\[ \text{Real Power} \quad KW \quad \text{(purely resistive load)} \]

\[ \text{Power Factor} \]

\[ \text{KVA} = \text{Volts} \times \text{Amps} \times \text{KVA} \]

\[ \text{KW} = \text{KVA} \times \cos \theta \]

\[ \text{kVAR} = \text{KVA} \times \sin \theta \]

Note: Electric Company will charge a penalty if customers' power factor is too low.

Two methods:
1) Change demand based on KVA
2) Impose penalty for low power factor (typically when \( \cos \theta < 0.9 \))

How to "correct" power factors?
Add some capacitance to "pull" the real KVA back toward the real axis.
\[ \text{KW} = \frac{V \cdot A \cdot N_p \cdot \text{PF}}{\text{KVA} \cdot \cos \theta} \]

\[ \text{KVAR} = \text{KVA} \cdot \sin \theta \]

\[ \text{KVAR} = \frac{\text{KW} \cdot \sin \theta}{\cos \theta} \]

\[ \cos \theta = 0.82 \]

\[ \theta = \cos^{-1}(0.82) \]

\[ \sin \theta = \_ \]

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**Power Factor vs. % Amps**

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**Lighting Systems**

**Industrial Lighting**

High Intensity Discharge (HID)

- Mercury Vapor: White Light
- Sodium: Yellowish light
- Metal Halide: White light

**Efficacy of lighting - Lumens/Watt**

Sodium lights have highest efficacy of all types

Fluorescent lighting is becoming very popular for industrial applications

> T-12

> T-8

> T-5

Number of \( \frac{1}{8} \)" Diameter of bulbs