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Designing and constructing a DC microgrid with uninterrupted power supply capability and optimizing its energy usage by smart controlling system

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Abstract

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Abstract:

This paper outlines the methodology of designing and implementation of a solar powered system which can be used to make a human comfort zone during day time without using battery backup but with the use of Supercapacitors. Basically, major converter losses are reduced in this system. In acquiring a highly efficient power supply, the charge controller plays an important role. When a DC microgrid powers DC loads based on a renewable source such as a PV system; energy storage becomes mandatory due to fluctuating nature of the source. Localized DC-energy storage within DC-DC converters could address this requirement. A variation of supercapacitor assisted regulators could provide localized energy storage with low-noise and fast transient response [1]. 12 V LED lights will be powered from this system. LEDs can be powered directly via a supercapacitor bank from the regulated Photovoltaic energy. In the case of Inverter type Air Conditioner, in order to overcome converter losses, the DC Bus inside it should be accessed. Typically, DC Bus voltage inside the Variable Frequency Drive (VFD) is 1–414 times the supply voltage. Hence DC-DC Converters are used to power up the inside circuitry of the Inverter Air Conditioner from the solar panel. In order to optimize the energy usage and reduce electricity consumption, light dimming and air conditioning control systems were added to control the light intensity and switching of the air conditioner.

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I. Introduction

As the technology advances, so does the living standards, which increases the demand for power consumption. Hence new methods to harness energy from reliable sources are essential rather than relying on non-renewable and environmental pollution causing methods like burning fossil fuel. Many natural resources that are widely used to generate power today are non-renewable. In contrast, Solar Power is a source, which provides “clean and green energy” to support the power demand as an alternative energy source. Not only has it provided an environmental friendly method to harness power but also it can be used as a potential foundation for energy generation [2].

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