

Ohm's Law

Ohm's Law: $P = V \times I$

Power = Voltage x Current

Watts = Volts x Amps

It means that the power being drawn is the product of current and voltage.

Also Ohm's Law: $V = I \times R$ (R = resistance)

Is equal to $I = V/R$

And as $P = V \times I$

By substitution it follows that $P = V^2/R$

This means for example that a 10% reduction in a 240V supply voltage on a 25 Ohm load will cause the power to drop from 2304W to 1866W, a saving of 19%.

Of course not all electrical equipment can be modelled as a simple resistance, but especially for many lighting applications it can!

Electrical motors behave different from lighting with a more variable resistance/load. Electrical motors designed to work anywhere in Europe will have an optimum operating point at 220V. When the voltage supplied is higher, in the UK for example the average supplied voltage is 242V, the motor will deliver its torque, but as a result of the higher (unnecessary) voltage will use additional energy as heat and vibration and not for an improvement in performance. So by reducing the supply voltage to the optimum voltage, the power being drawn is reduced. For this kind of applications savings of 8-12% can be achieved, rather than the full 19% as predicted by Ohms Law.