Electrical Review suppliersguide

section 10: UPS / Standby Power

DOWNTIME. The dreaded D-word that strikes fear into the hearts of data centre operators the world over. Avoiding downtime is pretty much the aim of the game, as surges, sags and general power problems can (and will) have devastating effects to an organisation.

No one is immune from an outage, and with downtime costing an average of £5,000 per minute, it is probably wise to have a UPS system in place you can rely on, ready to plug the gap should the worst happen.

But while your UPS is undoubtedly a critical lifeline, there is no question this technology comes with a hefty energy bill. Energy efficiency is an increasing priority, but unfortunately if you want efficiency, it usually means having to sacrifice availability. Giovanni Zanei of Vertiv explores how you can improve the efficiency of your system, without the once inevitable availability trade-off.

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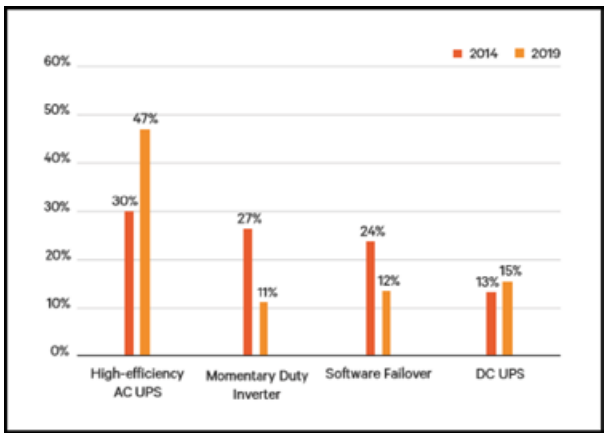
The efficiency trade off

Want to improve the efficiency of your UPS system without having to sacrifice on availability? Giovanni Zanei, senior director, global large power offering at Vertiv, discusses how this can be achieved – without having to rely on ECO Mode.

IN OUR ALWAYS on and connected world, there is an increasing expectation that online services – from Netflix to business email – will just work.

One way to ensure that consistent uptime and availability is through the use of UPS technology. UPS systems provide clean power to electronic devices such as computer networks and servers, building management and security systems. UPS also protects against power outages which could potentially lead to a halt in operations, a loss of information, productivity and profit for businesses.

According to Vertiv's recently released *Data Centre 2025* report, in terms of protecting the availability of data centre services, AC UPS systems continued to be the strategy of choice for survey participants, growing from 30% in 2014 to 47% in 2019.



However, while UPS provide resiliency, they also come with an energy cost. Given that most organisations are also focused on improving energy efficiency, and lowering carbon emissions, controlling energy costs, and thus the energy efficiency, is an increasing priority.

The energy efficiency of a UPS is the ratio between the power entering the UPS and the power exiting the UPS to supply the load. Whenever current passes through the internal components of a UPS, a certain amount of energy is dissipated as heat, which results in energy losses.

Additional energy is also consumed when air conditioning systems operate to sustain the ideal environmental temperature of the installation. Whilst a certain amount of energy loss is inevitable, it is evident that the reduction of UPS power consumption and the consequent increase of its efficiency will significantly contribute to lowering excess energy waste, maximising the overall running cost-saving of the energy bill.

The savings generated by increased UPS efficiency extrapolated over 24 hours a day, 365 days a year over a five-year period, would not only exceed the purchase price of a UPS but also actively contribute to reducing CO2 and other global warming emissions, ensuring the lowest environmental impact of the chosen power protection solution.

> Controlling energy costs, and thus the energy efficiency, is an increasing priority

Double-conversion mode

Nowadays, the most common UPS mode of operation used for supplying secure power to data centres is double conversion mode, which ensures a Voltage and Frequency Independent (VFI) type of operation by providing the highest level of power quality to the load at all times.

At the same time, as there are two stages of power conversion, this is also the mode of operation that consumes the largest amount of energy. Even when considering a double conversion UPS, there are significant differences in terms of double conversion efficiency: legacy UPS may operate with 93% efficiency when operating in double conversion mode, while the highest efficiency present-day UPS can achieve levels approaching 97%.

Pros and cons of eco-mode UPS

To further increase efficiency, most UPS manufacturers have introduced high energy efficiency modes of operation, such as ECO mode. However, most of these modes still serve as marketing hype rather than a concrete way of improving the data centre efficiency.

One would not expect the reliability of a UPS to be affected while operating in ECO Mode. In fact, in ECO mode, some of the internal components present inside the inverter and rectifier are less stressed, so the reliability of a UPS may actually increase.

On the other hand, since there is no power conditioning performed by the UPS during this mode of operation, there may be a decrease in power quality supplied to the load, thus affecting the load power availability.

It seems that the increased efficiency with ECO mode comes with drawbacks to load availability. So, is it possible to find the right balance?

Minimising the trade-off between availability and energy efficiency

Recently, new efficiency improvements have been introduced to the market. And these modes are finally contributing to reduce data centre PUEs to the minimum possible, while still maintaining the highest levels of availability.

One interesting feature comes from a combination of two deep-rooted innovations:

- Capability for the inverter to work as an active filter (VI mode), hence compensating on the reactive power of the load
- Capability for the inverter to instantaneously assume the load and maintain the output voltage within the IEC 62040 Class 1 specification 1. Hence the UPS can transfer safely from high efficiency mode (easily reaching 99% efficiency) to inverter mode with a 0-millisecond transfer (e.g. in the order of microseconds in worst case scenarios after a mains short circuit failure), thus providing complete load power protection under any input power outage condition. This is the same output performance and power quality offered in standard double conversion UPS but with 60% reduced losses.

How does it work?

The combination of these two technologies creates a Dynamic Online mode which offers an operating efficiency up to 99% without sacrificing availability to the load.

Dynamic Online mode is the latest high efficiency mode of operation offered by Vertiv with Liebert Trinergy Cube and Liebert EXL S1, developed with the understanding that many of our customers do not want to trade-off any level of reliability for incremental gains in efficiency. A UPS with Dynamic Online mode offers an operating efficiency up to 99% without sacrificing reliability.

By analysing the mains quality and adjusting the mode accordingly, the superior availability of a double conversion mode can be combined with the excellent energy cost savings of a high efficiency mode for a reduced total cost of ownership.

How businesses around the world are using this mode to improve the way they work

Analysing data received from customers already taking advantage of this Dynamic Online mode, if you compare the cost of energy dissipated by a transformer free 1 MW UPS and the same UPS using this mode, the saving on the energy bill can surpass $15,000 per year. That's equivalent to the energy required to drive 28 times around the equator using an electric car.

And just as electric cars offer a more sustainable approach for transport, new UPS technologies are helping to manage the trade-off between availability and efficiency in the IT world.

Finding the right balance ultimately depends on the specifics of the business and the applications being supported, but suppliers of UPS equipment will continue to innovate in order to give customers as much choice as possible in how they choose to balance efficiency and availability.

Super-efficient UPS in a low carbon world

In an increasingly environmentally-aware age where efficiency is almost as important as availability, Chris Cutler of Riello UPS examines the consequences for the next generation of uninterruptible power supplies.

THERE'S HARDLY A week gone by in recent months where the activists from Extinction Rebellion haven't launched their latest audacious campaign in the fight against climate change.

It's debatable whether the Government bowed to this and wider public pressure or not when it pledged to become the first major developed economy to enshrine in law a commitment to achieve net zero carbon emissions by 2050.

What's indisputable though, is that resource efficiency isn't just an optional extra or nicety for us working in the power industry any more, it's the top priority alongside system resilience.

Economic and environmental benefits

Electricity is one of the biggest operating costs an IT business has. Indeed, power and cooling typically accounts for between 40-60% of a data centre's total expenditure. Needless to say, any inefficiency quickly adds up, resulting in higher than necessary energy bills.

There are other implications too. Organisations today are compelled to comply with increasingly stringent government rules and regulations on curbing carbon emissions.

Then there are growing pressures – from shareholders, customers, and even employees – for businesses to take their environmental responsibilities seriously or face up to the consequences.

The good news is that UPS efficiency has improved significantly over the past decade or so. Advances in semiconductor technology and the introduction of IGBTs (Insulated Gate Bipolar Transistors) eliminated the need for sizeable step-up transformers, ushering in the era of transformerless UPS systems.

These types of uninterruptible power supply offer substantial efficiency improvements (around 5% higher compared against transformer-based systems). They also have a flatter efficiency curve, meaning that they are more efficient at lower loads – many transformerless UPS these days can achieve 95%-plus efficiency even at loads of just 20-25%.

> Partnering a UPS with premium batteries plus advanced communications and monitoring software transforms it into a 'virtual power plant'

And because they don't include any bulky, heat-generating transformers, they require far less energy-intensive air conditioning to keep cool, another way to keep electricity costs – and waste – down.

Efficiency isn't just about energy use

While reduced power consumption is a key characteristic of modern UPS, efficiency shouldn't just be viewed through the prism of electricity and energy use.

Resource efficiency comes in many forms, with how to most effectively utilise server room space, one of the main dilemmas data centre operators and facilities managers face.

In years gone by, UPSs were bulky, heavy, and noisy pieces of kit – the stereotypical big black industrial box in the corner of the room. Fast forward to today, and thanks to the rise of transformerless and modular systems, a UPS can deliver the same power as in decades gone by in a fraction of the footprint.

Another recent advance is that many UPS now offer easy front panel access for servicing and maintenance, eliminating the need for rear entry.

These developments offer operators greater flexibility in terms of installation (i.e. units can go right up against the wall or even back-to-back), minimising the amount of space needed for the UPS system and ensuring more room for server racks or other equipment.

From power protection to power management

As society weans itself off coal and other fossil-fuelled power generation, our electricity grid is evolving from a single over-arching entity into a dynamic and distributed network of smart grids.

With renewables and battery storage playing an increased part in keeping the nation's lights on, rather than controlling power generation to meet demand as we've done in the past, demand will be controlled in real-time to meet the supply. Energy users will be producers too, with electricity flowing in both directions as they feed power back into the grid.

This calls for a rethink of the role of

uninterruptible power supplies and a move away from just power protection to a wider emphasis on power management.

Partnering a UPS with premium batteries plus advanced communications and monitoring software transforms it into a 'virtual power plant' capable of demand side response, helping to support the wider energy network, cut energy bills, and even earn revenue by selling surplus electricity back to the grid.

The next generation of super-efficient UPS

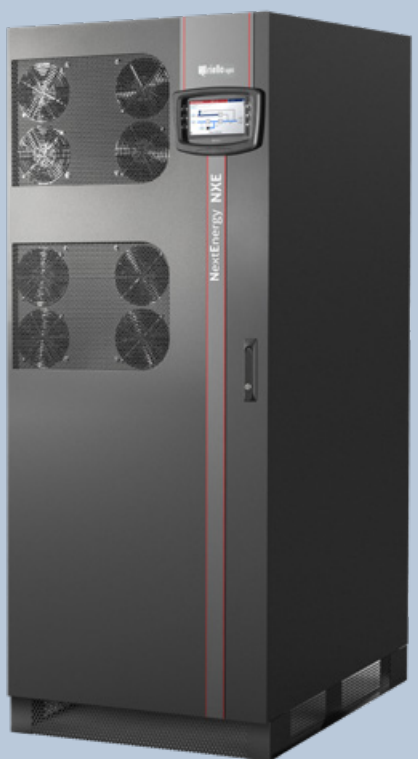
One uninterruptible power supply that combines all three of these qualities is the new and improved NextEnergy (NXE) series.

First introduced in 2017 with 250 kVA and 300 kVA versions, a 400 kVA model followed earlier this year. This expansion was accompanied with a raft of upgrades, one of which has seen the footprint of the NXE 250 reduced by a third (0.68m2 compared with the original's 1.02m2).

The three-phase, transformer-free NextEnergy series delivers unity power factor and TÜV-certified operating efficiency up to 97%. It incorporates a whole host of energy saving features including an Efficiency Control System (ECS) that optimises the performance of parallel installations according to the load and redundancy.

Because the NXE has a slightly higher operating efficiency at, for example, 50% load than at 20%, in an installation with four 300 kVA units, the ECS will automatically choose to run just two of the units at 50% load (96.6% efficiency) rather than having all four operating at 20% (95% efficiency). This equates to a 16% reduction in wasted electricity.

The NextEnergy also offers a choice of eight operating modes, including the maximum protection of Online, an ECO mode which offers up to 99% efficiency when carrying less sensitive loads, Voltage Stabiliser for power conditioning, and a brand new Active ECO mode.



This latter function performs as an active filter that reduces harmonics and eliminates the need for any power factor correction, meaning it offers higher availability than ECO mode but at a higher efficiency (98.5%) than Online, the ideal middle ground.

In addition, the NXE features forced front-to-top smart ventilation and complete front panel maintenance access, which eliminates the need for rear clearance. This allows for installation in virtually any configuration (against the wall, in a corner, side-to-side, back-to-back) so facilities managers can easily make the best use of their floorspace.

This versatility stretches to the fact that the NextEnergy doesn't require a neutral connection, so can work with either a three or four-wire distribution system.

Thanks to its combination of exceptional performance and efficiency, the entire NXE range has earned a place on the Energy Technology List (ETL). This is a government scheme that encourages businesses to buy 'best in class' energy efficient products by enabling them to offset 100% of the cost against their taxable profits. It secured inclusion on the list after exceeding strict energy efficiency thresholds across a range of load ratings.

Just another reason why the NXE is the next generation of modern, efficient UPS.

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Vertiv brings together hardware, software, analytics and ongoing services to ensure its customers' vital applications run continuously, perform optimally and grow with their business needs. Vertiv solves the most important challenges facing today's data centres, communication networks and commercial and industrial facilities with a portfolio of power, cooling and IT infrastructure solutions and services that extends from the cloud to the edge of the network. Headquartered in Columbus, Ohio, USA, Vertiv employs around 20,000 people and does business in more than 130 countries. For more information, and for the latest news and content from Vertiv, visit Vertiv.com.

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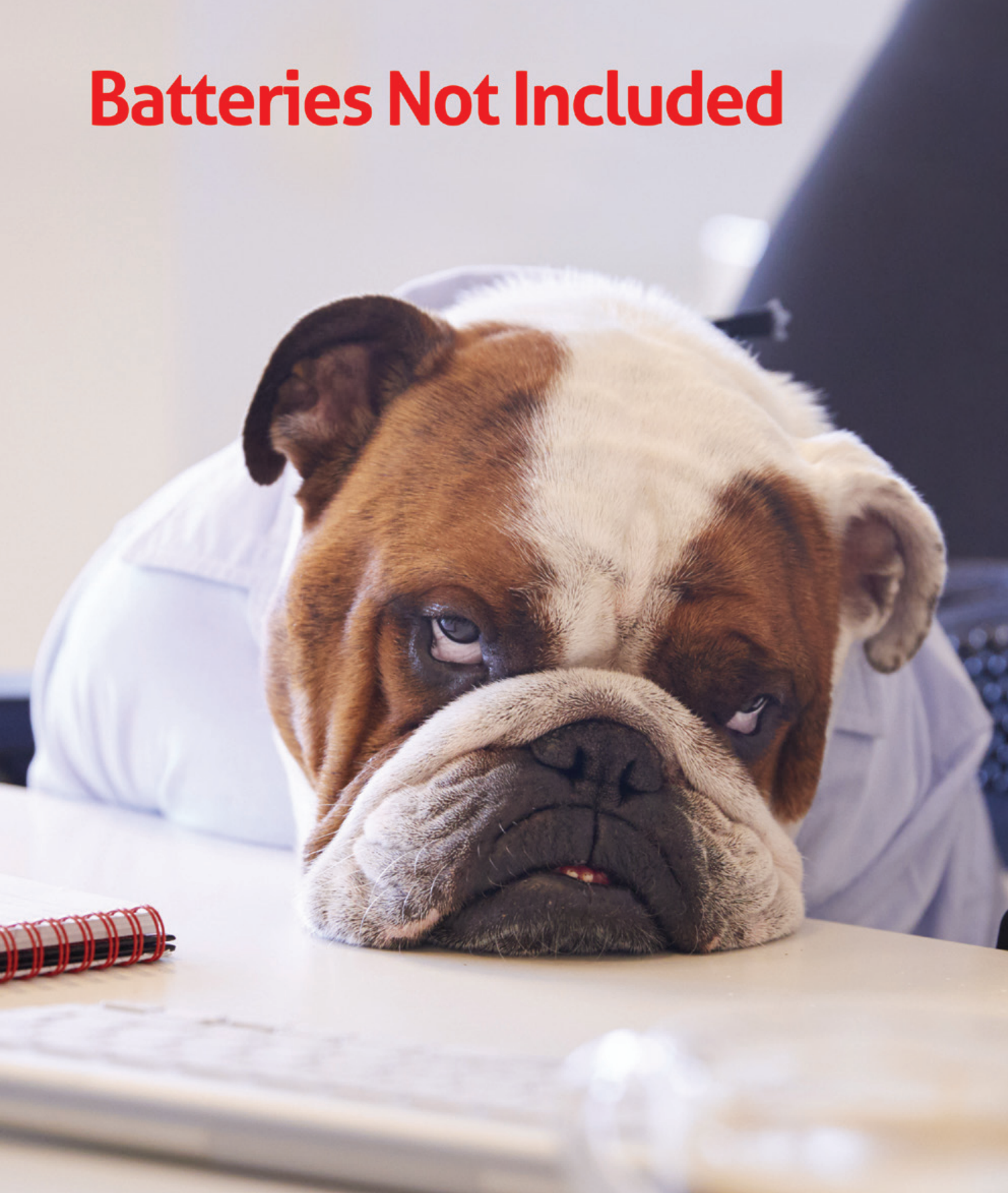

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