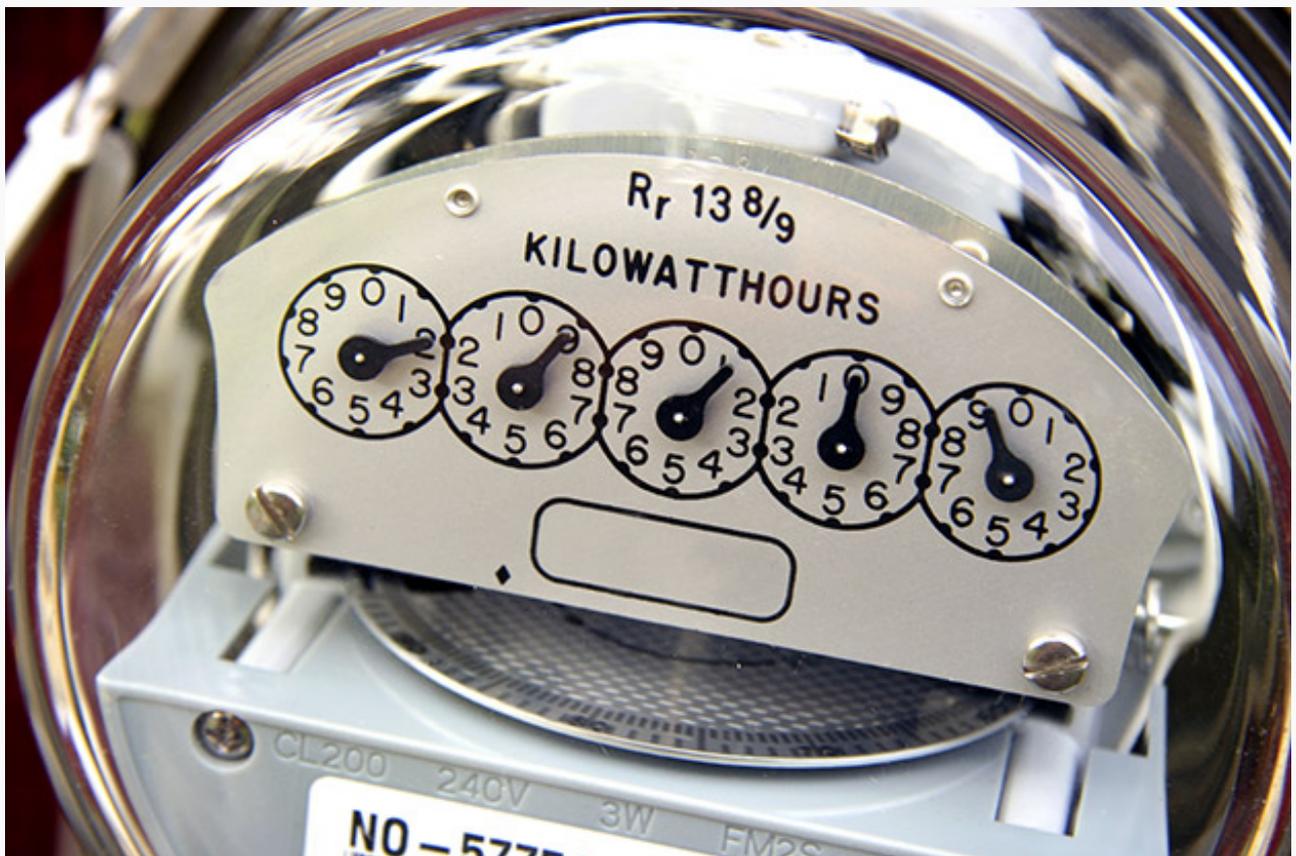# Power Measurement In a Three-Phase System

Edvard

Power Measurement In a Three-Phase System (on photo: Traditional power meter)

Wattmeter

Electrical power is measured with a *wattmeter*. A wattmeter consists of a *current coil* connected in series with load, while the other potential coil is connected parallel with load.

Depending on the strength of each magnetic field movement, the pointer gets affected.

The *true or real power* is directly shown in a wattmeter. In three-phase systems, power can be measured using several methods. For temporary measurements, a single wattmeter can be used.

However, for permanent measurements, a *three-phase wattmeter* having two elements is used which indicates both balanced and unbalanced loads.

For an unbalanced load, two wattmeters must be used as shown in the *Figure 1*.

The total power is calculated by adding the measurement readings given by the two wattmeters. With this method, the power factor can also be obtained.

When using the *two-wattmeter method*, it is important to note that the reading of one wattmeter should be reversed if the power factor of the system is *less than 0.5*. In such a case, the leads of one wattmeter may have to be reversed in order to get a positive reading. In the case of a power factor less than 0.5, the readings must be subtracted instead of being added.

The power factor of the three-phase system, using the *two-wattmeter method (W1 and W2)* can be calculated

as follows:

Since the sum and subtraction of readings are done to calculate total true power of a three-phase system, methods shown are not used practically in industry.

$$\tan\phi = \frac{1.732\left(W_1 \times W_2\right)}{\left(W_1 + W_2\right)}$$

Rather three-phase power analyzers are used which are more user-friendly.

Power Factor Meter

What's common for Beer Mug and Power Factor? Learn.

It is similar to a wattmeter in principle, only **two armature coils** are provided with mountings, on a single shaft. They are 90° apart from each other.

Both armature coils rotate as per their magnetic strengths. One coil moves proportional to the restive component of the power, while the other coil moves proportional to the inductive component of the power.

Energy Meter

This shows the **amount of power** (*electric energy*) used over a certain period. In a watthour meter, there are **two sets of windings**.

One is the voltage winding while the other is the current winding. The field developed in the voltage windings causes current to be induced in an aluminum disk. The torque produced is proportional to the voltage and current in the system.
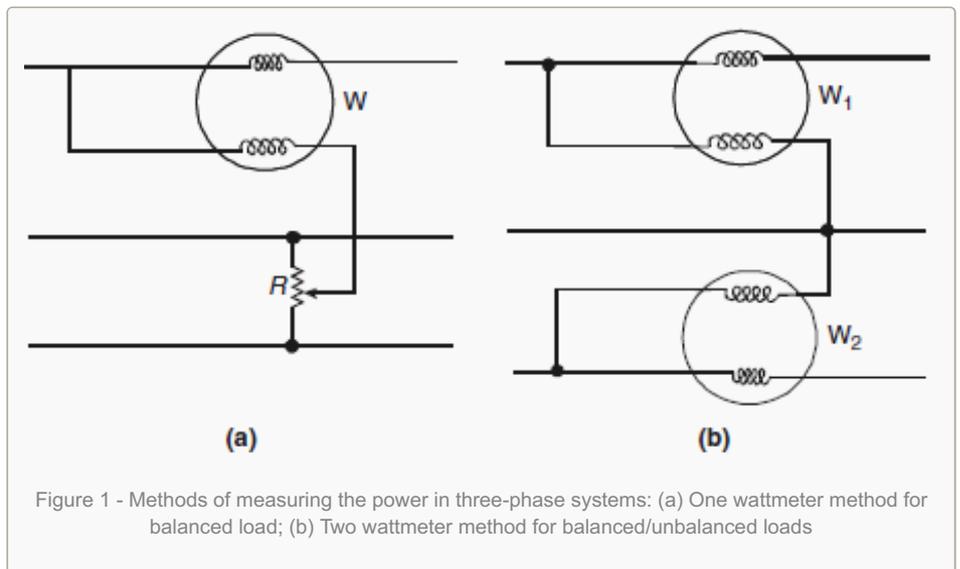

Figure 1 - Methods of measuring the power in three-phase systems: (a) One wattmeter method for balanced load; (b) Two wattmeter method for balanced/unbalanced loads

The disk in turn is connected to numeric registers that show *electric energy used in terms of kilowatt-hours*.

Reference: *Practical Troubleshooting of Electrical Equipment and Control Circuits – M. Brown*

Source:
http://electrical-engineering-portal.com/power-measurement-in-a-three-phase-system