Voltage Optimisation
Brief Introduction

How Electricity Energy is billed

Consumers are charged for the energy used over the billing period, measured in KWh.

The total energy used is measured by the power (rate of energy consumption) used over each metered time interval.

What is important is how much energy a device uses at each time (power consumption).

How Electricity Energy is consumed

Each device will be rated to consume energy at a nameplate power rating (eg: 100 Watts). This power rating is based upon standard conditions, of which the voltage level is most important. If of recent manufacture, the device's operation will have nameplate voltage rating of 220 Volts AC (ie: the nominal voltage).

The impedance or resistance to the flow of electricity is inherent in the device and does not change.

If the supply voltage (the voltage from the power supply) is greater than the assumed nominal voltage, the inherent device impedance will mean that the electrical current, the amperes ("amps") going through the device will increase proportionally. The higher current and the higher voltage lead to higher, and unnecessary power consumption.

Technically, the calculation of power consumption is as follows: Power (electrical) consumed = Voltage^2 (squared) / Impedance (real load of the device). This is without going into more technical depth and explaining other parameters such as power factor. Notice the square law. As a simple guide, if the supply voltage goes up by 5% then the energy consumption will increase by 10% (typical cases).

Some reasons as to why the Voltage at Consumer Input is High

Electricity suppliers are not required and do not guarantee a constant voltage. In Australia they are only required to ensure that the voltage is generally within the range between 216 V (230 V – 6%) or 253 V (230 V + 10%).

Voltage control is a complex and difficult task at the supply level given that the consumer is at the end of a massively complex transmission and distribution system, hundreds of kilometres long and the consumer shares this supply system with hundreds of thousands of other users, each changing their electricity use from moment to moment during the day.

This is why the voltage at the consumer's input meter box can vary between approximately 216 to 253 Volts, as the tools that the electricity supplier has to manage voltage level, are many kilometres away.

The electricity supply system is generally managed to ensure voltage levels are higher (but within boundaries) in order to safely manage the whole transmission and distribution system; hence the consumer most often ends up with supply voltage at his user input, materially higher than 240 Volts in most cases. Across Australia, the average end user voltage is 247 Volts. That means that VO can provide consumers with reductions in energy bills by 15% or more in many cases.

Voltage Optimisation ("VO") Benefits

VO is an intelligent device that adjusts the incoming supply voltage from the external electricity supplier so that the consumer's electrical devices are fed with a pre-programmed level of input voltages, appropriate to the design of the consumer's electrical devices.

Note carefully the aim of the VO is to reduce the excess voltage so that it is at a constant desired level (in most cases this will be 220 Volts).

Summary

Lower voltage means less energy consumed, but load devices will still do their job as they will be operating at their nameplate design conditions. Equipment will be operating at maximum design efficiency, and dissipating less waste heat. That’s good for our environment, as it reduces CO2 emissions.

Lower voltage means less electrical stress (lower voltage lowers the stress on electrical insulation) and less thermal stress on the device (less wasted power means less wasted heat is generated). For most electrical devices this means a longer life for the device and often less servicing or replacing of that device at a longer interval. The laws of insulation life and semiconductor life provide that for each 10oC temperature decrease, the life of the equipment will be doubled. This would lead to further cost savings which we do not cost into the primary analysis of cost/benefits.

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