AC Power Control Methods used in automatic surplus energy controllers

Introduction

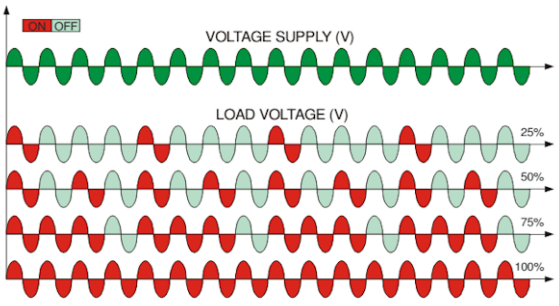
Before choosing a surplus energy diverted for a microgeneration system, some knowledge of the different technologies used by these devices is essential. Selecting such a device by price or features is simply not enough, by making the wrong choice you could fall foul of European legal standards and problems could arise which could effect the microgeneration system and other appliances in the property and nearby properties.

In order to make full use of all of the available surplus energy from a grid-tied Photovoltaic or Wind Turbine system, the load(s) must be effectively and automatically controlled. Simply switching on and off heating appliances is usually not effective as the appliances tend to be large and so draw a lot of power. The power drawn is likely to be greater than the power generated by the inverter which means the difference would have to come from the grid supply. Therefore the power being delivered to the heater must be adjusted, to match or 'track' the excess power from the renewable energy system. Furthermore, this tracking needs to be fast enough to prevent any power being drawn from the grid supply as the output from the system rapidly changes with the wind or as clouds pass over. Also the available surplus power will instantly change as the home-owner switches on and off their appliances.

The varying of the power level to a load is often referred to as 'proportional power control'.
There are several known methods of providing proportional control of AC power. Simple control methods often use a TRIAC, this type of device acts like an AC switch that can be electronically controlled. There are serious limitations to consider when using TRAICs in AC power control, in addition EMC compliance can be almost impossible to achieve once power levels exceed a few hundred watts.

Burst-Fire Control

Bust-fire control is usually implemented by use of a TRIAC. With this method, the average power delivered to the load is adjusted by selectively switching in and out mains cycles. e.g. for a 50% power level, over a set period of time, half of the cycles will be on and half will be off. This is illustrated in the diagram, four different output power levels are shown.



Pros

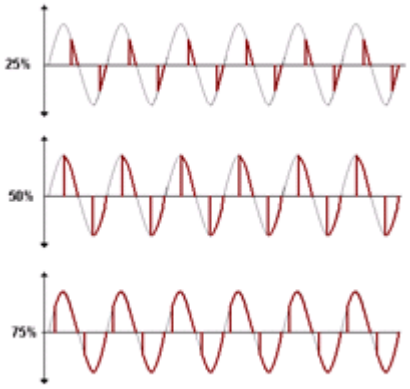
- Simple and therefore cost effective
- Switching is done at the 'zero-cross' point, resulting in minimal RF interference

Cons

- Can cause current harmonics in mains supply
- Will cause voltage fluctuations on mains supply which can sometimes cause lights to flicker
- May not be compatible with some smart meters
- Can cause measurement errors in some energy monitor devices
- Not able to be short-circuit protected

Phase-Angle Control

In this method of control, the output is turned on each half cycle after a delay period. By varying the delay the power level is adjusted. The diagram opposite shows the output voltage waveform at three different power levels. Again, a TRIAC is often used in this control method.



Pros

- Simple and therefore cost effective
- Will not cause voltage fluctuations

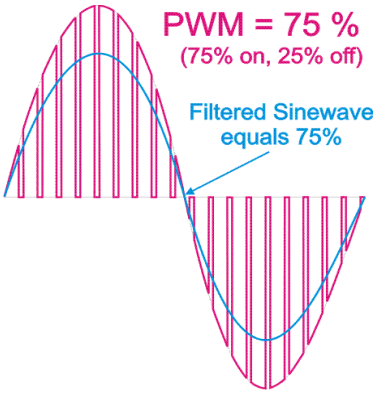
Cons

- Will cause severe current harmonics in mains supply, some inverters may find this troublesome
- Almost certain to cause RF interference
- Known to cause heating of neutral conductors
- May not be compatible with some smart meters
- Can cause measurement errors in some energy monitor devices
- Not able to be short-circuit protected

truSINE™ PWM Control

This is the power control technology implemented in the immerSUN®. It is basically 4eco's propriety control method. As the name suggests, the power being delivered to the load is kept as a true sine wave; only the voltage is varied.

This control method cannot be achieved using TRIACs and so is much more difficult to design, requiring many more components which increases cost. However, the benefits far outweigh the initial cost.



Pros

- **Compliant with EN 61000-3-3** (voltage fluctuation and flicker): Will never cause lights to flicker
- **Compliant with EN 61000-3-2** (harmonic current emissions): Will never cause problems with inverters
- Fully short circuit protected in case of load fault
- Over-load protection
- Power factor correction
- Soft starting to avoid power surges
- Smart meter compatible
- Compatible with third-party energy monitors

trusine™
power control technology

Cons

- More expensive than TRAIC based technologies

Conclusion

Careful consideration needs to be given as to which controller is used. Choosing to save money on the initial cost of the unit may be false economy as problems could arise after installation, these problems can range from annoying

radio interference to electrical damage to inverters. By choosing immerSUN with it's truSINE™ power control technology, you can be assured of reliable, trouble free operation for many years.

The immerSUN is the ONLY such EU EMC Compliant product on the market for less than £1000!