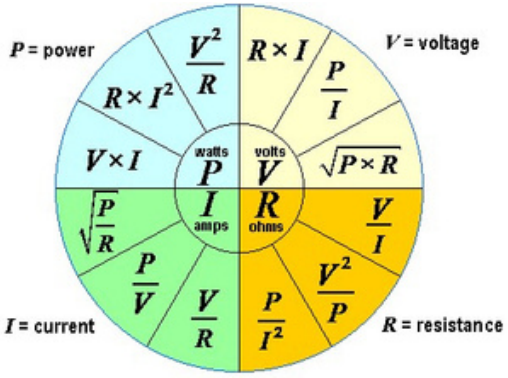
VOLTSMART & OHMS LAW

George Ohm 1789-1854



All Electricians will have studied Ohms Law at some time or other, usually as part of an apprenticeship. However, many go on to rarely use it fully during their career. Most will occasionally refer to a fraction of it, in a simple form, W(Power)= V(Volts) x A(Current), for working out adequate cable sizes.
This often leads to the common misconception of assuming that Wattage is a constant, along with the fact it's usually stamped on equipment like this 50W lamp, so using the above formula would intimate that if Voltage is reduced, the Current would go up!
In actual fact the lamp is only rated at 50W if exactly 230v is present, any more, such as the 242v UK average and the lamp will be running at over 55W, burning hotter and drastically reducing its life expectancy. It's the physical resistance of the wire element in the lamp that's a constant, not the Wattage, which is actually Voltage Dependent.
We therefore need to use the formula as shown in the Ohms Law Circle above. $P = \frac{V^2}{R}$

With equipment like this (100% Voltage Dependent) for every reduction or increase of 1% Voltage, a corresponding decrease or increase of 2% Watts of power is realised.
Let's take a closer look at what this means with a typical domestic 230v '2kW' Hair dryer or commercial Hand dryer.

$P\ 2000 = \frac{V\ 230^2}{R}$ So R= 26.5 Ω

You will see by the table below that depending what voltage is applied to the same piece of equipment, life expectancy and running costs (at typical 15p/KWh) can vary dramatically.

Combined Resistance, motor and heater = 26.5 Ohms (Ω)

Voltage	Current Drawn	Power Consumed	Running Cost / Hour	Result
Design Voltage = 230V	8.7A	2000W	30p	Running and Costing as designed
Average UK Voltage = 242V	9.13A	2210W	33p	Running hotter, vibrating more, costing more to use, and reducing life expectancy
Optimised Voltage = 220V	8.3A	1826W	27p	Approx 19% energy and financial saving compared to UK Average Voltage