ETAtec
Energy Efficiency

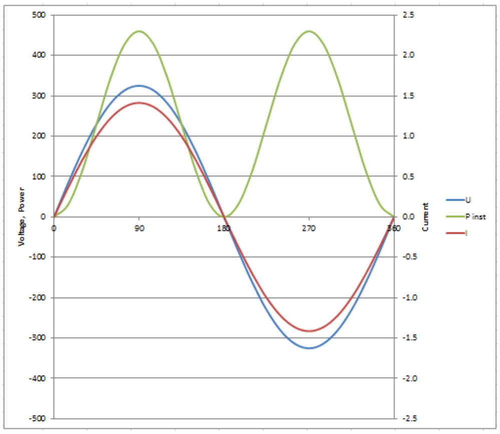
Power Factor Correcton

First we need to recap what power factor is.

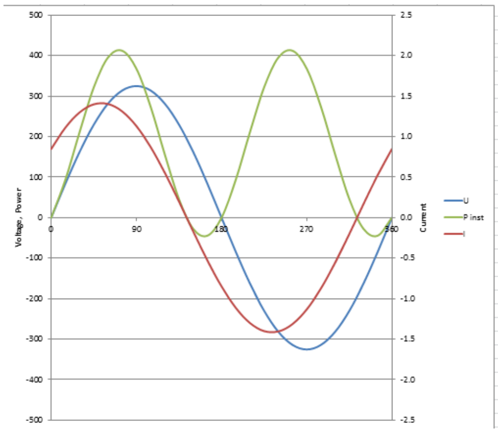
We learned in school that power is the product from voltage times current (P=U*I). This is correct for direct current (DC) and also for alternating current (AC) provided it is a linear load such as an incandescent light bulb.

However, for a non-linear load such as a motor, the current will lag behind (power factor <1) or lead the voltage (power factor >1).

Lagging behind or leading means that the peak of voltage and current will not occur together, as a result the actual *real* power (green line on pic 2) is lower than the product of nominal voltage and current (pic 1)



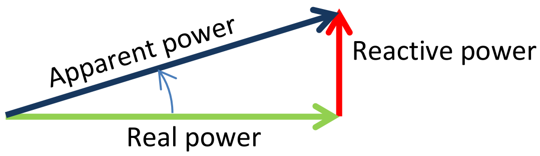
Pic 1 – Powerfactor = 1



Pic 2 – Power factor = 0.8

This means that the current supplied must be actually higher to achieve the same power. This is a strain on the entire network and a cost factor.

The actual (delivered) power is called *real* power, expressed in *Watt* (W) or *kilo Watt* (kW) – the green line
Product from voltage and supplied (higher) power is called *apparent* power, expressed in *VoltAmpere* (VA)
The “lost” power is called *reactive power*, expressed in *VoltAmpere reactive* (VAr)



Now, the real cost is not in the delivered power in kW, but in the apparent power in kVA. For many industrial applications this is charged. For many commercial applications, where kilowatts are charged, a “demand charge” is made i.e. this is a real cost. If the powerfactor is corrected to close to 1 and VA’s are charged, the costs would be lower. Also the current is reduced, so everybody is better off.

Virtual every equipment or appliance today has a power factor of <1, so installing power factor correction makes an economical sense.

Some typical values:

Fluorescent Lamps uncompensated	0.5
Fluorescent Lamps compensated	<0.9
LED lamps	<0.9
Motors (pump or fan at 75% load)	0.7
Incandescent lamps (no transformer)	1.0
Refrigeration	0.7
Air Conditioning	0.7

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