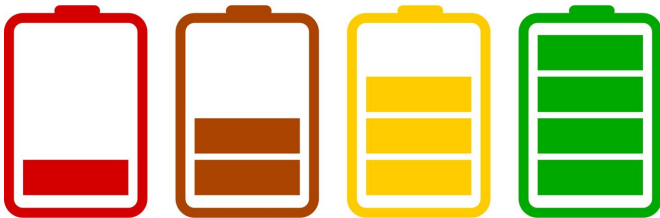


UK needs to act to prevent electric vehicle battery waste mountain, new study says

6 November 2019



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Recycling technologies for end-of-life lithium ion batteries (LIBs) are not keeping pace with the rapid rise of electric vehicles, storing up a potentially huge waste management problem for the future, according to a new study.

A review of lithium ion [battery](#) recycling led by the University of Birmingham suggests that, while [electric vehicles](#) (EVs) offer a solution for cutting pollution, governments and industry need to act now to develop a robust recycling infrastructure to meet future recycling need.

The study, carried out in collaboration with researchers at the universities of Newcastle and Leicester, is published today in the 150th anniversary issue of *Nature*.

Dr. Gavin Harper, Faraday Research Fellow at the University of Birmingham, is lead author on the paper. He said: "The recycling challenge is not straightforward: there is enormous variety in the chemistries, shapes and designs of lithium ion batteries used in EVs. Individual cells are formed into modules, which are then assembled into battery packs. To recycle these efficiently, they must be disassembled and the resulting waste streams separated. As well as lithium, these

batteries contain a number of other valuable metals, such as cobalt, nickel and manganese, and there is the potential to improve the processes which are currently used to recover these for reuse."

The issue of LIB waste is already significant and is set to grow as demand for EVs increases. Based on the 1 million [electric cars](#) sold in 2017, researchers calculated that 250,000 tonnes or half a million cubic metres of unprocessed pack waste will result when these vehicles reach the end of their lives.

There is also an enormous opportunity for the UK. Analysis by the Faraday Institution—the UK's independent institute for electrochemical energy storage research—points to the need for eight gigafactories in the UK by 2040 to service the demand for LIBs. The UK will need to develop sources of supply for the [critical materials](#) required for these batteries and recycled material could play a important role.

Professor Andrew Abbott, of the University of Leicester and co-author on the paper, said: "Electrification of just 2 per cent of the current global car fleet would represent a line of cars that could stretch around the circumference of the Earth—some 140 million vehicles. Landfill is clearly not an option for this amount of waste. Finding ways to recycle EV batteries will not only avoid a huge burden on landfill, it will also help us secure the supply of critical materials, such as cobalt and lithium, that surely hold the key to a sustainable automotive industry."

The study identifies a number of key challenges that engineers and policy-makers will need to address, including:

- Identifying second use applications for end of life batteries
- Developing rapid repair and recycling methods, particularly given that large-scale

storage of electric batteries is potentially unsafe

- Improving diagnostics of batteries, [battery packs](#) and battery cells, so the state of health of batteries can be accurately assessed prior to repurposing
- Optimising battery designs for recycling to enable automated battery disassembly, safer than the current manual handling techniques
- Designing new stabilisation processes that enable end-of-life batteries to be opened and separated, and developing techniques or processes to ensure that components are not contaminated during [recycling](#).

Provided by University of Birmingham

"These batteries contain huge amounts of power and at the moment we are still relatively unprepared about how we deal with them when they reach the end of their life," explains co-author Professor Paul Christensen, of Newcastle University, who is also working with a number of UK Fire and Rescue Services on developing protocols for dealing with lithium ion battery fires.

"One of the areas of research for this project is to look at automation and how we can safely and efficiently dismantle spent batteries and recover the valuable materials such as lithium and cobalt. But there's also a public safety issue that needs addressing as second-life EV batteries become more widely available. What we need is an urgent look at the whole lifecycle of the battery—from digging the materials out of the ground to disposing of them again at the end."

Paul Anderson, Co-Director of the Birmingham Centre for Strategic Elements and Critical Materials, adds: "Meeting these challenges will require a large amount of ambition as well as a consistent approach to policy-making. This is essential if we are to create solutions within the design process that will allow us to make a smooth and sustainable transition to electric vehicles."

More information: Recycling lithium-ion batteries from electric vehicles, *Nature* (2019). [DOI: 10.1038/s41586-019-1682-5](#) , [nature.com/articles/s41586-019-1682-5](https://www.nature.com/articles/s41586-019-1682-5)

APA citation: UK needs to act to prevent electric vehicle battery waste mountain, new study says (2019, November 6) retrieved 27 September 2022 from <https://techxplore.com/news/2019-11-uk-electric-vehicle-battery-mountain.html>

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