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# Faraday Battery Challenge

Scale up activities



September 2024

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# What is the Faraday Battery Challenge?

The world is undergoing a transition to a low-carbon future, but transport remains the largest source of carbon dioxide emissions in the UK, accounting for 29% of emissions<sup>1</sup>. Developing low-cost, reliable and long-range electric vehicles is the key to reducing these emissions, with batteries playing a crucial role, not only in the automotive sector but in applications across aerospace, rail, marine, off-highway vehicles and static storage. The UK and the EU have established clear end dates for the sale of petrol and diesel vehicles, which is driving the demand for battery-powered electric vehicles. This transition to an electrified future will require many types of batteries, with some yet to be imagined. Therefore, the next generation of battery technology must be developed, along with exploration and de-risking of new production processes that ensure long-term UK success in battery manufacturing and car-making.

This is the reason the Faraday Battery Challenge exists. It is a £610 million investment from the UK government in battery technology. The mission-led programme coordinates and manages applied research, business-led innovation and national scale-up infrastructure in support of the UK's transition to electrification. Delivered by Innovate UK, on behalf of UK Research and Innovation (UKRI), the Faraday Battery Challenge supports the development of sustainable batteries that are cost-effective, high-performance, durable, safe and recyclable.

The Challenge has positioned the UK as a leading scientific, technological, and industrial player in the development of batteries. The significant investment has not only contributed

to the growth of UK companies, but also signaled to investors that the UK is an attractive opportunity for innovation and production in the battery sector. This initiative has promoted innovation and collaboration among researchers, businesses, and other stakeholders, which has enhanced the UK's credibility in this sector. The support provided by the Faraday Battery Challenge extends far beyond the automotive industry and encompasses cross-sector activities in skills development, policy, regulations, and more.

The Challenge is designed to support innovation from early-stage, university-led research through to near-commercial scale facilities to test manufacturing, providing the UK with a world-beating innovation landscape to commercialise battery technology. It is focused on three pillars: research, business-led innovation and scale-up. The Challenge draws together these pillars to accelerate the delivery of a pipeline of activity, and has built a globally competitive scientific capability at scale, harnessing our best talent toward solving the challenges for battery technology.

This document highlights the UK's battery electric transition in action, with the cutting-edge projects of the Faraday Battery Challenge. These projects are blazing a trail towards a cleaner, more sustainable future, backed by groundbreaking research and innovative technology that are the driving force behind the UK's electrifying transition to a battery-powered future. As you will see through these projects, the UK is well-positioned to thrive in the emerging low-carbon economy, with robust infrastructure, a skilled workforce, and a strong innovation ecosystem in place to drive the transition to electrification.



Tony Harper, Faraday Battery Challenge Director

**“The Faraday Battery Challenge is a pioneering ‘lab to factory’ programme focused on delivering the research, business-led innovation, infrastructure and people required for the UK to prosper from the unprecedented opportunities arising from the mass transition to electrification.**

**Just over six years into the programme, this brochure illustrates the breadth and depth of cutting-edge capability that has been built and reinforces why the UK is amongst the very best in the world in battery technology development.”**

<sup>1</sup> [Transport and Environment Statistics 2021 Annual report](#).

# Faraday Battery Challenge



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Scaling high tech  
business

Building a  
Science Superpower

Open access scale  
up with Gigafactory  
capability

## Research

The Faraday Institution is the UK's independent institute for electrochemical energy storage research, skills development, market analysis and early-stage commercialisation.

It brings together research scientists and industry partners on projects with commercial potential that will reduce battery cost, weight, and volume, improve performance and reliability, and develop whole-life strategies, including recycling and reuse.

## Business-led Innovation

The Faraday Battery Challenge Innovation programme is supporting UK businesses to push the boundaries of battery innovation and grow the UK battery supply chain. £130m of funding from Innovate UK for UKRI has been invested for businesses to lead feasibility studies, and collaborative research and development projects across the battery value chain, in collaboration with the UK's world leading academics and research technology organisations.

## Scale-up

The UK Battery Industrialisation Centre (UKBIC), the first facility of its kind in Europe, opened in 2021 and enables companies of all sizes to develop manufacturing capabilities for battery technologies to get them to market quickly.

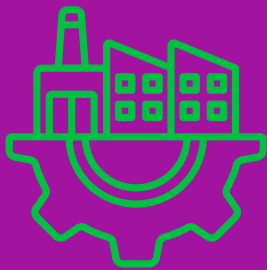
## Contact

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E: [faradaybatterychallenge@iuk.ukri.org](mailto:faradaybatterychallenge@iuk.ukri.org)

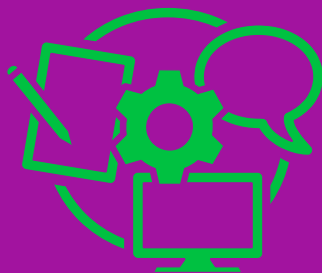
W: [Faraday battery challenge – UKRI](https://www.faradaybatterychallenge.org)

# UK Battery Industrialisation Centre



**35**

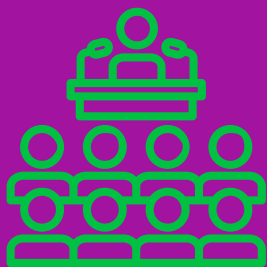
companies on more than 70 contracts to support the growth in cell scale-up, and module and pack development and manufacturing



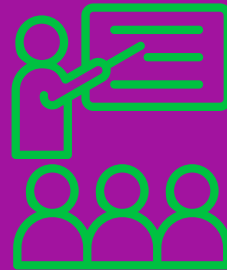
More than

**£2m**

CR&D funding for 6 major projects

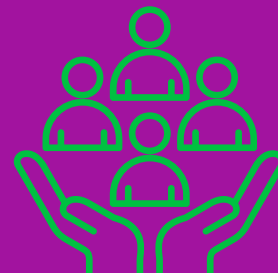


An active conference and events programme at UKBIC, elsewhere in the UK, and overseas. Participated in Cenex Expo (previously, Low Carbon Vehicle conference), the Battery Cells & Systems Expo, The Battery Tech Expo (Silverstone), The Battery Tech Sweden, The Battery Show USA, The Battery Show (Stuttgart), JSAE, and other key events



**1,986**

hours of external training delivered since 2023, across lineside bespoke training and publicly available bookable training courses



**140**

employees (as of June 2024), with many more moving back into the UK supply chain

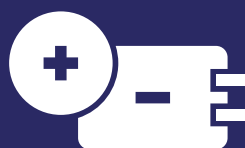


Almost

**500**

visits from a range of organisations, including 30 international delegations from the USA, Canada, Japan, Australia, Germany, Singapore, Sweden, China, Thailand, and others

# Scale-up



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# UK Battery Industrialisation Centre (UKBIC)

UKBIC is the UK's national manufacturing battery development facility, providing manufacturing scale-up and skills for the battery sector.



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Opened in 2021, UKBIC's construction was part-funded through the West Midlands Combined Authority and was delivered through a consortium of Coventry City Council, Coventry and Warwickshire Local Enterprise Partnership and WMG, at the University of Warwick.



Our purpose-built facility is where businesses come to develop their battery manufacturing processes at the scale they need to move to industrial production. It's also where those working in the industry can develop new skills by joining us on the production line, learning from our specialist teams.

UKBIC is part of the £610m Faraday Battery Challenge, which is delivering a research and innovation programme that covers "Lab to Factory" development, cutting-edge research, national scale-up infrastructure, and skills and training.

Based in Coventry, the facility can be accessed by organisations with existing or new battery technology, or companies looking at entering the industry. The flexible facilities are designed so that several users can run projects at the same time in dedicated and security-controlled discrete areas. We don't take a share in any customer Intellectual Property (IP) developed through the facility, we're just here to help drive innovation and support the development of new ideas.

## New facilities at UKBIC

**Created with an initial investment of £130m, an additional £74m from UK Research and Innovation (UKRI) was announced in 2023, and is being used to enhance and expand the facility with a number of new initiatives:**

- Our innovative Flexible Pilot Line (FPL) will bridge the gap between the facility's existing Industrial Scale-up Line (ISL) and smaller, kilogram-scale demonstrators available elsewhere. Coming in 2025, the new specialist line will provide developers with a more cost-efficient route to market, helping them move from research and development to large-scale production in more manageable steps. The new FPL features individually controlled rooms, each set from -40°C to ambient dew point on a zonal basis, allowing a controlled environment from room to room.



- Our new Battery Development Laboratory is due to become operational in Autumn 2024, and will boost the facility's capabilities in key areas of battery material characterisation, cell analysis, and forensic activities – all to support manufacturing development. The enhanced laboratory will specialise in the characterisation of raw materials, slurries, coated electrodes, and finished cells, and will also have processing, electrochemistry, forensics and CT scanning capabilities.



■ We are also building an innovative, flexible clean room space, the Clean and Dry Zone, which will also become available later in 2024. The research and development zones will offer flexible clean room spaces, providing controlled conditions for equipment testing, temporary equipment installation for manufacturing work, or other research and development projects. Rooms will range from 93m<sup>2</sup> to 256m<sup>2</sup>, with the option to extend further by removing interior walls, while one room is also equipped with a higher ceiling to accommodate processes which require additional height. Each room will have individual, card-controlled access to protect customer intellectual property.



■ Also coming in 2024 is an area dedicated to Cell Characterisation. The new bespoke cell cyclers and environmental chambers will be housed in a 135m<sup>2</sup> air-conditioned unit inside an existing formation, ageing and testing area. The facility will include extended life-cycle testing, environmental control, and temperature measurement functions.

## Supporting SMEs on their scaleup journey

**In May 2024, UKRI funded small and medium-sized (SME) battery developers to the tune of £1.5 million to enable them to work with us at UKBIC.**

The winners of the second SME Credit competition – Altium and Nyobolt – will each be given the chance to scale up their projects as they move from technological potential towards commercial capability. In addition, the projects will further enable UK competitiveness across the battery value chain by:

- supporting SME research and development for the scale up Sf battery technologies within the UK;
- Help demonstrate technologies at suitable scales to customers;
- Move UK battery innovations from technological potential towards commercial capability; and
- Develop and secure material and manufacturing supply chains for battery technologies in the UK.

The projects we have supported so far involve cylindrical and pouch cell technologies, and include bringing advanced lithium titanate oxide (LTO) battery technology and a new cathode active material (CAM) to the UK for the first time.

This latest funding builds on an earlier SME Credit competition, which was launched in 2023 and has seen Nyobolt and Addionics already work with UKBIC.



## Delivering skills and training

**UKBIC also delivers specialist skills and training to the wider industry, both at home and abroad. Companies can send their employees to work with us and learn first-hand from the organisation's team of specialist battery manufacturing trainers.**

Our main public access course is Introduction to battery manufacturing, which takes place over two days. The course is designed to provide a basic introduction to battery manufacture and use, covering in detail how to develop and create battery technologies, and offering the chance to experience life on the line at our facility in Coventry.

As a founding member of the Electrification Skills Network, we have also already given comprehensive training to several European and US battery developers.

More specialist training courses we offer include: Introduction to Electrode Processes, Introduction to Cell Assembly, Introduction to Formation, Ageing and Testing Processes, Substance Awareness, Clean and Dry Rooms in Battery Manufacturing, and Fundamentals of Sustainable Manufacturing Processes.



## Views on the UKBIC opportunity

Sean Gilgunn, UKBIC's managing director, said:

**“As the national manufacturing development facility, we were established to provide manufacturing scale-up and skills for the battery sector – and that remains at the heart of everything we do.**

**“Our existing high-volume specialist manufacturing equipment is perfect for those organisations in need of representative scale-up, but not necessarily for those organisations at an earlier technology readiness stage of their development. The new facilities now under construction will change all that.**

**“These new elements will help those organisations looking to scale up their battery technology, as they go from desktop research to the FPL, the ISL, and beyond. The construction of these facilities and their potential impact will be hugely significant for UKBIC and the wider battery industry as it progresses.”**



Sean Gilgunn, UKBIC's managing director

## Customer feedback

Feedback on customers after participation in UKBIC's two day introduction to battery manufacturing, a course designed for anyone interested in gaining practical knowledge about the fundamentals of battery manufacturing process, materials, and technologies.

Lisa Bingley, operations director at the MIRA Technology Institute, said:

**“It was great to get an understanding of the whole process of battery manufacturing along with an update on the future of the sector. The tour was especially good, as it linked to the knowledge obtained during the training course.”**

Derek Siu, Research Associate, Imperial College London, added:

**“The introduction to battery manufacturing was an excellent overview. The mix of theory and factory tour was ideal and unparalleled outside of UKBIC.”**

### Contact

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# Case Study: Ilika

## Supporting UK battery scale-up: UKBIC's ongoing collaboration with Ilika, pioneers in solid-state battery technology

### Executive summary

**Project BUS100:** The objective of this completed £180,000 Advanced Propulsion Centre-funded feasibility study was to determine whether a MWh-level manufacturing line for Ilika's Goliath solid-state batteries (SSB) could, in principle, be installed economically at UKBIC, utilising some of the existing lithium-ion battery (LIB) manufacturing equipment to supply automotive cells to Ilika's customers at an acceptable price point. Demonstrating cell manufacturing on production-intent equipment, at MWh-scale, is key to Ilika's scale up plans.

**Project SiSTEM:** This ongoing Automotive Transformation Fund £2.7 million funded project – under the Scale Up Readiness validation (SURV) 2 programme – included consortium members Agratas and MPac. The project aims to develop a 1.5MWh SSB assembly line and undertake physical trials at UKBIC, where UKBIC's formulation and coating lines will be trialled with Ilika's SSB chemistry, in order to verify the expectations from Project BUS100. It's important that the manufacturing of this novel technology can use existing equipment in the LIB industry as much as possible, in order to enable adoption of SSB.

### Timeline with milestones and deliverables

**Framework agreement signed between Ilika and UKBIC: November 2020.**

**Project BUS100: July 2022 and January 2023.**

**The deliverables of this feasibility study were:**

- To provide a gap analysis of Ilika's requirement vs the existing UKBIC installed equipment;
- To establish how the Ilika and UKBIC manufacturing lines could be integrated;

- To develop a cost model for installing and integrating the Ilika equipment into UKBIC; and
- To establish whether there was a business case for making the required investment to install SSB manufacturing in UKBIC which met Ilika's volume requirements.

**Project SiSTEM: October 2023 and is due to last 18 months**

- The main deliverable of the project is to establish that it's possible to coat a solid-state electrolyte onto a previously coated anode material using a reel-to-reel manufacturing process.

### Project innovations

**Project BUS100:**

The outcome of BUS100 was generally positive. The study concluded that, subject to physical trials to accommodate Ilika's process and the acquisition of some minor additional equipment, it would be technically possible to utilise part of the existing UKBIC electrode line to manufacture Ilika's SSB cells; and using some of UKBIC's industrial-scale equipment for a large-scale trial, albeit for a smaller part of the year only, could in principle provide sufficient cells to Ilika's customers, and demonstrate production at scales relevant to gigafactories.

**Project SiSTEM:**

Activities in SiSTEM are currently in the technology transfer stage when it comes to collaborating with UKBIC, with electrode manufacturing trials planned later in the project. The outcomes of the project will be assessed in 2025.

### The benefits of working with UKBIC

"UKBIC has always been attentive to our needs and offered solutions to help Ilika move our development forward. They've delivered on cost and in good time and have been flexible to adapt to our developing needs.

"The advantage of collaborating with UKBIC is that we can access UKBIC's GWh-scale equipment, which is important to us given our asset light business model, enabling us to de-risk industrialisation and demonstrate giga-scale production to potential licencees.

"UKBIC helps companies negotiate the so-called 'valley of death' stage in their development between pilot and volume-manufacturing, by making industrially relevant facilities available; and we can collaborate with UKBIC's pool of researchers and engineers who have expertise both in LIB R&D and production activities, as much of the process is similar to the SSB process, and that enables an understanding of the link between the two technologies."



Denis Pasero,  
Ilika's Product Commercialisation  
Manager

# Advanced Materials Battery Industrialisation Centre (AMBIC)

£12m to deliver the UK's national battery materials scale up facility



Photo credit: Centre for Process Innovation (CPI)

**“AMBIC will bring together two emerging regions of battery innovation and manufacturing; the North-East and Midlands, under one facility to de-risk and accelerate battery materials scale up in the UK. Through the Faraday Battery Challenge’s £12m investment in the High Value Manufacturing Catapult, we will establish a truly world-class facility to support the growth of a battery materials supply chain. With AMBIC and previous investments in UKBIC and the wider ecosystem, the UK will now be in a position to support businesses from “powder to pack” and from lab to commercial scales.”**



Thomas Bartlett,  
Challenge Deputy Director for the Faraday Battery

The Faraday Battery Challenge (FBC) is enhancing battery scale-up support in the UK with a new facility that will give companies access to state-of-the-art materials synthesis and processing equipment. The funding is part of a co-investment strategy between the FBC and the HVM Catapult, aligned to a common strategic vision for the UK battery scale up ecosystem in order to support the development of a battery supply chain in the UK.

The Advanced Materials Battery Industrialisation Centre (AMBIC), which will be delivered by the HVM Catapult, will provide innovation capability for the synthesis and processing of immediate and next-generation battery materials. It adds to the growing open-access scale up capability being delivered by the FBC, which includes the UK Battery Industrialisation Centre and its new £36m Flexible Industrialisation Line.

The £12m facility will be delivered by CPI and WMG, two of HVM Catapult’s seven centres of innovation. CPI’s expertise in chemicals processing and WMG’s cell development capabilities will be brought together to allow companies and researchers to scale their innovations from the laboratory to commercially relevant scale and enable “powder to cell” support.

AMBIC will help deliver the UK’s ambitions in battery materials by:

- Bringing together scalable, commercially relevant equipment into one facility to fast-track battery materials development.
- Helping to stimulate and grow the chemical and materials supply chain to collaborate and invest in the UK, leading to economic growth and jobs, and attract inward investment.
- Aligning to existing cell manufacturing and validation facilities, and supporting the wider UK scale-up ecosystem.
- Having the flexibility to accommodate equipment supplier trials.
- Enabling rapid, cost-effective product and process design.
- Enabling the provision of a skills and training programme complimentary to the National Electrification Skills Framework and Forum and other skills activities being supported by the FBC.

Both facilities at CPI and WMG will be open-access, and activities will typically be project-based and can be funded via CR&D or commercial contracts. CPI and WMG engineers and scientists will operate the equipment to achieve customer requirements for material synthesis and cell processing.

**“The next generation of battery technologies are critical to the green energy transition and a major opportunity for UK manufacturing. Realising that potential will require combining our collective expertise and this investment from the Faraday Battery Challenge is a brilliant example of that in action. In CPI and WMG, the Advanced Materials Battery Industrialisation Centre has two centres that are at the very forefront of chemical processing and battery cell development;. Together, they can turbo charge battery materials scale-up.”**



Katherine Bennett,  
CEO of the High Value  
Manufacturing Catapult

At WMG, the advanced cell-prototyping equipment can be accessed directly or through research grants and collaborations. Initial enquiries for access to WMG’s facilities should be routed through WMG’s business development team on [WMGBusiness@Warwick.ac.uk](mailto:WMGBusiness@Warwick.ac.uk).

The facilities are currently being set up at both sites (CPI in the North-East of England and WMG in the West Midlands) and will be fully operational from March 2025. WMG’s advanced cell prototyping line is due for commissioning in March 2025 and will be user ready from May 2025.

**“The Advanced Materials Batteries Industrialisation Centre will enhance the UK’s existing competitive advantages in batteries technology, and it stands to become a catalyst for the UK to address some of the biggest challenges we face as a nation. By giving innovators the opportunity to harness our expertise, we can tackle issues such as climate change, while growing a sector that will be vital to the future of the economy.”**



Frank Millar,  
Chief Executive, CPI

**“Cathode and anode active materials make up more than 50% of the value of an automotive battery cell. For the UK to take its great academic research into production, and to capture the billions of pounds of resulting economic value in the UK, we need facilities which allow the UK to scale up and fully evaluate new materials. This investment, alongside the combined skillsets of CPI and WMG will provide that capability for the UK.”**



Professor David Greenwood,  
CEO WMG

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