Energy-Efficient Motor: Saving and Payback

Power and energy saved by replacing a motor with a more efficient one at the same output, the yearly cost saving and the simple payback.

Method: Input-power difference at equal output; Bureau of Energy Efficiency; ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Shaft output (load)	22.000	kW
Efficiency of the existing motor at this load	89.000	%
Efficiency of the new motor at this load	93.500	%
Running hours per year	6,000.0	h
Electricity price per kWh	8.0000	
Price of the new motor (or extra cost)	150,000	

Calculated results

Parameter	Value	Unit
Input power saved	1.1897	kW
Energy saved per year	7.1381	MWh
Cost saved per year	57,105	
Simple payback (years)	2.6267	

Notes for this case

• For the same shaft output the input power is P/η, so a better motor saves P(1/η₁ − 1/η₂). Saving grows with running hours: replacing a motor that runs most of the year usually pays within two to three years, a lightly used one may never pay. Compare efficiencies at the actual load (efficiency of an old or rewound motor is often a few points below its nameplate), and note that a high-efficiency motor runs slightly faster, which raises the load on fans and pumps.

Formula and method

$$\Delta P = P\left(\frac{1}{\eta_1} - \frac{1}{\eta_2}\right), \quad \Delta C = \Delta P t\, c, \quad t_{pb} = \frac{C_m}{\Delta C}$$

Variables

P	Shaft output (load)	W
η_1	Efficiency of the existing motor at this load	-
η_2	Efficiency of the new motor at this load	-
t	Running hours per year	s
c	Electricity price per kWh	-
C_m	Price of the new motor (or extra cost)	-
ΔP	Input power saved	W
ΔE	Energy saved per year	J
ΔC	Cost saved per year	-
t_{pb}	Simple payback (years)	-

Method and standards

Motor payback.

Assumptions and limits

- Same shaft output; constant tariff.

References

Input-power difference at equal output, Bureau of Energy Efficiency, Energy Efficiency in Electrical Utilities (Guide Book 3)

Report details

Report reference	FCC-QBRB-5J9Q (the same inputs always give the same reference)
Generated	23 November 2026, 18:18 UTC
Calculator	Energy-Efficient Motor: Saving and Payback
Method last reviewed	17 November 2026
Software release	FireCAD Calc, release of 22 November 2026
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/motors/energy-efficient-motor-payback

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.