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Power Generation Through Duel Energy System

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Abstract: - Renewable energy has been on an increasing demand in the recent due to over stress on non-renewable resources and their increasing cost. Thus producing electricity with the use of renewable resources like Wind and Solar has been taken up in this project. A Windmill, which rotates when there is enough wind, generates electricity owing to magnetic coupling between the rotating and stationary coil. A horizontally rotating prototype of Windmill is being used in this project. Silicon based wafers which are cascaded together to form a Solar Panel is being used in this project to generate electricity. Dual Power Generation Solar + Windmill System harnesses both the Solar and Windmill i.e., Wind Turbine Generator to charge a 12V Battery.

Key Words: — Renewable, magnetic, Windmill, Solar, 12V Battery.

I. INTRODUCTION

A. Renewable Energy Sources

A wind generation system can be used basically in three distinct applications: isolated systems, hybrid systems, and grid connected systems. Basic characteristics of the systems include a power stage and energy storage capability. Generally, small size isolated systems demand energy storage by the use of batteries or in the form of gravitational potential energy in order to store the water pumped in reservoirs raised for posterior use.

The major types of renewable energy sources can be summarized as follows:

- Solar energy
- Wind energy
- Geothermal energy

Wind Power: Wind power is the conversion of wind energy into a useful form of energy, such as using wind turbines to make electrical power, windmills for mechanical power, wind pumps for water pumping or sails to propel ships.

Solar Energy: Solar energy, radiant light and heat from the sun, is harnessed using a range of ever-evolving technologies such as solar heating, solar photovoltaic, solar thermal electricity, solar architecture and artificial photosynthesis.

Geothermal Energy: Geothermal energy is fast emerging as a significant source of electricity in several island nations, mainly in the Indian oceans and the pacific regions. Indonesia is setting up two geothermal power plants each of 55 MW capacity on the island of Java. A further 2220 MW would be added by the year 1997 Geothermal energy accounts of 8% of New Zealand's installed power capacity.

B. Bio Energy

Biomass is second to hydropower as a leader in renewable energy production. Biomass has an existing capacity of over 7,000 MW. Biomass as a fuel consists of organic matter such as industrial waste, agricultural waste, wood, and bark. Biomass can be burned directly in specially designed power plants, or used to replace up to15% of coal as a fuel in ordinary power plants. Biomass burns cleaner than coal because it has less sulfur, which means less sulfur dioxide will be emitted into the atmosphere. Biomass can also be used indirectly, since it produces methane gas as it decays or through a modern process called gasification. Methane can produce power by burning in a boiler to create steam to drive steam turbines or through internal combustion in gas turbines and reciprocating engines.

II. LITERATURE REVIEW

Hybrid models have been an effective means of producing generating electricity throughout the world. Lots of research work has-been done and continuing the accommodate new advances in this system. This project reports the probabilistic performance assessment of a wind, Solar Photo Voltaic (SPV) Hybrid Energy System. In addition to this solar/wind system with backup storage batteries were designed, integrated and optimized to predict the behavior of generating system. This project proposes a hybrid energy system combining solar photovoltaic and wind turbine as a small scale alternative source of electrical energy where conventional generation is not practical. A simple and cost effective maximum power point tracking technique is proposed for the photovoltaic and wind turbines. This technique uses linear programming principles to reduce the cost of electricity while meeting the load requirement. A controller that monitors the operation of autonomous/grid linked system is designed.

III. SOLAR ENERGY SYSTEM

A. Photo Voltaic (PV) Panels

Solar Electric panels are also called Photovoltaic (or PV) panels. A PV Panel is a device that converts solar radiation (sunlight) into direct current electricity. This electricity can be used to power electric appliances or charge batteries.

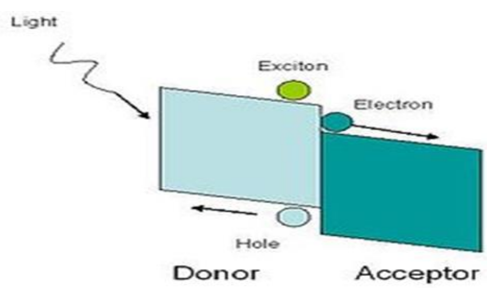

Fig.1. Solar Panels

B. Solar Cell Power Generating System

Where Sunlight is, there is potential for solar power generation. A solar cell, sometimes called a Photovoltaic Cell (PV), is a device that converts light energy into electrical energy. A single solar cell creates a very small amount of energy (about .6 volts DC) so they usually grouped together in an integrated electrical panel called a solar panel. Sunlight is a somewhat diffuse form of energy and only a portion of the light captured by a solar cell is converted into electricity.

C. Types of Solar Cells

Monocrystalline Silicon:

This type of solar cell uses a single layer of silicon for the semi-conductor. In order to produce this type of silicon it must be extremely pure which means it is the most expensive type of solar cell to produce.

Polycrystalline Silicon:

To make polycrystalline silicon cells liquid silicon is poured into blocks that are subsequently sawed into plates. This type of approach produces some degree of degradation of the silicon crystals which makes them less efficient. However, this type of approach is easier and cheaper to manufacture.

Knowing Your Energy Needs:

A photovoltaic cell is a cell which generates electricity directly from light energy. Photovoltaic cells come in many sizes, but most are 10 cm by 10 cm and generate a little more than half a volt of electricity. PV cells are bundled together in interconnected solar panels to produce higher voltages and increased power.

D. Types of Connection

Solar Photovoltaic systems for the homes and businesses can generally be classified into two categories those that are designed to make use of an existing electric grid (grid-tied system) or those that are designed for rural use where no electric grid is available (off-the-grid system). In a grid-tied system there is no need for a battery system to store the energy that the solar panels generate. Instead the power grid itself acts in a sense as a giant battery that uses any excess electricity that your solar panels may generate, and which you can draw from on cloudy days when there is insufficient sunlight to fully power your home.

E. Considerations Before Sitting and Installing Solar Panel Cells

Proximity to The Power Grid:

If your home or home site is more than half a mile from the nearest power line you may want to consider going with an off-the-grid solar system using some combination of passive and active PV systems with batteries. Electric utilities can charge $50,000 or more to run a line to your home and battery systems with generators typically run far less than that.

Sand and Dust:

PV panels work best when they are kept clear of debris or dust. Even a small amount of obstruction can significantly impair their performance. This is why regular maintenance is always recommended to keep the panels clean.

Financial Incentives:

Many farmers and small business owners in the rural communities will gladly stay in the rural areas doing business and many more will move there if local, state, and federal government becomes very aggressive in providing financial assistance to individual and small business in the rural areas that invest in solar power generation.

Cost of Electricity:

PV systems make particular sense in locations which have high electric rates. In the US states such as California have very high electric rates (20 to 30 cents per kilowatt hour).

F. Block Diagram Explanation

The two renewable sources, which are going to be hybridized, are the solar and the Pico hydropower. Solar energy is obtained from the solar panel and the Pico hydropower is obtained from the Pico hydro power plant. The power from the solar panel, which is in dc form, is stored directly in the battery.

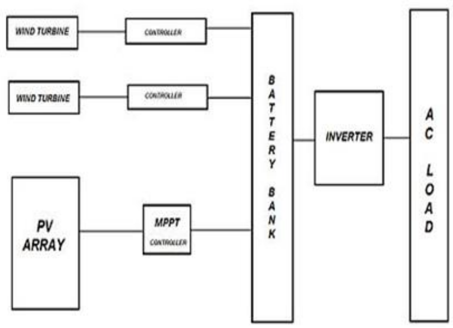

Fig.2. Circuit diagram for solar power

The power from the Pico hydro turbine, which is in ac form is converted by using suitable rectifiers and is stored in the battery. The suitable inverters invert the hybridized power stored in the battery. This output is given to the load through the switches. The fuzzy logic program is processed in the control unit. The input to this is given in the form of slope diagrams and fuzzy sets. The slope diagram is drawn by considering radiation in terms of flux and the flow rate in terms of lit/sec. The fuzzy program is executed in this unit by getting the input values of the radiation and the flow rate.

After execution, the fuzzy unit gives the crisp value. This controls the on or off positions of the load through the corresponding switches.

G. Description of Equipment's

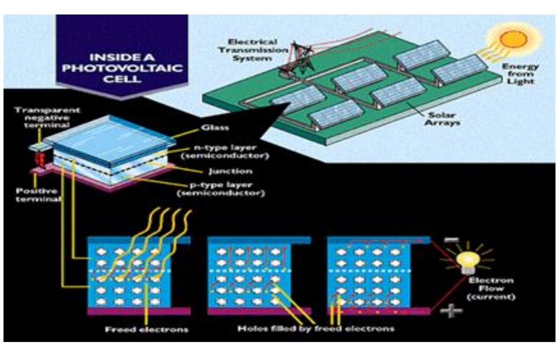

Fig.3. Overview of solar system equipment's

Mechanical design of solar cell Photovoltaic, or PV for short, is a technology that converts light directly into electricity. Photovoltaic is also the field of study relating to this technology and there are many research institutes devoted to work on photovoltaic. Due to the growing need for solar energy, the manufacture of solar cells and solar photovoltaic array has expanded dramatically in recent years. Photovoltaic production has been doubling every two years, increasing by an average of 48 percent each year since 2002, making it the world's fastest-growing energy technology. At the end of 2007, according to preliminary data, cumulative global production was 12,400 megawatts. Roughly 90% of this generating capacity consists of grid-tied electrical systems. Such installations may be ground-mounted (and sometimes integrated with farming and grazing) or building integrated. Financial incentives, such as preferential feed-in tariffs for solar-generated electricity and net metering, have supported solar PV installations in many countries including Germany, Japan, and the United States.

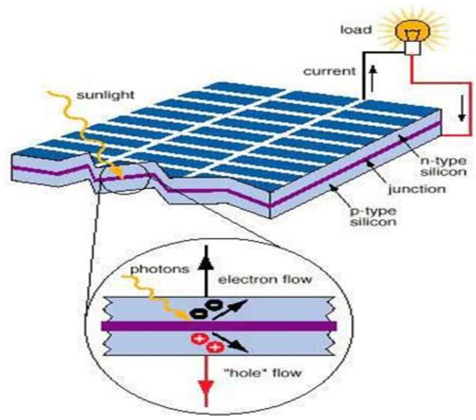

Fig.4. solar panel receives sun energy

H. Applications

Power Stations:

Many of these plants are integrated with agriculture and some use innovative tracking systems that follow the sun's daily path across the sky to generate more electricity than conventional fixed-mounted systems. There are no fuel costs or emissions during operation of the power stations.

In Buildings:

Photovoltaic arrays are often associated with buildings: either integrated into them, mounted on them or mounted nearby on the ground.

I. Solar Panel Out Put

The four solar panels used in our project and we are set it in project tower, then we are given connection to control unit and it is produce some specific output.

The solar panels are generating

12V 25W - 4no's

Series 120V DC 88W

Parallel 12V DC 172W

IV. WIND TURBINE

A. Wind Turbine

A wind turbine is a machine for converting the kinetic energy in wind into mechanical energy. If the mechanical energy is then converted to electricity, the machine is called a wind generator.

Fig.5. Wind turbine

B. Windmill

If the mechanical energy is used directly by machinery, such as a pump or grinding stones, the machine is usually called a windmill.

C. Vertical Axis Wind Turbines

Although vertical axis wind turbines have existed for centuries, they are not as common as their horizontal counterparts. The main reason for this is that they do not take advantage of the higher wind speeds at higher elevations above the ground as well as horizontal axis turbines.

Types of Vertical Axis Wind Turbines:

Savonius Wind Turbine:

The Savonius turbine is S-shaped if viewed from above. This drag-type VAWT turns relatively slowly, but yields a high torque. It is useful for grinding grain, pumping water, and many other tasks, but its slow rotational speeds make it unsuitable for generating electricity on a large-scale.

Flapping Panel Wind Turbine:

This illustration shows the wind coming from one direction, but the wind can actually come from any direction and the wind turbine will work the same way.

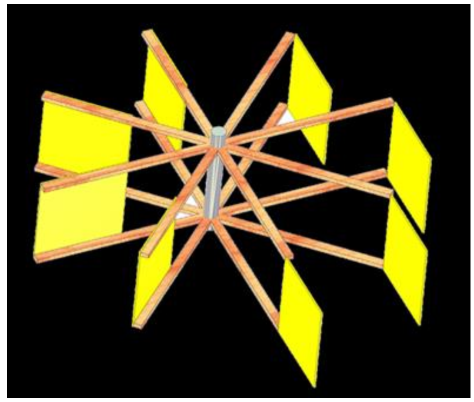

Fig.6. Flapping Panel Wind Turbine

The Different Types of Generators Used in Wind Turbine:

- Asynchronous generator (constant / variable speed / preferably high speed generators)
- Synchronous generator (variable speed / slow speed)
- Doubly fed induction generator

Turbine's Swept Area:

Area perpendicular to the wind direction that a rotor will describe during one complete rotation or the area of imaginary circle formed during the rotation of wind turbine is called swept area.

D. Parts of Wind Turbine:

The main parts of the wind turbines are various types:

- Rotor
- Wind vane
- Blades
- Yaw drive
- Nacelle
- Yaw motor
- Low speed shaft
- Gear box
- High speed shaft
- Brake
- Generator
- Controller
- Anemometer
- Pitch
- Tower

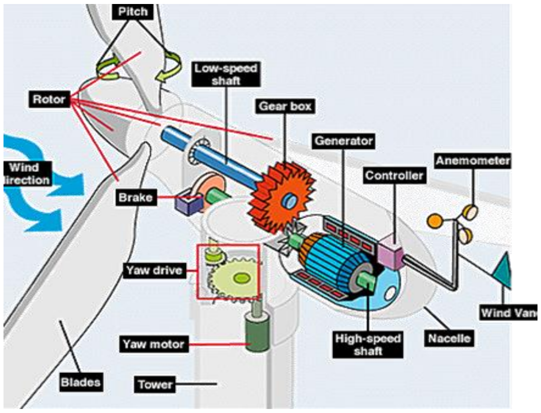

Fig.7. Over view of wind turbine

V. Hybrid Systems

A. Introduction:

The escalation in electrical energy costs associated with fossil and nuclear fuels, and enhanced public awareness of potential environmental impacts of conventional energy systems has created an increased interest in the development and utilization of alternate sources. Photo voltaic and wind energy are being increasable recognized as cost effective generation sources in small isolated power systems. A realistic cost benefit analysis requires valuation models that recognize the highly erratic nature of these energy sources while maintaining the chronology and inter dependence of the random variables inherent in them.

B. Block Diagram of a PV/Wind Hybrid System

A hybrid energy system usually consists of two or more renewable energy sources used together to provide increased system efficiency as well as greater balance in energy supply.

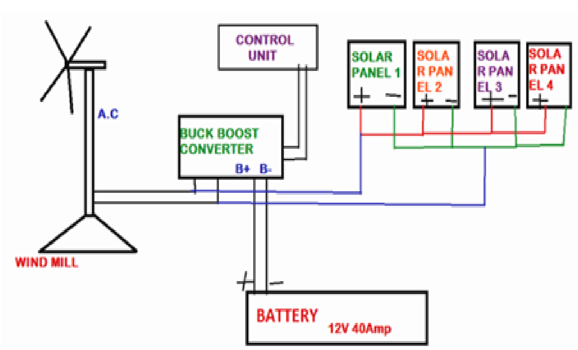

Fig.8. Block diagram of a PV/wind hybrid energy system

C. Overview: Wind/Solar Hybrid Systems

Erratic energy sources like wind and solar are not dispatch able, that is, available on command of utility dispatchers. Sometimes or often, the wind blows when it is cloudy, or the sun shines when the wind is calm. A system that combines various energy sources is called a “hybrid” system. Diesel generators are often used for “reliable” power, and wind or solar are used to decrease the fuel costs. Studies of a site can indicate the optimal combination of wind, solar, and diesel (or gasoline) to provide power at the lowest overall annual cost

VI. Fabrication Of Tower

A. The Different Types of Towers Used in Wind Turbine

Tubular Steel Tower:

Area of contact is more – hence more loading but evenly distribution–Attractive – cost is more.

Tubular Concrete:

Area of contact is more – high elasticity – loading high but even distribution – cost slightly less.

Lattice Tower:

Area of contact is less – less loading – load distribution is uneven –transportation / fabrication easy.

Four Legged Tower:

Area of contact is less – less loading – load distribution is uneven – transportation / fabrication easy.

Guy Wired Tower:

Area of contact is less – less loading – load distribution even – transportation / fabrication easy and not suitable for huge wind turbines.

Hybrid Tower:

A combination of tubular and lattice- Less obstruction- Strong.

VII. Site Selection Criteria

A. Introduction:

The objective of this paper is to apply geographic information system (GIS) integrated with multi criteria decision making (MCDM) for effective site selection for large wind turbine in Thailand.

B. Site Selection of Wind Turbine

Site Selection Process:

Site selection for large wind turbine requires consideration of a comprehensive set of factors and balancing of multiple objectives in determining the suitability of a particular area for a defined land use. The selection of suitable project areas involves a complex array of critical factors drawing from physical, demographical, economic, policies, and environmental disciplines. The current spatial decision making could benefit from more systematic methods for handling multi-criteria problems while considering the physical suitability conditions. Selection criteria must also satisfy the optimistic criteria.

Site Selection Tools:

Geographic information systems (GIS) and Multi criteria decision making (MCDM) techniques have been used in solving site selection problems. A brief description of the strength and weakness of each tool with regard to sitting problems is provided below.

Geographic Information Systems (GIS):

Geographic information systems (GIS) have emerged as useful computer-based tools for spatial description and manipulation. Although often described as a decision support system, there have been some supporting modules for site selection based on various area conditions, and conflicting objectives.

VIII. COMPONENTS AND SPECIFICATIONS

The project components specifications are given below;

- Wind mill output voltage: - 16.4V @LOAD from turbine @ 2m -2.5m/s.
- Buck boost converter: - 14.5V DC 40Amp Battery.
- Solar Panel: - 12V 22W - 4no's
  Series 120V DC 88W
  Parallel 12V DC 172W.
- Battery: -12V 40Amp Battery.
- Inverter: -12V DC -230V AC Up to max 300W.
- Submersible Pump: -¼ HP Pump and pumping 6ft230V AC 60Hz 50W.

A. Buck Boost Convertor

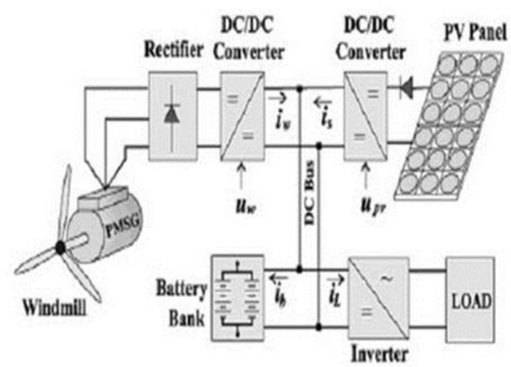

Fig.9. Buck boost converter

Two different topologies are called **buck–boost converter**. Both of them can produce an output voltage much larger (in absolute magnitude) than the input voltage. Both of them can produce a wide range of output voltage from that maximum output voltage to almost zero.

- The inverting topology – The output voltage is of the opposite polarity as the input
- A buck (step-down) converter followed by a boost (step-up) converter – The output voltage is of the same polarity as the input, and can be lower or higher than the input. Such a non-inverting buck-boost converter may use a single inductor that is used as both the buck inductor and the boost inductor.

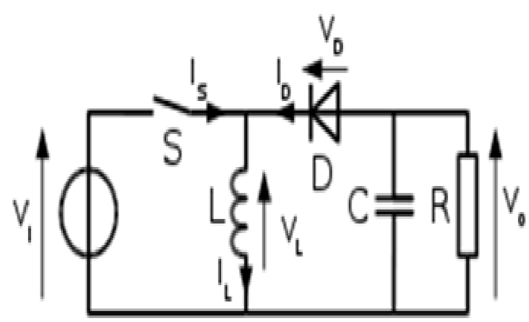

Fig.10. Schematic of a buck–boost converter.

IX. WATER PUMP TECHNOLOGY

A. Water-Lifting Devices:

Water-lifting devices are used to lift water to a height that allows users easy access to water. Lifting devices can be used to raise groundwater, rainwater stored in an underground reservoir, and river water.

- Deep-well diaphragm pump
- Centrifugal pump
- Electrical submersible pump
- Axial flow pump
- Hydraulic ram pump.

There are other water-lifting devices that are not described in this manual, such as the progressing cavities pump, the manual diaphragm suction pump, the treadle pump and the chain pump. Other devices, such as the air-lift pump, are not included because they are not applicable to drinking-water supply systems.

X. SOLAR LIGHTING SYSTEM

A. Introduction

A Solar lantern is a simple application of solar photovoltaic technology, which has found good acceptance in rural regions where the power supply is irregular and scarce

Fig.11. Solar lighting system

Solar Street Light system is designed for outdoor application in un-electrified remote rural areas. This system is an ideal application for campus and village street lighting. The system is provided with battery storage backup sufficient to operate the light for 10-11 hours daily. The system is provided with automatic ON/OFF time switch for dusk to down operation and overcharge / deep discharge prevention cut-off with LED indicators.

XI. ELECTRIC BASIC TERMINOLOGIES

Watt (W):

A unit of measure of power (1W = 1J/second), which is the amount of work performed per unit of time.

Kilowatt hour (Kwh):

A unit of measure of energy (1kWh = 3.6×10^6 J).

Ohm's Law:

Ohm's law states that the current through a conductor between two points is directly proportional to the potential difference across the two points. Introducing the constant of proportionality, the resistance, one arrives at the usual mathematical equation that describes this relationship:

$$I = \frac{V}{R}$$

Where I is the current through the conductor in units of amperes, V is the potential difference measured *across* the conductor in units of volts, and R is the resistance of the conductor in units of ohms. More specifically, Ohm's law states that the R in this relation is constant, independent of the current.

XII. COST ESTIMATION

The cost of this project will be estimated as following

S.NO	DESCRIPTION	QTY	AMOUNT
1.	TOWER FABRICATION	1	6000
2.	P.V.SOLAR PANEL	8	25000
3.	WIND TURBINE	1	6520
4.	BATTERY	1	2400
6.	INVERTER	1	2750
7.	¼ WATER PUMP	1	3700
8.	ELECTRONIC DISPLAY	3	850
9.	LED BULBS	2	200
		TOTAL	47500

Labor Cost:

Lathe, drilling, welding, draining, power hacksaw, gas cutting cost

Overhead Charges:

The overhead charges are arrived by "manufacturing cost"

Manufacturing Cost = Material Cost +Labor Cost
= 30100 + 4500
= 34600

Overhead Charges = 20%of the manufacturing cost =7920

Total Cost:

Total cost = Material Cost +Labor Cost +Overhead Charges
= 35300 + 4500 + 7700
= 47500

XIII. CONCLUSION & FUTURE ENHANCEMENT

A. Conclusion:

The project carried out by us made an impressing task in the field of power generation for lighting the bulb and running the water pumps. It is very useful for the farmers. This project will reduce the cost involved in the concern. Project has been designed to perform the entire requirement task at the shortest time available. Increasing of energy demand in energy market, we have to adopt and implement some specific resources. The promotion of energy production from renewable sources represents an imperative objective in present times justified by environment protection, the increase of energetic independence by supplying sources diversity and economic and social cohesion reasons.

B. Future enhancement:

- Non-Renewable energy sources, the future of solar energy looks bright.
- In future days, solar and wind energy will be the most effective utilization of renewable energy sources.
- In the near future, wind energy will be the most cost effective source of electrical power.

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