kVAh Billing: Bill Saving from Power Factor Improvement

Monthly kVAh drawn and bill under kVAh billing at the present and an improved power factor, the saving, and the capacitor kvar needed at the average load.

Method: Apparent-energy billing

Input parameters

Unit system: SI

Parameter	Value	Unit
Monthly energy (kWh)	150,000	
Present average power factor	88.000	%
Improved power factor	99.000	%
Tariff per kVAh	8.5000	
Average load	300.00	kW

Calculated results

Parameter	Value	Unit
kVAh at present power factor	170,455	
kVAh at improved power factor	151,515	
Present bill	1,448,864	
Monthly saving	160,985	
Capacitor size at the average load	119.18	kvar

Notes for this case

• Under kVAh billing every unit of reactive energy is paid for: kVAh = kWh/pf. Leading power factor counts as lagging under most kVAh tariffs, so avoid over-compensation at light load; use automatic capacitor banks.

Formula and method

$$E_S = \frac{E}{pf}, \quad \Delta B = cE\left(\frac{1}{pf_1} - \frac{1}{pf_2}\right), \quad Q_c = P(\tan\varphi_1 - \tan\varphi_2)$$

Variables

E	Monthly energy (kWh)	-
pf_1	Present average power factor	-
pf_2	Improved power factor	-
c	Tariff per kVAh	-
P	Average load	W
$E_{S,1}$	kVAh at present power factor	-
$E_{S,2}$	kVAh at improved power factor	-
B_1	Present bill	-
ΔB	Monthly saving	-
Q_c	Capacitor size at the average load	var

Method and standards

kVAh billing.

Assumptions and limits

- Average power factor over the month.

References

Apparent-energy billing

Report details

Report reference	FCC-M8HF-4W52 (the same inputs always give the same reference)
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Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/electrical/power/kvah-billing-power-factor-saving

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.