



## What Creates the “Waste” Amperage in a Power Factor?

The main cause of power factor "waste" is **equipment that creates magnetic or electric fields**. These devices temporarily store energy and then return it to the power source instead of converting it into useful work.

The biggest culprits are:

- **Electric motors** (especially induction motors)
- **Transformers**
- **Fluorescent and HID lighting with magnetic ballasts**
- **Welding equipment**
- **Large industrial inductive loads**

## Why does this happen?

Think of an electric motor.

When you plug in a motor:

1. Some electricity turns the shaft and does useful work (real power).
2. Some electricity is used to create and maintain the motor's magnetic field.

The magnetic field is like a spring:

- During part of each AC cycle, it **stores energy**.
- During the next part, it **gives that energy back** to the power source.

This back-and-forth flow of energy is called **reactive power**.

## An analogy

Imagine pushing a child on a swing.

- Part of your effort keeps the swing moving higher—that's **real power**.
- But some effort is just pushing and catching the swing as it comes back—that's like **reactive power**. Energy moves back and forth between you and the swing, but it doesn't increase the average height.

Electric motors behave similarly. Energy flows from the power source into the motor's magnetic field and then back again 50 or 60 times every second.

## So what is the actual "waste"?

The reactive power itself isn't wasted because most of it is returned to the source. The waste comes from the **extra current** needed to carry that back-and-forth energy.

Extra current causes:

- More heating in wires ( **$I^2R$  losses**)
- Larger voltage drops
- Increased loading of transformers and generators
- The need for thicker cables and larger electrical equipment

## Why capacitors help

Capacitors also store energy, but in an **electric field** instead of a magnetic field.

If a capacitor is installed near a motor:

- The motor takes reactive energy from the nearby capacitor instead of from the utility.
- The capacitor and motor exchange this energy locally.
- Much less reactive current has to travel through the power lines.

As a result, the utility mainly supplies the **real power** that actually does useful work.

**In short:** Motors and transformers create the need for reactive power because they require magnetic fields to operate. The "waste" isn't the reactive energy itself—it's the extra current needed to move that energy back and forth through the electrical system, which increases heating and reduces the capacity of the power network.