

Energy Metering

The original electricity generators charged their customers by the number of light bulbs in their property, but they soon realised that a more accurate measurement of energy used would be required to optimise their return on investment. After some abortive attempts to measure energy by weighing the amount of material deposited onto electrolysis plates, the Ferraris disc was developed in 1885 and is still widely used today (those who haven't been converted to smart meters will likely have one in their property). The principle of operation is that electrical coils induce eddy currents in an aluminium disc positioned in the air gap of the coils. One coil is connected to the voltage being measured and another one is connected to the current. The phase of the voltage is shifted by 90°, and the two magnetic fields combine to produce an accelerating torque proportional to the in-phase magnitude of the voltage and current. A separate DC coil produces a braking torque on the disc proportional to speed. The result is that the speed of rotation of the disc is proportional to power, and the number of rotations is proportional to energy, which is normally recorded as kilowatt hours.

Modern electronic energy meters also measure voltage and current, but they multiply the instantaneous values electronically and sum the resulting power figure over time. Our meter works like this, but has the added advantage of measuring a number of other parameters, such as power factor, mains frequency, etc. Also, the values can be read by our programmable logic controller via an industrial serial bus called Modbus. Siemens engineers don't really approve of this standard as it was developed by an arch competitor called Allen Bradley as a rival to the Siemens sponsored Profibus standard. As a result, they make it possible but fiendishly difficult to use it in their automation systems!

Like all electricity meters, simply reversing the polarity of the current measuring device changes the power measured from a positive to a negative value (or makes the Ferraris disc spin backwards). However, like many impoverished citizens over the past 120 years, we would only resort to such measures in situations of extreme deprivation!