Product category briefing: voltage reduction

The power drawn by an electrical appliance is the current multiplied by the voltage. In a simple resistive load such as a filament lamp, the current is proportional to the voltage and therefore at reduced voltage the power is reduced more than in proportion: a 5% reduction in voltage for example yields a 9.8% reduction in power. The penalty for reduced power consumption, however, is reduced light output. Likewise an electric heater will deliver less heat, but if the heater is thermostatically controlled, it will run for a greater proportion of the time in order to maintain the required output over time, and to maintain an energy balance the energy input over time will also be unchanged. Electric motors that are required to deliver a certain mechanical energy output will consume electrical energy to match, regardless of voltage. Electronic equipment such as computers, LED lights and so on, which have onboard power supplies that regulate their output must (as a result) use the same power at lower voltage. Note that all such regulated equipment will hold its output constant by drawing a higher current at lower voltage; this normally increases its internal losses, causing slightly *higher*, rather than lower, energy consumption.

Meanwhile ovens, kettles, laser-printer fuser units and other intermittent thermal equipment will paradoxically suffer increased energy consumption. This is because reducing heater power extends the warm-up time.

There are people selling so-called voltage “optimisation” (more truthfully, “reduction”) devices. They exaggerate the savings that can be achieved by ignoring those categories of appliance which consume the same amount of energy—or more—at lower voltage. Nearly all fail to mention the continuous additional overhead power consumed by their equipment.

These people are motivated purely by profit and exploiting the fact that most potential customers do not have enough scientific knowledge to expose the exaggerations or falsehoods in their claims, which are often supported by endorsements obtained from gullible customers. Test results, where quoted, may be cherry-picked or based on flawed methodology, and demonstrations are designed to mislead for example by confusing power with energy but more commonly by ignoring the loss of output that must inevitably accompany reduced energy input.

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