

Application note

Assessing the total cost of ownership of UPS batteries

Understanding the total cost of ownership of your UPS battery can prevent downtime, thereby saving time and money.

Whether you are a consultant, planner, facility manager, end-user or original equipment manufacturer (OEM), when selecting an uninterruptible power supply (UPS), it is essential to consider the total cost of ownership (TCO) of the battery used as back-up. By investing in reliable, long-life and easy to install batteries, lower TCO can be achieved.

Yet rarely are battery investments and running costs discussed; despite these having one of the biggest impacts on the overall operating costs of the UPS. By considering the TCO of a battery installation and NOT just the initial purchase cost, savings in operating costs of up to 37% can be achieved.

Use of UPS batteries

UPS batteries are primarily short-term to medium-term sources of stored energy. Batteries can support a critical load for seconds or minutes. System capacity can be increased by adding more battery strings. While batteries are not the primary source of backup power, they usually support the load until an alternate source of power is available, such as a standby generator.

Factors affecting TCO

High performance and long service life are important factors that combine to result in a significantly lower TCO. Only the TCO represents the true value of owning a battery.

Considering and controlling each of the following results in lower overall TCO for UPS users:

- High performance
 - Look for batteries with a high-rate discharge capability that sustains stable performance for a long service term.
- Maximum reliability
 - Higher battery reliability can be achieved through:
 - resilience to high operating temperature.
 - homogeneous voltage during discharge and float charge.
 - shallow voltage discharge profile maintains higher power across discharge cycle.
- Long life – battery life is affected by:
 - Temperature operating range
 - To help determine battery life in relation to temperature, remember that for every 10°C above 20°C, the life of the battery is reduced by 50 percent.
 - Battery chemistry
 - A battery's ability to store and deliver power slowly decreases over time. Premium battery chemistries like thin plate pure lead (TPPL) have high grid corrosion resistance, thereby maximising power availability across battery life.

As a consequence of the above, the following benefits include:

- Fewer replacements
- Reduced maintenance and service costs
- Lower disposal costs
- Reduced reliance on thermal management equipment

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Best batteries for UPS use

Today several sub-categories of batteries are available in the market making it difficult for users to make the right and best choice, see table below.

Datacentre applications predominantly use valve regulated lead-acid (VRLA) batteries. These operate on the principle of oxygen recombination which minimises the water loss during recharge. As such the battery's are a maintenance-free solution compared to vented wet cells which need to be periodically topped up with water.

Based on the same electrochemical process found in standard lead-acid battery technologies, TPPL batteries utilise very thin plates made of 99.99% "pure" lead, lead dioxide and electrolyte, held in an absorbed glass mat (AGM) between the plates.

High purity of materials allows for a more efficient chemical reaction resulting in higher energy densities than standard lead-acid batteries can provide.

Coupled with very low internal resistance, the high purity of the materials used gives a significant reduction in the float current required to maintain full charge, compared to standard VRLA designs. This reduces energy consumption.

The TPPL technology, used in PowerSafe® SBS® EON Technology®, has an outstanding reputation for longer storage and service life. It is also renowned for its lower energy consumption and maintenance costs, leading to lower operating expense compared with standard VRLA batteries.

Determining, predicting and measuring TCO

It is often thought that the lower the purchase cost, then the lower the TCO. However, much more benefit can be gained by considering the operating costs. Consideration must be given to maintenance needs, service intervals and life expectancy.

Here we provide ways to determine, predict and measure the TCO for a lead-acid battery used within a UPS. When deciding to invest in a battery it is important to measure the TCO in order to predict how the investment will be paid back.

Total cost of investment of a battery for a UPS system depends on:

- Capital cost
 - Initial investment
- Rack or cabinet installation cost
 - Installation
- Operating cost
 - Maintenance
 - Energy consumption

	VRLA AGM-lead calcium	VRLA AGM	VRLA AGM TPPL	Flooded lead-acid
	<i>DataSafe® HX</i>	<i>PowerSafe® V-FT</i>	<i>PowerSafe® SBS® EON Technology®</i>	<i>Flooded</i>
Design life (float mode at 20°C)	10 years	12 years	15 years	15 years
Operating temperature range	-30°C to +45°C	-30°C to +45°C	-40°C to +50°C	-10°C to +45°C
Storage time (at 20°C)	6 months	6 months	24 months	3 months



- Spare parts stock, logistics and handling
- Training cost of maintenance personnel
- Temperature management

Initial investment cost:

Within the lead-acid battery family, technological advances have moved lead-acid from simple flooded types to VRLA and TPPL. Purchase price is not, however, the only deciding factor when considering overall costs.

There are additional long-term costs to consider and here we show the differences between the various lead-acid options so that they can be judged individually.

Rack or cabinet installation cost:

Batteries are often installed in cabinets next to a UPS but can also be set up in racks or on shelves in dedicated battery rooms.

Operating cost:

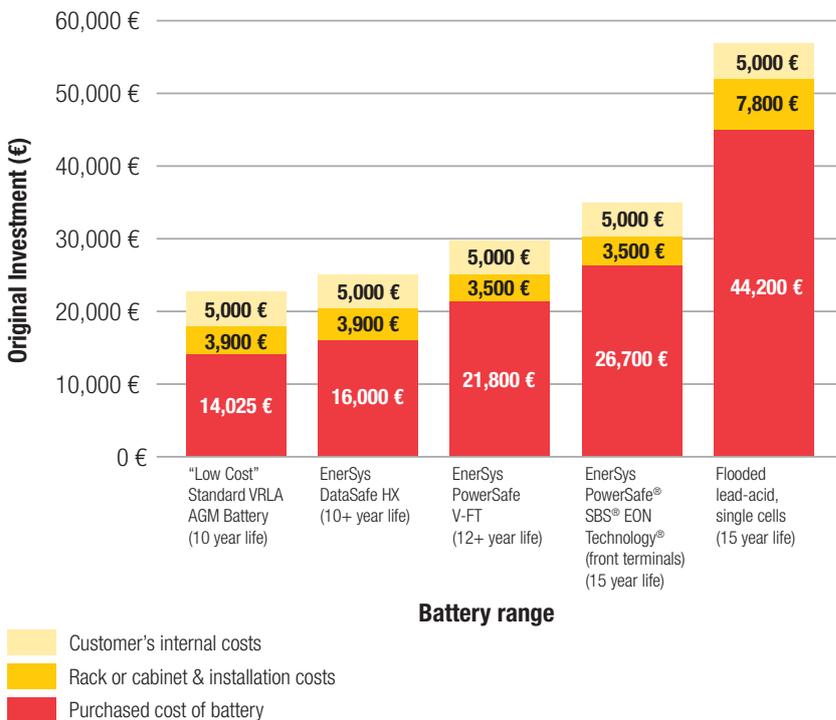
Keeping a battery operational incurs annual maintenance and service costs. Battery service and maintenance are critical to UPS reliability and safety. Periodic inspection and maintenance increases the overall system reliability. For example, ensuring connections are tight and identifying weak blocks, avoids failure to deliver back-up power.

Customer's internal costs

The time spent by customers in evaluating, designing, transporting, installing and commissioning, procuring, downtime and supervision of the installation by their own staff, needs to be taken into consideration.

Initial investment in a battery for a typical UPS application

Cost comparison of various lead-acid battery ranges; 15 minutes, 300 kVA.



Impact of TCO on battery types used in a UPS

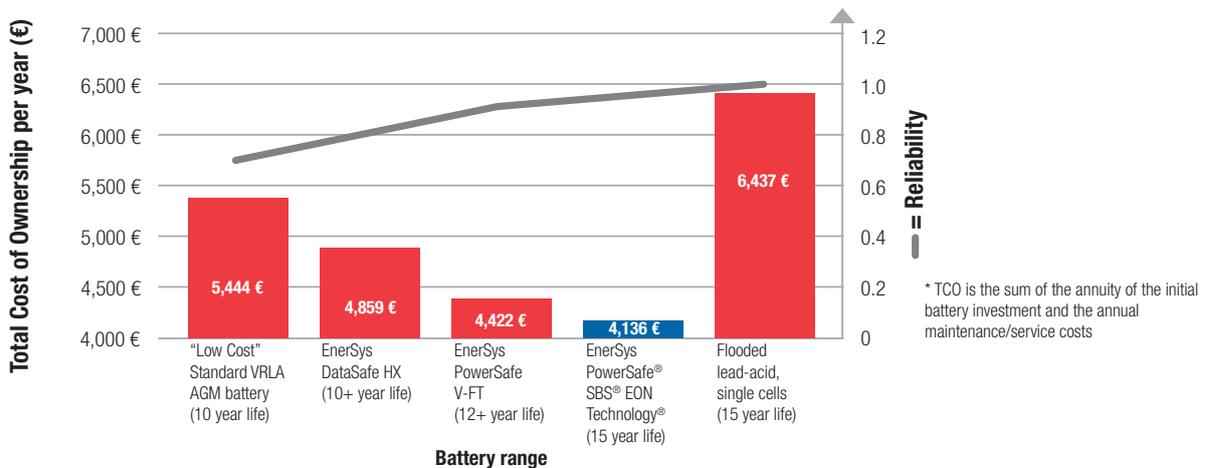
Based on the above criteria, a comparison can now be made between the annual costs over the lifetime against the original investment. The TCO is the sum of the initial battery investment and the annual operating costs.

The following assumptions are made:

Calculation assumptions					
Battery type	"Low Cost" Standard VRLA AGM battery	EnerSys DataSafe® HX	EnerSys PowerSafe® V-FT	EnerSys PowerSafe® SBS® EON Technology®	Flooded lead-acid, single cells
Average service life of battery (in years)	6	7	9	11	12
Maintenance cost per year	500 euro	500 euro	400 euro	400 euro	800 euro
Replacement costs per year as a % of original investment	4%	2.5%	1.5%	1%	1%
Replacement costs per year	1,122 euro	800 euro	654 euro	534 euro	884 euro

Battery's annual total cost of ownership in a typical UPS application *

Cost comparison of various lead-acid battery ranges



Summary

The main factors affecting the total cost of ownership (TCO) of a UPS battery system are initial investment costs, rack or cabinet installation costs and operating costs such as energy consumed, maintenance, spare parts stock, logistics, handling and training.

brings nearly the same reliability as the flooded lead-acid option but at the fraction of the TCO. TPPL offers a long life, resilience to corrosion and sustains a stable performance throughout the service life.

Investing in a TPPL battery, such as PowerSafe® SBS® EON Technology®, offers the best value TCO. Such an investment

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