

OPERATION AND CONTROL OF HYBRID TRAIN USING RENEWABLE ENERGY

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Abstract-The renewable energy plays vital role for today's world as in near future the non-renewable energy sources that will get exhausted. All the conventional energy resources are depleting now a days. So we have to shift from non-renewable to renewable energy sources. In this the combination of two renewable energy is takes place that is wind and solar energy. This process play the sustainable energy resources without damaging the nature. We can give continuous power by using hybrid energy system. Basically our system involves the integration of two energy system that gives uninterrupted power. Solar panels are used for converting solar energy and turbines are used for converting wind energy into electricity. This electrical power can utilize for various purpose. Generation of electricity will be takes place economically. Our paper deals with running train with the generation of electricity by using two sources combine which leads to generate electricity with minimum cost without damaging our environment.

IndexTerms- solar,wind, train.

I.INTRODUCTION

Energy is one of the main sources for human survival on earth. We are dependent on one form of energy or the other for fulfilling our needs. We use these sources for generating electricity, running vehicles etc. But the main drawbacks of these fossil fuels are that they are not eco-friendly and they are not renewable. To deal with these problems of fossil fuels, we need to look at these drawbacks of energy. With regards to this idea we have to design a train which runs on renewable that is solar and wind energy. Many specifications we have to know about hybrid train and so on each specification to move perfectly. Our paper depends on solar panel, wind turbine. The non-renewable energy resources are depleting now a days. Soon it will be completely vanished from the earth. So we have to find alternate way to generate power. Then that resource should be reliable, pollution

free and economical. The renewable energy resources is the good alternative energy resources for the conventional energy sources. There are many renewable energy resources like geothermal, tidal, wind, solar etc. the tidal energy has drawbacks like it can only implemented on sea shores. While geothermal energy needs more heat from earth. Solar and wind are easily available in all condition. The renewable energy resources like solar and wind are the good alternatives. Solar energy has drawback that it could not generate power in rainy season, in order to overcome this drawbacks we need to use two energy resources so that if any one of source fails the other will keep on generating electricity. And in good weather condition we can use both sources in parallel combination.

II. PROPOSED SYSTEM

Hybrid system is the combination of two renewable energy sources for giving electric supply to the vehicle. In other words it can be explained as “renewable energy system which is developed to extract power by using two renewable energy resources is called as the hybrid system.” Our hybrid system has more reliability, high efficiency and lower cost.

In our proposed system solar and wind energy is used to generate the power to operate vehicle. Solar and wind has good energy sources than any other renewable energy sources. Both the renewable energy sources are easily available in all areas. It can be easily installed in any places.

A. Solar Energy

Solar energy is the energy which is produced by the radiation from the sun. This energy is available on the earth continuously. Solar energy is free of cost. It doesn't produce any gases so it is a pollution free energy. It requires low maintenance. Only drawback in the solar system it can produce only in day time. But when it compared to other renewable energy it has higher efficiency than other energy sources. It needs only high initial cost. It has long life of producing energy for utilization.

B. Wind Energy

Wind energy is the energy which is operated from blow of wind. To produce energy we use wind mill. It is a other type of renewable energy sources. In the generation of electricity from the wind mill needs less cost. It requires low maintenance and low cost. Operation of the wind mill is a continuous and throughout a day. It does not produce any and radiation. Capital cost of each wind mill is less when compared to efficiency from the wind energy. Generation of electricity from wind mill is depends upon the rotation of the blades.

The main drawbacks of using wind renewable energy cannot generate continuous electricity. To overcome this drawbacks we can use both solar and wind energy together. If any one source fails to generate power other sources will maintain the generation of power. In our proposed system we can use both renewable

sources combine. This helps to give continuity of generation. It will make system more reliable. The major disadvantage is installation of wind farm needs high cost. A main advantage is by using this wind farm that can generate continuous power supply.

III. DESIGN OF PROPOSED SYSTEM

For designing of the hybrid system we need to determine the data as follows,

A. Solar System data:

1. Daily duration of Sun shine in hours.
2. Radiation horizontally from the daily solar (KWH/m²/day).

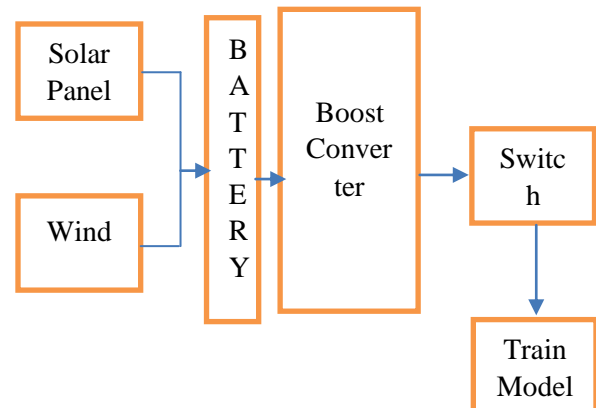
B. Wind System data:

1. Annual speed Wind mill (m/sec).
2. Wind turbine generate electricity.

Below figure shows the block diagram of proposed hybrid system of power generation using wind and solar power. This block diagram includes following blocks.

- i. Solar panel
- ii. Wind turbine
- iii. Battery
- iv. Boost Convert
- v. Train Model (DC Motor, Wheels, Chassis)

BLOCK DIAGRAM OF PROPOSED SYSTEM



i. Solar panel

Solar panels are used to convert solar radiation into electrical energy. The physical of photovoltaic cell is very similar to that of classical diode. The solar panels have the photovoltaic cell.

The sun produces the photons, that photons strike the electrons in the photovoltaic cell. The process of flow of electrons occurs in the solar panel it can produce current. The charge carriers in the panel region create a voltage gradient and it gets accelerated under the electric field. Series connection of solar panel gives required voltage for utilization. Solar panels are the device to convert solar energy into the electrical energy.

ii. Wind turbine

Wind mill is the system which generate electricity in the turbine with the help of blow of wind. Basically wind turbine is classified into major types are vertical and horizontal. Speed of the wind is directly proportional to the generation of electricity. As the speed of wind increases generation of power is also increases correspondingly. The generation of power from wind is fluctuating. That fluctuating power stored in battery and it also use to give load.

iii. Battery Bank

We have to choose the size of battery bank based on the required load. The fulfill energy of the battery then given to the load. the following data of battery bank is given below,

iv. Boost Converter

A **boost converter** is a type of DC-to-DC power conversion. This converter step up voltage from its input supply to its output load. It is a type of switched - mode power supply. The boost converters contains two semi conductors (diode, transistor) at least one and also contain energy storage elements (capacitor and inductor) to reduce the voltage ripple and acts like a filter. It is connected next to the input supply for step up the output voltage.

V .Train Model (DC Motor, Wheel)

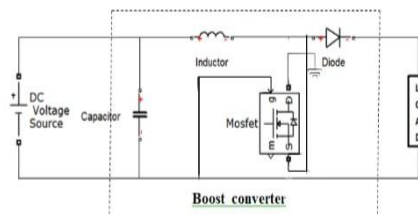
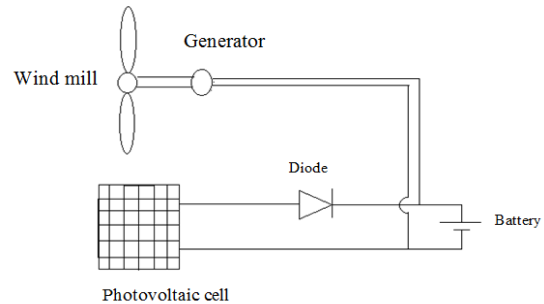
V. i. DC Motor

A DC motor is a type of electrical machine. It converts electrical power into mechanical power. The principle of dc motor working under "Conductor of current carrying placed in the field of magnet, it gives the mechanical force". Nearly all types of internal mechanism are same. In vehicle module DC motor is a load and it produce mechanical force for movement.

V.II. Vehicle module Wheel

The wheel of train is specially designed for running on the train track. This same process can be followed in our proposed system we just use the boost converter for boosting energy given to the DC motor.

CIRCUIT DIAGRAM OF PROPOSED SYSTEM



Fig(b)

IV. PROPOSED CALCULATION

The total power generated by this system is combination of wind energy and solar energy and the addition of the power generation calculation was given below,

Mathematically it can be determined as,
 $PG = NOW * PGW + NOS * PGS$

Where,

PG is the total power generated
PGW is the power generated by wind turbine
PGS is the power generated by solar panels
NOW is the number of wind turbine
NOS is the number of solar panels used

A. Calculations of wind energy

The power generation of wind mill can be represented as,

$$PGW = \frac{1}{2} \rho (A_w) (V)^3$$

Where,

P is power in watts (W)
p is the air density in kilograms per cubic meter (kg/m^3)
 A_w is the swept area by air in square meters (m^2)
V is the wind speed in meters per second (m/s).

B. Calculations for solar energy

The power generation of solar panel can be represented as,

$$PGS = I_{ns}(t) * A_s * \text{Eff}(pv)$$

Where,

$I_{ns}(t)$ = isolation at time t (kw/m^2)
 A_s = area of single PV panel (m^2)
 $\text{Eff}(pv)$ = overall efficiency of the PV panels and dc/dcconverters.

Overall efficiency is given by

$$\text{Eff}(pv) = H * PR$$

Where,

H = Annual average solar radiation on tilted panels.
PR = Performance ratio, coefficient for losses.

V. CONCLUSION

In our paper we are using renewable energy of both solar and wind energy. Both renewable energies are used to operate the train. By using of this method we can reduce the more power consumption of electric train. Using of renewable energy in the electric train has high efficiency than compared to the ordinary electric train we currently used in the tracks. It only requires high initial cost and it also pollution free. By implementing of our method we can reduce the passenger ticket charges and save electric power for future.

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