Hybrid, Micro-inverter and Battery based Standalone System for Rural and Urban Water Delivery

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ABSTRACT

The work describes a solar powered micro-inverter and battery operated hybrid electrical energy source implemented at the University of the District of Columbia's Experimental Farm. The goal of the project is to provide round the clock electricity for maintaining specified temperature in a series of green houses as well as supply irrigation water to a variety of crop systems including sustainable agriculture projects comprising hydroponic, aquaponics, specialty and ethnic vegetables and fruits production and urban forestry. hydroponic crop systems at the Farm. The advantages and shortcomings presented by a micro-inverter based system, when combined with the traditional battery storage/inverter are analyzed. The system is proposed to bea model for a self-powered, standalone small scale hybrid system, ideal for semi-rural and rural farming.

INTRODUCTION

UDC, as a land-grant university, owns a research farm: The Muirkirk Agriculture Research Farm , located in Beltsville,MD used for:

- **Food production uses, including irrigation;**
- **Aquaponics systems**
- **Hydroponic systems**
- **Need to diversify power delivery with micro-inverter technology**

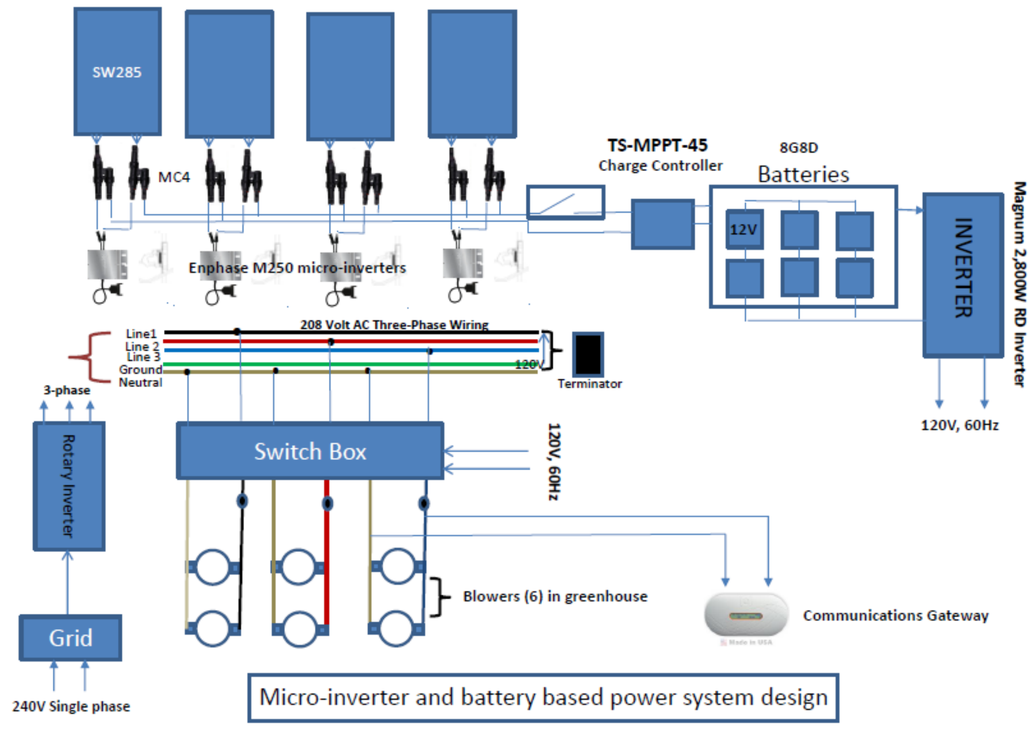
PROJECT OBJECTIVE

- **To complement the existing electric power delivery with micro-inverter technology using the AC coupling scheme**
- **To provide power to several greenhouse blowers 24/7 and other agricultural**
- **projects**

DESIGN APPROACH:

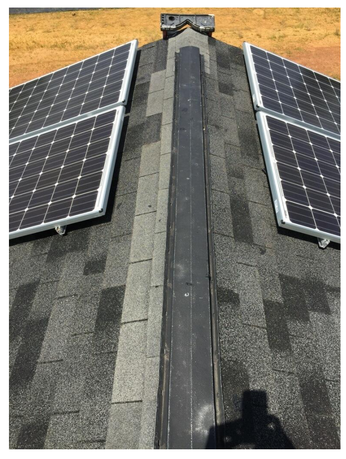
- **Investigate the micro-inverter technology's capabilities**
- **Provide a virtual "grid" with a rotary inverter as substitute to a 3-phase battery system for the the AC coupling technique**

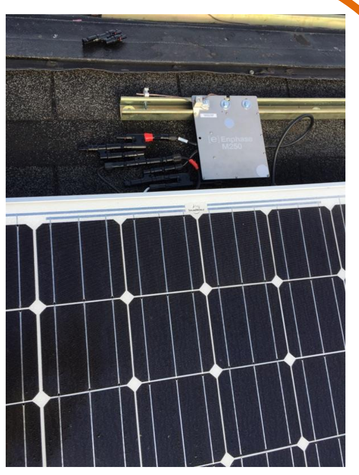
AC coupling

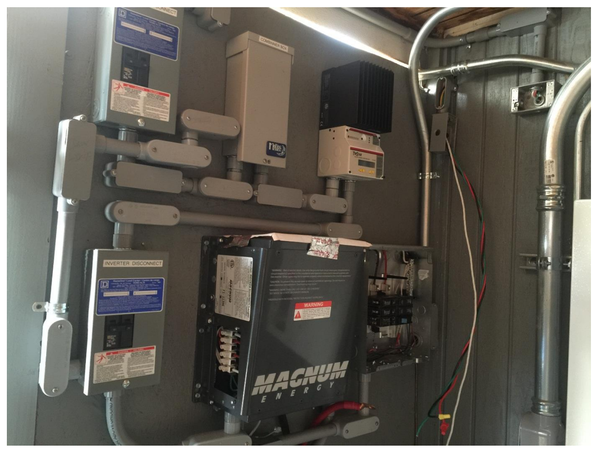


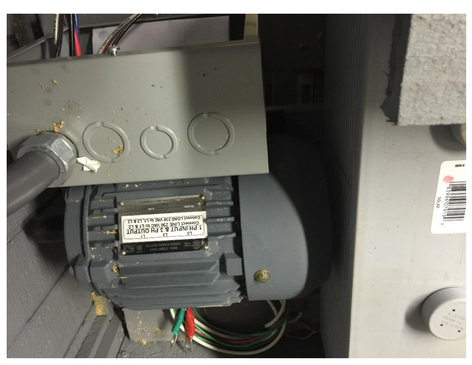
Micro-inverter and battery based power system design

Hybrid Micro-inverter Battery-Based Power System









Project implementation

CONCLUSION

The proposed hybrid system, including a set of micro-inverters in combination with a traditional battery-based solar power system presents a good solution for a round the clock electric power delivery, which minimizes the use of the batteries. It has however limited use in grid isolated rural areas where there will be a need to provide additional batteries for AC coupling. The pilot project described here uses a rotary inverter which is tied to the grid. The proof of concept is well established but further study is required for a cost effective AC coupling application of micro-inverters.

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