UPS Efficiency: Losses, Cooling and Yearly Cost

Power lost in a UPS at a load and efficiency, the extra cooling energy to remove it, and the yearly cost, compared between two UPS efficiencies.

Method: UPS loss and cooling energy balance

Input parameters

Unit system: SI

Parameter	Value	Unit
IT or critical load	60.000	kW
Efficiency of UPS 1 at this load	92.000	%
Efficiency of UPS 2 at this load	96.000	%
Cooling system COP (0 = no cooling)	3.0000	
Hours per year	8,760.0	h
Electricity price per kWh	8.0000	

Calculated results

Parameter	Value	Unit
Loss of UPS 1	5.2174	kW
Loss of UPS 2	2.5000	kW
Yearly energy (loss plus cooling), UPS 1	60.939	MWh
Yearly energy (loss plus cooling), UPS 2	29.200	MWh
Cost saved per year with UPS 2	253,913	

Notes for this case

• A UPS that delivers P at efficiency η draws P/η, losing P(1/η − 1) as heat in the UPS room; air conditioning then spends that heat divided by its COP to remove it. Efficiency depends strongly on load: double-conversion UPSs are least efficient at light load, which is where many run with redundancy. Use efficiencies at the real load, and eco or line-interactive modes where the application allows.

Formula and method

$$P_L = P\left(\frac{1}{\eta} - 1\right), \quad E = P_L\left(1 + \frac{1}{COP}\right)t$$

Variables

P	IT or critical load	W
η_1	Efficiency of UPS 1 at this load	-
η_2	Efficiency of UPS 2 at this load	-
COP	Cooling system COP (0 = no cooling)	-
t	Hours per year	s
c	Electricity price per kWh	-
P_{L1}	Loss of UPS 1	W
P_{L2}	Loss of UPS 2	W
E_1	Yearly energy (loss plus cooling), UPS 1	J
E_2	Yearly energy (loss plus cooling), UPS 2	J
ΔC	Cost saved per year with UPS 2	-

Method and standards

UPS losses.

Assumptions and limits

- Constant load and efficiency.

References

UPS loss and cooling energy balance

Report details

Report reference	FCC-1CTT-0D8T (the same inputs always give the same reference)
Generated	23 November 2026, 18:08 UTC
Calculator	UPS Efficiency: Losses, Cooling and Yearly Cost
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/batteries-ups/ups-loss-cost

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.