable. In such times, fast charging is not supported, as the priority shifts to supplying critical local loads.

Future Scope

Power electronics is a key enabling technology in connecting all types of energy resources to the dc bus. The converters support dc voltage through a droop control scheme. The control proposed here is adaptive as that the voltage–power droop curves are modified depending on the outcome of the operational optimization. As a novelty, asymmetric droop curves were proposed for the converters connected to the storage so as to support the objective of bringing the actual battery SOC close to the desired one as scheduled. This ensures in particular for the multilevel energy storage, that the contribution toward dc voltage control does not compromise its role in providing adequate energy reserve. This project is eco-friendly as it does not cause any pollution. It is anuseful inventionand many practices are being tried to make it useful for various other fields.

References

[1] IEEE Journal of emerging and selected topic in power electronics, Vol. 2, NO. 1,march 2014 115 DC Micro grid for Wind and Solar Power Integration Kai Strunz, Ehsan Abbasi, andDuc Nguyen Huu

[2] “Global wind report: Annual market update 2012,” Global Wind Energy Council, Brussels,Belgium, Tech. Rep., 2012.

[3] H. Polinder, J. A. Ferreira, B. B. Jensen, A. B. Abrahamsen, K. Atallah, and R. A. McMahon, “Trendsin wind turbine generator systems,” IEEE J. Emerg. Sel. Topics Power Electron., vol. 1, no. 3, pp.174–185, Sep. 2013.

[4] F. Giraud and Z. M. Salameh, “Steady-state performance of a grid connected rooftop hybrid wind-photovoltaic power system with battery storage,” IEEE Trans. Energy Convers., vol. 16, no. 1, pp.1–7, Mar. 2001.[1] Khan, B.H.: Non-Conventional Sources of Energy, 5/e, Mc Graw Hill Education(India).

[5] Fitzgerald, A.E., Charles Kingsley & Stephen D. Umans : Electric Machinery, 3/e, Mc Graw Hill Publication (India)

[6] Mueller, O.M.; Mueller, E.K,”Off-grid, low-cost, electrical sun-car system for developing countries”,Global Humanitarian Technology Conference (GHTC), 2014 IEEE Year: 2014,Pages: 14 -17, [1] DOI: 10.1109/GHTC.2014.6970254.

[7] Milliman, Jacob & Christos Halkias: Integrated Electronics, 2/e, Mc Graw Hill Education(India).

[8]Khan, F.A., Pal, N., Saeed, S.H.: Review of solar photovoltaic and wind hybrid energy systems for sizing strategies optimization techniques and cost analysis methodologies. Renew. Sustain. Energy Rev. **92**, 937–947 (2018) .

