



How is the Energy Measured in AC Circuits?

Part II

Types of Electrical Energy

Electrical energy is classified into three types: **Active Energy, Reactive Energy and Apparent Energy**. The classification is based on the type of power: **Active Power, Reactive Power and Apparent Power**

1. Active Energy is defined by following equation:

$$\text{Active Energy (kWhr)} = \text{Active Power(kW)} \times \text{Time (hr)}$$

2. ReActive Energy is defined by following equation:

$$\text{Reactive Energy (kVAhr)} = \text{Reactive Power(kVA)} \times \text{Time (hr)}$$

3. Apparent Energy is defined by following equation:

$$\text{Apparent Energy (kVAhr)} = \text{Apparent Power(kVA)} \times \text{Time (hr)}$$

Active Energy is further classified depending on direction of the power(Positive or Negative).

Active Energy

Active Energy Import

Active Energy Export

Reactive Energy

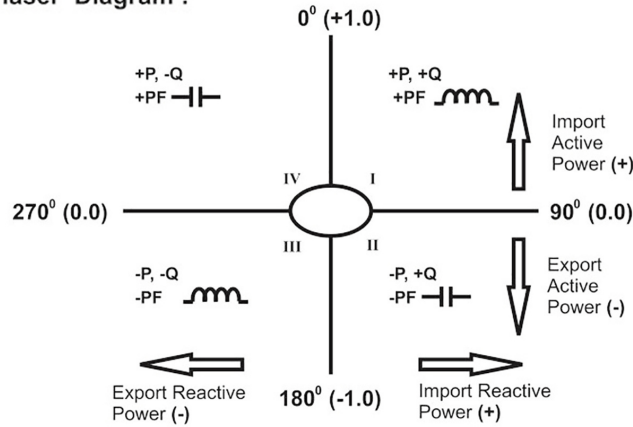
Reactive Energy Import

Reactive Energy Export

Direction of power depends on the quadrant (I,II,III or IV) in which the load is used.



Phaser Diagram :



Connections with respect to active Power	Quadrant	Sign of Active Power (P)	Sign of Reactive Power (Q)	Sign of Power Factor (PF)	Inductive / Capacitive
Import	I	+ P	+ Q	+ ve	L
Import	IV	+ P	- Q	+ ve	C
Export	II	- P	+ Q	- ve	C
Export	III	- P	- Q	- ve	L

The above diagram illustrates the direction of Active Power (P) and Reactive Power (Q) in all the four quadrants of measurement

When the sign of Active Power (P) is positive, it is called Import Active power and hence Import Active Energy. This is possible in Quadrant I and IV

When the sign of Active Power (P) is negative, it is called Export Active Power and hence Export Active Energy. This is possible in Quadrant II and III.

Similarly, when reactive Power (Q) is positive, it is referred to as import and when negative it is export.

Conclusion

To sum up, when the load consumes Active Power, Active Power is Positive and therefore called **Import Active Energy**. When the generator supplies active power, the sign of active power is negative and therefore called **Export Active Energy**