

A Single-Phase Voltage Regulator for a Typical Maltese Household

Author: John Licari

While renewable energy is beneficial for the environment, it also brings new challenges to properly control the energy flow in modern electrical power networks. In the past, consumers normally experienced low voltages in their homes, while nowadays, consumers might also experience over-voltages during certain times of the day! Electrical power networks, including the Maltese network, were designed for a single centralised source of energy (the power station). Power is expected to flow from the main energy source toward consumers, with voltage drops being experienced along the way.

Due to the increase in locally installed systems, electrical power can flow upstream toward the substation during certain times of the day. This causes distribution voltage

levels to rise, potentially leading to over-voltages. Unfortunately, most residential equipment cannot withstand over-voltages, leading to damaged appliances or reduced lifetimes. Moreover, PV systems are automatically disconnected if the voltage exceeds a predefined threshold, leading to the loss of renewable energy (Figure 1).

Project REVOLT materialised following an idea by Dr John Licari, Prof. Cyril Spiteri Staines, and Dr Alexander Micallef of the Department of Electrical Engineering. The aim is to design and build a voltage regulator which can provide any household in Malta with a stable voltage. This is achieved by correcting the voltage both in the case of under and over-voltages. Figure 2 shows the concept of the voltage regulator.

Over the years, a number of low-voltage regulators have been proposed that either use special-purpose transformers, or complex power circuitry for voltage compensation. REVOLT aims to design a regulator which can use standard low-cost transformers (without any moving parts) and a simple-to-control power converter. The purpose of this device is to enable the consumer's voltage to remain within the nominal voltage range as defined by national and European standards. 

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Figure 1

A typical home connected to the electrical supply experiencing an over-voltage event. Supply over-voltage will disconnect the home's PV system!

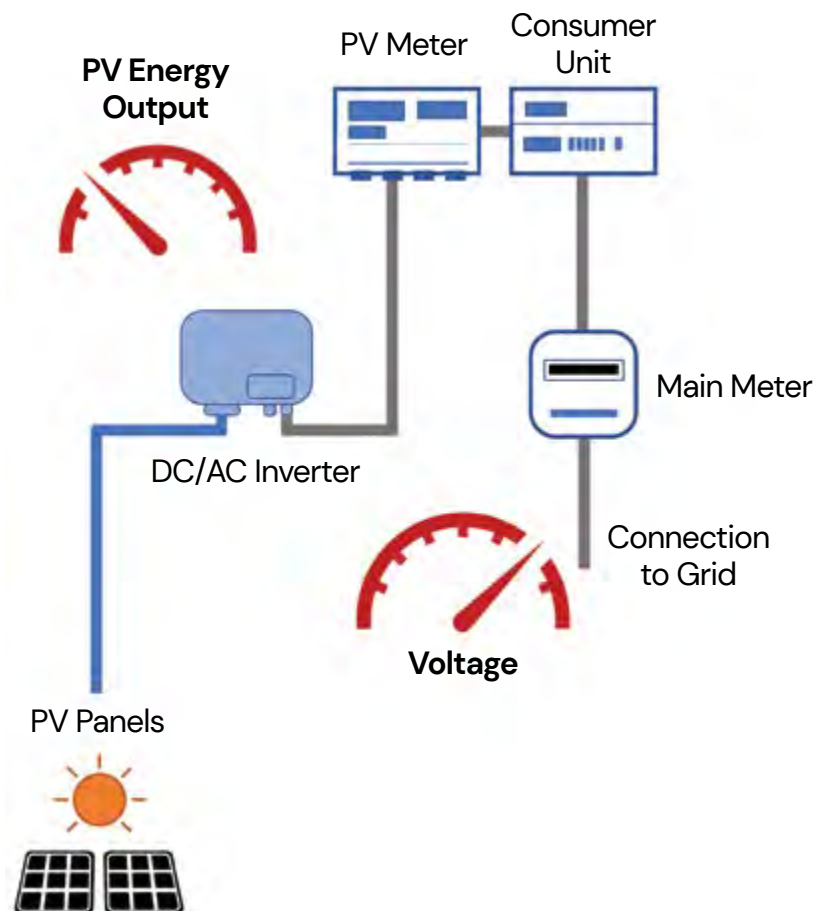


Figure 2

The REVOLT voltage regulator corrects the voltage supply input to the home.

