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Energy Management and Control System for Smart Renewable Energy Remote Power Generation

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Abstract

This paper presents the application energy management system and control system for smart renewable energy power generation. The development of communication platform is use LAB-View technology as a basis design for overall system. The proposed prototype is construct PV 1.8 kWp, Battery 18 kWh, 5 kW Generator. The main central control system will acquire data from the remote renewable energy system. All necessary monitor data are including power generation, load consumption, protection system, and other control parameters will be store at a control unit. All monitoring data are monitored as real-time data therefore the operator can also evaluate the system situation in the current states and make decisions to take an immediate action if needed. The system can be improved by learning from monitored data recorded. Moreover the system itself can forecast and make a decision for future power analysis.

Keywords

Energy Management System; Smart Renewable Energy power Generation

References

[1] Boonyang Plangklang, 2007, documentation of teaching Advance Topic in Electrical Engineering.

[2] Krisada Prom Observation, Boonyang Plangklang. 2008 "Design and analysis of integrated power system for home solar power," Conference on Electrical Engineering No. 31, Nakhon Nayok, 29-31 October 2008.

[3] J. Schmid, Photovoltaic systems Technology, teaching script, IEE-RE, University of Kassel, Germany, 2002.

[4] Shane Duryea, Syed Islam, and William Lawrance, "A Batteries Management System for stand-alone Photovoltaic Energy System," IEEE Industry Applications Magazine, pp.67-72, May/June, 2001.

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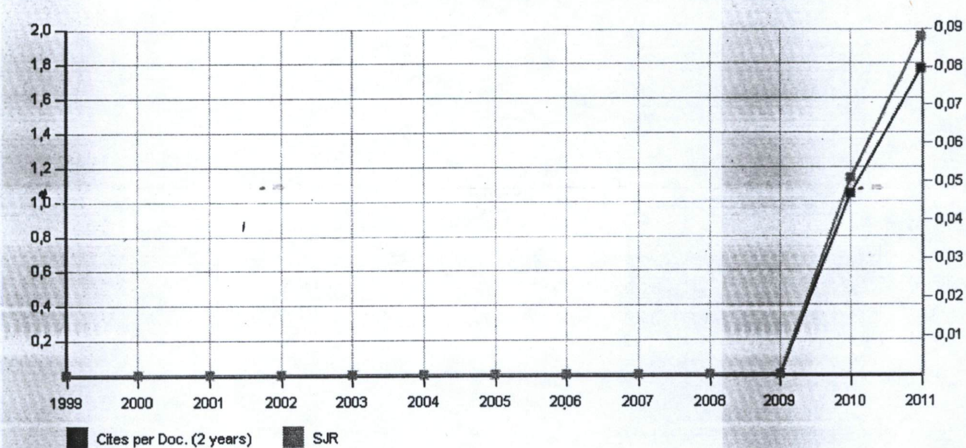

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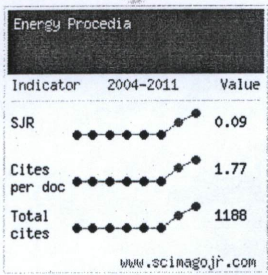

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Energy Management and Control System for Smart Renewable Energy Power Generation

S. Kohsri and B. Planglang

Abstract— This paper presents the application energy management system and control system for smart renewable energy power. The development of communication platform is used LAB-View technology as a basis design for overall system. The main central control system will acquire data from the remote renewable energy system. All necessary monitoring data including power generation, Load consumption, protection system, and other control parameters will be stored at a contril unit. All monitoring data will be monitored as real-time data therefore the operator can also evaluate the system situation in the current states and will make decisions to take an immediate action if needed. The system can be improved by learning from monitored information that affects the system. Moreover the system itself can forecast and make a decision for future power analysis. The proposed prototype is constructed in Thailand as PV 1.8 kWp, Battery 18 kWh, 5 kW Generator.

Keywords: Energy Management System,Smart Renewable Energy power Generation

1. INTRODUCTION

Energy is considered an important mechanism in developing countries to develop advanced But in the current environment, energy consumption is insufficient to state the high cost, which directly resulted in the development of Thailand. Renewable energy sources have been invented. Because renewable energy is not always Such as solar energy, it is only during the day. Therefore, the total renewable energy sources to hybrid to provide a stable power supply is necessary. From this issue of the research has recognized the importance of research and development of a prototype hybrid system solar electricity and wind up. (PV-Battery-Diesel hybrid system). Hybrid electric or hybrid system . This includes solar energy Including diesel generator together. A hybrid power generation system in parallel (Fig. 1) It is the most popular. This behavior is a diesel generator to supply power to the load directly. Solar panels and batteries with serial Inverter duplex. (Bi-directional inverter). Which is connected to the electrical load. During the low demand for electricity. Electricity generated from solar power is the power load to the rest of the diesel generator to charge batteries Inverter.

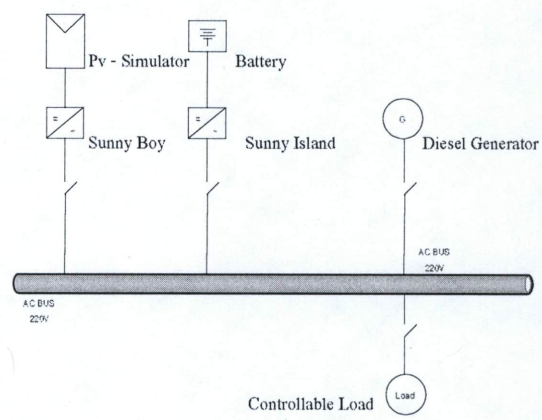

Figure 1 integrated solar power systems [1]

Details of the system, which consists of. Production of electricity from solar energy and diesel generators. A system that can supply electricity to the load at any time. Designed system will focus on the use of solar energy as a primary source of energy and with a variety of sources. The diesel generators. The system will also be recorded impressions act of observing systems real-time. Which is like the care that Power generation systems that are still active in normal or not normally should be monitoring the work of electricity every day and reports produced. The information in the form of daily monthly and yearly, etc. All information is stored in a computer system.

2. Principles of System Design and Simulation of Hybrid Power Systems.

Design principles of a system designed to cover the entire system, including systems to measure and record results. Information in the preliminary design is the size of the load and power consumption of the load at different time of day (Load Profile). In this paper offers loads for housing in rural areas using electrical appliances needed (see Figure 2).

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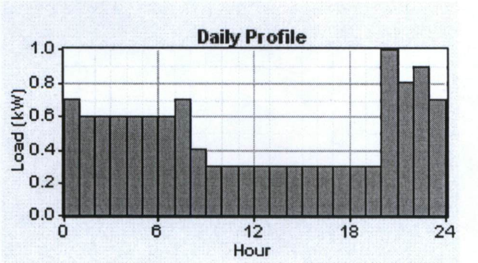

Figure 2 Map of electricity each day

From Figure 2 is a data storage of electrical energy, but each day Which is used as basic data for analysis. Will be seen that the system is equipped to produce electricity in many parts wit each device. It is limited in functionality, such as solar cells is limited. That if the light incident on the panel would not be too low to produce electricity to the system. The generator too. In the production of electricity if the load increases. It may not be able to respond to immediate demand for electricity. Another important device is the inverter is rated to work with. Therefore, there needs to be studied, testing and recording behavior Operation of the system as a whole. Results were then used to calculate the load for the size of the solar P_{peak} starting power quality system (Q) the equation (1). The equation from the estimated theoretical (E_{th}) and carried out by (E_{el}) the energy from sunlight as equations (2), (3) that the equation for calculating the size solar cell the equation. That (6) [2].

$$Q = \frac{E_{el}}{E_{th}} \quad (1)$$

$$E_{th} = \eta \cdot E_{glob} \cdot Aarray \quad (2)$$

$$P_{peak} = \eta \cdot I_{STC} \cdot Aarray \quad (3)$$

$$E_{th} = P_{peak} \times \frac{E_{glob}}{I_{STC}} \quad (4)$$

$$Q = \frac{E_{el}}{E_{glob} \times P_{peak}} \times I_{STC} \quad (5)$$

$$P_{peak} = \frac{E_{el} \times I_{STC}}{E_{glob} \times Q} \quad (6)$$

When

P_{peak} = size of the solar cells at standard STC (kWp)

E_{el} = energy required to load or equivalent per year (kWh / a) if the equivalent per day. Sun must be a day (kWh / d)

I_{STC} = standard solar radiation STC (1 kW/m2)

E_{glob} = energy from the sun per year (kWh/m2a) if a day is thought to be loaded per day (kWh/m2d)

Q = power quality system

E_{th} = the power of the theory (kWh / a)

η = efficiency of solar panels (decimal)

Array = area of the PV (m2).

From equation (6) the power quality can be represented in the system of equations to determine the size of solar power P_{peak} which the quality of the system in accordance with Table 1.

Table 1 shows the power quality system with integrated power generation system [3]

Component/System	Q
PV module (Crystalline)	0.85...0.95
PV array	0.80...0.90
PV system (Grid-connected)	0.60...0.75
PV system (Stand-alone)	0.10...0.40
Hybrid system (PV/Diesel)	0.40...0.60

With that in mind the value of solar P_{peak} calculated above. The next is the value P_{peak} used to calculate the battery capacity. Derived from the relationship between battery capacity and maximum power of PV (Figure 4) the magnitude of this battery will follow the rules of Schmid's Formula, which can be calculated from equation (7).

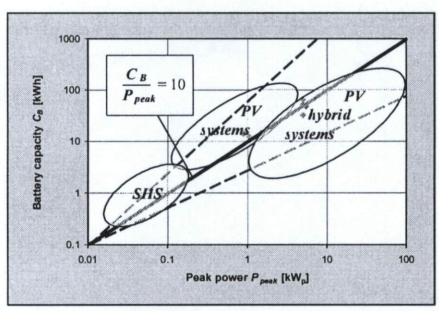

Figure 3 The relationship between the capacity of the battery and maximum power of PV [3]

$$CB = 10 \times P_{peak} \quad (7)$$

When

CB = Capacity of the battery [kWh]

P_{peak} = Maximum power of the region PV [kWp]

This calculation will still be able to adapt and be flexible by demonstrating that it can be flexible up to + / - 20%, depending on system design as a system which After calculating the values now. Is the value derived from the analysis by Simulation. Homer by the computer program to test a download of the energy from the sun through a database of program analysis points to Homer to locate the program Google Map. Choose the location of the university district Rajamangala. The model is based on the location on earth Simulation scenarios (see Figure 5)

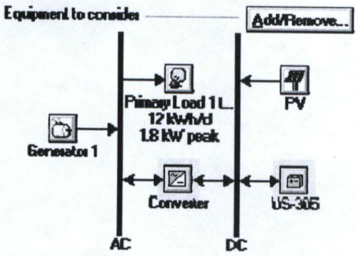

Figure 4 Using the simulation program of Homer

From Figure 4, the design and evaluation of the program system optimum PV 1.8 kWP, Diesel Generator Size 2 kW, Battery capacity = 18.3 kWh from the Simulation system design that the system can load the continuity. And there is no blackout period. The image can be seen that the actual load (see Figure 5).

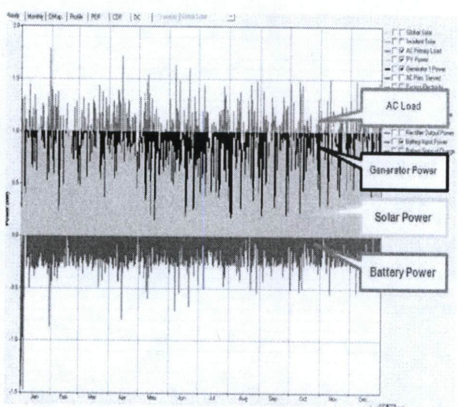

Figure 5 Simulation results of system design

From Figure 5 Simulation of the system software that Homer can be seen during the day, solar cells (yellow) to produce the power to pay to download it. Energy and the rest are stored at the battery (blue) during the night, solar can not power enough to download it. Electrical energy is stored in the battery will be drawn with the use of energy from diesel generator (black) Allows the system to power the load continuously. Stability in the workplace is no better time or a lack of power blackout.

3. design and implement a set of energy management.

Idea of this research project. To create a modern energy management systems in integrated solar electric system efficiency to bring energy to the extreme as shown in Figure 6.

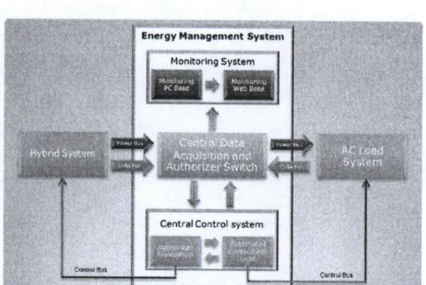

Figure 6 Diagram of the Energy Management System

From Figure 6, the system will save the energy consumption measured in real-time with a management system, while power users are likely to increase the burden of higher than normal power supply. Management suite will cut some of the load required to stay within the set, the priority of the device in advance. And tailor-made equipment in order of importance. You can also command and control many details. The remaining energy from the system enough to keep the battery as shown in Figure 7

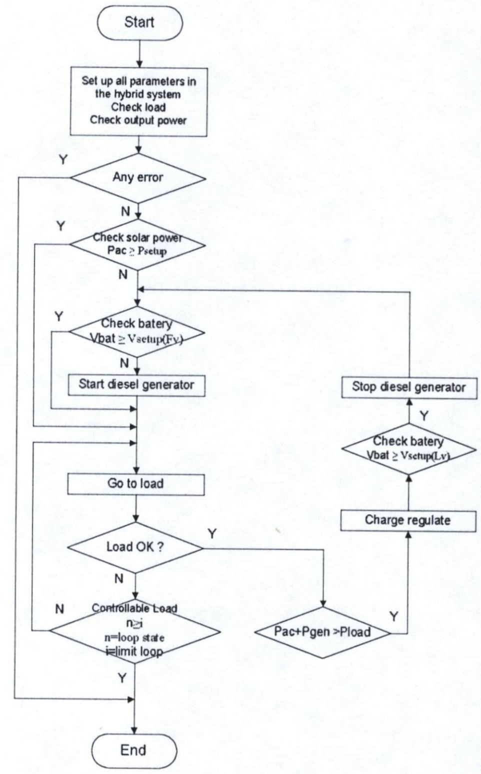

Figure 7 Flow chart of operation of the system

From the design and evaluation of programs. The appropriate size of the system. Next step is designing the airport infrastructure "energy management system" .The integrated power system in accordance with the conditions presented. Includes the design, installation system that separates into two main sections. By a separate set of information and a series of running with a series of central processing (see Figure 8)

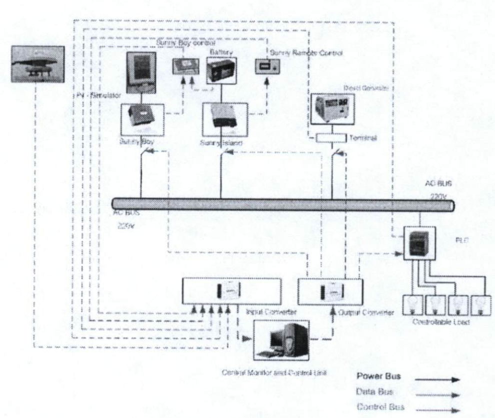

Figure 8 a diagram of the hybrid power management system

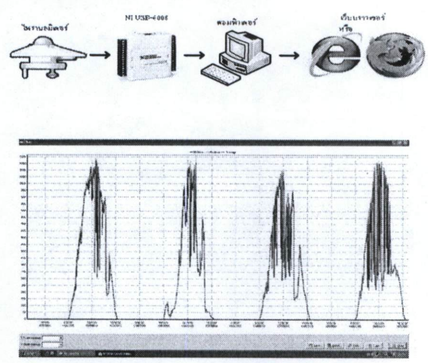

Figure 9 graphs the data from the solar sun sensors During 4 days of sample storage.

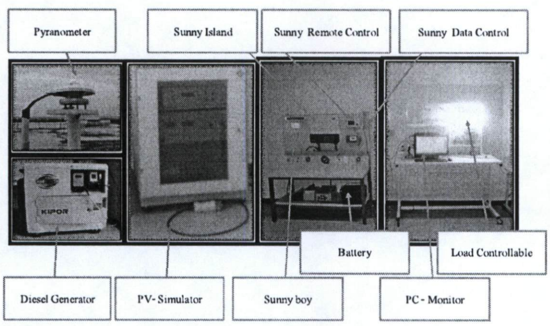

Figure 10 Actual system installation

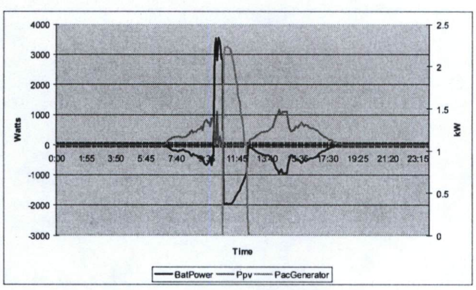

Figure 11 Actual system installation

Figure 11 shows the power of the battery. Solar cell And generator ,this was seen clearly during the night is not the work that has the solar cells. There is no charge to the battery curve is zero and will start producing solar electricity at the time approximately 7:05 pm was the time during the day from the graph that there is energy produced from solar energy production has been charging the battery Because of the load test to study the function of the generator during the day at approximately 10:30 am until approximately 12:30 pm ,see that power is used to load the battery power and solar energy. Until the battery power levels were lowered to the level of the battery State of Charge at 40% on by setting the control system instructs the generator to the electric power system and battery power with these grandnephew of dispatch. Until the battery is fully charged higher value set in the generator system to stop working. But while the generator load and remaining ions with energy control system, power supply will be cut from other parts. Issue is not bringing the energy supply from solar cells to power with a generator

4. Conclusion

The principles of design power management in electricity distribution and control systems for renewable energy the calculation and use Homer Simulation study to test the functionality and performance evaluation of the system before actual installation. Found that the system designed to work according to set up the load continues to design the system sizing have 1) PV Size 1.8 kWP, 2) Generator Size 2 kW, 3) Battery capacity size of 18.3 kWh recording system, also known as real-time can be accessed by computer via local host to access information remotely the structure of the system will be located in a room set in the virtual test support equipment. It working in all together and ready to create the form above

REFERENCES

[1] Boonyang Planglang, 2550, documentation of teaching Advance Topic in Electrical Engineering.

[2] Krisada Prom Observation, Boonyang Planglang. 2551 "Design and analysis of integrated power system for home solar power," Conference on Electrical Engineering No. 31, Nakhon Nayok, 29-31 October 2551.

[3] J. Schmid, 2002, “Photovoltaic systems Technology

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ENERGY MANAGEMENT AND CONTROL SYSTEM FOR SMART RENEWABLE ENERGY POWER GENERATION

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