



A Second Life for Batteries

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The surge in the deployment of utility-scale and electric vehicle batteries requires a regulatory regime to govern what we do with all these batteries once no longer fit for their initial purpose. The existing regimes in the EU and UK are not fit for purpose – however, they appear to be advancing.

Introduction

Recent exponential growth in battery deployment and use has swung commercial and regulatory focus to the treatment of ‘spent’ batteries. The focus, in particular, is how we treat the new wave of larger batteries used for utility-scale energy storage and electric vehicles (EV) and behind-the-meter domestic purposes.

Existing regulations primarily anticipate use of small, portable batteries, such as traditional Alkaline AA batteries or lead-acid batteries used in petrol and diesel cars to supply current to the starter motor and ignition system. However, draft EU regulations providing a more modern and robust battery recycling regime that address modern uses or large batteries have been published and are expected to come into force in 2022. Other countries, including the UK, are expected to follow suit with their own regulations. An overhaul of the current dated regulations is overdue.

We explore below the drivers for these changes and the key features of the anticipated regulatory developments.

Second life drivers

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Large batteries are rife and are set to significantly multiply. Battery growth has been accelerated by the global drive to reduce emissions backed by multi-Government pledges to achieve net zero (by varying dates and varying degrees of commitment), which now cover more than 70% of global CO2 emissions according to the IEA. By 2030, global energy storage capacity is projected to be twenty times larger than capacity in 2020 according to BloombergNEF. Similarly, the IEA projects that the current 10 million EVs on the road globally could grow to as many as 230 million by 2030. In the UK, the Government's ambition is to end all sales of petrol and diesel cars by 2030, with projections of the UK's EV stock reaching up to 16 million by that date in the UK alone.

This leaves the world with a lot of batteries reaching the end of their initial purpose, even before we look to growth in utility-scale energy storage and uses for batteries in the drive for decarbonisation. The environmental interest in not disposing of toxic batteries in landfills and reducing the scope of mining activities required to extract raw materials is perhaps obvious, but there are other (less altruistic) reasons to recycle or repurpose batteries, such as:

- **Financial:** when a battery can no longer maintain its initial purpose, it may still be able to perform other functions. For example, after several years of use an electric bus battery may not hold sufficient charge to continue powering the bus, but it may still hold enough charge to function as part of a larger utility-scale battery storage facility. Once a battery is no longer fit to perform any other useful function, there may still be value in recycling the battery and extracting its raw materials. Repurposing and recycling therefore adds value to a battery's life and may provide an economic justification for greater use and implementation of batteries in various elements of our lives.
- **Geopolitical:** The Western world's geopolitical interest in batteries lies mainly in the Chinese dominance of the battery supply chain. China controls much of the global mining for lithium, cobalt and other materials critical for battery cells, as well as the vast majority of the world's raw material refining and manufacturing capacity for batteries. If raw materials can be recycled or repurposed from existing batteries, the dependence on one nation for the production and processing of new raw materials is reduced and energy security bolstered.

Battery life

Lithium-ion batteries, which are the predominant type of battery used in EVs and utility-scale battery storage today, as with all batteries, degrade as energy is processed. Lithium-ion batteries are typically assumed today to reach their end-of-life when the battery degrades to 70%-80% of its initial capacity. Power is still there, but it is insufficient to fulfil its initial purpose.

How long it takes for batteries to reach this stage will depend primarily on the type of battery and its use. For example, batteries used in buses are cycled much more regularly than a typical EV battery, so will reach end-of-life more swiftly. Relatedly, utility scale batteries are used in very different conditions to EVs and might only discharge for a duration of a few minutes or even seconds per day.

However, most of these batteries are currently expected to have a lifespan of about 5 to 10 years. For example, warranties currently provided by most manufacturers of utility scale batteries generally provide that, after a 10 year period, the battery will hold between 60%-80% of its original capacity (subject, of course, to various usage assumptions).

Recycle or repurpose?

Battery recycling processes differ depending on the type of battery used. In the case of lithium-ion batteries, recycling usually entails either acid leaching and reduction (hydrometallurgical) or high temperature smelting (pyrometallurgical) of the batteries to recover the valuable materials. The valuable materials recovered from lithium-ion batteries are predominantly cobalt, nickel (both generally the most expensive parts of the battery), copper, lithium, manganese and rare earth metals. These materials are can then be recycled to produce new batteries.

The repurposing process is more varied and will depend on the battery. For example, an EV battery may be reconfigured into a different energy storage function where it would not be required to discharge for prolonged periods, such as (in combination with other batteries) utility-scale batteries or for domestic purposes. Equally, end-of-life utility-scale batteries can be repurposed as co-located or back-up storage for solar projects or to store energy at EV charging stations. A number of projects implementing repurposed batteries have already been successfully, and commercially implemented.

Repurposing is not mutually exclusive with recycling. A battery can be repurposed once or even twice before being recycled, and doing both will increase the economic value of the battery and reduce its carbon footprint. However, there is still a way to go on both fronts. Batteries are not necessarily designed with repurposing in mind and may be obsolete in 10 years' time. Equally, more large scale and advanced battery recycling facilities are required to maximise the extraction of raw materials and cope with the exponential growth in battery use.

Given the above drivers, a sophisticated regulatory regime is required to provide a framework to encourage and support the treatment of used batteries.

Current UK regime

The Waste Batteries and Accumulators Regulations 2009 (SI 2009/890) (“Waste Batteries Regulations”) governs producer responsibility for batteries in the UK. The Waste Batteries Regulations implemented aspects of the EU Batteries Directive 2006 (2006/66/EC), the purpose of which is to minimise the negative impact of batteries on the environment and to make producers responsible for their collection, recycling and disposal. These regulations are part of the EU law retained in the UK following Brexit.

The Waste Batteries Regulations differentiate between industrial batteries (i.e. utility scale and EV batteries), automotive batteries (i.e. yesterday’s standard old car battery), and portable batteries (i.e. any other sealed batteries that can be hand-carried by a person without difficulty, such as AA and smartphone batteries).

The Office for Product Safety and Standards enforces the Waste Batteries Regulations against ‘producers’ of automotive and industrial batteries. A producer includes any person in the UK that places batteries on the market for the first time in the UK in a professional capacity (irrespective of the placing technique used and including through sales by distance communication).

Under the Waste Batteries Regulations, industrial battery producers are required to:

- register as a producer with the Secretary of State;
- provide a scheme under which they accept to retrieve waste industrial batteries provided to end-users. This must be free of charge to the end-user and within a reasonable time following request by the end-user. The producer must publish details of how an end-user can use the scheme;
- ensure waste batteries retrieved are responsibly treated and recycled by an approved battery treatment operator (meeting minimum recycling efficiencies) or delivered to an approved battery exporter for foreign treatment and recycling; and
- maintain written records of the amount in tonnes of batteries that, in each year, it places on the market for the first time in the UK and has been responsible for taking back and recycling.

Target annual collection rates are also required, currently set at 45% of the average annual amount of portable batteries placed on the UK market, and (with some variations depending on battery type) at least 50% of the materials in a battery have to be recycled. UK success rates in achieving these targets have been inconsistent.

The Waste Batteries Regulations focus more on waste-management than creating a circulate economy for the reuse and recycling of batteries. The

regulations are supplemented by various vehicle-specific 'End-of-Life Vehicles Regulations' for the reuse, recovery and recycling of scrap vehicles. Whilst these include provisions for depolluting toxic materials and car batteries, the dismantling and recycling targets are by weight – so, similar to the Waste Batteries Regulations themselves, are more of a regime for scrap metal management and disposal.

In 2018, the UK Government published “Our Waste, Our Resources, A Strategy for England (Resources and Waste Strategy)”. This report indicated that the Government will consult on reviewing the end-of-life vehicle regime in England as part of its extended producer responsibility framework in mid-2021. Whether this will be progressed (and, if so, if it will address batteries in detail) is yet to be seen.

So, whilst a UK battery recycling regime exists (as well as other less material recycling terms we have not detailed above), it is thin on detail and does not adequately address considerations of a circular economy and the exponential growth in industrial battery use. In particular, there is no distinction made between recycling and repurposing nor an accompanying framework for the latter, and there is little detail on specific provisions required for EV batteries.

EU proposals

The EU Commission proposed a new regulation on batteries and waste batteries in December 2020 (the “Draft EU Regulation”) to replace the 2006 directive on which the UK’s Waste Batteries Regulations is based. This is part of the EU’s new Circular Economy Action Plan – which, for batteries is aiming at a safe, circular and sustainable value chain for all batteries. The Draft EU Regulation would apply to all “economic operators”, being manufacturers, producers, importers and distributors of all types of batteries which are placed within the EU market – whether industrial, automotive or portable, and independent of their origin.

The proposals in the Draft EU Regulation include a framework to help facilitate repurposing batteries so that they can have a second life – and to encourage a market in second life batteries. We set out below the key proposals.

- **Battery dataspace:** To ensure transparency and clarity on battery conditions, data sharing is at the forefront of the Draft EU Regulation. A common electronic exchange system or “battery dataspace” would be established (by 1 January 2026 according to the Draft EU Regulation) as a means of registering all batteries with a capacity above 2KwH on the EU market. The database would be available to the public and contain information on each battery model including its lifetime, charging capacity and any safety risks or hazardous substances.

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- **Battery passports:** The database would be linked to an individual digital “battery passport” for each battery with a capacity above 2KwH, accessible using by a QR code printed on the battery itself. The operator who places the battery on the EU market is responsible for updating the battery passport. These mechanisms will help to trace batteries and their management throughout their lifecycle.

The battery passport should help second life battery purchasers, users and operators to make informed decisions and allows recyclers to better plan their operations and increase recycling efficiency, whilst making used batteries more marketable.

- **End-of-life criteria:** The Draft EU Regulation also proposes that second life batteries must fulfil specific end-of-life criteria, including passing a ‘health check’ before being sent for repurposing. This approach, supported by extended producer responsibility requirements, aims to encourage the repurposing of batteries while ensuring that waste batteries are treated in line with EU waste legislation and provide consumer confidence in the second life battery market.

Obligations relating to second-life batteries are also extended to those carrying out repurposing operations to ensure that the examination, performance testing, packing and shipment of batteries and their components is done with adequate quality control and safety instructions. A battery management system is proposed to be made available to battery owners, operators working on their behalf and operators carrying out repurposing or remanufacturing operations. This system would store the information required to determine the state of health of a battery (and its residual value).

- **Battery contents:** To address environmental concerns, the Draft EU Regulation requires that all batteries are to be produced using responsibly sourced materials and with restricted use of specified hazardous substances and minimum recycling content thresholds (to apply from 1 January 2030 and increase over time thereafter). It is proposed that from 1 July 2024, rechargeable industrial batteries will need a carbon footprint declaration to be placed on the EU market and, from 1 January 2027, the recycled content in batteries in the EU will need to be declared.
- **Carbon footprint:** It is also proposed that rechargeable industrial batteries will need a carbon footprint declaration to be placed on the EU market including related labelling concerning the environmental impact of that battery over its life cycle. The intention is to establish carbon footprint performance classes that will provide for the identification of batteries with overall lower carbon footprints. Furthermore, contracting authorities subject to the public procurement process are then obliged to consider such information (and award criteria based on this declaration) to ensure that batteries are chosen with significantly lower environmental impacts over their lifecycle.

- **Collection rates:** New targets for the collection, treatment and recycling of end-of-life batteries are also to be enshrined in law. All industrial and automotive batteries will need to be collected in full, and the collection rate for portable batteries is proposed to be raised from 45% to 65% by 31 December 2025 and 70% by 31 December 2030.

It was originally proposed that the Draft EU Regulation would be implemented on 1 January 2022. However, it is currently still proceeding through the standard EU legislative procedure. The Draft EU Regulation has been reviewed and commented on by various European Parliament committees, each of which has proposed that certain amendments be made. For example, the Committee on the Internal Market and Consumer Protection has proposed 237 different amendments. Given the complexity and importance of the legislation, it has taken longer to finalise and is now expected to be implemented later in 2022.

Whilst the Draft EU Regulation may still be amended before it is enshrined in statute, we expect the headline provisions outlined above to remain subject perhaps to adjustments to some of the projected timelines for achieving these provisions and potentially to some of the stated thresholds.

Detractors of the Draft EU Regulation argue that it may be too restrictive and stifle innovation in the European battery market slowing down Europe's transition to low emissions as well as deterring companies from entering the European battery market. The Draft EU Regulation, however, is a welcome development and, even though it is not perfect, it should help to enshrine a clear recycling and repurposing regime, establish relevant targets, increase transparency and battery specific information sharing, and to enhance the marketability of used batteries.

UK developments

In 2020 the UK Government issued a policy statement reiterating the UK's commitment to achieving a 'circular economy' and indicating that various legislative changes are intended to be enacted (with some steps already taken).

The UK Government has also announced various funding and grant schemes focused on EV recycling. For example, £40 million was made available under the Industrial Strategy Challenge for 27 projects to make EV batteries longer lasting and cleaner in November 2017. Additionally, in 2021 the Office for Zero Emission Vehicles funded a £17 million competition to support the transition to zero emission vehicles, including solutions that enable battery recycling.

However, the Waste Batteries Regulations are still the prevailing legislation in this area and, as discussed above, do not address the challenges of the modern battery economy. The UK Government may be conscious that the framework established by the Draft EU Regulation could provide regulatory

clarity that attracts investment in battery development within the EU in preference to the UK.

In an October 2018 BEIS report entitled 'Electric vehicles: driving the transition', it was noted that second life battery applications, EV end-of-life disposal and battery recycling were nascent areas that could offer significant industrial opportunities. The report recommended that the "Government explores the potential value of these [areas] to the UK and takes a lead in developing those that are promising, before other countries gain a competitive edge".

The UK Government has been beating the same drum as the EU on energy transition, batteries and on a circular economy. While it is not yet clear when the UK might overhaul the Waste Batteries Regulations or what such overhaul might look like, the pressure is mounting for the UK Government to develop this area and the UK Government is sure to at least consider the Draft EU Regulations when formulating its own policy.

Conclusion

The existing battery recycling regulations in the UK, the EU and most other jurisdictions pre-dates the enormous growth (and further expected exponential growth) in the EV and utility-scale battery market. The current regulations focus on waste management, rather than repurposing and recycling batteries in a more sustainable, circular economy. Accordingly, regulatory updates are required.

The Draft EU Regulation is a welcome and well-thought through framework to monitor and facilitate the recycling and repurposing of batteries. The experience of the EU in implementing the Draft EU Regulation will be followed closely by other countries, including the UK, who will hope to learn from the EU's experience and borrow elements for the overhaul of their own regulatory regimes.

Introducing a framework for repurposing batteries is particularly significant and, coupled with an enhanced recycling regime, will improve the marketability of batteries, reinforce an additional link to a now circular supply chain and further attract investment to the energy storage sector.

We will monitor with interest how these legislative developments in the EU will progress, and if nations outside of the EU will follow suit.

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