

Second life energy storage firms position themselves ahead of EV battery boom

Reuse | Batteries from electric vehicles can find a 'second life' in energy storage systems, making more use of these valuable devices, and offering a potentially low-cost way to sidestep supply chain bottlenecks. Cameron Murray meets some of the companies harnessing used automotive batteries to play a part in the energy transition even without wheels.

The shortage of lithium-ion battery cells continues to hamper the stationary energy storage system (ESS) industry, and the mismatch in supply and demand does not look like going away anytime soon. That means the value proposition of repurposing used electric vehicle (EV) batteries into ESS units is as clear as day.

In this article we interview four companies doing this; BatteryLoop (Sweden), Octave (Belgium), Evyon (Norway) and Moment Energy (Canada), while touching on others that have previously spoken to PV Tech Power.

Big volumes of second life EV batteries are expected to become available for this starting from 2025 and with up to 227GWh hitting the market by 2030, according to McKinsey, the potential is huge. That figure would exceed the expected demand for utility-scale lithium-ion ESS by that point.

But the deployment of such second-life systems is at a very nascent stage, and the majority of operational systems use relatively new battery cells rather than ones with a few years of EV activity behind them.

While overall global cumulative battery energy storage deployments are somewhere in the low double-digit gigawatts (GW), operational second-life systems outside of China probably only total a few hundred megawatts (MW) at the very most, based on the number and scale of announced projects.

Supply of battery modules

As mentioned, most battery modules which are in today's operational second life ESS units are relatively unused. These include battery modules from test vehicles, manufacturing process breakage which means the battery is not suitable for an EV but fine for ESS, and cases of oversupply. But

the portion of systems which are made up of actual second life modules is growing.

In the case of newer batteries, second life ESS companies can offer similar 10-year warranties to regular ESS ones. For used batteries bespoke warranty or service agreements may need to be formulated, although sophisticated monitoring and control algorithms can mean similar warranties to first life are possible.

Companies can buy modules directly from OEMs, and Renault, Nissan and Mercedes-Benz seem to be leaders in selling to second-life solution companies. Batteries can also be bought from battery recyclers' marketplaces but it's a highly illiquid market with obscure pricing dynamics for now.

"There is a trade-off in terms of remaining lifetime of the batteries and the purchase price: a battery module with a lower state of health is cheaper but will have to be replaced more often," says Maxime Snick, co-founder and general manager of Octave.

Because of the variability in battery module size, companies need to have a fairly flexible architecture platform to design new systems when a new module type comes in with enough volumes to build a new product - a system typically needs a homogeneous set of modules.

BatteryLoop has secured used batteries from electric trucks and built an architecture around that while another firm, Germany-based Tricera, has built systems using electric forklift batteries.

Customers and use cases

With the size of the systems that these companies offer generally in the few hundreds of kWh, their main deployments to-date have been in the commercial and industrial (C&I) segment. All four mentioned a focus on deploying systems to optimise



Image: BatteryLoop

BatteryLoop's energy storage system.

PV and EV charging as well as the obvious behind-the-meter C&I use cases like peak shaving.

Both Nordic firms cited commercial real estate owners and developers as typical end-users, with Evyon's chief commercial officer (COO) Ralph Groen adding that construction sites are now a big opportunity too. A requirement by 2025 in Norway for emissions-free construction in major cities means big demand for on-site chargers for electrical machinery and vehicles, and the company sells its units to firms building those charging solutions.

Moment Energy's main projects to-date have been at a scuba resort, a few off-grid residential deployments and upcoming off-grid projects with the respective departments of defence in the US, Canada and New Zealand.

All four companies are moving into the grid-connected or grid-scale market in different ways.

Utility Ottawa Hydro intends to purchase 480kWh of Moment's systems for the firm to deploy in different neighbourhoods to prevent the grid being overwhelmed by an increase in EV charging loads.

Bergström says BatteryLoop is starting to focus on working with energy companies

Image: Octave



or big industrial sites to provide frequency services, energy trading and grid support. "There's increasingly more and more renewable energy in the generation mix so there's more opportunities here," he says.

Groen mentioned arbitrage/energy trading as another use case of its systems while Snick says that Octave has put some of its systems into a virtual power plant (VPP) which provides flexibility services to the grid operator.

Drivers of demand

The demand drivers for energy storage more broadly will be well-known to readers of PV Tech Power and other Solar Media titles. An increasing demand for flexibility services and load shifting of intermittent renewable energy grows on the utility-scale side, and a desire to reduce electricity bills through peak shaving and optimise self-generation or EV charging on the C&I and residential end.

For second life ESS solutions specifically, sustainability is a big one. Groen says that it is becoming more and more of a driver for C&I customers and project proposals are now scored on their supply chain circularity, from 1-10.

Bergström similarly says that second life battery systems help real estate owners get more points in assessments for Leadership Energy and Environmental Design (LEED), a certification for how environmentally friendly a building is, which can then open up green financing opportunities.

The costs of second life ESS solutions are also more-or-less at parity with first life ones. "The same for NMC batteries, a bit higher when it comes to LFP," adds Bergström.

Design and software provider to fully integrated manufacturer

It being a relatively new market, these companies vary greatly in what parts of the process they do in-house versus contracting out, but all take charge of the module procurement and design of the ESS unit.

Octave's first battery system installation, at a waste incinerator site.

Moment Energy claims to be the biggest player doing second life ESS solutions in North America and has its own 15,000 square foot facility that tests modules and assembles them into enclosures (including any initial disassembly).

"We're fully vertically integrated. The only thing we outsource is sheet metal bending of the frames and enclosures," CEO Edward Chiang says.

BatteryLoop meanwhile outsources the production of its units but does the installation and system integration with adjacent technologies (PV, EV charging etc) as well as grid connection. Octave and UK-based Connected Energy subcontract out their production and system integration.

CEO Rasmus Bergström explains BatteryLoop's approach: "We are software people, and it becomes more complicated with unions if we have our own blue-collar employees. We prefer to steer production, which takes place in Sweden and to a lesser extent Germany."

There's also variability in the extent to which the companies develop their own battery management systems (BMS) and energy management systems (EMS) to wrap around the offer of their physical product.

Despite being the smallest outfit interviewed for this report, Octave has developed both in-house BMS and EMS platforms and is putting a lot of effort into developing sophisticated models for combining its ESS with on-site EV charging.

Moment Energy, the only one to have its own manufacturing facility, has its own BMS but does not provide an EMS. Octave and Connected Energy offer microgrid controls to integrate their ESS with other power loads/sources.

Chiang: "We will work with any EMS platform. It's a crowded market already so we chose not to focus on that."

Connected Energy CEO Matthew Lumsden described its bespoke BMS as its 'secret sauce', Evyon uses a master BMS from a 'leading European provider' while

BatteryLoop buys its modules with attached BMS, on top of which it builds a multi-string and battery controller.

Outsourcing of production should not come as a surprise, considering the world's largest battery energy storage system (BESS) technology provider Fluence also uses third-party manufacturing to build its modular product.

Money raised and deployment targets

Moment Energy has a project pipeline of over 20MWh projects but, like BatteryLoop, could deploy 100MWh based on its battery volumes if it had enough manufacturing capacity, Chiang says. It has raised US\$9 million in seed funding and an additional US\$7-15 million in funding is on its way by the end of the year.

Evyon has raised over €10 million to-date and has secured access to 40MWh of battery modules for delivery to customers during 2023, Groen says. Octave for its part is targeting 7MWh of deployments over the next 12 months.

Bergström wouldn't disclose BatteryLoop's near-term deployment targets, only saying that the order book is 10 times larger than a year ago. The company is part of big recycling firm Stena.

Major challenges

So, what are the challenges for these companies? As with 'first life' BESS solution companies, supply chain and scaling are the main things that come up.

"Our main challenge right now is just being able to scale up manufacturing fast enough, and getting the UL 1974 certification, which is just a matter of time," Chiang says.

"My headache on the supply chain is the ingoing material for electrical cabinets and general components," Bergström says. "I have the battery volumes to deploy 100MWh today, but I don't have the capacity in terms of the size of my company."

Snick similarly says that it is the supply of the surrounding electronic equipment needed for an enclosure that is the bottleneck, not the battery modules themselves.

All to play for as a huge opportunity looms

The second life market looks set to boom in the coming years as EV uptake grows. But it is still taking shape so it will be fascinating to see what roles OEMs, battery recycling firms and system integrators carve out for themselves in the space. ■

Nissan's LEAF electric vehicle. The firm is one of the leaders in working with third-party second life ESS companies.



Image: Nissan