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🗂️ EN · العربية

PRACTICAL LIGHTING KNOWLEDGE

Power *factor*

The watt you pay for vs the watt that lights the room, and the 0.9 line on your driver datasheet.

Paying for watts you never use?

A low power factor means part of the current you draw does no work. It just heats the wires, and the utility bills you for it.

DEFINITION · 1 OF 2

kW

Real power. The watts that **do the work.**



It lights the lamp, **turns the motor,**
heats the room. The useful part.

DEFINITION · 2 OF 2

kVA

Apparent power. The total current
the wire must carry.



kW plus reactive power (kVAR) that **shuttles back and forth** doing no work.



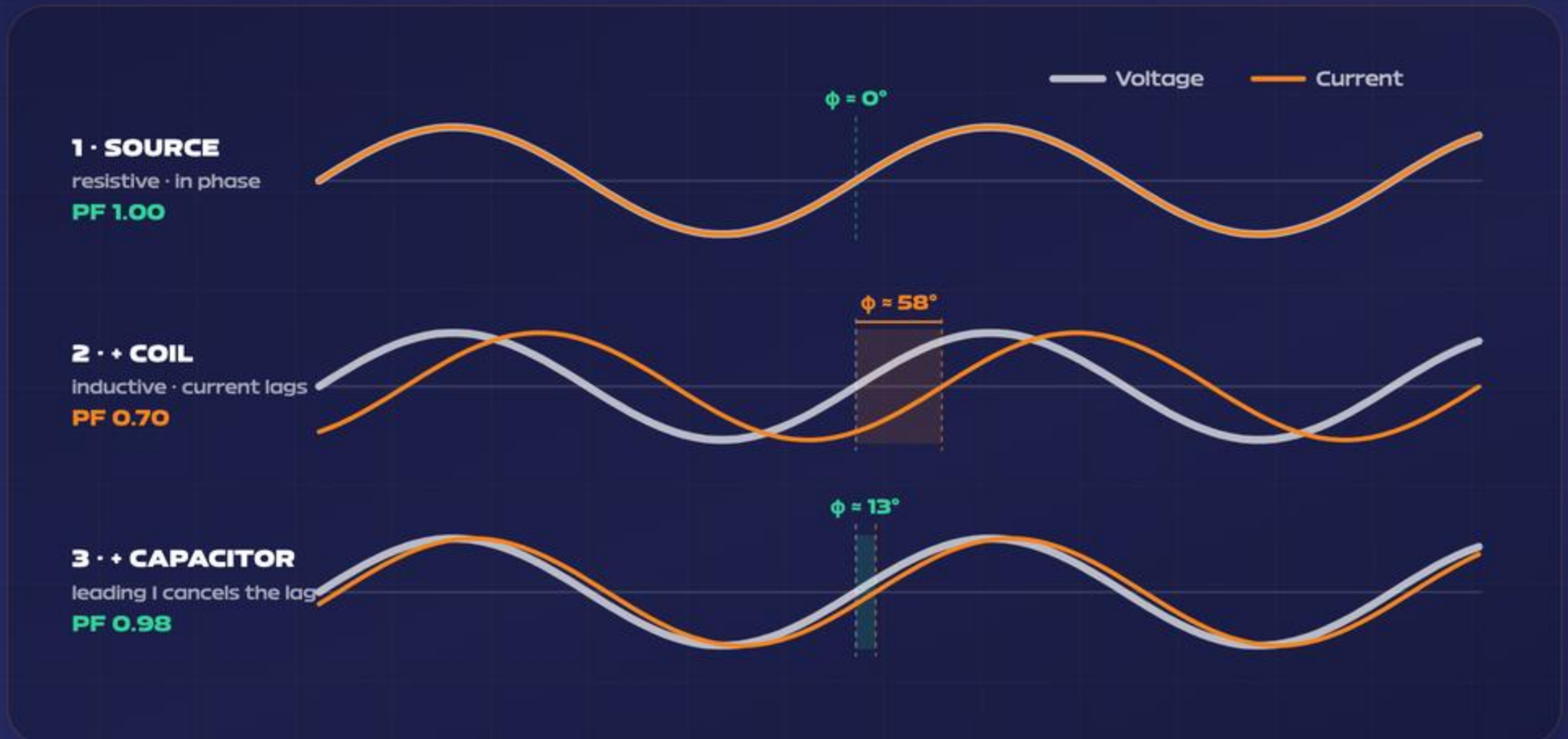
THE RELATIONSHIP

$$\text{PF} = \frac{\text{kW}}{\text{kVA}} = \cos \phi$$

A PF of 0.95 means 95% of the current you draw does real work. The other 5% just heats the wires.

THE MECHANISM

A coil drags it down.
A capacitor pulls it back.



Inductive loads, motors, drivers, ballasts, push current to **lag** the voltage, so PF falls. A **capacitor bank** feeds leading current that cancels the lag, and PF climbs back toward 1.0.

Three takeaways to keep.

Same 100 W of real work. The kVA the grid (and SEC) sees depends entirely on power factor.

ACTIVE PFC

The modern
project default

0.95

PF · $\approx 105\%$ kVA

BARE LED DRIVER

Looks capacitive
to the grid

0.70

PF · $\approx 143\%$ kVA

VERIFY ON SITE

Cheap drivers drift
under load

< 0.9

PENALTY ZONE

PF numbers you can screenshot.

kVA drawn per 100 W of real power. SEC bills large customers on kVA, not just kWh.

1.00 · ideal, resistive

100% kVA

0.95 · active PFC driver

≈ 105% kVA

0.90 · good LED driver, SEC line

≈ 111% kVA

0.85 · passive PFC, surcharge

≈ 118% kVA

0.70 · uncorrected LED

≈ 143% kVA



The common spec mistake.

Reading PF as displacement angle alone. LEDs add **harmonic distortion**, so a 0.95 displacement driver with bad THD can read **0.80 true power factor**.

NEXT TIME YOU SPEC A DRIVER

Demand $PF > 0.9$, then verify it.

Write the threshold into the spec. Then measure at install with a power-quality analyser, not a clamp meter. If your supplier cannot share the data, that is the answer.

- ✓ True power factor under load, not just displacement
- ✓ THD and per-phase data at commissioning
- ✓ Active PFC across the full dimming range



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