Connected Energy

Connected Thought

Powering a Circular Economy, One Battery at a Time

Repurposing electric vehicle batteries as energy storage

SECOND LIFE FIRST

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The clean energy transition will see a rising demand for critical minerals over the next 20 years[1], with electric vehicles and battery storage accounting for half of this growth due to the materials required for battery manufacture.

The increasing demand for electric vehicles (EVs) presents a significant opportunity towards a cleaner and more sustainable future for transportation, moving away from fossil fuels and decarbonising the transport sector. However, lithium-ion batteries are a cornerstone of EV technology and their production and disposal come at an environmental cost.

The batteries in many earlier EV models are beginning to reach the end of their useful life for powering a vehicle and whilst recycling technology is improving and recyclers are gearing up for larger volumes of batteries, the industry needs to consider complimentary solutions to maximise the commercial value and minimise the environmental impact of those batteries.

The clean energy transition also depends on finding sustainable solutions for energy storage. The response to climate change is moving fast, meaning that there is a much greater penetration of renewable energy. Energy storage is increasingly being relied upon to support the transition to renewables and according to BloombergNEF[2], the global market is set to grow by 21% annually to 2030.

One avenue that holds significant untapped potential to solve both environmental challenges is to give electric vehicle batteries a second life in energy storage.

Stationary storage systems can be designed to operate EV batteries within their design parameters, meaning that retired EV batteries are well suited for this application. This can extend the life of a battery by ten years, maximising the use of the critical minerals within it.

This white paper sets out the potential of second-life batteries to revolutionise the battery industry and create a more sustainable energy future. We will discuss the environmental and economic benefits of second-life batteries, explore their applications in stationary energy storage, the challenges in making second life work and the economic and policy considerations that are required to make this a leading industry for the future.

Matthew Lumsden
CEO, Connected Energy

Tania Saxby
Head of Sustainability, Connected Energy

1 IEA: Mineral requirements for clean energy transitions
2 BloombergNEF

Energy transitions are already the major driving force for total demand growth for some minerals. Since 2015, EVs and battery storage have surpassed consumer electronics to become the largest consumers of lithium, together accounting for 30% of total current demand.[3]

3 IEA: the role of critical minerals in clean air transitions

EV batteries: a problem for the EV industry

Over the decades ahead, the adoption of electric vehicles is anticipated to experience significant growth.

Analysis by Statista[4] estimates that the global unit sales of EVs are anticipated to reach 17m vehicles by 2028. The heavy-duty electric vehicle market is also rising, with the uptake of electric buses and trucks growing at a rapid pace. Globally over 100,000[5] electric trucks and buses were sold in 2023 with markets such as China leading the way.

Due to the increase in electric vehicle production, demand for critical minerals is rising. Lithium-ion batteries use several critical minerals (lithium, graphite, cobalt, nickel) in their production, many of these are obtained from a small pool of relatively high-risk nations, some of which are engaging in mineral extraction practices that raise concerns.

Mitigating this environmental cost and commercial risk by harnessing the circular economy to reuse and repurpose batteries before recycling can significantly reduce the need for new material extraction required for the energy transition.

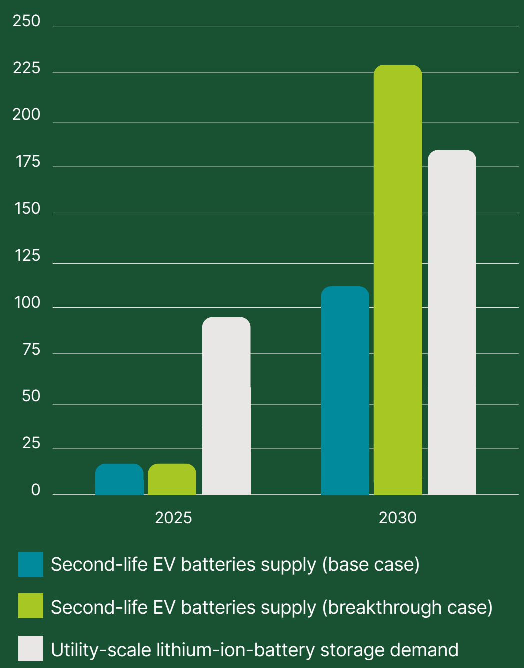
Within a vehicle, a battery can be subjected to demanding use cycles with its life typically limited to 8 – 15 years. At this point, the vehicle begins to experience a reduction in range but the battery can still hold around 80% of its original capacity. As increasing numbers of EV batteries come to the end of their life in a vehicle, effective reuse and repurposing strategies must be in place to optimise the low carbon economy.

The opportunity

> Due to the rapid rise of EVs in recent years and even faster expected growth over the next ten years in some scenarios, the second life-battery supply for stationary applications could exceed 200 gigawatt-hours per year by 2030.

McKinsey & Company
https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/second-life-ev-batteries-the-newest-value-pool-in-energy-storage

Utility-scale lithium-ion battery demand and second-life EV[6] battery supply,[6] gigawatt-hours/year (GWh/y)



4 Statista, Mobility insights
5 IEA: Trends in heavy electric vehicles
6 Only for batteries from passenger cars

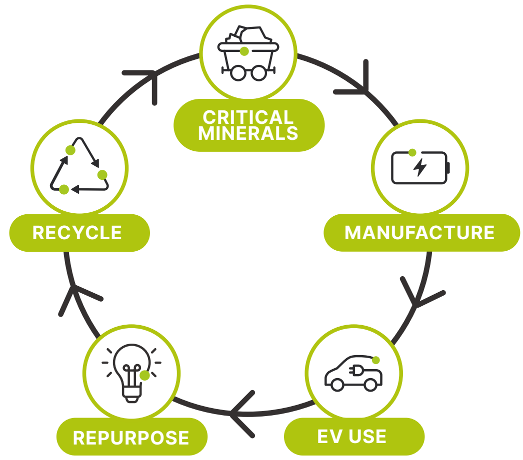
Repurpose before recycling

This growing demand for batteries to power the energy transition set against the associated requirement to mine and refine large volumes of critical minerals places a contradictory strain on the principles of sustainable supply chains.

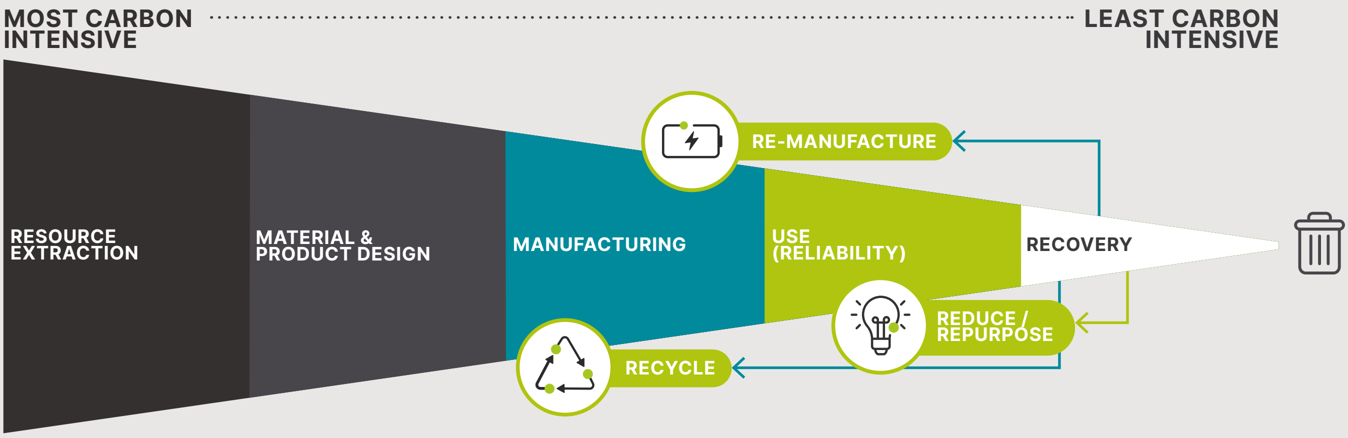
A better and more sustainable approach is to adopt a circular model, which puts repurposing before recycling and aims to keep products and materials in use for as long as possible. In a circular economy model, materials find a new role. In the context of EV batteries, this means repurposing them in stationary energy storage after they can no longer power an electric vehicle.

This approach reduces reliance on virgin materials, lowers the environmental impact, creates a more sustainable system and reduces exposure to higher risk economies where raw materials are sourced.

A circular model for EV batteries

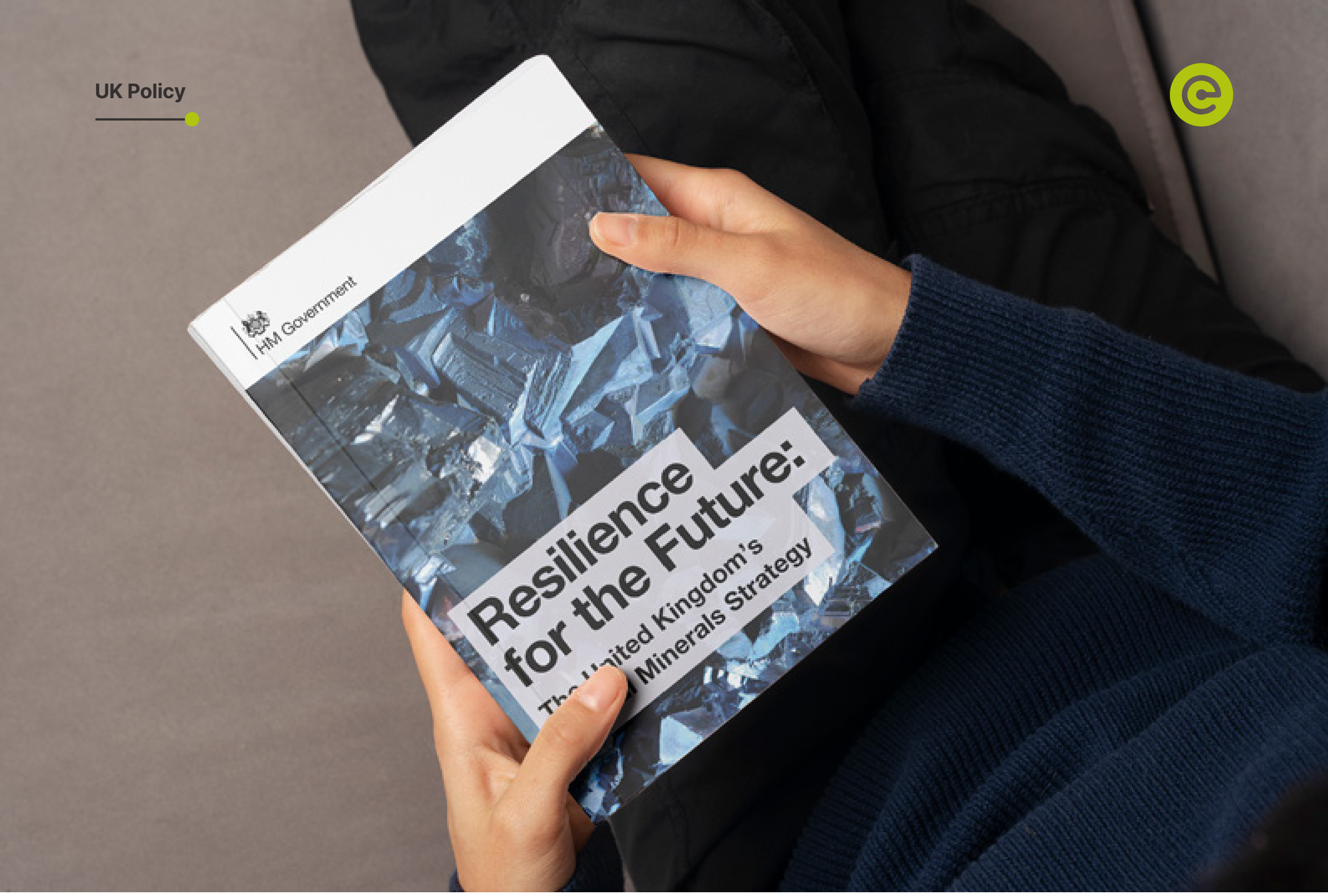


The carbon intensity of a product life cycle



Effectively managing these materials is a multifaceted challenge requiring a deep understanding of material flows and their environmental and economic impacts at each stage of the circle.

Reuse and repurpose, for example, are far less resource intensive than the process of recycling – which should be left to the very end of the process.



In support of UK policy

The UK's Critical Minerals Strategy[8]

The strategy identifies the growing requirements for the minerals required for EV batteries – and the need to ensure a resilient supply and accelerate the UK's domestic capabilities. In it, the strategy recognises the need to accelerate a circular economy of critical minerals in the UK – by increasing recovery, reuse and recycling to alleviate the pressure on the primary supply.

The UK's Battery Strategy[9]

The UK's Battery Strategy sets out the vision for developing a globally competitive battery supply chain by 2030.

Central to the strategy is the need to accelerate domestic capabilities and secure the critical minerals needed. It looks at ways in which the UK can design and develop batteries, strengthen the resilience of manufacturing supply chains and enable the development of a sustainable industry.

8 UK Critical Minerals Strategy
9 UK Battery strategy

Connected Energy: giving EV batteries a second life in energy storage

Connected Energy is helping battery owners to see the opportunities and the business cases to repurpose batteries. Rather than seeing an excess of electric batteries as a costly liability, they can be given a new purpose, a second life and one that helps to extend their value.

Alex Charr
Chief Operating Officer, Connected Energy

Technical & commercial innovation.

Connected Energy was established in 2010 and is now one of a few companies worldwide to have the proven technology to repurpose electric vehicle batteries as energy storage.

Over the last ten years, the company has designed and developed products which are now operating at commercial locations throughout the UK and Europe. The company has an established, full turn-key approach to additional services, including data modelling and service and aftercare as well as introducing innovative data-led solutions to monitoring and managing battery performance.

This fleet of operational systems has enabled Connected Energy to develop, test and prove systems utilising second life batteries from a range of OEMs and a diverse set of applications to develop the knowledge and expertise to develop large scale systems required to deploy second life batteries in large volumes.

With a clear understanding of the technology, the growing volume of batteries and the rising market for battery energy storage, Connected Energy is now building on the success of its commercial products by advancing its own development sites. Sites will range from 10MW up to 100MW+ and will provide a scalable solution to meet the increased demand for large capacity energy storage. Having forged partnerships with stakeholders spanning the full value chain, including battery owners and OEMs, a primary focus is to scale up the product in line with the second-life battery availability.

Benefits and applications for repurposed EV batteries

With the increasing demand for electricity and the growing use of fluctuating renewable sources such as solar and wind power, battery storage is becoming a key component in the shift to cleaner power and maintaining a stable electricity grid. In 2023, the battery energy storage sector was the fastest growing energy technology, with deployment more than doubling year-on-year[10].

A study by Lancaster University showed a 450tonnes C02e saving for each MWh of Connected Energy second life system installed, when compared to a system using new lithium-ion batteries.

Key benefits:

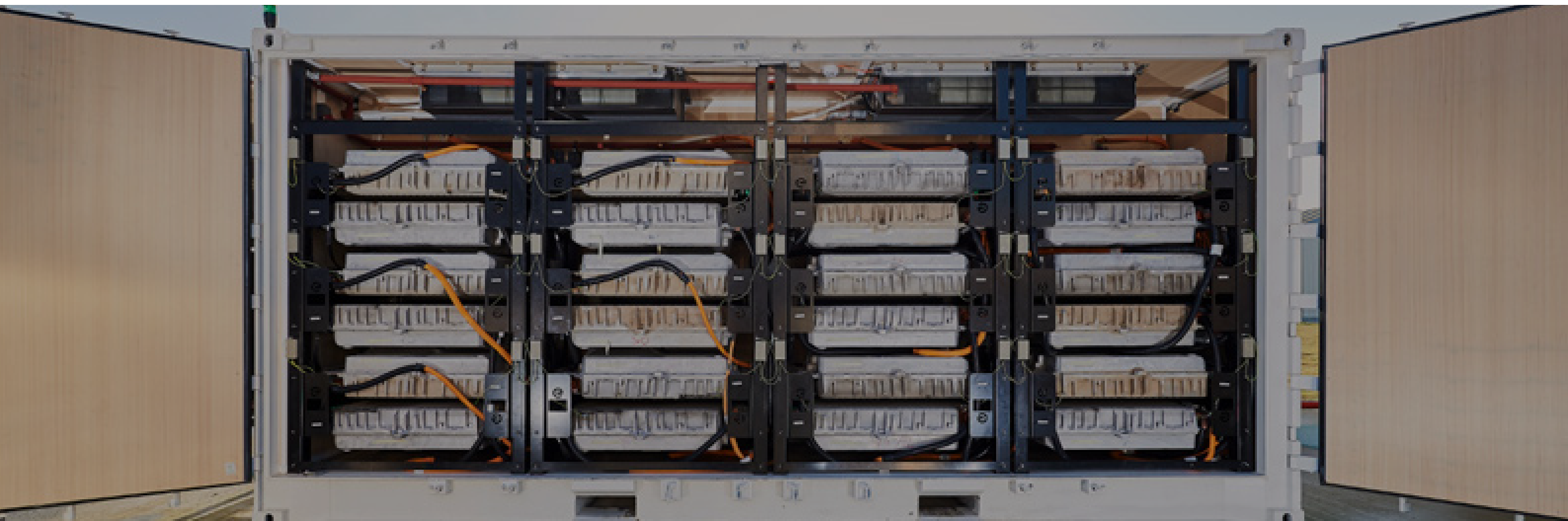
Environmental: Repurposing batteries extends their lifespan, reducing the need to produce new ones to meet the growing demand. This lowers the environmental impact of electric vehicles and energy storage, causing a reduction in greenhouse gas emissions.

Conservation of critical minerals: Lithium-ion batteries contain valuable materials such as lithium, cobalt, and nickel. Repurposing batteries reduces the need for new materials, negating the import of critical minerals and lowering the dependency on foreign supplies.

A circular economy: Geopolitical and environmental stresses are building risk into national economies but embracing the principles of the circular economy can reduce these risks. A repurposing initiative on the scale of electric vehicle batteries could be an important part of creating more resilient economies.

Cost-effective: Repurposing batteries can benefit consumers and businesses alike. Giving a battery a second life value can improve the economics of electric vehicles as well as enabling lower cost energy storage. A recent study by Deloitte* estimated that adopting a multi-life cycle model for EV batteries has the potential to reduce car battery costs by up to €3,000, making car prices more competitive and helping to close the gap to Chinese competitors.

Economic: The adoption of electrification will displace some traditional business models and sources of competitive advantage. Adopting a circular economy model for batteries will bring about scalable commercial opportunities and clean technology jobs to fill emerging gaps.



10 IEA: Battery and secure energy transitions
11 https://www2.deloitte.com/cz/en/pages/consumer-and-industrial-products/articles/a-multi-life-approach-to-battery-utilisation.html

Applications for energy storage

Second life battery storage systems applications:

Renewable energy integration: Solar and wind power generation are variable, depending on sunlight and wind availability. Energy storage systems can store excess energy produced during peak times and release it back to the grid when needed, smoothing out these fluctuations and providing a better fit between supply and demand.

Peak shaving: Electricity demand fluctuates throughout the day, with peaks typically occurring during mornings and evenings. Second-life storage systems can help reduce peak demand by storing energy during off-peak hours and releasing it during peak periods, lowering overall energy costs and reducing carbon.

Supporting EV charging: As power demands grow with the electrification of passenger, fleet and commercial vehicles, energy storage can be used to manage demand and overcome the challenges of grid connections. In second life terms - the batteries of yesterday's vehicles therefore charging the vehicles of tomorrow.

Backup power: Battery energy systems can provide backup power for businesses, and critical infrastructure resilience.

Microgrids: Energy storage systems can add sophistication and flexibility to microgrids by helping to operate localised power supply that can operate independently of the main grid.

Large-scale energy storage: Multiple second-life batteries can be combined to create large-scale energy storage facilities, which will play a significant role in balancing electricity supply and demand at grid level across a wider region.

Revenue generation: Battery energy storage can be used to participate in the dynamic energy trading market, helping to monetise second life batteries.

Battery energy storage: in action

Nottingham City Council has installed 600kW of second life stationary storage at their EV fleet depot.

Installed to help transform the site's energy use, the system stores excess electricity from the on-site solar arrays which is then used later to charge their EV fleet and reduce electricity use during peak times. Additionally, with the flexibility afforded by the system, the site aims to participate in grid services by trading stored electricity, and through vehicle-to-grid services via the 40 bi-directional EV chargers.

Not just batteries in a box

While repurposing EV batteries for energy storage is a strategic imperative, there are several challenges to overcome for large-scale integration.

Developing second life system starts with the OEM and ends with the recycler, and each part of the chain needs to be considered.

This section delves into Connected Energy's key learnings from developing second life systems and working within circular economy principles.

The challenges of making second life work

Battery sourcing

At this early stage of the industry, used EV batteries can be difficult to source with a variety of ownership models and a lack of standardisation of collection and returns processes. This fragmented nature of supply makes it challenging to collate batteries in large enough volumes for industrial-scale applications. Working in collaboration with OEMs is key to understanding the model for returned batteries, gaining access to a stable and predictable supply and understanding the future battery flow.

Relationships with OEMs

Developing systems that are robust, safe and optimised for performance also requires collaborative relations with OEMs and agreements to share data on battery communication, control, functionality, health and performance. Relationships have been slow to develop, due to the lack of available battery supply, other priorities and a lack of imperative, however there is now a growing focus on second life and attempting to create sustainable partnerships and business models.

Assessing battery health

EV batteries degrade over time, and by the time they reach their second life, they will have varying capacities. Rigorous testing and data interrogation are required to understand their potential second life value with acceptance testing used to assess the limits and capabilities of each battery.

Optimising battery health

Once in a system, inconsistencies in degradation require management to maximise the overall performance of a system. Control systems are needed to ensure multiple batteries can be optimised to work collectively to provide the overall system power and capacity ratings. Remote monitoring and analysis, in the case of Connected Energy by using AI, are also required to spot anomalies in performance and respond accordingly.

Warranties

Gaining long-term performance warranties for second life use is challenging but they are required by most customers. The second life offering has to be equivalent to that of a new system and that requires guarantees. Increased OEM participation can provide customer confidence by mitigating performance risks and Connected Energy is working with several OEMs to create contractual models that meet the requirements of customers.

Finance

Financing also presents a hurdle for large-scale second-life energy storage projects. Funders require guarantees equivalent to first life systems to enable them to understand, compare and manage the risks. New second life business models are required to manage the differences between first and second life. To address this challenge, establishing standardised data collection and performance tracking procedures for second-life batteries is essential. Futureproofed agreements which provide confidence that batteries are replaceable at a viable cost, and compatible with the existing installed technology are also key.

Full value chain

Essentially the business model is the key enabler to establishing a circular model across the whole life cycle of EV batteries. To maximise the commercial value of second life batteries, the economics must work from each part of that chain. Determining the optimum time for a battery to move into repurpose and then onto recycling requires collaboration across the full value chain including OEMs, fleet operators and recyclers.

The risks and rewards must be spread appropriately across the whole value chain for the second life commercial model to work.

The power of data: how data is revolutionising energy storage

We've touched upon the importance of data in accessing the state of health of batteries for energy storage however data – and its continuous assessment – is the fuel that drives energy storage systems.

At Connected Energy, we have now gathered a wealth of data on second life battery performance which is being used to continually improve prediction capabilities and ensure robust safety processes.

Our systems provide over 2.4 million data points each day, ranging from information on power outputs, temperature readings, telemetry data, state of charge and health. Using AI and machine learning, we can collate, interrogate and analyse these data points which provide new levels of insight into the battery's condition, enabling us to track second life performance with unprecedented accuracy.

The importance of data:

1. Optimising performance

Continuously tracking data on operating temperatures, charge, efficiency and overall system health, enables optimisation of the performance of systems. This provides greater levels of dynamism and flexibility, optimising how the batteries are used and monetised.

2. Extending battery life

Monitoring and optimising individual packs allow for greater flexibility in operation. This is particularly beneficial for systems built from packs with different states of capacity – enabling the operator to call on higher capacity packs more frequently and allowing the packs to reach the same state of health over time. In doing so, we can implement efficiency strategies which can lead to higher up-time and fewer interventions for battery swaps.

3. Enhanced safety

As yet there are no Government or industry standards for the safe use of second life batteries in non-domestic applications. By working closely with battery and EV OEMs we are creating our own safety systems and processes that capitalise on the investment already made by the OEMs and build on them. By feeding battery and wider system data into our AI models, we are constantly tracking batteries so that any performance anomalies can be detected and managed. By doing so, we are breaking new ground with design and operational safety.

4. Smarter network management:

Data from storage systems, combined with information on consumer demand and renewable energy production, helps network operators make smarter decisions about grid management. They can anticipate peak demand periods, respond to the variability of renewable generation, and tactically charge and discharge energy storage systems to reduce reliance on traditional power plants and minimise curtailment.

5. Boosting efficiencies

Data allows for real-time monitoring of energy consumption patterns. This empowers consumers and businesses to identify areas of energy waste and optimise their energy usage. This not only saves money but also reduces the overall demand on the grid, further improving efficiency.

6. Assessing a third life

Furthermore, this insight provides an understanding of the true life cycle of batteries. This intelligence can help form data-led decisions on when they should be used during their second life and at which point they should then be transferred to a third life or a recycler – to capitalise on their value.

The safety considerations of repurposing an EV battery into stationary storage

Although safety incidents at battery energy storage sites are rare, safety is paramount, and a significant consideration industry-wide.

Connected Energy's approach is to only work with OEMs who will collaborate closely with us, sharing data and technical expertise to ensure the highest product safety and performance.

Connected Energy capitalises on the wealth of knowledge and investment that OEMs have already embedded in the design of their battery packs and battery management systems.

Challenges and risks

Degradation and variability: Unlike new batteries with uniform performance, second-life batteries have undergone varying degrees of degradation. This variability needs to be factored into the control strategy for the batteries so that batteries are treated according to their individual merits.

Lack of standardized testing: Currently, there is no universally accepted method for evaluating the health and remaining capacity of second-life batteries. Batteries need to be tested or historical performance data needs to be analysed so that faulty batteries are not built into systems which could create longer term problems.

System integration complexity: Integrating second-life batteries into energy storage systems requires careful consideration of factors like thermal management, battery balancing, and potential interactions with other components. It is important that batteries are operated within the parameters set by the OEM and the BMS so that they function within an understood safety envelope.

Safety-first strategies

Connected Energy has put in place a safety-first approach with the following steps:

Access to data from the OEM partners
Key to underpinning the safety of any second life system is access to the data and communication protocols that enable the system to be safely controlled and monitored. Working hand-in-hand with OEMs enables the optimum levels of control to be achieved using verified information and without having to backwards-engineer any of the safety critical systems.

Rigorous Battery Selection and Testing
Implementing a multi-stage testing process is crucial. Systems should be built using EV batteries that leading manufacturers have tested and that testing continues with the system developer. This must involve initial screening to identify unsuitable batteries, followed by in-depth diagnostics to assess remaining capacity, internal resistance, and other health indicators. Only batteries meeting strict safety and performance criteria should be integrated into second-life systems. If historical duty cycle data is available this is also extremely valuable in assessing and predicting battery life.

Capitalising on the OEM safety features
Only through working with battery and automotive suppliers, can a developer capitalise on the huge investment made into the design of the battery and underpin the safety of a system. Through collaboration agreements, it can be ensured that the original battery management system remains unmodified – the same system that is trusted by millions of EV users to get their families and goods from A to B – to ensure continued safety.

Comprehensive Safety Protocols
Establishing clear safety protocols for all stages of the second-life process, including handling, storage, transportation, installation, operation, and maintenance is critical. These protocols should be tailored to the specific characteristics of the second-life batteries being used.

Battery integration
In addition to the safety mechanisms within the battery pack developed by the battery or EV OEMs, it is important that systems exist that are able to detect a problem within this subsystem. Connected Energy has employed automotive style design failure mode effect analysis (DFMEA) processes to ensure systems are in place to manage potential battery problems.

Safe system designs
The design of the storage system itself also plays a role. Features like active and reactive thermal management, fire suppression, smoke detectors and sounders and air ventilation are built into our systems as safety measures. Systems are also designed to issue alerts in the event of a problem and have auto-shut down procedures if a major fault is detected.

Continuous monitoring
Each system is monitored around the clock. Alerts are dispatched to engineers if issues are detected by the systems and AI is used to quickly recognise any anomaly in the performance and initiate a response. This continuous monitoring and analysis enables the use of changes in performance trends to initiate pre-emptive maintenance.

Economic and Policy Considerations

The second life battery industry has the opportunity to be an exciting, high-value, rapidly expanding sector.

With the continuous increase in returned EV batteries, this is an industry that has the opportunity for enormous growth. However, there is still much uncertainty brought about by the lack of policies across Europe. This is where governments must play a role – supporting the private sector with regulatory support to ensure the safe and proper management of batteries in second life applications.

Strong governmental policy, incentives and recognition of the opportunity for second life batteries will enable the growing second life industry to capture the scale of the forthcoming opportunity.

The following policy considerations will enable a more robust market for second-life batteries.

Policy considerations

Issue	Recommendation
Regulatory frameworks which puts repurpose first: There are currently no clear guidance to make repurposing a European standard for batteries. The EU battery regulation provides some focus on a full lifecycle approach however repurposing is overlooked.	Targets to be mandated enforcing a maximum carbon footprint of the whole lifecycle of battery production which encourages repurposing and reuse.
Incentives to repurpose before recycling: The whole battery ecosystem has the potential to deliver huge, long term economic value – and the value of battery repurposing has a key role to play in conjunction with upstream materials and manufacturing and downstream recycling, thereby ensuring the full value of batteries is maximised. This is particularly impactful as it can reduce dependence on critical minerals.	Regional battery strategies must place an increasing focus on the segments of the circular economy creating distinctions between reuse, repurposing and recycling. Given the resource and environmental benefits of reuse and repurposing these should be defined and differentiated with incentives created to encourage their adoption.
Battery traceability: The opportunities to improve regional resilience and security of critical minerals by keeping battery materials within local territories and ensuring that maximum value is derived before it is recycled.	The forthcoming introduction of the Battery Passport in the EU in 2027 will go some way to improving traceability. This should be backed by UK policies that assign responsibility for battery collection and hold battery manufacturers responsible for the entire lifecycle of their products, including collection, recycling, and repurposing.
Standardisation: Lack of standardized testing and certification procedures for second-life batteries makes it difficult to guarantee their performance and safety, hindering wider adoption.	Regulations are required for the development of standardised testing and safety protocols for second life batteries. Clear regulatory frameworks will foster industry-wide best practices and provide a foundation for safe and responsible second life battery implementation.
Subsidies and Incentives: Utilising second life batteries comes at a cost however there is currently no incentive that makes second life systems more economically competitive.	Government incentives, such as taxable benefits which recognise the importance of repurposing in the procurement process, should be considered.
Supply Chain Development: As a market in its infancy, the supply chain including logistics, battery handling and testing advancements requires development.	Investing in building a robust supply chain for collecting, testing, and redeploying second-life batteries is essential for scaling the industry. This includes creating infrastructure for responsible battery disposal.
End-of-Life Regulations: Ensuring recycling is the final stage of EV batteries will help to complete the circle and maximise the environmental impact.	Investment in recycling facilities and the implementation of regulations which cover both collection rates and recycling efficiency are needed.

The future of battery energy storage

As the energy landscape continues to evolve, energy storage is a vital component in the wider transition to clean energy – in the shape of large, utility scale sites.

These sites can range from 10MWhs to hundreds of MWhs of battery energy storage with systems working together to store and discharge vast amounts of energy. They charge up during periods of excess generation, storing it for use when demand spikes. It can then be released to the grid, to help balance the local and national network.

Whilst still a relatively new technology, utility scale storage is rapidly evolving. As the requirement for storage capacity increases, as more renewable energy comes on stream, geographically distributed utility scale sites are expected to play an even bigger role in the future of our energy grid. Helping to balance intermittent, renewable supply with demand – an application which batteries are well suited.

Utility scale sites can provide a range of services, but an increasingly important application is energy trading. Energy trading, which serves to help balance supply with demand, not only aids the transition to renewable generation but also becomes a key revenue generator for energy storage operators. Energy trading requires longer duration systems which are particularly compelling to the owners of second life batteries.

A new wave of customers: battery owners

This changing landscape has several different customers – from owners of solar farms and wind turbines through to utilities. However, the stakeholder with the most to gain in finding a second life use for EV batteries is the one facing the biggest challenge – that of the battery owner.

With the goal of achieving sustainable battery lifecycles, battery owners are increasingly interested in novel ways to extend battery lifecycles. Stationary energy storage – and in particular large scale development sites - are of particular interest.

This could see battery owners increasingly working collaboratively with stationary storage providers, potentially retaining ownership of their batteries and receiving a revenue from their use. Finally, as a market for second life batteries develops, we are likely to see increased engagement from large fleet owners, who will be interested in maximising the value that they can get from the sale of their batteries by balancing use and degradation.

OEMs: Increasingly working collaboratively with energy storage providers, potentially retaining ownership of their batteries and receiving a revenue from their use.

Fleet operators: those who purchase EVs outright and own the batteries. By exploring second life applications they can maximise the return on their initial investment.

Financiers: who specialise in financing zero-emission assets such as large EV fleets. These institutions have a stake in ensuring that the batteries they finance retain their value.

> By developing solid relationships and agreements with battery owners, energy storage companies can be ready to deploy batteries at scale in utility scale sites – ready for the rising increase in second life batteries.

Matthew Lumsden
CEO, Connected Energy

The importance of second life: a manufacturer's perspective

Volvo Energy

Volvo Energy is developing battery circularity by repurposing electric vehicle batteries into energy storage with Connected Energy. Proactively planning for the end of life of their EV batteries, the company champions battery energy storage as an element that is essential to the global increasing need for electrification and the increasing uptake of renewable energy.

Each battery in Volvo's vehicles is monitored closely using detailed battery data and AI. This means that the performance and state of health is tracked allowing for the assessment of the suitability for second life application.

In 2024, Volvo Energy and Connected Energy signed a letter of intent with the ambition to jointly develop a battery energy system.

> The Volvo Group is driven by ensuring that every battery that powers our vehicles is used to its full potential, before being recycled. As vehicle electrification gathers pace, we will soon see millions of electric vehicle batteries complete their first life in a vehicle. But those batteries will still have an enormous potential, only having degraded by 20-30%. Our mission is to reuse and repurpose them to maximise their value.

Elisabeth Larsson
Senior Vice President of Sales and Services, Volvo Energy

Read more about our collaboration with Volvo Energy

MOBILIZE

Connected Energy and Mobilize (a brand of Renault Group) have a long-standing collaboration which, for the last seven years, has breathed new life into former Renault Kangoo ZE batteries as stationary energy storage.

Renault's main motivation for entering its batteries in the second life market was to reduce the battery's environmental impact and to postpone the need for recycling.

Since the relationship began, Connected Energy has placed over 700 Renault batteries into a second life in our energy storage systems.

Kangoo were the first EV batteries repurposed by Connected Energy which paved the way for the integration of next generation batteries such as the Renault Zoé.

Read more about our our work with Mobilize

“Our collaboration with Connected Energy helps us lessen the environmental impact of EV batteries over their entire lifespan.

Additionally, there's a financial benefit. By repurposing these batteries, we enhance their value, thereby helping to lower the cost of electric vehicles.

Designed to meet rigorous mobility standards, our EV batteries seamlessly transition to stationary applications, contributing to the stability of the electrical grid.

Thomas Bertrand
Energy Storage Director
MOBILIZE (Renault Group)

What comes next: recycling

There will come a time – after around 8 – 10 years – when a battery within energy storage begins to reach the end of its useful life in a system. At this point, recycling is the inevitable next step in its life cycle.

Introducing a full life cycle for a battery, which includes repurposing and then recycling, ensures that the maximum value is gained from each battery - ultimately reducing its environmental impact and helping to reduce the dependency on critical minerals required for new battery production.

But a co-ordinated approach is required. By working together, energy storage companies and recyclers can better understand the value at each stage of the process, ensuring that the battery is moved from repurposing to recycling in a way that brings maximum environmental and economic value to both parties as well as battery manufacturers and automotive OEMs.

Collaborating to extend the lifecycle of EV batteries: a case study

Connected Energy is collaborating with Altilium - a leader in EV battery recycling in the UK – to better understand and develop sustainable and environmentally responsible business models for the repurposing and recycling of EV batteries.

Through this collaboration, both companies will monitor and manage the batteries through the various stages of the lifecycle to develop a model which captures the most residual value. The collaboration will also give Altilium more visibility of available feedstock for its recycling facilities, including its planned Teesside refinery (ACT 4). The plant will have the capacity to recycle waste batteries from 150,000 EVs a year, producing 30,000 MT of CAM, enough to meet 20% of the expected UK demand by 2030.

By promoting the reuse and recycling of EV batteries, Altilium and Connected Energy will help to build a circular economy for EV batteries in the UK, reducing the UK's reliance on imported materials and decreasing the carbon footprint associated with battery production and disposal. This in turn supports the UK's goals to achieve net-zero emissions by 2050.

The collaboration also aims to establish responsible repurposing and recycling protocols, to be adopted as industry wide standards, following the waste hierarchy principles of re-use, re-purpose and recycle.

> Developing a circular economy model for EV batteries is essential to ensuring a responsible management of end-of-life batteries. To do so, it is critical that the value chain works together to support the growth of the entire battery eco-system. Our relationship with Connected Energy will help us to do this."

Rod Savage
Program Director, End-of-Life Batteries at Altilium

Conclusion: Second Life First for a Sustainable Future

With the transition to electric vehicles well underway, within the next five years we expect to see a significant increase in the volume of batteries reaching the end of their first life.

The potential for repurposing those batteries in stationary storage is hugely exciting and will bring about both environmental and economic benefits. Offering a comparable alternative to new batteries, second life storage helps to solve several of the UK's key energy challenges all at once; from the need for grid storage to support greater renewables penetration and improve energy security to providing additional power capacity to support the electrification agenda.

Second-life batteries offer a transformative opportunity to create a more sustainable and circular economy for the battery industry. By promoting "Second Life First" practices, governments, businesses, and consumers can work together to maximise battery lifespan, minimise environmental impact, and pave the way for a clean energy future.

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