

Ups efficiency vs load

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The efficiency of a UPS (uninterruptible power supply) is defined as the ratio between the output electrical power and the input electrical power. For example, in a UPS with 97% efficiency, 97% of the input electrical power is used to power the load (at the UPS output) while 3% is absorbed by the UPS and lost in thermal dissipation.

The average static double-conversion UPS system operates between 90% efficient at 30% load to about 94% efficient at 100% load. The efficiency percentage can go up or down a little depending on the technology used, and whether the UPS contains an input isolation transformer.

A large UPS running a small load (40%, for example) may only be 85% efficient. When comparing UPS systems and calculating UPS efficiency, there are two things you need to keep in mind: UPS systems have different efficiency rates; UPS efficiency differs, depending on the load level; The energy efficiency of a UPS system is influenced ...

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For a UPS, higher efficiency equates to lower losses of electrical energy in terms of heat output – low efficiency UPS often require more air conditioning to help keep ambient temperatures safe.

Even a 1% or 2% improvement in operating efficiency can add to up substantial energy costs over the full service life of a UPS (i.e. approximately 10 years), particularly for larger systems with higher power ratings. However, in any discussion about UPS efficiency, it's worth keeping two things in mind:

The efficiency ratings that UPS manufacturers publish are based on running in online operating mode with a 100% fully-rated load. But as the load reduces, so too does UPS efficiency. As an example, a UPS running at 20-25% load may only be capable of 85% efficiency.

Efficiency is particularly important with parallel-redundant installations, as any inefficiencies arising from individual UPSs that are under-loaded will be exacerbated at scale. This can be a major issue with many legacy installations, where UPS often run at less than 50% of their rated capacity.

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In general, UPS efficiency has improved significantly over recent years thanks to a series of technological advances, principally the development of transformerless UPS systems like Riello UPS's Sentryum, Multi Sentry, and NextEnergy ranges.

The difference in operating efficiency between modern transformer-free UPS and the older transformer-based UPS designs can be as much as 5-6%, although this divergence is less for the latest transformer-based models. Transformerless UPS have a flatter efficiency curve too, meaning that many versions can achieve high efficiency (>95%) at 25% load all the way through to full load.

Running the UPS in its dedicated energy-saving mode, commonly known as ECO mode, can boost efficiency to 98-99%. It achieves this by in effect operating as a line-interactive UPS, so the load is powered by the bypass line with the inverter inactive but ready to take over if there's a mains supply failure or fluctuation.

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