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INTERCONNECTED DC MICROGRID FOR EFFICIENT USE OF RENEWABLE ENERGY SOURCES

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Abstract

The use of a dc micro-grid with the interconnection of the main ac power supply, which is provided from renewable energy sources such as the sun, wind, and other sources, was investigated in this article. Micro-grids will play a significant role in the future development of the energy sector, but the generation phase may differ. In this article, we show that when we use green energy sources for dc applications such as smartphone chargers, laptop chargers, and LEDs, the performance of the dc micro-grid device improves by up to 40%. This is due to the reduction of ac to dc and back to ac, which results in excessive power conversion losses in the current system. The PIC16F73 microcontroller is used to power the micro-grid device and solar tracker, increasing the model's performance. When this sort of device is attached to a specific load, it uses more power during off-grid renewable generation, resulting in more pulse width modulation (PWM) waveform generation, demonstrating the system's failure compared to renewable energy sources.

Keywords: Microcontroller, NPN Transistor, Solar cell, Voltage Regulator

1 Introduction

A microgrid is made up of integrated distributed outlets such as ac/dc loads, home appliances, and household applications. It's used when there are a lot of different types of loads in a dc setting. In India, the majority of power plants generate ac power that is only appropriate for ac loads. There must be a switch from ac to dc electricity as this power is used for dc equipment such as cell chargers, portable chargers, fluorescent lights, and so on. As a result, there are

"unnecessary power management stages in the handling of power generation to the customer" (Acharjee, 2013; Prasad, Kamath, Jagadisha, & Girish, 2012).

The integrated DC micro grid concept is used to improve the total device reliability by effectively using renewable energy sources. When powered by renewable energy sources such as photovoltaic cells, wind turbines are used as a pollution-free source of energy that is interconnected to traditional sources to increase total device performance and meet load requirements. The energy transfer from dc to ac and back to dc is reduced with the dc micro grid approach (Cuzner & Venkataramanan, 2008; Liu, Wang, & Loh, 2011; Loh, Li, Chai, & Blaabjerg, 2013).

The power server can take both ac and dc power and only outputs dc power. The ac power from the mains is converted to dc with a high conversion efficiency and minimal failure. Since the battery is the strongest storage unit for a dc structure, the dc micro grid stores the access energy directly in the battery. To preserve our climate today, we use green energies. Solar photovoltaic cells are useful for this in our nation because we have a lot of solar radiation. This is divided into three sections: generation, transmission, and delivery. It is split into three regions: generation, generation and transmission, and generation and transmission (Gea-Bermúdez, Pade, Koivisto, & Ravn, 2020; Guo, Ma, Liu, Jones, & Li, 2016). All three are present in the third area. Solar energy, on the other hand, is a variable form of energy since variable solar radiation is obtained on the planet or on the solar PV module, so the variable source has a significant effect on its regulation and provision of a controllable source of energy. While this cannot be monitored, the maximum usable solar radiation on the earth's surface can be obtained using a simulation and incorporating solar energy generation method by adjusting the tilt angle of the plate.

The efficiency of the PV module is often influenced by the amount of dust collected on the PV cells or PV module; as the amount of dust on the PV cells increases, the efficiency of the PV modal decreases by up to 50%; however, consider dust-free PV modal and adjust the tilt angle to achieve opt. The need for electricity cannot be met by fossil fuels, and they often emit pollutants into the

atmosphere, contributing to the greenhouse effect. As a result, it is important to investigate renewable energy sources such as solar energy.

Solar energy is divided into two types: photovoltaic (PV) and solar hybrid thermal (SHT), with PV having a higher performance than SHT (Chow, 2010; Kumar & Tiwari, 2010). However, in order to increase this, the two are combined in the same usable roof surface region, allowing the full roof surface area to be used. The cost of the PV modal is also one of the main influences on the growth of the solar system; hence, to minimize the cost of the PV system, various forms of construction are constructed using various materials and are used according to the application. In this way, the expense of a solar PV device is reduced whilst the performance is improved, and further study is being conducted on the most recent materials used in solar PV modules in order to improve PV module efficiency.

2 Energy Requirements Today

Scientists and engineers have the responsibility of making "conventional energy" sustainable and "renewable energy" available (Murthy, 2012). Oil now provides just 28% of overall energy requirements, but coal is used to meet the remaining energy needs (Table 1). In contrast, natural gas provides 20% of the energy requirement and nuclear provides 2.8 percent of the global energy requirement, leaving 16.2 percent of the global energy need to be met by renewable energy (Table 2). Today, we need more resources than ever before, as well as the development of long-term energy supplies. The more extensive electric power is provided in the thermal power plant, from a current point of view. It would not be sustainable in the future, but we must grow it as a modern alternative energy source, such as solar energy. According to the International Energy Agency (IEA), about 1.3 billion citizens worldwide do not have access to power, and almost 2.7 billion do not have access to clean cooking facilities. In India, 400 million people do not have access to electricity, and the regular average per capita electricity consumption for those who are wired is about 2 kWh (Shenai & Shah, 2011).

Table 1. Sources of energy are needed

Energi source	Needed	Units
Natural gas	20.0	%
Coal	28.0	%
Nuclear	2.8	%
oil	33.0	%
Renewable energy	16.2	%

Table 2. Renewable energy's current situation

Renewable energy	Capacity (W)	Units
Wind	21.26×10^9	W
Solar	2.65×10^9	W
Hydro	3.81×10^9	W
Biomass	1.37×10^9	W
Bagasses cogeneration	2.51×10^9	W
Waste to power	0.11×10^9	W

3 Methodology

In this model, the 16x2 displays all of the parameters (solar panel, wind motor, mains supply, bus bar, LDRs) in the form of voltage only, which is in Dc nature, which reveals the importance of a solar output panel with a 5 watt rating in their display. The PIC16F73 microcontroller, which is now the most advanced hardware, is used to change all of the parameters. The most of the operations was carried out with a 5 volt supply.

As the mains are turned on, the overall power produced by renewable energy is often allocated to the distributed load, reducing the use of traditional sources. When offloading or onloading occurs in this model, the transistor is used for standby work.

The LM317 voltage regulator is used to power the motor that generates artificial wind. When the motor's speed is strong, the contribution from the wind is often high. Solar detection is accomplished using the LDR sensor. Where the possible variation is large in comparison to others, it works quickly and absorbs photons released by the sun or artificial sun (incandescent light)

The whole bus bar is secured in this model, and the bus bar's voltage does not surpass 9.99 volts. As a result, the power of the solar panels is limited to 9.99 volts. When the solar panels, wind generator, and mains are all turned on, the extra electricity is stored in a battery. The total plant performance is increased as a result of this strategy, and we can secure our fissile fuel supply on a wide scale.

4 Results

Renewable energy sources, such as wind and solar, improve device performance by up to 40% when opposed to fossil energy sources, and there is no requirement for conversion with this form of system (Prasad et al., 2012). Future generations will benefit from the use of solar and wind energy. The traditional sources can be rescued on a wide scale with the assistance of this model, ensuring that our future remains bright (Figure 1).

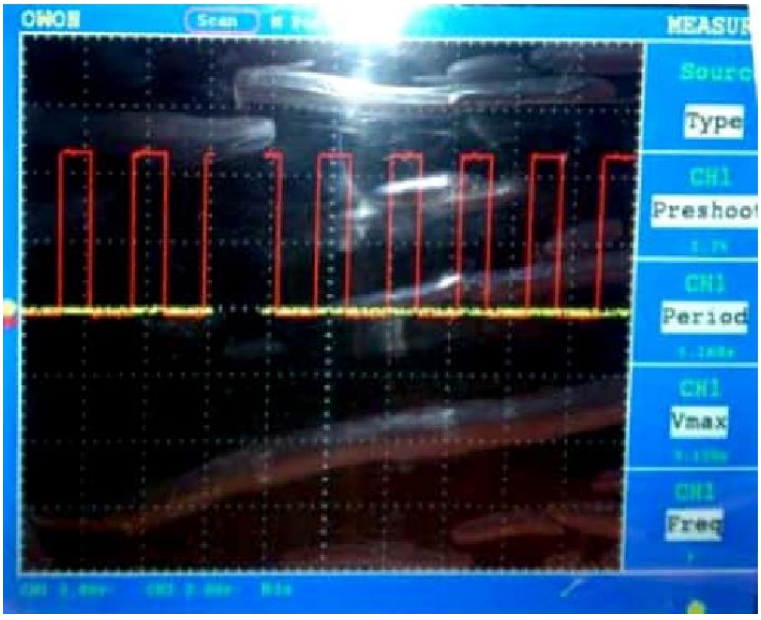

Figure 1. Maximum utilizing the main power source

When the solar monitoring system is in use, the panel's performance increases due to the extraction and emission of electrons occurring at a breakneck level, resulting in maximum generation. When the complete load is on and renewable energy sources are turned off, the bus bar voltage is 5.91 volts when renewables are operating at maximum volume and high rpm (Figure 2). The voltage performance of the tiny model is shown by the bus bar voltage of 9.91 v. The combination of "load connected to mains only" and "load connected to renewable sources with mains" determines the improvement in bus bar performance in terms of voltage.

Figure 2. Minimum utilizing the main power source

More pulse width modulation occurs in this model as power is delivered to the load via primary ac sources. The minimum pulse width modulation (PWM) occurs while renewable sources provide the electricity to the load. As a result, the usage of green energy sources in the grid improves the system's performance. The electricity produced by the solar panel varies in time and fluctuates in nature. As

a result, MPPT is used to produce the maximum amount of energy from the heat (Rizk & Chaiko, 2008; Shenai & Shah, 2011).

With 40% of India's 1.20 billion people without access to grid electricity, the country's current 186 GW installed power capacity will need to be doubled by the end of this decade to meet the needs of its growing population and high GDP growth economy for off-grid generation of power to meet the country's energy needs by micro-grid use. As compared to fissile fuel power generation, photovoltaic modules and wind energy sources are more effective. As a result, intelligent grid infrastructure is the perfect solution for reducing the use of traditional energy sources. When offloading happens in geographic areas and the education market, interconnected networks are beneficial. It is still in standby mode, allowing it to run easily when conventional power sources malfunction. It will save up to 15% of energy while still the productivity by 40%.

5 Conclusion

As compared to fissile fuel power generation, photovoltaic modules and wind energy sources are more effective. As a result, intelligent grid infrastructure is the perfect solution for reducing the use of traditional energy sources. When offloading happens in geographic areas and the education market, interconnected networks are beneficial. It is still in standby mode, allowing it to run easily when conventional power sources malfunction. It will save up to 15% of energy while still the productivity by 40%.

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