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DUAL CHARGING MODE OF UNINTERRUPTED POWER SUPPLY

Anusha D N, Manu M R, Ravi R, Venu C P

Project Guide: **Smt. Sheila H**

Department of Electrical and Electronics,

Vidya Vikas Institute of Engineering and Technology, Mysore-570028

Abstract- Solar Power and Uninterruptible Power Supply (UPS) are two technologies that are growing rapidly. The demand for solar energy is mainly driven by the trend towards cheaper solar cells, making it economically profitable for a larger range of applications. However, solar power has yet to reach grid parity in many geographical areas, which makes ways to reduce the cost of solar power systems important. This is investigates the possibility and potential economic synergies of combining solar power with UPS systems, which have been previously researched only from a purely technical point of view. This is instead evaluates the hypothesis that a combined solar and UPS system might save additional costs compared to regular grid systems, even in a stable power grid. The primary reason is that online UPS systems rectifies and inverts all electricity, which means that solar energy can be delivered to the DC part of the UPS system instead of an AC grid, avoiding the installation of additional inverters in the solar power system.

Keywords- Uninterruptible Power Supply, Solar Converter, Inverter. Battery, Regulator.

I. INTRODUCTION

Interruptible Power Supply is critical to many sectors of the economy such as operation of units in hospitals, banking operations, information technology systems, etc. and generally, a constant power supply is cardinal to rapid economic growth and sustainable development. In developing countries in particular, where power failure is a regular feature, there is great need for improved UPS systems. A power supply system that incorporates a renewable source of energy as contained in this work provides a viable option to overcome the problem of disruption of work in progress due to power failure.

The main components to all forms of Uninterruptible Power Supply systems include maintenance free lead-acid battery bank, switchgears, inverters and source of energy. The UPS constructed in this work is configured to operate fully in automatic mode with provision for recharging the backup battery from solar energy. Internal switching control incorporating MOSFETs and rectifier systems also allow automatic use of the mains supply when available, for operating the load and recharging the battery. In this study, functions of the main components along with their efficiencies and reliabilities are discussed and the results of performance tests of the constructed UPS are presented.

II. BLOCK DIAGRAM

The UPS system can serve several functions related to power quality and power reliability. The main functionality of UPS systems is to provide back-up electric power for a specified time (the autonomy time) if the main power supply is cut off or in any other way is unable to deliver satisfying power for a specific application. The typical time range can be anything between a few seconds up to several hours depending on application. For large-scale applications such as computer halls, UPS systems typically only serve as an intermediate power source before reserve generators can be started in less critical systems, for example household applications, a UPS commonly constitutes the sole reserve power system.

When the UPS is converting the incoming power from the grid during normal operation it is also possible for the UPS to adjust the voltage and frequency to user-defined levels. This can be used when the load uses another voltage or frequency compared to the power grid.

Typical large-scale systems that need to be protected by UPS systems are data centers, airport lighting, medical systems and industrial processing plants. These applications typically use more advanced UPS systems that not only serve as back-up power but also use the power quality protection that certain UPS systems provide.

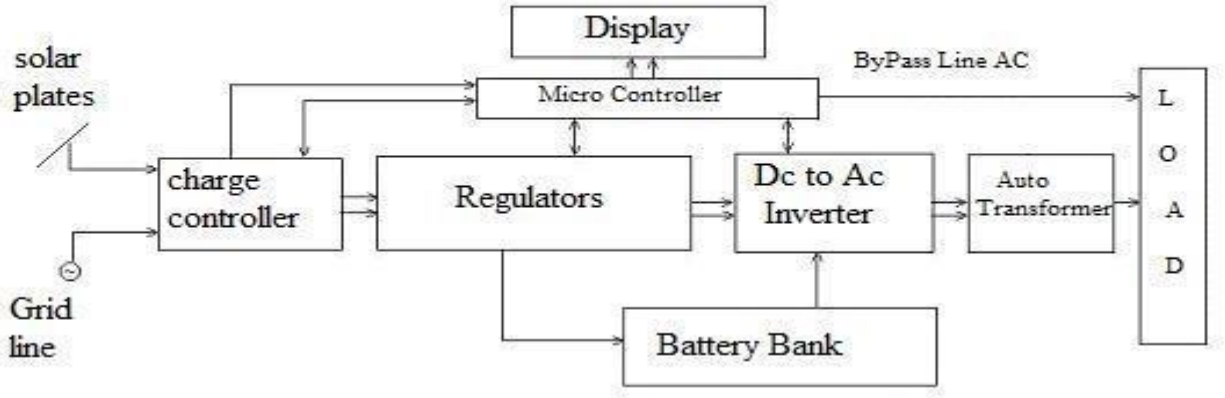

Figure 1 Block diagram of dual charging hybrid inverter.

III. RESULT

The aim of this paper is to evaluate if the combination of solar energy and UPS is technically feasible and have any economic synergies compared to a stand-alone solar power system and separate UPS system. The results from the prototype system indicate that the main cause of ripples is not the addition of solar power but from other components. The impact of solar power on critical parameters especially the Threshold of output AC voltage is largely unaffected by the addition of solar power. In the case of power outages the solar power can even be beneficial compared to a regular UPS system.

The economic analysis clearly shows that the investment cost of solar charge controllers is significantly lower than for solar inverters. During the work with this thesis the impact of the combined system of total system efficiency was also discovered to be an important synergy. By using a combined system less power has to be rectified by the UPS and thus the conversion losses decreases. This discovery accounts for the main part of the difference in generated energy between the combined and the stand-alone system.

Figure 3.1.DUAL charging mode of UPS model

Figure.3.2.Final over view of project

The payback calculation indicates that the payback time of the combined system is significantly lower. In summary the combined system has a high potential as an alternative to stand-alone solar energy for

companies or investors that are also in need of reliable power. A result from the study is thus that a UPS system is a complex system requiring high-performance components and careful design to work properly. In order to make the combined system full fill the strict requirements of a UPS system the two components (UPS and solar energy) would need to be integrated and the system carefully tested before being used in a real application. The main aim to integrate solar energy and UPS in order to minimize the electricity bought from the grid when the normal power grid is functioning. The results of this study indicate that there are economical synergies when combining solar energy and UPS systems even in locations with a stable power grid.

IV. CONCLUSION

The conclusions drawn regarding the technical feasibility of the combined system is that it is technically possible (with minor modifications) to combine solar energy and UPS systems on a common DC-line. The addition of solar energy does not have any significant impact on the power quality of the UPS system. In the case of power outages in the electricity grid solar power can benefit the system with both less impact on power quality at the point of disconnection from the grid and also increase the autonomy time of the UPS. The economic synergies related to the combination of solar power and UPS systems are two-fold: the investment cost of the system and the total generated energy. Based on prices for commercially available inverters and solar charge controllers the conclusion is drawn that the investment cost of the combined system is significantly lower than for separate systems. Using wholesaler data the cost for inverters was higher throughout all sensitivity analysis with inverters from Microtek Company only becoming the cheaper alternative when the prices for solar charge controllers were doubled.

The economic synergies related to the combination of solar power and UPS systems are two-fold: the investment cost of the system and the total generated energy. Based on prices for commercially available inverters and solar charge controllers the conclusion is drawn that the investment cost of the combined system is significantly lower than for separate systems. Using wholesaler data the cost for inverters was higher throughout all sensitivity analysis with inverters from Microtek Company only becoming the cheaper alternative when the prices for solar charge controllers were doubled.

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