



Frequently asked questions

Second life batteries

1. What is a second life battery?

- a. A second life battery is one which is deemed to no longer be suited to its originally intended use within a vehicle.
- b. This may be because the level of degradation has reduced the range of the vehicle so much that it can no longer cover the desired range, or it may be because the vehicle operator/owner has chosen to replace or upgrade the battery to either increase range further or increase the potential payload by installing a newer technology/higher energy density battery.
- c. As batteries are charged and discharged they gradually lose their ability to hold energy and this is termed degradation.
- d. Batteries suited to use in second life are typically around 25% degraded.

2. How long can batteries last in 2nd life?

- a. Connected Energy works on the basis that second life batteries will need to be replaced when they are 50% degraded.
- b. How long batteries can be used in second life depends on how they are used and how the energy storage systems are configured but Connected Energy anticipates that they will have a lifetime of 5 to 10 years.
- c. Connected Energy already has systems that have been operating for 4 years.

3. How many second life batteries are available?

- a. Currently, usable second life batteries are available in low numbers of thousands but quantities are predicted to ramp up significantly from 2024/25 when volumes will increase dramatically.

4. Working with Renault

- a. Connected Energy has been working very collaboratively with Renault for the last 5 years and most of its systems utilise Renault batteries. The business aims to continue to build this relationship with Renault and develop increasingly innovative and customer focused products for the UK and European markets.

Connected Energy

1. Connected Energy began to focus exclusively on the development and deployment of energy storage systems using second life batteries in 2015. Prior to that the team traded as Future Transport Systems and focussed on E-mobility related consultancy and was involved in managing early EV fleet and infrastructure trials and demonstration projects.
2. Connected Energy has its head office and Commercial Hub in Newcastle upon Tyne and a Technical Centre in Norfolk.
3. Connected Energy currently employs 25 people across a range of disciplines and anticipates reaching 30 plus people by the end of 2022.
4. Connected Energy's systems are called E-STOR and M-STOR. The E-STOR systems are containerised units mainly intended for installation behind the meter on industrial and commercial sites. The M-STOR systems will be utility scale systems that are likely to be installed to provide balancing services to the grid or be collocated with renewable



- generation to provide a degree of high value dispatchability. The M-STOR systems will be developed as long-term assets designed to monetarise a 'flow' of varied batteries.
5. Connected Energy has 15 systems operational or in development in the UK, Belgium, Germany and the Netherlands with the oldest systems having been in operation for over 4 years.
 6. Connected Energy has a 1.2MW system installed on Umicore's site in Belgium (Umicore recycles lithium-ion batteries) and has recently installed a cluster of 3x300kW systems on site for Cranfield University.
 7. Systems provide a range of functions including generating revenue by providing flexibility services to National Grid; managing electrical load profiles to flatten peaks loads – e.g. reducing the load of EV chargers by providing some electricity from the grid and some from the energy storage system; optimising energy systems by helping to manage the flow of energy between on-site generation and on-site loads.
 8. Connected Energy does not yet have a flow of depleted batteries leaving its systems but once it does, it will seek the most environmentally sustainable recyclers to meet its requirements.
 9. Connected Energy's strategy is to continue to sell its smaller containerised E-STOR systems but with its new investment it will scale up to much larger M-STOR systems designed to manage the increasing flow of batteries becoming available from around 2024. It aims to build and operate a 20MW/40MWh system from 2024 to demonstrate its technology and business models at scale.
 10. Connected Energy has battery agnostic control systems that can be adapted to respond to battery availability. Its larger M-STOR systems will utilise a mix of battery types which will depend on battery availability and cost when the systems are installed.
 11. The business model of Connected Energy is a function of both battery availability and the commercial attractiveness of the energy storage market. In the short term it plans to increase its sales in Europe but also begin operations in the USA.

Carbon savings

1. A carbon impact analysis undertaken by Lancaster University has indicated that for every MWh of second life batteries installed there is a lifetime benefit of 450 tonnes CO₂e over the use of new lithium-ion batteries.
2. In addition to providing a lower impact energy storage solution, the use of energy storage is also a key enabler of grid decarbonisation. Energy storage enables non-dispatchable, distributed renewable generation to be balanced with the load on the grid.

Safety

1. Connected Energy has developed battery energy storage technology that uses the EV batteries exactly as they are in the car but in a storage system, so that as far as the batteries are concerned, they *are* in a car. A controller has been developed which is capable of communicating with multiple batteries at the same time and in the same language as they would in the car, that also interfaces with a bi-directional battery charger, which converts the current from DC to AC and vice versa so it can connect to the grid.



2. Connected Energy has set out to establish the benchmark in safety for second life systems.
 - a. It will only use batteries if it has the full cooperation of the battery supplier.
 - b. It uses tested but unchanged battery packs so it capitalises on all the investments in safety and control systems made by the OEM.
 - c. It has additional safety systems to identify any problems with the batteries or the battery management systems.
 - d. It is embedding AI into its systems so it can identify performance anomalies early.
 - e. All systems are remotely monitored in real time so action can be taken quickly if required.
 - f. In the event of a problem batteries can be quickly powered down and isolated.

On new investors

1. Connected Energy now has investors with interests in battery supply, energy storage finance, utilisation, monetisation and recycling and it regards this model as key to scale up. A collaborative approach is, in its opinion, essential to making the second life model work commercially and at scale.
2. Connected Energy plans to work with each of its key investors to leverage their knowledge and expertise in scaling up its business.