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Case Study

A Second Life for Lithium-Ion Batteries in Nigeria

Innovate UK Global Alliance Africa collaborates with Hinckley Recycling in Nigeria to identify effective solutions for end-of-life care for lithium-ion batteries.

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Introduction

The UK battery industry reflects a new market destination with significant business opportunities. The estimated global Lithium-Ion (Li-ion) battery market is worth over \$40 billion¹. These batteries could create millions of tonnes of waste if not recycled.



As the global demand for batteries continues to surge driven by increased electric transportation and consumer electronics, the need for more efficient and environmentally conscious recycling processes has become a national and global priority.

International partnerships, such as the collaboration between Hinckley Recycling (Nigeria), Enverse (UK/Singapore), SLS Energy (Rwanda) and Aceleron (UK) through Innovate UK Global Alliance Africa's Open Innovation (OI) programme, are critical in driving this vision forward.

These alliances are directly contributing toward the UK's Africa Technology and Innovation Partnership (ATIP) objectives in promoting sustainable initiatives that leverage innovation to address key development, social, and economic challenges².



1. pubs.rsc.org/en/content/articlelanding/2021/ma/d1ma00216c
2. devtracker.fcdo.gov.uk/programme/GB-GOV-1-300704/documents

The Challenge

In 2022, the e-waste recycling specialists, **Hinckley Group**, launched two Open Innovation (OI) challenges with support from Innovate UK Global Alliance Africa to improve circular usage of Li-ion batteries.

At the time, Hinckley were receiving 10,000-15,000 battery packs every year without the technology to successfully track, trace and repurpose the batteries as a second life energy source. This led to the launch of two concurrent OI challenges:

1. **Battery Inventory System - Track, Trace and Report on Lithium-Ion Batteries** focused on developing a tracking system to code individual batteries based on their potential to be reused within the circular economy.
2. **Innovative Solutions for Second-Life Batteries** focused on identifying affordable second-life battery solutions to satisfy diverse use cases such as roadside kiosks, personal mobility, and light and cooling services.

Following a competitive process, three innovative Solution Providers were selected:

- **Enverse**, a global expert in industrial data analytics, selected to develop a battery inventory management system (BIMS) that included an integrated traceability system.
- **SLS Energy**, an established circular economy provider in Rwanda with expertise in energy storage-as-a-service for second life batteries.
- **Aceleron Energy** (now owned by **ADVIK**), a UK renewable energy specialist, selected to develop and apply their expertise in innovative storage technology.

The partnerships were launched in a visit to the Hinckley Recycling site in Lagos. Solution Providers gained first-hand understanding of the problem and engaged directly with Hinckley Recycling on defining the required solutions through their new collaborations.



“The positive outcomes of the project build mutual trust and confidence, establishing a solid foundation for continued cooperation. This synergy paves the way for ongoing advancements, potential expansions into new markets, and the exploration of additional sustainable energy initiatives.”

Léandre Berwa, CEO, SLS Energy

The Hinckley Recycling challenges showcase the strengths of the Open Innovation (OI) programme in connecting global stakeholders to develop new technological innovations and establish long-term multinational partnerships that deliver market-ready solutions for Global Alliance Africa partner countries.



In September 2024, Hinckley Recycling secured an investment of \$5m to establish Africa’s first Lithium battery recycling plant in Ogun State, Nigeria, to turn the threat posed by these toxic wastes into a thriving business creating at least 100 direct jobs. As a result of the OI pilot projects, Enverse and SLS Energy have established a new long-term partnership with Hinckley Recycling, including the scaling up of existing operations in Nigeria, as well as identifying new and emerging markets for second life battery circular economy solutions³.

“The Global Alliance Africa and Hinckley Recycling teams worked closely together to define their most pressing challenges, then collaborated with challenge winners to develop innovative solutions that can be integrated and scaled for the Nigerian market. Our in-country team will continue to support our partners after their successful outcomes to maximise the potential of their hard work.”

Babar Javed, Open Innovation Knowledge Transfer Manager, Innovate UK Business Connect

Circular Economy innovations are core to creating a more sustainable climate and to promoting a resilient future economy. In line with UK Research and Innovation (UKRI) objectives, the OI projects on second-life Li-ion batteries in Nigeria actively seek to keep critical resources in use for as long as possible, extracting their maximum value when in use and recovering products and materials after use.

This, in turn, contributes towards achieving net zero carbon emission targets, as well as reducing waste and pollution and enhancing resource security⁴. This innovation targets Sustainable Development Goal (SDG) 12, focusing on sustainable production and consumption patterns, especially with regards to chemicals and waste⁵.

The following spotlights highlight how each of the OI projects are contributing towards addressing sustainability challenges in Africa through a circular economy approach to recycling and reusing of Li-ion batteries.

“Through Global Alliance Africa, the collaboration between Innovate UK and the FCDO has been instrumental in driving impactful innovation through initiatives like the Hinckley Li-ion battery Open Innovation projects. By providing critical expert support and funding, this partnership enabled the development of scalable, sustainable solutions for second-life battery usage and inventory systems. These projects not only addressed the need for resource efficiency and clean energy in Africa, but also established long-term global partnerships and investment for economic opportunities and environmental benefits.”

Dr Nee-Joo Teh, Head of Global Alliance, Innovate UK Business Connect

3. punchng.com/uk-plans-5m-lithium-battery-recycling-plant-in-ogun

4. www.ukri.org/what-we-do/browse-our-areas-of-investment-and-support/manufacturing-and-the-circular-economy-theme

5. sdgs.un.org/topics/chemicals-and-waste

Spotlight 1: Enverse



As part of the Innovate UK Global Alliance Africa Open Innovation challenge, Enverse developed a battery inventory management system. The inventory system allows Hinckley Recycling to test and track the performance of individual battery cells (identified during the cell testing phase) and then adding that data to a bespoke, cloud-based digital battery passport system.

"It was great to share ideas with a professional software developer such as Enverse and see our ideas come to life in a software solution that could be easily adopted by the business."

Adrian Clews, Managing Director, Hinckley Recycling

One of the challenges faced by the project team was in ensuring the inventory process was designed using affordable, commercially available products (i.e. the battery tester, label printer and QR scanner) and that each step of the process took account of local conditions.

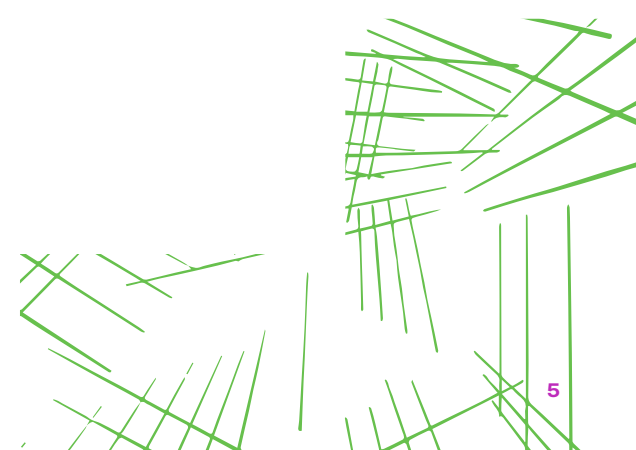
For example, frequent and unpredictable power outages posed a challenge to the battery testing phase. Enverse therefore created bespoke Li-ion cell test cycles that record data continuously to account for interruptions in energy supply during the 7.5 hours testing cycle. This also allows for cells to be grouped according to the specific tolerances and configurations required by the other OI solution providers, SLS Energy and Acleron Energy, therefore showing evidence of a truly collaborative approach to the technology development process.

"This product has paved the way for a combined battery inventory management system and battery passport solution... [that] extends the life of lithium-ion cells and reduces the carbon footprint. This solution also helps in providing electricity access and job opportunities in Nigeria."

Howard Han Wuen Low, Founder and CEO, Enverse



Going forwards, Hinckley Recycling and Enverse will co-own the products and IP and are currently working to build a customer base, both in Africa and within the emerging market in the EU, following anticipated regulatory changes related to battery passports.



Spotlight 2: SLS Energy



SLS Energy were commissioned to develop a sustainable and scalable solution for second-life batteries that met the needs of prospective end-users in the Nigerian market, both in terms of its technical specifications and its affordability.

“This solution [developed by SLS] provides low-cost, reliable, and clean energy storage and power backup for various business applications in Nigeria. It will provide the missing link for a more sustainable adoption of renewable energy and electric mobility by creating a circular economy for batteries.”

Léandre Berwa, CEO, SLS Energy

Initial market research identified telecommunication towers, mini-grids and businesses as the main markets for innovative second-life Li-ion battery solutions, with the product prototype subsequently developed by SLS Energy meeting these technical needs, as well as being projected to cost end-users 40% less than the average battery systems currently in the Nigerian market. The prototype battery system was piloted in Kigali and Lagos, with plans to expand the pilot to remote, rural regions of Nigeria where there is high demand for affordable energy storage solutions.

“SLS Energy were able to deliver a robust second life solution perfect for both home and industrial use. The systems come with a powerful specification which is managed by a custom Battery Management System (BMS) developed by Enverse.”

Adrian Clews, Managing Director, Hinckley Recycling

As well as offering cost-effective and reliable power supplies, the solution will have multiple positive environmental impacts, not only by creating a pathway to reuse batteries, but also by reducing reliance on diesel generators across the target market.

“Our solution highlights that there is untapped value in retired battery cells, encouraging more responsible end-of life management for these products and avoiding battery waste. This creates green jobs and avoids direct greenhouse gas emissions at the same time.”

Léandre Berwa, CEO, SLS Energy

The success of the pilot project has led to SLS Energy and Hinckley Recycling forging an ongoing partnership, including but not limited to, continuing to optimise the existing prototype, expand out to new markets, and to develop new sustainable energy solutions in the future.

“The solution is price competitive. We expect it to replace generators for those companies running small generators or as a modular system with multiple units for larger power users such as telcos [telecommunication operators].”

Adrian Clews, Managing Director, Hinckley Recycling

As a result the project has benefitted not only the two project partners, but also the wider innovation ecosystem in Nigeria and across the region by creating a new sustainable solution for Li-ion battery waste through second-life applications, thereby contributing to the accessibility and affordability of clean energy access in Nigeria.

“We are grateful for having the opportunity to work with incredible partners such as Hinckley Recycling and Innovate UK Global Alliance Africa. We received market and product exposure from an experienced partner in Nigeria, and we have created relationships that will unlock valuable commercial opportunities for both ends. Innovate UK’s funding was crucial to facilitating the process, as was the team’s support and understanding.”

Léandre Berwa, CEO, SLS Energy

Spotlight 3: Aceleron

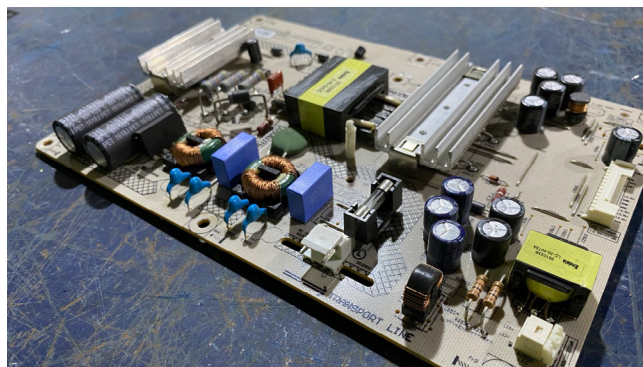


Aceleron Energy were also supported to develop an innovative solution for second-life batteries. Through a partnership with the WEEE Centre in Kenya, our partners on previous OI projects, Aceleron Energy had already developed a methodology for combining Li-ion cells via compression technology into battery packs tailored to the needs of end users (both in terms of voltage and energy capacity).

The pilot project with Hinckley Recycling further developed Aceleron Energy's methodology to create products suited to the Nigerian market and for supply chains available to Hinckley Recycling. The end solution developed offered a number of benefits, in particular, a modular design that uses compression technology that enables users to change individual Li-ion battery cells within the pack.

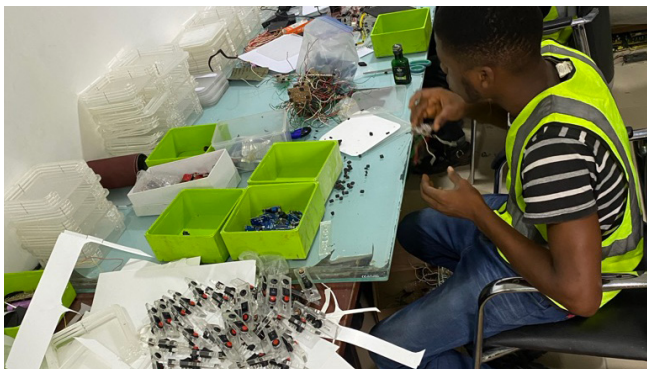
"[Aceleron Energy] had an innovative product... They've been in development for several years, and you could see that in the finished product, the casing, the performance, the reliability, the stability, everything was excellent."

Adrian Clews, Managing Director, Hinckley Recycling



"Our [Hinckley] engineers were provided with training on how to build the battery pack. They shipped the components to us, so we literally built a finished [prototype] at our facility. In doing so, our engineers really saw what can be achieved with second life batteries."

Adrian Clews, Managing Director, Hinckley Recycling



Following the development of a prototype based on its Ecostore/Essential battery pack, Aceleron Energy have delivered training and created technical manuals to support the Hinckley Recycling team to assemble and distribute the prototype to its target markets in Nigeria.



Spotlight 4: Hinckley Group



Hinckley Recycling's collaborative pilots with Enverse, SLS Energy and Aceleron, led to further developments with the UK's Manufacturing Africa programme and other partners. The Ogun state government is partnering with Hinckley on a \$5million investment to establish the first lithium-ion and lead-acid battery recycling and treatment plant in Africa.



“The introduction of UK-patented battery recycling technology will elevate Ogun State’s industrial landscape, establishing the state as a technological leader in battery recycling across Africa.”

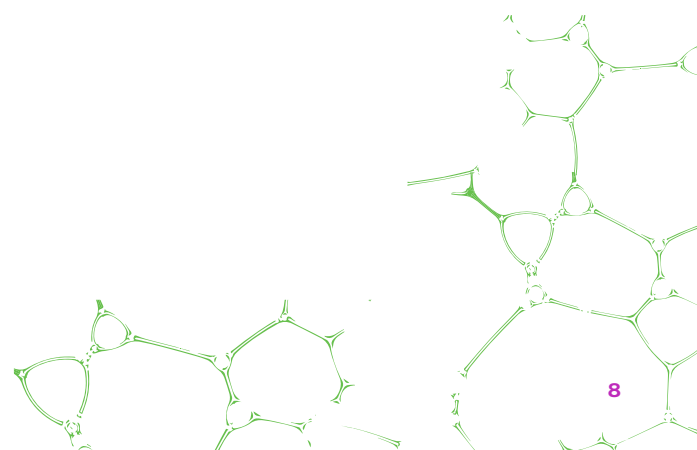
Sola Arobiieke, Deputy Director-General of the Ogun Investment Promotion and Facilitation Agency (OgunInvest)

Adrian Clews, Managing Director of Hinckley Group, said that Global Alliance Africa’s Open Innovation projects were significant to securing this investment. He estimates that 50% of projected revenue from the new plant is linked to the innovations delivered by the projects they ran with Enverse, SLS Energy and Aceleron.

“The battery we will be manufacturing in Ogun State will be the first of its kind in Africa, and we will make the state the leader in battery recycling in Africa. For the first time, it is now possible to recycle the cell back into chemical form in Africa and export the black mass, which contains the minerals inside the battery, to make new batteries.”

Richard Montgomery, British High Commissioner

The multi-million dollar investment was facilitated by Manufacturing Africa in collaboration with Ogun Invest, which has the governor, Prince Dapo Abiodun, as its chairman. This initiative will create jobs for youths in the state, help to rid the environment of electronic wastes and enhance knowledge and technology transfer. Hinckley Recycling was the first government-approved e-waste recycler in Nigeria in 2016, and their expansion into Ogun marks a significant milestone.





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