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A Low Cost Electronic Load for Renewable Energy Systems

A Low Cost Electronic Load for Renewable Energy Systems Optimization

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INTRODUCTION

A majority of the electricity currently produced in the world is generated using large fossil fuel or nuclear power stations. The efficiency of this kind of power generation is low, resulting in large quantities of wasted heat. The fossil fuel power station also produces a large amount of CO^2 increasing the greenhouse effect. One possible solution is to generate electrical power using renewable sources such as photovoltaic arrays or hydrogen fuel cells. Renewable energy sources can be directly implemented and controlled by the energy user thus avoiding energy transmission losses.

To optimize the energy production and usage, of RES, it is essential that an effective monitoring and control strategy is employed. In order to develop new control algorithms the designer needs to evaluate the RES parameters and at the same time simulate real test condition load profiles.

The system developed so far is composed of a monitoring tool that measures and displays, in real-time, the parameters of Photovoltaic (PV) solar panels, and of an electronic load that can simulate load profiles such as the averaged domestic or stepped power consumption. The monitoring system is implemented using a µcontroller and the electronic load is composed of a MOSFET, driven using a Pulse Width Modulated (PWM) output of a PIC µcontroller. Furthermore, the power consumption profiles are stored in the internal memory of the PIC µcontroller. This poster focus on the electronic load.

RESEARCH AREA

The Research is focused on different aspects:

- Energy production prediction
- Weather and system monitoring
- Control strategies for green energy generators
- Efficient use of produced energy
- Energy storage
- Demand Side Management...

AIM

The aim of this project is to design, build and test an electronic load capable of simulating different load profiles. The load will then be used to simulate the averaged load profile of a household thus giving the designer the possibility to optimise renewable energy production and energy usage.

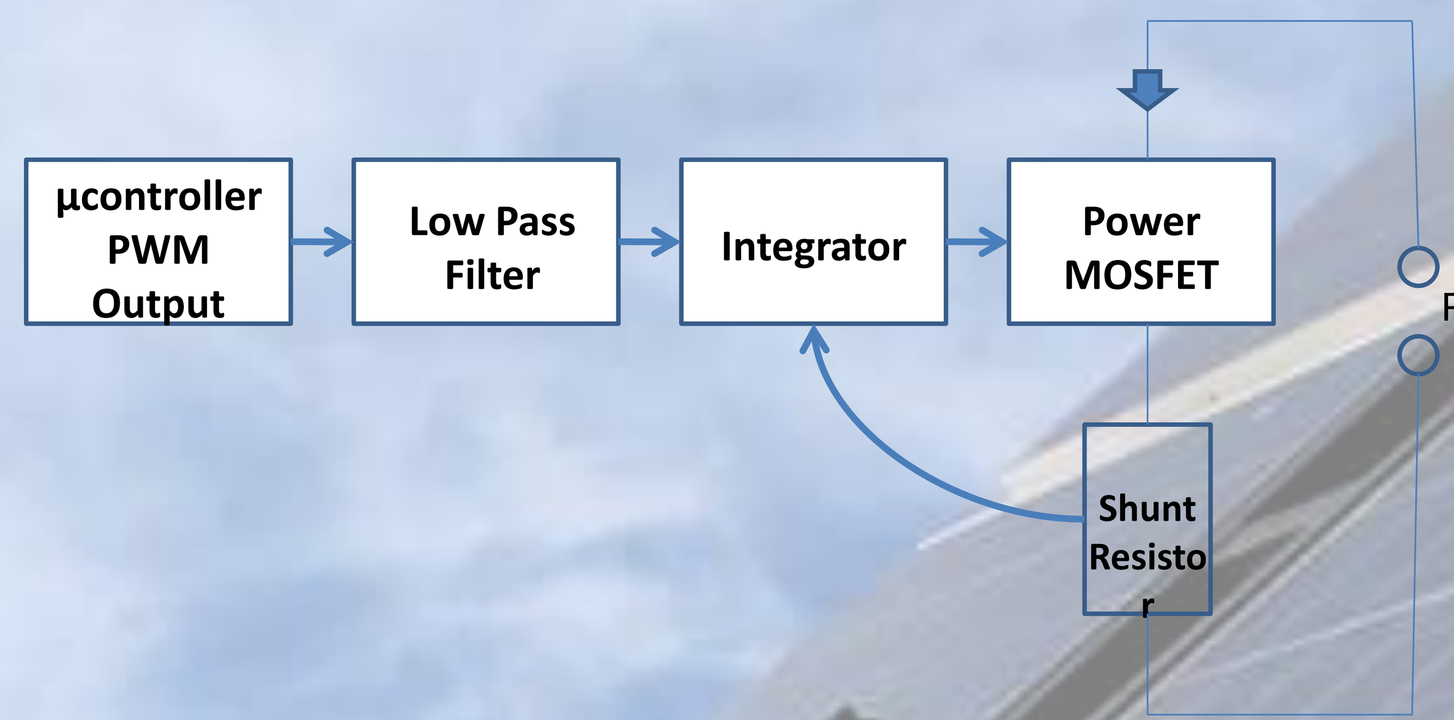

Fig.1 Block diagram of the designed electronic load

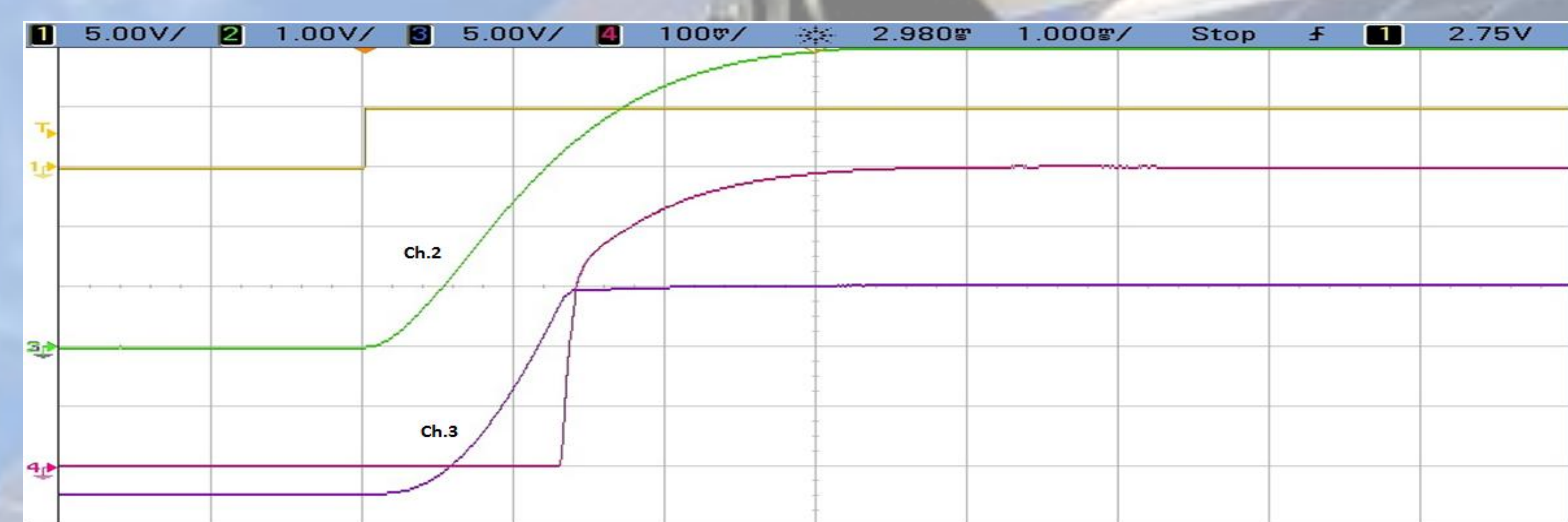

Fig.2 Load Time Response from 0 to 5A: Channel 4 Represents Current, 100mV = 1A.

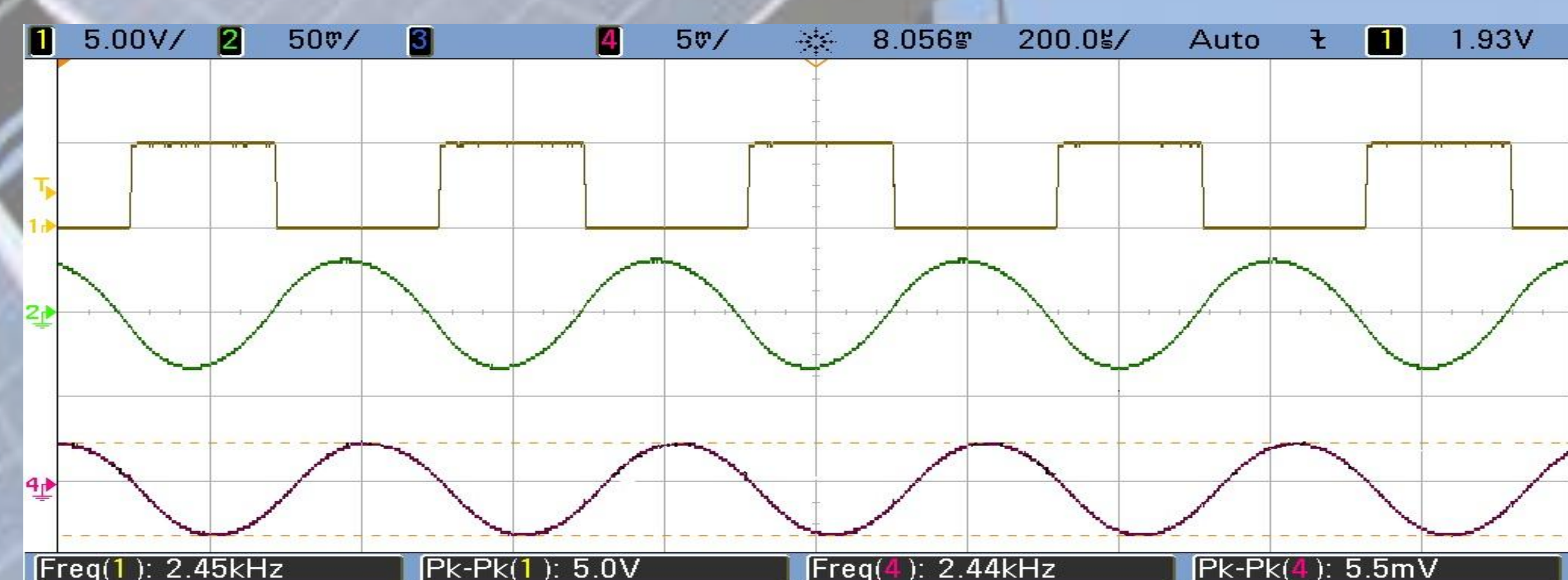

Fig. 3 Current Ripple for a 50% Duty Cycle (2.5A) Represented on Channel 4, 1mV = 10mA.

RESULTS

The block diagram of the designed electronic load is available in Figure 1. The Results demonstrate that the load have a good accuracy, and a relatively low current ripple. Fig.1 shows the load response time of approximately 4ms which is fast enough for the simulation of the load profile of an household (Fig.4). The current ripple is measured in Fig.3 and is approximately equal to 55mA for a 2.5A output which gives an total of ±2.2% of ripple compared to the set output current.

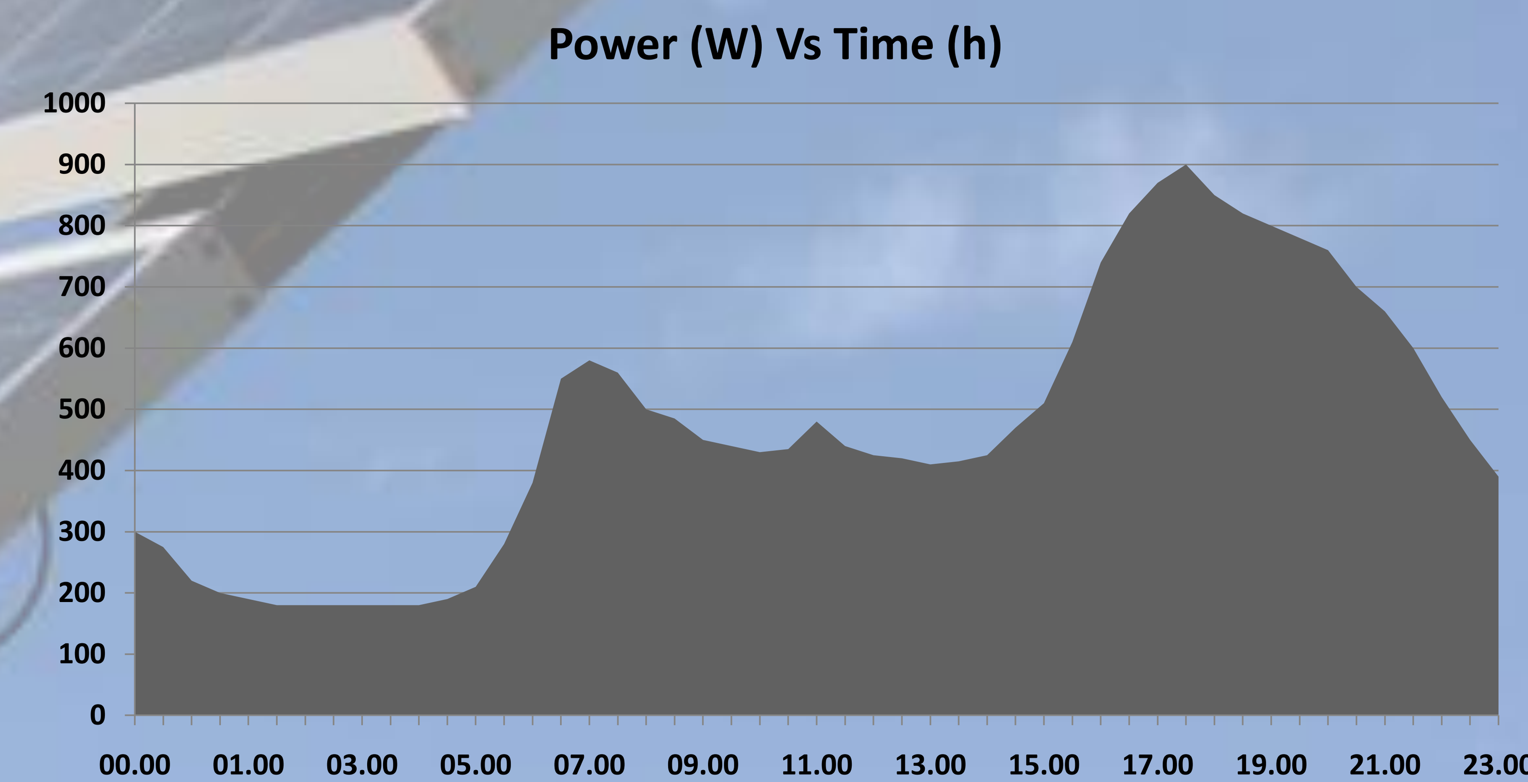

Fig. 4 Typical Winter Domestic Load Profile Produced by the Electricity Association

CONCLUSIONS

The electronic load was successfully tested and the performances assessed. Although the load is limited to a power dissipation of 75W, the working principle remains the same if higher power is required. The next step of the research will focus on the prediction, storage and generators and loads control. To obtain relevant results, simulations will be carried out and a hybrid system with heterogeneous “green” generators will be constructed. In order to develop an integrated and efficient system for domestic or small business usage.

CONTACT

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