TCO IN eGSE

In today's industrial landscape, increasingly geared towards sustainable choices in line with the European Green Deal, the shift from internal combustion to electric vehicles has become a strategic priority for the entire airport sector. Elisabetta Orlandi, Business Development Manager, at Flash Battery explains more.

The push for zero-emission solutions now extends to every area of ground support equipment (GSE): from GPUs to tow tractors, from pushbacks to beltloaders, not to mention PRM platforms and passenger stairs.

Nonetheless, the higher initial cost of lithium batteries still represents a barrier for many manufacturers and operators in the sector. But how significant is this cost over the long term? To answer that, it's necessary to look beyond the purchase price and analyse a key parameter — TCO or Total Cost of Ownership — an indicator of the overall economic value of an investment.

TCO makes it possible to objectively and comprehensively assess the true economic impact of an investment over the entire life cycle of the vehicle, considering not only the initial price but also all fixed and variable costs related to use and maintenance. These include purchase price, maintenance costs, energy or fuel expenses, downtime and productivity and the impact of grants and incentives linked to electric conversion.

With over 12 years of experience, more than 25,000 lithium batteries supplied to the industrial sector and 700 customised models distributed across 42 countries, Flash Battery has conducted an in-depth analysis of a real ground support equipment application, demonstrating how TCO calculations are an essential tool for making investment decisions that are genuinely informed and sustainable. The goal? To move beyond the logic of upfront costs and embrace a long-term vision where efficiency, sustainability and economic value converge.

Flash Battery case study

Flash Battery, one of the leading players in the energy transition for electric vehicles, carried out an in-depth Total Cost of Ownership (TCO) analysis on a real case in the airport sector, assessing overall costs over a ten-year period. The study examined three key factors: initial investment, maintenance expenses and energy balance (or fuel cost), comparing three different power sources – diesel, lead-acid and lithium.

As expected, the initial investment for a vehicle equipped with a lithium battery (€38,000) is higher than for an internal combustion or lead-acid vehicle (€30,450). Lithium requires a higher upfront outlay, but as the data shows it's the entire life cycle that completely changes the perspective.

For instance, maintenance is the factor that weighs most on overall TCO. A diesel vehicle requires about €25,200 in maintenance over ten years, a lead-acid version €22,200, while lithium drops to just €100.

Lithium electric vehicles need minimal servicing thanks to the absence of complex mechanical components or wear parts typical of combustion engines, such as filters, oils or exhaust systems.

By contrast, lead-acid batteries demand continuous maintenance: periodic water refills, cleaning of oxidised elements and complex management of charging infrastructure. The latter requires dedicated rooms, gas extraction systems and water demineralisation plants, all with a significant economic and operational impact.

Finally, the energy balance completes the analysis. Over the long term diesel is the most expensive cost item, reaching €77,000 compared with €12,350 for lead-acid and just €9,580 for lithium. The reason is twofold: the greater efficiency of electric systems (which convert 80% of energy into motion versus 30% for combustion engines) and lower cost volatility compared with fossil fuels.

The overall outcome of the analysis is striking and confirms that lithium technology, though requiring a higher initial investment, ensures a substantial reduction in TCO over time, translating into greater economic, operational and environmental sustainability for the GSE sector.

Lead-acid vs lithium batteries: a concrete comparison

Lead-acid batteries have a useful life that is roughly four times shorter than lithium batteries (1,000 life cycles versus more than 4,000). Their capacity to provide energy progressively decreases over time, making more frequent replacements necessary and increasing management costs.

When it comes to efficiency the difference is clear: lead-acid charging efficacy is around 75%, while lithium batteries reach 96%, ensuring a more efficient use of energy. Lead-acid charging times are also significantly longer (6-8 hours) and don't allow partial charging, often requiring spare batteries and manual replacement at the end of shifts.

In contrast, lithium batteries support fast and partial charging, allowing energy recovery during short operational breaks and minimising downtime.

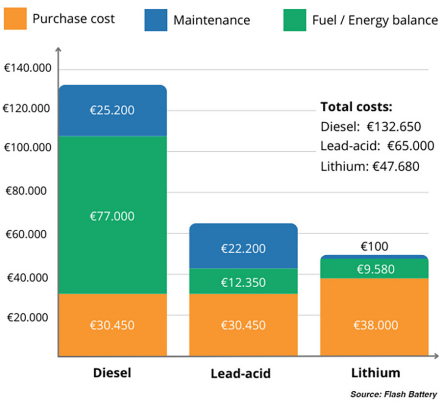
Another practical aspect: lead-acid batteries are heavier and bulkier (around 30 kg/kWh compared with 6 kg/kWh for lithium), increasing logistical complexity and risk during replacement operations. A clear limitation in a sector like GSE, where ergonomics, safety and response speed are crucial.

Why lithium powers the future of airports

The analysis clearly shows that investing in lithium is not just a technological choice but a strategic decision to boost airport efficiency, cost-effectiveness and safety. Although the initial investment is higher than for lead-acid or internal combustion solutions, the TCO analysis shows a positive economic return over the medium to long term. As shown in the chart, the diesel vehicle reaches a total cost of €132,650, the lead-acid version stops at €65,000, while the lithium option drops to only €47,680. Overall, these figures translate into a net saving of more than €17,300 compared with lead-acid and nearly €85,000 compared with diesel (a total cost reduction of around 27% and 64%, respectively), ensuring a significant, sustainable return within the ten-year period analysed. With minimal maintenance, rapid recharging and limited downtime, lithium guarantees superior operational continuity, a crucial advantage in the fast-paced, time-sensitive world of airport logistics.

TCO is thus an effective, strategic parameter for guiding investments as it factors in not only the cost of technology but also its real impact on daily operations. Looking beyond the initial price means recognising the full value of electrification: lower total costs, higher efficiency, tangible sustainability and a lasting competitive advantage. *ghi*

TCO analysis over 10 years for an industrial vehicle



Source: Flash Battery