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ELECTRIFICATION

THE EV BATTERY AFTERMARKET

A CUSTOMER EXPERIENCE, COMPLIANCE AND PROFITABILITY HEADACHE IN THE MAKING

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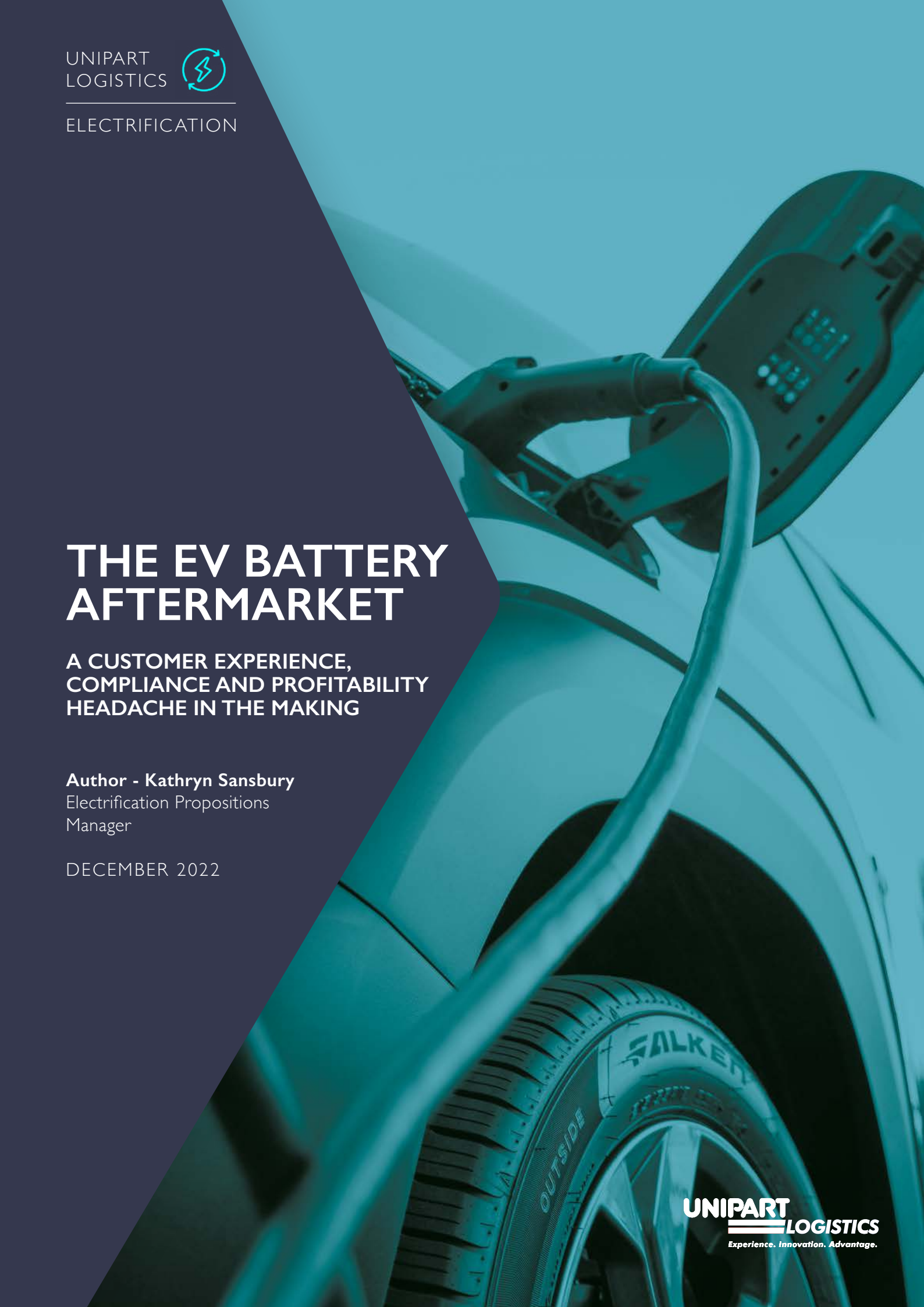
DECEMBER 2022



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Introduction

The EV battery aftermarket: A customer experience, compliance and profitability headache in the making

EVs are here, and are here to stay. It's no surprise that as automotive brands expand their EV product ranges, lithium-ion battery production is under pressure to keep up with demand. But, rapid production ramp-ups and high quality outputs rarely come hand in hand. In a world where customers expect exceptional customer service and a sustainable solution, automotive original equipment manufacturers (OEMs) must carefully manage the risks associated with battery warranty failures and establish an effective aftermarket strategy.

As **Richard Hankinson, Unipart Logistics' Automotive Director** commented, "It is becoming more and more critical to ensure that the aftermarket service provided to end customers of EV vehicles is not only highly responsive, but equally is sustainable, safe and cost effective for these large and complex batteries."

Continuing the discussion, **Owain Mortimer, SMMT Technology and Innovation Manager**, said, "UK demand for electric vehicles continues to surge thanks to an ever-growing choice of models driven by massive investment from manufacturers. The need to have a healthy aftermarket sector to help service and maintain this growing segment of the parc including their batteries, therefore, is self-evident. The focus must now be on defeating all barriers to greater uptake of EVs, which means ensuring the UK has all the skills and capabilities it needs to keep pace in the global race to net zero."

It is also important to look at the entire ecosystem of an EV battery. Although, this can be complex.

Trends we are seeing in the automotive industry for EVs

This year, almost half of surveyed UK drivers are considering an EV as their next vehicle of choice[1]. This figure continues to rise year-on-year, so what's driving this change?

- **Environmental concern**: The fight against climate change is now rightly at the top of the political agenda, and at the forefront of social conscience. As it moves from being a fringe issue to a global priority, those who can afford it are seeing the transition to EV as a relatively simple way of reducing their carbon footprint. Six in ten (62%) drivers say 'helping the environment' would be a good reason for buying an electric vehicle, according to an AA survey of 13,062 drivers. This rises to over 70% amongst the 18–24-year-old drivers[2].

- **Lower long-term costs**: Despite the initial higher costs of purchasing or leasing an EV, research shows the true life-time cost of running one is less expensive than a standard internal combustion engine (ICE) vehicle. Many well-off consumers worried about the increasing cost of living, fuel prices and energy prices, are switching to EVs and solar panels as a cost saver in the long run.

- **Legislation changes**: From 2030, the sale of new ICE-powered vehicles in the UK will be banned. Further afield, the EU and certain US states have planned the same from 2035. Monumental legislative changes such as these are pushing OEMs to gear up for the new EV market.

[1] Virta - Study confirms: UK's EV drivers want to charge at home and work - 20th July, 2022
[2] AA - 'Helping environment' top reason for buying an EV - 22nd June, 2022

- **Improved technology**: Improved battery performance and range, combined with widespread and faster charging capabilities means that 'range anxiety' is slowly starting to become an issue of the past. These technical developments have resulted in a 15-fold increase in EV models over the past decade[3], and around £400 billion is expected to be spent globally in the next five to 10 years to bring even more electric vehicle models to market[4].

- **Tax incentives**: Zero or reduced vehicle tax and incentives for company car schemes have enticed car-users to switch to EV.

In short, electrification is coming faster than first expected, as some key OEM leaders have recognised. McKinsey projects that worldwide demand for battery, fuel cell and PHEV cars will grow sixfold from 2021 through to 2030, with annual unit sales rising from 6.5 million to roughly 40 million over that period[5]. Thus, the need for a robust EV battery aftermarket strategy.

How do these trends affect the EV aftermarket?

As EV battery technology accelerates, OEMs are striving to bring improved powertrain performance, greater range and power to the market. Whilst the battery packs are trending towards lifespans much longer than the typical 8 year warranty, they do lose performance gradually over time through normal use. In addition, performance degradation can be exacerbated by excessive rapid charging and extreme driving styles. Furthermore, as EV batteries are still a continuously evolving technology, manufacturing faults and cell quality issues are not as uncommon as OEMs would like. Combined, these issues can result in warranty claims.

Considering the length of the warranty period and speed of battery technology developments, it's highly likely that battery production will have shifted from first generation, to second or third generation packs by the time a fault arises. But when an old generation EV has a battery issue, how will garages get them safely back on the road? If the required battery is no longer in production, how can OEMs balance the importance of customer experience, importantly the speed of these aftermarket services, against the cost of replacing early generation battery packs?

[3] SMMT - Car makers treble battery range and deliver 15-fold increase in model choice in a decade - 26th April, 2022
[4] SMMT - Plugging the gap report 2022 - March, 2022
[5] McKinsey & Company - Can the automotive industry scale fast enough? - 12th May, 2022

Why is an EV battery aftermarket strategy important?

As EV batteries are a developing technology, there is no escaping the need for replacement aftermarket packs.

It is known that one high-end automotive OEM simply scraps entire electric vehicles with battery issues as it is more cost effective to replace the whole vehicle than a battery. Another OEM's battery warranty replacement service costs the company £100k per pack, more than the vehicle itself. These are extreme cases, but as EVs become mainstream, customers will expect an efficient and sustainable service, just as they do with ICE vehicles.

OEMs have limited options in EV battery pack replacement. 1) They can keep production lines open for low volumes of old generation packs. 2) Invest in vehicle designs which can accept new generation packs. Or, 3) set aside and bulk-store old generation packs at forecasted aftermarket volumes.

Considering options 1 and 2, within any EV battery production facility, a reliable in-plant logistics provider experienced in handling cells, delicate and bulky components is crucial to ensure build plans are met. If OEMs choose to outsource their production activities, then an independent, flexible, low-medium volume EV battery manufacturer such as Hyperbat based in Coventry could be the ideal solution, rather than building a dedicated manufacturing facility.

Considering option 3, mass-storage of aftermarket batteries can be a sensible strategy to keep old generation stock which won't be manufactured again, however, the logistics surrounding this can be complex, requiring specialist services.

Each option has a huge cost impact on the OEM, as unlike combustion engines, most battery packs are not designed to be repaired or refurbished to service aftermarket needs. We have thankfully seen a shift, with some OEMs looking to move to plug and play module assembly designs, enabling individual module replacement to avoid full pack replacement. Perhaps there are trade-offs in weight and performance, but being able to repair packs results in a faster and considerably more sustainable and cost-effective aftermarket solution.

In short, an effective EV battery aftermarket strategy is essential to ensure customers are not left disappointed by their EV purchase if something goes wrong. Each OEM will need a unique strategy based on the technologies deployed in each new generation of pack, target service levels and finance available.

What are the challenges with aftermarket EV battery logistics?

- **Storage:** Batteries must be stored within a temperature and humidity range that meets cell manufacturers' guidelines and in a dust-minimised environment. A range of sensor technology can be used to enable monitoring and control of the environment, and risk-limitation solutions for thermal incidents are essential to obtain insurance approval.

- **Battery state-of-charge (SoC):** For safety reasons and to avoid degradation, batteries out of vehicles should be stored at around 30% SoC. As an EV battery will naturally discharge over time if left alone, it's important to monitor and top up the SoC when in storage. Whilst charging an EV is relatively straightforward, charging and discharging packs outside a vehicle requires specialist battery dedicated charging facilities and battery handling expertise.

- **There is no 'standard' EV battery:** As battery technology adapts, there is no 'one size fits all' solution. Because of this, EV battery charging facilities need to cater for bespoke services which are unique to each battery, e.g. battery capacity/range assessments, or a level of conditioning, such as cell balancing.
- **Safety:** EV batteries contain a large amount of energy, and if overcharged or handled incorrectly, they increase the risk of entering into a thermal runaway event. Chain-reactions such as this are incredibly difficult to stop once they have begun.
- **Transport and compliance:** Specialist expertise is required to navigate dangerous goods compliance in order to safely store, package, despatch and transport high voltage EV batteries in multiple regions.
- **End-to-end supply chain:** It is important to map out all destinations where the batteries will be stored across the supply chain, and to ensure that all facilities have the right materials and expertise in place to top up battery SoC if required.

New battery storage solutions and battery care packages will be required to support the industry

New battery care solutions will be required to support the industry, such as bespoke charging, monitoring and conditioning for EV batteries whilst they are in storage.

Advanced Battery Care

Short-term battery storage requires intelligent solution design and sensor technology to meet safety and warranty requirements

Long-term battery storage requires charging facilities to monitor and maintain a safe state-of-charge

Additional checks, tests, conditioning and data feedback loops are required to ensure battery state-of-health is maintained over long periods

Bespoke, but flexible

Batteries are not standard and differ widely from cell chemistry through to packaging. Global storage and transport regulations are not standard either, so an experienced logistics partner with deep insights into EV battery technology will provide you with the best guidance. It is important that the right battery solution is designed for your specific battery type and product type, such as cells, modules or full battery packs.

Safe and compliant end-to-end solutions

As EV batteries are classed as a dangerous good, it is imperative that compliant solutions are put in place across the whole EV battery life cycle whilst on air, land and sea. Depending on what mode of transport is selected, regional and global regulations are in place. These continue to evolve year-on-year as the journey to electrification progresses within the automotive industry. Currently, to air freight an EV battery, the SoC is restricted at being 30% or less, and the batteries must have passed specific industry testing to qualify for transportation. Transporting used or damaged EV batteries via any transport mode is currently more challenging than transporting new batteries, as although thermal runaway events are uncommon, the impact they can have can be significant.

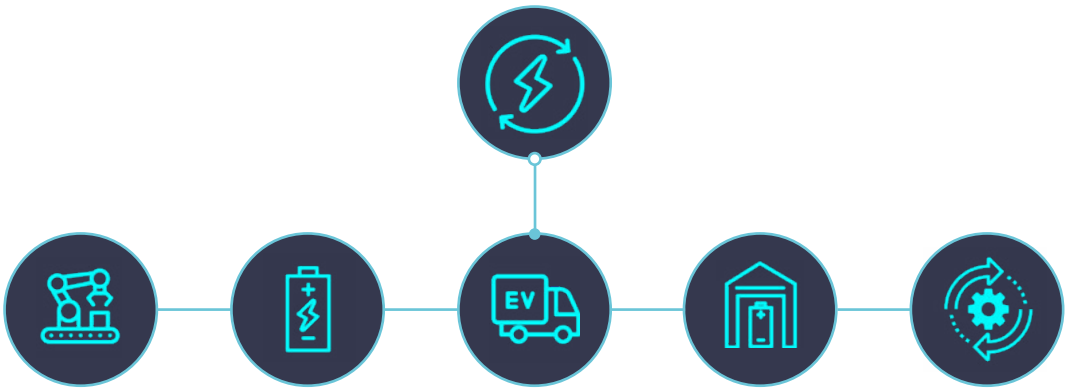
Selecting a partner with an unrelenting commitment to world class health and safety is needed to ensure people and products are safe, with effective risk mitigation strategies in place.

Working towards a sustainable future

It is clear that EV logistics requirements and environmental targets will evolve alongside the technology, and a journey partner is required to address challenges. It is projected that by 2030, 11 million metric tons of lithium-ion batteries worldwide will reach the end of their service lives[6]. With this in mind, particular focus should be given to end of life solutions, and ensuring you or your logistics partner has the relevant ecosystem in place to recover both value and carbon from your assets.

Visit our webpage for more information on how to start or continue your journey to Electrification.

Learn more



BRITISH SAFETY COUNCIL Five Star Environmental Sustainability Audit 2022

BRITISH SAFETY COUNCIL Globe of Honour 2022 Winner

2022 ROSPA Gold Medal Award

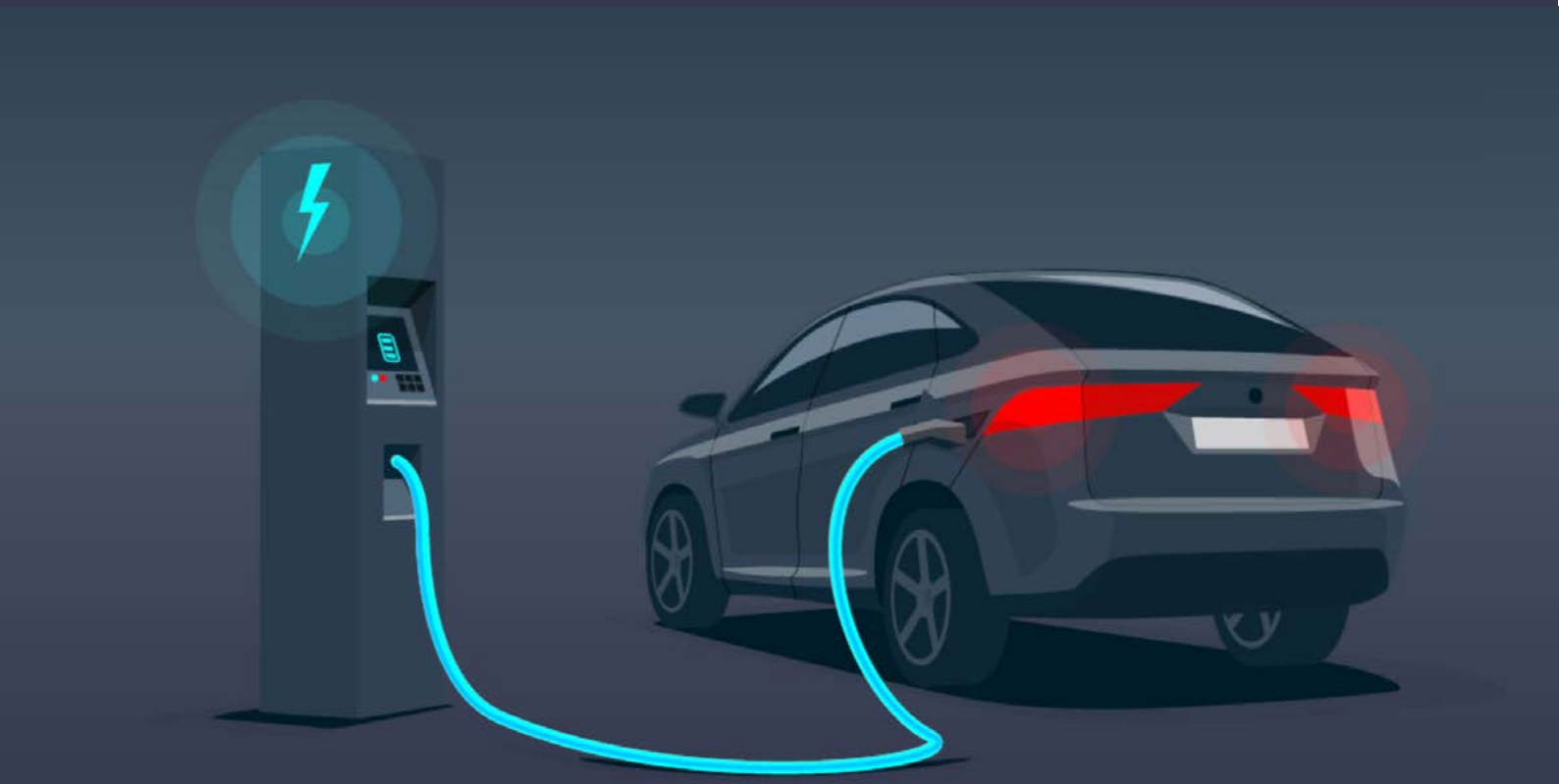
2022 ROSPA Transport, Storage & Distribution Sector Award Highly Commended

bsi. ISO 9001:2015 Quality Management

bsi. ISO 14001:2015 Environmental Management

UNIPART OUR CARBON PLEDGE RACE TO ZERO

[6] c&en - It's time to get serious about recycling lithium-ion batteries - 14th July, 2019



The Future

How we expect EV logistics challenges to evolve in the near future

Battery demand is due to outweigh supply: The industry really is 'going green', and the rate of this transition is difficult for the supply chain to keep up with. Despite significant investment and innovation, battery demand is due to outweigh supply within the coming years, even with planned gigafactories running at full capacity. The semiconductor shortage crisis is also predicted to affect the industry for years to come. Coupled together, these issues will add additional levels of complexity for EV manufacturing, which will continue to add to the existing lengthy delays for end-consumers.

Gigafactories will require expert logistics partners to support the set up of new facilities, in-plant production logistics expertise, as well as effective strategic and tactical supplier management, all whilst safely handling lithium-ion products locally and globally.

Introduction of alternative materials & technologies: Precious metals used within EV battery production, (such as nickel and cobalt) are finite, and therefore more sustainable options are required long-term for battery manufacturing. Options include the introduction of alternative materials, or a completely different powertrain technology in its entirety. Hydrogen fuel cells are a contender to replace lithium-ion batteries in the future; however, for now lithium-ion is here to stay. This is because the technology is continuing to improve, whilst hydrogen technology and the infrastructure surrounding it hasn't caught up. Fuel cell technology is growing rapidly in larger, heavier vehicle markets. As EV batteries are not standard, different technologies introduced into the supply chain will require varied storage solutions, hence why selecting a logistics partner with a view for the future is so important.

Circular economy:

1) **Recycling**: Currently, EV battery recycling produces large amounts of CO2 and global recycling services are limited. However, experts predict that the industry still has until the end of this decade to catch up, as the volume that currently needs to be recycled is low. Because of this, battery stockpiling strategies are likely to remain until sustainable, commercially viable solutions are available.

2) **Repair**: EV batteries have a 'first' life expectancy of 15-20 years. However, a challenge for OEMs will be to transition from an expensive "single use and replace" model, as currently EV batteries are not manufactured with the view of being repaired. Repair will make it cheaper for the OEMs when batteries are under warranty, but also cheaper for drivers if they buy a second hand car or continue to drive a car outside of the warranty period, therefore making them a more attractive purchase.

3) **Repurpose**: A number of OEMs have considered strategies to reuse 'old' EV batteries in alternative applications. This has a sustainable benefit as well as a financial one for end-consumers, as batteries still have significant capacity remaining at the end of their 'first' life. An increasing potential market for second life batteries is in commercial or domestic energy storage, where the long-term nature of energy usage is ideal for batteries that have perhaps reduced dynamic performance. A holistic view of battery failures and retargeting use is required, depending not only on whether a cell has failed, but also on categorisation of its place in the overall lifetime. Therefore, it may be at the end of its useful life in an EV, but it may have a further 3-5 years of useful life in an energy storage system that has a different specification.

Sources

1 - Virta - Study confirms: UK's EV drivers want to charge at home and work - 20th July, 2022

2 - AA - 'Helping environment' top reason for buying an EV - 22nd June, 2022

3 - SMMT - Car makers treble battery range and deliver 15-fold increase in model choice in a decade - 26th April, 2022

4 - SMMT - Plugging the gap report 2022 - March, 2022

5 - McKinsey & Company - Can the automotive industry scale fast enough? - 12th May, 2022

6 - c&en - It's time to get serious about recycling lithium-ion batteries - 14th July, 2019

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