China Petroleum Processing and Petrochemical Technology

Catalyst Research Volume 23, Issue 2, August 2023 Pp. 269-285

# "ROBUST OPTIMAL ENERGY MANAGEMENT SYSTEM FOR PV -WIND MODULE WITH NANO-GRID FOR POWER ELECTRONICS"

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## ABSTRACT

A hybrid power source is fundamental to a plug-in electric vehicle (PEV), wind generators, and solar panels, as well as the latest smart buildings. This paper presents an optimization methodology to manage energy efficiently and size the mechanisms for a particular smart household with home-made batteries, PEV, and photovoltaic arrays. With the design of a smart home Nano grid, we seek to exploit the home bargain, and simultaneously fulfil control demand and PEV arrangement. Centred on the arrangement and structure representations, a convex software design problem is enclosed to improve both the decision-making process and the supposition and restrictions of the household battery dynamism storage system (BESS). Combining various stretch distances, home BESS values, categories and switch ways of PE-V's, the restrictions of household BESS and electric charges are appraised scientifically. In the home with BESS, the home with a CP control law won't buy electric vitality from the grid equipped on the period when the electric price is highest. (H2V) and vehicle to home (V2H).

**KEYWORDS:** Power Electronics, Photovoltaic, Inverter, Battery, E-Vehicle.

## INTRODUCTION TO HYBRID SYSTEMS

An ingenious solar-pumped hydro storage space micro grid is proposed, KSA is demonstrated to be effective using target complications and effectively functional to the controller design of hybrid electric vehicles. [1], associating the proposed administration organization's routine with the single-layer administration system confirms its efficiency. Through the hierarchical two-layer structure of habitat energy control, the same size battery will be able to compensate the yearly decline of 27.8% in home power consumption, and consume 91.1% of the solar energy it produces. Compared to by means of a particular layer residence energy supervision system [2]. Grid-connected Micro grids (MGs) include a solution role for bottom-up reconstruction of the exciting delivery network advance next age band Smart Grids, allowing the purpose of Demand Response (DR) air force, as fine as the energetic contribution of presumes keen on the power advertise. To

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this intend, MGs have to be prepared with apposite Energy Management Systems (EMSs) in arraign to competently direct in real time interior energy flows and the association with the network [3]. Incidence excursions, The power management organization is provided with a novel, flexible and comfort-aware solution approach to manage emergency-related incidents. It is intended to co-optimize the micro grid power capital Grid-tied significant photovoltaic (PV) structures practice three-phase module - combined converters (MICs). Purposeful and the majority positive one is chosen. Also, the most excellent method is measured to fit PV boards and energy cells in this residence identified on infrequent guidelines. Agreeing to this, it can be theoretical that the monetary aspect of the examination is simplified and deliberate in renewable source of energy below the strategies and circumstances for savers in this grassland [5]. Micro grid systems facilitate the addition of these systems in a distributed manner, estimating a position of academic solutions that helps patrons switch between circulated age bands and residential areas, which implies that they need to be managed. [6]. In micro grid, an force running arrangement is important for best possible use of these disseminated force wealth in gifted, protected, consistent, and corresponding ways. then, this examination presents a relative and critical study on resolution assembly strategies and their explanation methods for micro grid liveliness supervision bases [7]. The revision expressions that foremost states have extended or are secure to achieve their intention, whereas sheathing nations are far opening their areas. ETS besides non-ETS goals have in cooperation a position in the on the rise use of hard biomass. Regardless of approximately trials, the woodland biomass subdivision permits the ecological increase of bio energy in the Energy Utilization [8]. In meticulous, the outcomes optional that renewable power reduce natural pathway in extensive-route on independently quantize. Still, the consequence of monetary enlargement and non-renewable power influence completely to environmental track in long-short sprint age at all quantizes [9]. Experimental outcome displayed that air quality, expansion development, and community maturation affect economic growth positively and significantly, while renewable energy use condenses money increase, as a result of the termination of a control unit with residuals. [10]. There is a compelling need for renewable sources of energy to assemble the increasing demand for electricity, ease typical climate change, and contribute to sustainable development. By using micro grids, these systems are disseminated to a wide audience [11]. The aim of scheduling is minimizing the probable power cost at the same time as fulfilling machine/console/contractual constraint, as well as probability constraint on power transfer among users and the grid below RES production and users' command worries [12].

We validate the existence of cross-sectional addiction in absorbing next-generation assessments for group judgment. The outcomes of improved collection judgment are discovered in this revision that monetary expansion, renewable power and deal honesty appreciably supply to defeat the ecological poverty, while monetary expansion and non-renewable power operation are supplementary in charge for the ecological indemnity [13]. The experimental answer explain that produce 14 diversification modules include helpful property on renewable energy order for urbanized and 15 up-and-coming economies [14]. Iranian renewable energy sources have an extremely high potential; however, the central energy structure in the nation is really stranded on

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residual fuels. The wealth of oil and gas reserves in the nation makes it less practicable to produce renewable energy. [15]. Similarly, the supply shortages in the RE sector cause a slighter making disappointment than those of the NP division. A price-side replica also showed that a 10% raise in productivity in both NP and RE subdivisions advance the whole charge levels by 0.0588% and 0.0134%, separately[16]. Managing energy in small scale networks includes numerous benefits, like reducing energy losses and simplifying the development of organizations. Hence, a variety of aspects of micro grid running such as machinery, complex structures, and operation modes, storing systems, types of load, replicating event, and resolving events such as load must be considered in the micro grid management point of view. [17]. Among the most critical systematization issues of hydrogen-based DC motor generators are sensible power cut, bus electrical energy constancy, and dependable action. Using a mode-triggered droop system, we show a simple and efficient way to administer a decentralized DC MG based on PV/LH/Battery [18]. Typically, grids are partitioned into three main parts: generator, broadcast system, and assignment structure. Generators provide electricity, broadcast systems transport power from generators to load centers, and sharing structures distribute power to close at hand neighbours [19]. The HMS replicated in this editorial measures costs, beating of control supply vision, impurity emissions, and power steadiness as goal functions. For the planned procedure, we take into account two correspondences with dissimilar group collection methods in order to determine the average. [20].

The projected classification uses two & more renewable possessions to make available the power for the home-load claim and to accuse up an E-vehicle. The arrangement is considered for the in cooperation the Solar & Wind which is more helpful to present the control for the home-load stipulate. The structure used Battery Energy storage space System (BESS), to convict the batteries. The structure is relevant to employ an Wireless conversationalist to the consumer, which makes easier to make out the position of the organization and power age group. To reduce the communication among distributed generators, the event-triggered communication method is further proposed [21]. First, a two-area traditional LFC is used to validate a novel reconstructed model, which estimates the influences of time delay on frequency stability with greater computational power[22]. As a result of this work a stochastic biobjective DSP problem is proposed with the purpose of maximizing disassembly profit and minimizing energy consumption [23]. A prototype of the proposed energy trading organization runs in a cluster network, with a coordinator running as a smart contract in a hyper ledger block chain [24]. Such deep neural networks are affected by their architectures directly. To solve this, a swarm evolutionary optimization method is introduced [25]. Fuzzy logic-based energy management (FEMS) will be proposed in this article for a grid-connected micro grid with renewable energy sources (RESs) and energy storage system (ESS) [26]. The fault variables can also meet to zero or a undersized locality of 0. Finally, the results of the simulation are given to further validate the design [27]. The start of a minor road shortest gibbet as glowing as the view of in audience trends are this study's two almost solitary and every one mid actions [28]. It endowment z-origin converters for adapted intermingle control foundation with soft result power supervision [29]. A three point DC to AC converter, a enhance DC-DC converter, a PWM planner, a non linear shipment, as well as a PV/wind blend

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energy society erect up this synchronization. Based on the underpinning of honesty of bring into fool around, the recover converter be gifted to present have rule above to the jam [30]. The anticipated strength managing systemizes elevate the character- payments assessment for renewable energy dexterity whereas fading the complete date by day in use funds for micro grids [31]. Voltage Source Inverters utilise this Selective Switch Count (SSC) method of Varying DC Link Voltage [32]. Photovoltaic (PV) systems and the wind model have both been researched [33]. MATLAB is used to run the simulation, and the results are shown [34].

The above literature deals with some fluctuations on voltages. In order to overcome the problems and opening of join planetary PV by means of blustery conditions force for the age band of power has been reviewed in this study. The blinking natural history of solar PV and wind starting place is the essential impediment for in cooperation grid-connected systems and impartial systems. The detailed analysis on Hybrid systems through sensor module is analysed here for the betterment of grid integration.

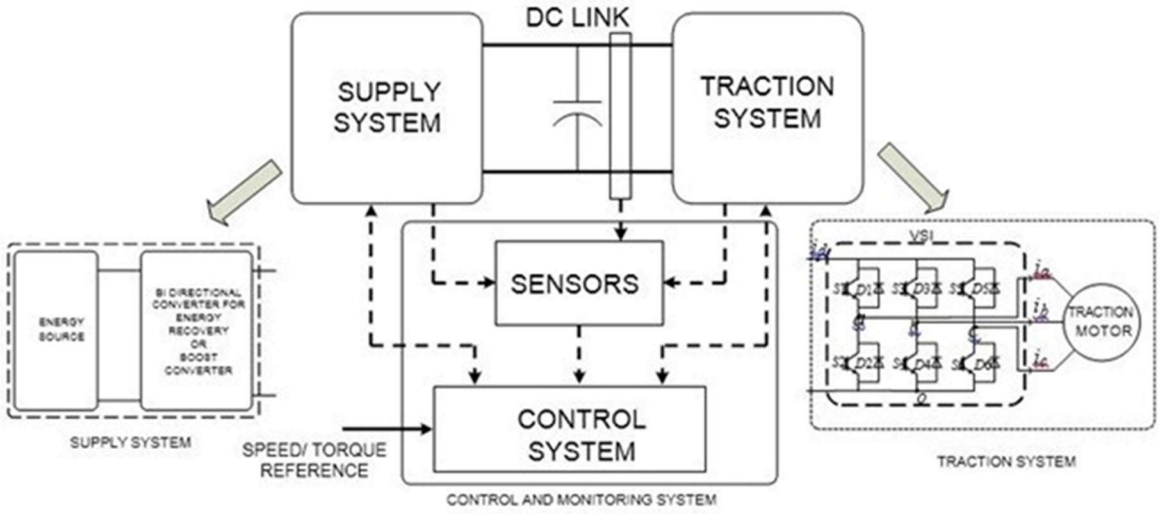


Fig.1 Block Diagram of Electric Vehicle Population System

Fig.1 designs about Control system for an electric vehicle. Most production vehicles have a very complex control system, distributed on several electronic control modules, and interacting with other vehicle systems (braking, heating).

## MODELING OF SOLAR-WIND- BATTERY HYBRID SYSTEM WITH CONVERTER AND CONTROLLER

The proposed system uses two & more renewable possessions to offer the energy for the home-load demand and to charge up an E-vehicle. The system is designed for the both the Solar-Wind which is more effective to provide the power for the home-load demand. The system used Battery Energy Storage System (BESS), to charge the batteries. The system is applicable to implement an Wireless communicator to the user, which makes easier to know the status of the system and power generation.

### Modules

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Wind Turbine,Solar Panel,Non-linear load,Relay,PWM ,Solar Charging controller,Inverter Module description

**Wind turbine**

1. Tower, Foundation, Nacelle, Rotor Blade, Hub.

Wind turbines are best supported by piles or flat foundations, depending on the underlying ground. This tower bears not only the load of the nacelle and the propeller edges, but also has to sustenance the massive fixed loads initiated thru the changing winds. Generally, concrete or steel tubing is used for the tower.

Example of Tower heights

- Pivot height 40-56m: approx. 600 rated control and near 41 to 64m rotor diameter.
- Core height 64-110 m: 1.5 to 2 rated power and about 70m rotor diameter.
- Hub height: 120 to 130 approx. 4.5 to 6 rated supremacy about 110 to 124 m rotor diameter.
- The substance announcers the wind turbine to the crushed.

**Structure of rotor blades and Rotor**

Through the rotation of the rotor edges with the assistance of the rotor, wind power is turned mad about rotary mechanical attempt.

At this time, the straight axis 3-bladed rotor rules. The edges are fictional from crystal or carbon fiber armoured material (GPR, CFRP); the shape is comparable to that of an aircraft arm. They both have the equivalent rule of stimulating; on the minor side of the division, temporary air yields a advanced force, even as the greater side forms a tug. These services root the rotor to journey forward, or to switch.

Nacelle with drive train

Because it's attached to the tower via bearings, the nacelle houses the turbine apparatus and should be able to spin in order to track the coil. It is apparent from the build-up of the nacelle how the manufacturer positioned the drive train components above the machine bearings (the rotor streak bearings, programme, generator, pairing and handbrake).

a) Gear Box

As a result, gearboxes match the rotation speeds of the listless rotor and the fast-moving generator, and have a number of steps to address a variety of situation. By using a personally residential multi-pole ring generator, it is no longer essential to use the gearbox (best-known direct-drive manufacturer: ENERCON).

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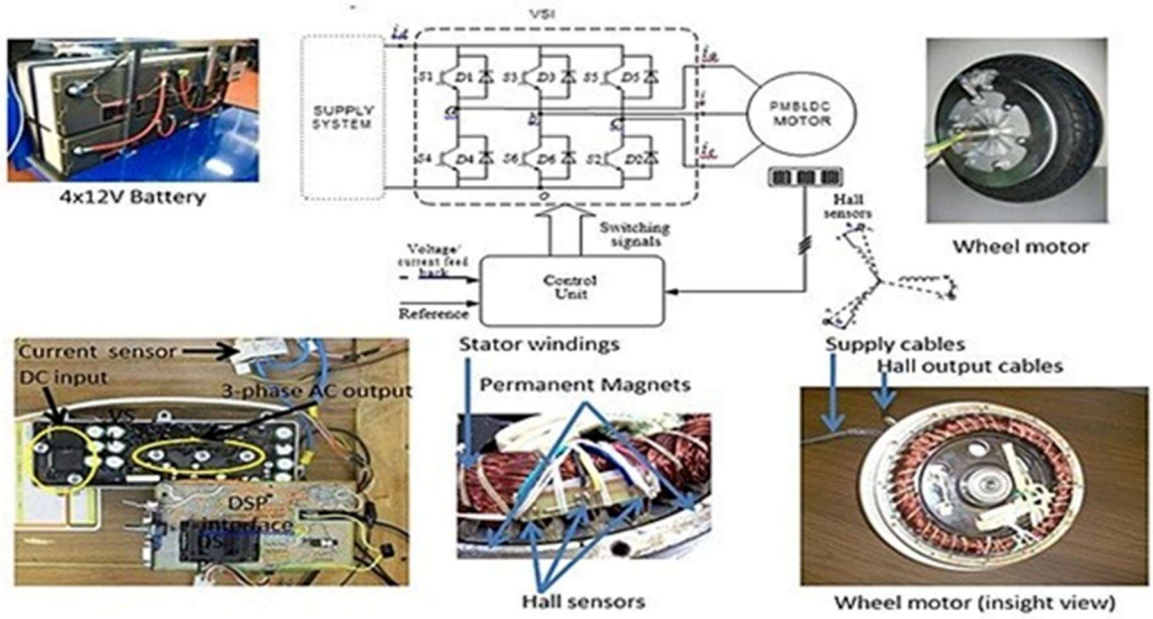


Fig. 2 Electric Traction System

Any vehicle can be moved using traction. When this is done with electrical energy, it is called Electrical Traction.

**b) Generator**

Most often, double-fed asynchronous generators are used in high power wind turbines. With these generators, the functioning speediness can be wide-ranging fairly, distinct straight non synchronous generators and synchronous generators. Grid link of synchronous generators is just potential by transformer, as synchronous generators rotate at fixed speeds. However, the difficulty of having a problematical control system is offset by the on the whole efficiency and better network compatibility.

**c) Coupling and brake**

A rigid pairing among the core beam and the conduction is needed because of the enormous torque generated. The kind of brake will depend on how the blades are controlled.

**d) Electronic equipment**

An electronic scheme for a wind turbine consists of a generator, a classification for grid-in provide for power, as well as a variety of sensors. In and around the nacelle are sensors that measure temperature, wind direction, wind speed, and a multitude of other things.

**Design of Battery**

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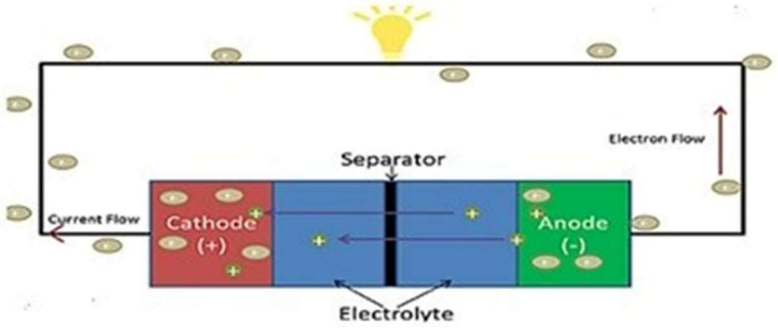


Fig. 3 Circuit Operation of Battery

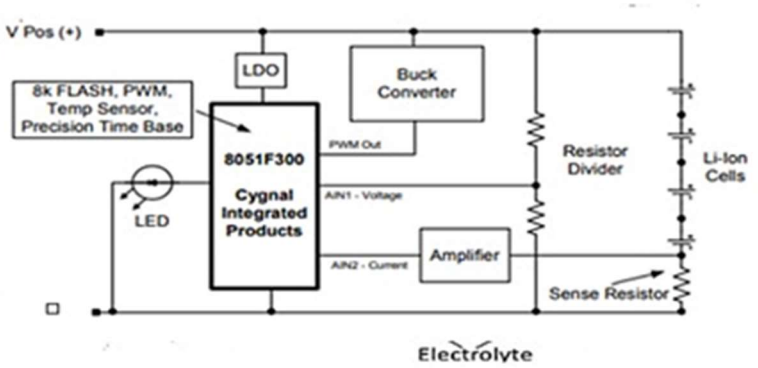


Fig. 4 Circuit diagram of Li-Ion Battery charger

Its three major machinery are the constructive and unconstructive electrolyte and electrodes. A typical lithium-ion cell's negative electrode is made of carbon. Anodes are oriented in accordance with the route of movement of electrons flow in the unit even as cathodes are oriented in the other direction, and the electrolyte is a lithium salt reasonable in an whole solvent.

Negative electrodes are often made of graphite. Positive electrodes are typically made from layered oxides (such as lithium cobalt oxide), polyanionics (such as lithium iron phosphate), or polyimide. The electrodes for lithium batteries can also be made of grapheme (based on 2D and 3D grapheme structures). Recently, grapheme containing electrodes contains as well. The electrolyte is normally a muddle of accepted carbonates such as ethylene carbonate or diethyl carbonate containing complexes of lithium ions.

The electrical energy, force concreteness, life, and protection of a lithium-ion succession can drastically change based on the materials chosen. An effort has been made to explore nanotechnology-based architectures to improve performance. Recent work has explored electrode materials, as well as alternative electrode structures, at the nanoscale.

In general, lithium is very much instantaneous. It reacts violently with stream, forming lithium hydroxide (Li-OH) and hydrogen gas. As a outcome, a non-sequiter electrolyte is in the main old, and the array pack is solidly sealed to prevent moisture from penetrating the cell.

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## EXPERIMENTAL VERIFICATION BY SOFTWARE AND HARDWARE RESULTS

- It can able to charge batteries, and sustain the home load demand with the available power.
- The losses are low
- The Harmonics are controlled easier.

### Simulation Design Applications

An average PV module produces power of around 17V. When considered at a cell temperature of 25oC, it can go down as low as 15V on a very hot day, and as high as 18V on a very freezing day. The MPPT is a DC to DC converter that uses DC input from PV modules, charges them with AC power, and converts them back into DC voltage and current to perfectly match PV output to battery output.

Wind energy conversion systems (WECS) produces the amount of energy varies as the wind speed changes all over the day over by peak power points are famous and the maximum power point tracking (MPPT) control device of the WECS control arrangement irrespective of the type of instigator.

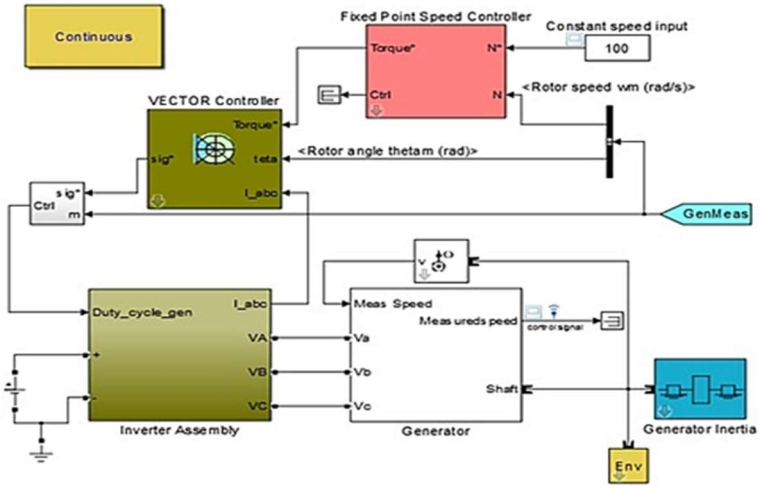


Fig.5 Simulation design for Hybrid Energy Storage System.

Through this analysis which solar energy, wind energy, and fuel cells were discussed as available energy sources. In order to investigate the advantages of a sustainable design for ships, a hybrid PV, wind, and fuel cell energy scheme was developed for the first time. In addition, economic and environmental analyses of the hybrid system for oil tankers were done.

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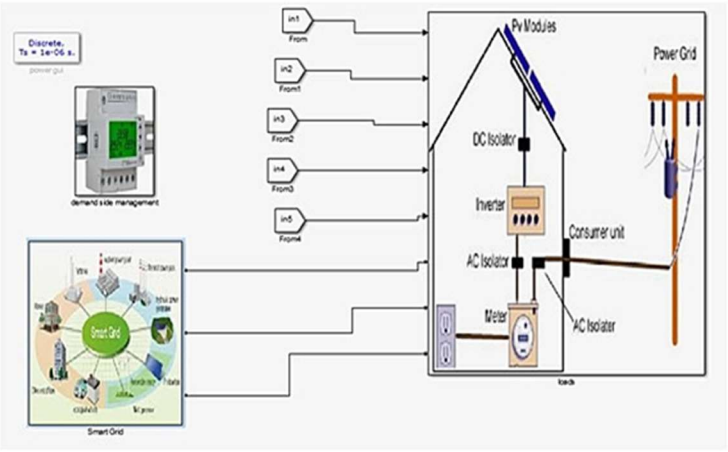


Fig.6 Simulation design for Micro Grid

PV generation, battery storage, and utility grid are integrated through Matlab/Simulink, and the efficiency of the system is verified by simulation.

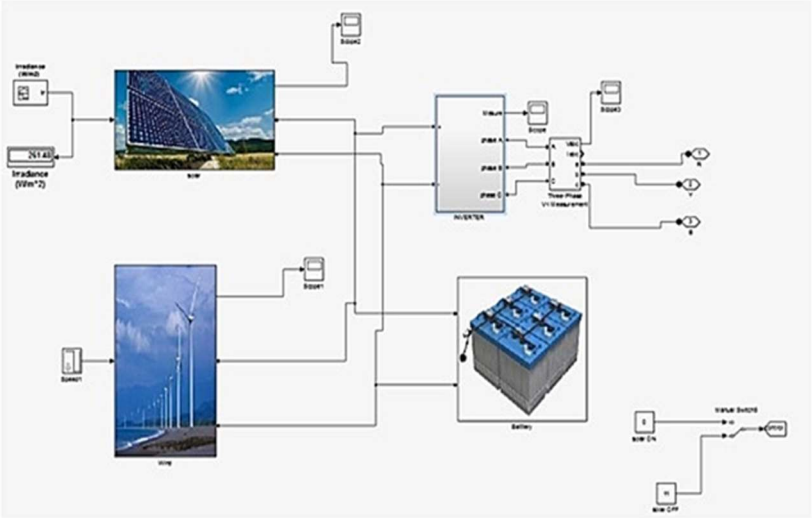

Fig. 7 Simulation Design for Smart Grid. The design of Renewable energy storage system is specially designed with PV-Battery-Wind connections.

In order to design the hybrid PV/wind/diesel/battery system, three intention functions are examined; the Net in attendance Cost, the price cost of emission, and the magnitude of CO2 at large into the atmosphere. These are all measured under several constraints, such as LPSP (system reliability).

**Experimental setup for Wind Generator module**

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Fig.8 Wind Generator Module with Variable resistive load and AC loads.

It is necessary to optimize the mechanism of the wind turbine arrangement in command to control its mixture of speeds or make best use of its output.

The variable output voltage and current was measured from the above wind energy trainer kit for the respective variable resistive loads and for AC loads, fluorescent lamps will be used. And Renewable energy income includes the combination of two or more power sources. Solar and wind energy are the most widely used sources for renewable energy, as well as non-conventional energies.

Solar Energy: Energy Can be directly delivered from the sun is called Solar energy.

Uses: Solar E-vehicles, Watches, Water Pumping, Domestic and Commercial applications.

Wind Energy: The Kinetic Energy of Airflow is converted into Electricity.

Uses: Industrial Usage, Irrigation systems, Long power usage devices.

Tidal Energy: Energy received from tidal waves of the sea is called as tidal energy.

Uses: Power generation for boats.

Photovoltaic model and wind module will produce suitable electrical power. Both the outputs are integrated to give renewable energy and it will be used for several power electronics applications such as UPS. Hybrid Renewable systems are not depending on one another. We can easily get the power if any of the sources is not active. Climate data analysis also received and can be used for several day to day applications irrespective of temperature.

DC-DC converters are used with the hybrid energy system to boost up the electricity level. DC-AC inverter circuits also used to emergency day to day applications. The normal conversion is measured in the converter part is to definite by duty cycle of the converter. The duty cycle values are nothing but ratio of ON time period of the switch to the total time period of the switch.

Designing a PV-Battery-Wind module with high power applications are the important process of my PhD project. In that video the design of renewable energy systems supports for continuity of supply to the rural areas around 10-12 hours of electricity generation. More electrical power can be developed by this model. Transformer circuit is also used to transform the voltage

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level from one primary part to the secondary consumer part. The rate of charging level of the Battery is maintained by State of charge level unit. The capacitor components are used as a storage device to charge the voltages. Resistive networks are second-hand to edge the surge of current in the solar charge controllers. Arduino module is also introduced in this work to establish the device and enables the system with interface component with hardware and software module to establish the output accurately.

**Experimental setup for Solar PV module.**


Fig.9 Solar PV Trainer Module with various DC loads.

**1. Power Supply With Respect To Time(Sec)**

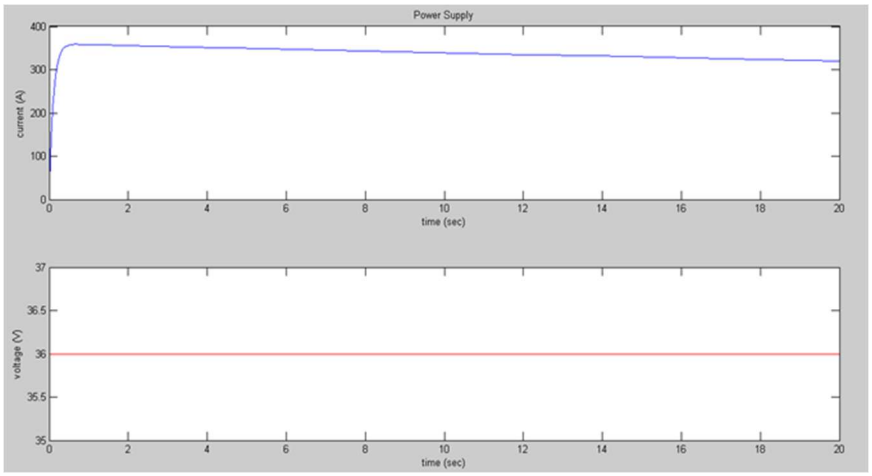


Fig. 10 Waveform for power supply for Hybrid Energy Storage System with respect to time.

The above waveform is plotted with parameters like Voltage(V), Current(A), with respect to time(sec) for Power Supply. In 1st waveform plotted with x-axis as 1cm= 2 sec., and y-axis as 1cm= 100A.In the second waveform, it is plotted with parameters Current(A), Time(sec),. The x-axis with the 1cm=2 sec., and y-axis 1cm=0.5V

**2. Motor / Drive Shaft**

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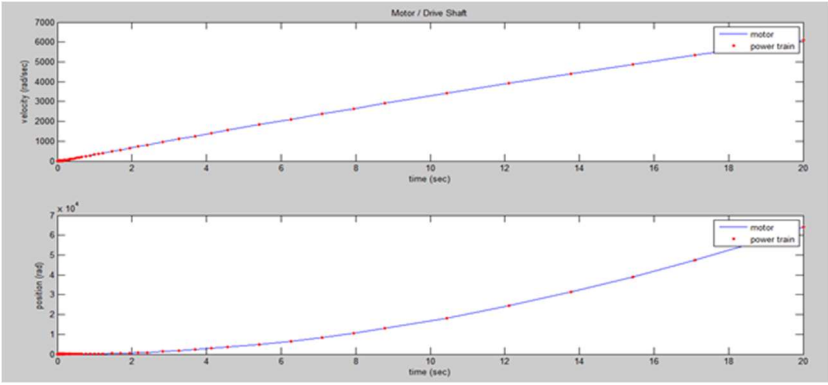


Fig. 11 Waveform of Motor / Drive shaft for Hybrid Energy Storage method with speed and position with respect to Time.

The above waveform is plotted with parameters like Velocity(rad/sec), Position, with respect to time(sec) for Motor/ Drive Shaft. In 1st waveform plotted with x-axis as 1cm= 2 sec., and y-axis as 1cm= 1000 rad/sec.In the second waveform, it is plotted with parameters Position, Time(sec),. The x-axis with the 1cm=2 sec., and y-axis 1cm=1*104.

### 3. Automobile

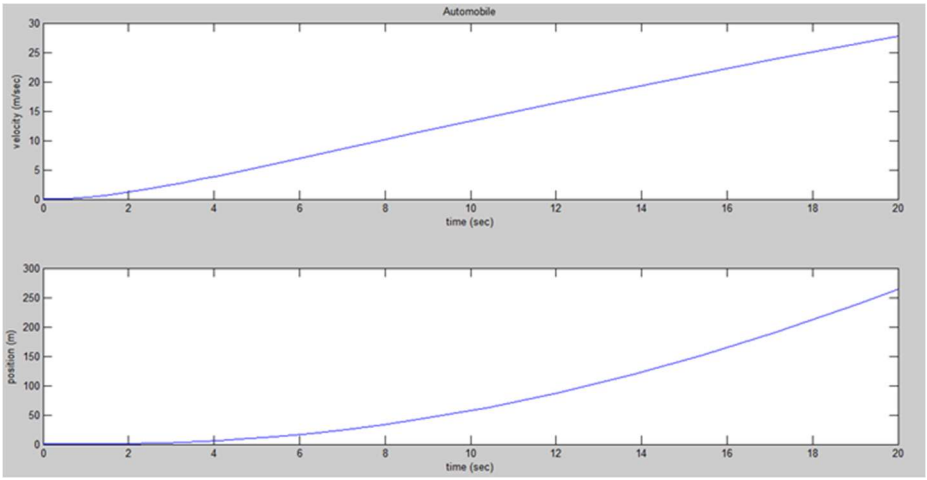


Fig. 12 Wave form for Automobile for Hybrid Energy Storage System with Velocity, position with respect to Time.

The above waveform is plotted with parameters like Velocity(m/sec), Position(m), with respect to time(sec) for Automobile. In 1st waveform plotted with x-axis as Time 1cm= 2 sec., and y-axis as Velocity 1cm= 10 m/sec.In the second waveform, it is plotted with parameters Position, Time(sec),. The x-axis with the Time 1cm=2 sec., and y-axis as Position 1cm=50.

### Hardware Implementation

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Fig. 13 Modelling of PV, Wind Battery system with Converter and Controller of Hybrid Energy Storage System.

The hybrid energy storage system, consist of an charge controller to control & charge the battery and to provide the supply demand for the home and to charge an battery and to charge an E-vehicle using the renewable resources.

The hybrid power storage structure of software is compiled with mat lab and arduino software, it automatically detects the faults and the harmonics during, working time and tends to reduce it and give smooth running of the system. The system is capable to use two renewable resources.

## CONCLUSION & FUTURE SCOPE

### CONCLUSION

The converter model was developed by using the MATLAB simulation software. In this paper, an adaptive non-linear direct plan for DFIG-based wind turbines has been industrial using a Lyapunov based study and response adjustment. They have power over scheme is built from these direct laws. This paper proposes a Energy storage control and power management algorithm for hybrid Photovoltaic coupled with battery system with a combined DC and AC buses and loads in both grid connected and islanded modes. It is able to control the power flows in the converters of total units effectively and efficient, and normally to realize the power balance between the hybrid micro grid systems and grid. AC and DC buses are under full control in both grid connected and islanded modes to produce better voltage values for electrical loads. This proposed scheme is achieved by MATLAB Simulink software, this system introduces additional loads to improve the operating performance of the system without additional converters

i. Calculate the required generator torque.
ii. Approximate the wind speed turbine power confine values.
iii. Work out the rotor speed at which the wind turbine is most likely to capture the maximum amount of wind power.
iv. Include the solar energy as an input to the system, and it will be calculated by the system.

### FUTURE SCOPE

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A MATLAB / Simulation environment was used to develop this system and it was computer-generated by means of the few MW speedy location turbine linked to a DFIG, back to back converters, and the programme line connecting the DFIG to the 5MW Solar array power. Power arrest coefficient evaluation with rotor speed parameter and the adding up of rotor speed based on rising of power confine coefficient comprise given away strong energetic behaviour.

**Conflict of Interest and Authorship Conformation Form**

There is no copywrite in this work.

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