Time-of-Use Tariff: Saving from Shifting Load

Yearly saving from moving energy from peak to off-peak hours under a time-of-use tariff, allowing for storage losses and any demand-charge reduction.

Method: Time-of-use tariff arithmetic with storage round-trip efficiency

Input parameters

Unit system: SI

Parameter	Value	Unit
Energy shifted per day (at the load)	500.00	kWh
Peak energy rate per kWh	11.000	
Off-peak energy rate per kWh	6.0000	
Round-trip efficiency (1 for moving the process itself)	100.00	%
Reduction in billed maximum demand	100.00	kW
Demand charge per kW per month	350.00	
Days per year shifted	300.00	

Calculated results

Parameter	Value	Unit
Energy saving per day	2,500.0	
Energy saving per year	750,000	
Demand charge saving per year	420,000	
Total saving per year	1,170,000	
Break-even efficiency (below this, shifting costs money)	54.545	%

Notes for this case

• Each kWh moved out of the peak saves the peak rate but costs the off-peak rate for the energy needed to replace it; with storage (batteries, chilled-water or ice tanks, hot-water tanks) the losses raise that to E/η. Shifting pays only if the round-trip efficiency is above the ratio of off-peak to peak rates. If shifting also lowers the billed maximum demand, the demand charge saving is often larger than the energy saving.

Formula and method

$$\Delta C_e = E\,c_p - \frac{E}{\eta}\,c_o, \quad \Delta C = n\,\Delta C_e + 12\,\Delta P\,c_d$$

Variables

E	Energy shifted per day (at the load)	J
c_p	Peak energy rate per kWh	-
c_o	Off-peak energy rate per kWh	-
η	Round-trip efficiency (1 for moving the process itself)	-
ΔP	Reduction in billed maximum demand	W
c_d	Demand charge per kW per month	-
n	Days per year shifted	-
ΔC_e	Energy saving per day	-
$\Delta C_{e,y}$	Energy saving per year	-
$\Delta C_{d,y}$	Demand charge saving per year	-
ΔC	Total saving per year	-

c_o/c_p	Break-even efficiency (below this, shifting costs money)	-

Method and standards

Time-of-use.

Assumptions and limits

- Constant tariffs; same energy at the load.

References

Time-of-use tariff arithmetic with storage round-trip efficiency

Report details

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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/time-of-use-load-shifting

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.