Flexible and scalable digital-twin platform for enhanced production efficiency and yield in battery cell production lines

Project Partners & Services Booklet

V1.0

www.BATTwin.net

Partners

Funded by the European Union

Innovate UK

The BATTwin project has received funding from the European Climate, Infrastructure and Environment Executive Agency under grant agreement No. 101137954. The contents of this booklet are the sole responsibility of the parties and cannot be considered as reflecting the position of the European Union.

UK Participants are supported by UK Research and Innovation (UKRI) under the UK government's Horizon Europe funding guarantee.

Contents

BATTwin Project

The BATTwin is a 42-month project that started in December 2023. This project has received funding from the European Climate, Infrastructure and Environment Executive Agency under grant agreement No. 101137954 (€ 6,355 million grant). UK Participants are supported by UK Research and Innovation (UKRI) under the UK government's Horizon Europe funding guarantee.

Project Coordinator:	**Politecnico di Milano - Italy**	
Partners		
University of Oldenburg Germany	**The Royal Institute of Technology (KTH)** Sweeden	**Sivas University of Science and Technology** Turkey
Arts et Métiers Institute of Technology (ENSAM) France	**Upcell Alliance - European Battery Manufacturing Alliance** France	**Syxis Vsi** Lithuania
CESI School of Engineering France	**Cambridge Nanomaterials Technology Ltd** UK	**N-ABLE** France
Conservatoire National des Arts et Métiers (Cnam) France	**Institute for Computer Science and Control - SZTAKI** - Hungry	**Schneider Electric Automation GmbH** Germany
Verkor SA France	**Sunlight Group Energy Storage Systems** Greece	**Bureau Veritas Italia Spa** Italy
COMAU SPA Italy	**Ansys** UK & Germany	**The University of Warwick** UK

Project Objectives

The objective of BATTwin is to support the high demand for battery manufacturing equipment in Europe, by developing a novel Multi-level Digital Twin platform towards Zero-Defect Manufacturing in battery production, that will reduce defect rates in battery production lines. The solution integrates four pillars:

(i) a multi-sensor data acquisition and management layer, supported by data semantics through a Digital Battery Passport data model,
(ii) process-level digital twins, modelling the critical stages of electrode manufacturing, cell assembly and conditioning through multi-physics, data-driven and hybrid approaches,
(iii) system-level digital twins, based on simulation and analytical modelling,
(iv) user-centric, goal-driven digital twin workflows, increasing the explainability of digital twins and driving the user in system design and control. The approach will be tested in two industrial pilots producing different battery chemistries and geometries, validating the flexibility and scaleability of the approach towards Zero Defect European Gigafactories

Politecnico di Milano

Main Contact in the project

Prof. Marcello Colledani
Project Coordinator
Email: marcello.colledani@polimi.it

POLITECNICO
MILANO 1863
www.mecc.polimi.it

Politecnico di Milano, Department of Mechanical Engineering, Manufacturing and Production Systems Unit, Smart and Sustainable Manufacturing Research Group

About us

Politecnico di Milano is a technical-scientific University that offers education programmes for future engineers, architects and designers.
Founded in 1863, Politecnico di Milano is one of the most prestigious Universities worldwide, ranking 1st in Italy, 36th in Europe, and 98th globally, according to the latest QS World University Rankings 2026 (June 2025). Politecnico has always invested in the quality and innovation of teaching and research by developing profitable business relationships with entrepreneurial and manufacturing companies through experimental research and technology transfer. Politecnico offers undergraduate, postgraduate, PhD and Post-Doctoral programmes. Politecnico currently employs more than 1.800 Faculty members and counts about 49.000 enrolled students (8.000 of whom are international), working and attending lectures on six different campuses.
The University is organised into 12 Departments, thanks to which it aims to improve its impact on our society by promoting sustainable and responsible scientific-technological innovation.
Strategic research is carried out in many fields, including energy, transportation, planning, management, design, mathematics, natural and applied sciences, ICT, built environments, and cultural heritage, throughout more than 280 research infrastructures and 6 Large Infrastructures: the Wind Tunnel (with its unique construction and features), the Material Testing Lab (LPM), PoliFAB (research infrastructure for micro and nanomanufacturing), PolimiFactory (the makerspace of Politecnico di Milano novel design processes are developed) DRISMI (the latest generation of innovative driving simulators) and LABORA (virtual and physical modelling lab).
Every year, Politecnico di Milano brings in more than 146 million euros thanks to the combination of signed research contracts and external funding. These self-funding activities considerably contribute to its final financial statement. In particular, Politecnico di Milano is the first among Italian Universities and 7th in Europe per the number of financed projects by the European Commission. In the framework of the Horizon 2020 programme (2014-2020), 437 projects (34 ERC) were funded up to a total of 189 million euros. Concerning the new Horizon Europe Programme (2020-2027), the number of funded projects up to today is 305 (36 ERC), meaning grants for a total of 161 million euros.

The Department of Mechanical Engineering counts 148 Professors and researchers, 30 research fellows and 282 PhD students. In 2025, according to the *QS World University Ranking by Subject – Mechanical, Aeronautical and Manufacturing Engineering*, Politecnico ranks 1st in Italy, 5th in Europe and 12th worldwide. The researchers of the Department of Mechanical Engineering work together accordingly to their research areas, each part of a different Research Unit (Mechanical Systems, Machine and Vehicle Design, Materials, Manufacturing and Production Systems, Measurements, Methods and Tools for Product Design. Further details on the Department's organisation are available on the website: Organization | Dipartimento di meccanica.

The roots of the Department of Mechanical Engineering date back to the very founding of Politecnico di Milano in the early 1860s. At that time, the Royal Technical Institute established a Mechanical Engineering programme. This early foundation laid the groundwork for what would later become the Department, shaping the research activities, the innovative spirit and the courses that now define the Mechanical Engineering degree.

The Department offers spaces and labs of excellence for researchers to perform cutting-edge research. With its large-scale state-of-the-art technological infrastructure and research facilities, broad theoretical, methodological and technological knowledge, international reputation and successful Alumni, the overall mission of the Department of Mechanical Engineering is to deliver world-class research and education in Mechanical Engineering, with particular regard to its application in enterprises. The researchers working at the Department develop innovative solutions, design methodologies and new technologies, and engineer systems, products, and industrial processes. Research outcomes are also enhanced through technology transfer to the industrial sector, promoting sustainable and responsible growth in society and industry. High-level university education, enriched by research results and innovative teaching methodologies, aspires to train exceptional engineers who use their scientific knowledge and skills appropriately, ethically, and consciously to improve the social contexts—both Italian and international—in which they operate.

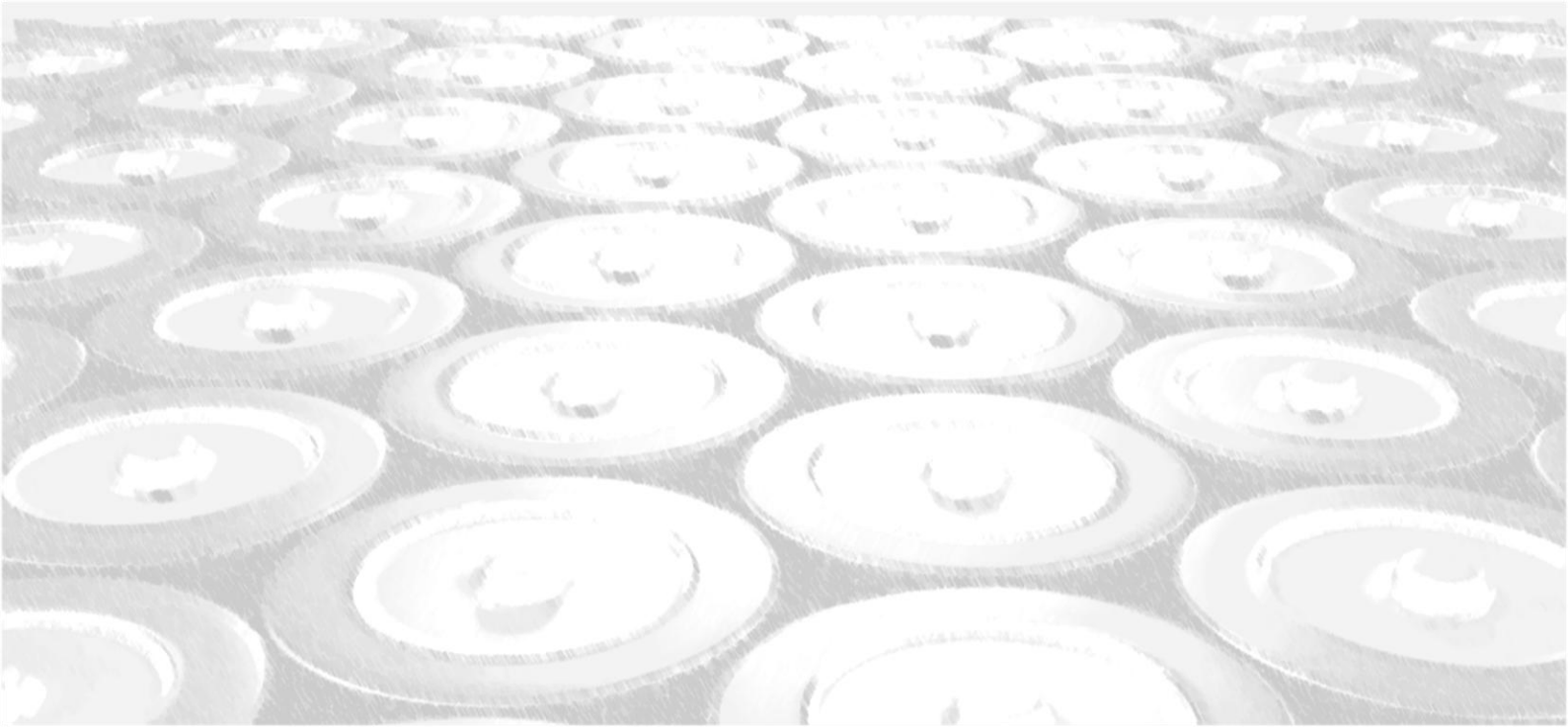
The Department's research areas operate in various fields of engineering, actively contributing to scientific progress and technological advancement. Through their research activities, they foster the development of new knowledge and pioneering solutions in their respective fields. The Smart and Sustainable Manufacturing group focuses on developing advanced technologies and methodologies for manufacturing, circular economy, and sustainable processes, integrating digital solutions and human-operator modeling, to enhance efficiency, resilience, and environmental sustainability. Detailed topics are:

- Cyber-physical de- and remanufacturing for circular economy: process and system design and operation
- Modeling and monitoring of human operators in manual processes
- Battery lifecycle management: manufacturing, disassembly, second-life, and mechanical pre-treatment
- Mechatronic products (e.g. electric motors) manufacturing and de-remanufacturing
- Sustainable manufacturing processes: flexible forming and re-forming of sheets and tubes and environmentally benign lubro-cooling methods

- Biointelligent manufacturing
- Micromachining and high precision milling for advanced applications
- Composite recycling and reprocessing
- Industrial applications of metal foams in manufacturing
- Zero-defect manufacturing methods and digital solutions for high-added value products
- Robust production planning and scheduling
- Prognostics and Health Management of machines, tools, and components
- Integration of digital technologies (CPS, DPP, DT) and materials in circular manufacturing

Role in the project

Project coordination and management; state-based modelling of resources in battery manufacturing system and performance evaluation of battery production line at system-level; analysis of defect management strategies.



University of Oldenburg

Main Contact in the project

Prof. Dr.-Ing. Habil. Andreas Rauh
Email: andreas.rauh@uni-oldenburg.de

Carl von Ossietzky Universität Oldenburg
https://uol.de/en

About us

Research Group Distributed Control in Interconnected Systems (DCIS), Carl von Ossietzky Universität Oldenburg, Department of Computing Science
In recent years, the **Carl von Ossietzky Universität Oldenburg** has developed a strategy fostering its strength in the following profile lines in both research and education:

- Environment and Sustainability
- Humans and Technology
- Society and Education

The Department of Computing Science of the University of Oldenburg essentially contributes to each of these profile lines. Major contributions within the profile line **environment and sustainability** can be found by the focal points sustainability and future energies. Here, the **focal point** future energies integrates university research in particular with non-university players such as the associate institute OFFIS and the DLR Institute for Networked Energy Systems. The overarching goal of this collaboration, from the point of view of DCIS, is the integrated operation of networked energy system components, control technologies, control-oriented modelling of complex and large-scale systems and their order reduction as well as the assistance of the transition of existing structures into networked, digitalized energy systems by means of control techniques. In addition, DCIS contributes to the other two profile lines by control engineering techniques. These techniques are integrated into human cyber-physical systems that can be found in the areas of Industry 4.0 (i.e., cyber-physical production systems), as well as transportation and human assistance and healthcare technologies.

Our Products & Services

The Research Group DCIS deals with methodological approaches for control-oriented modeling and synthesis of optimal, robust and adaptive methods for the control and state estimation of complex dynamic systems. Depending on the objective of the model use, problem-specific description forms are derived for offline control synthesis as well as for real-time capable implementation by using ordinary or fractional differential equations and distributed parameter representations. All of them are interlinked with uncertainty models and a reliable sensitivity analysis in all design and implementation phases.

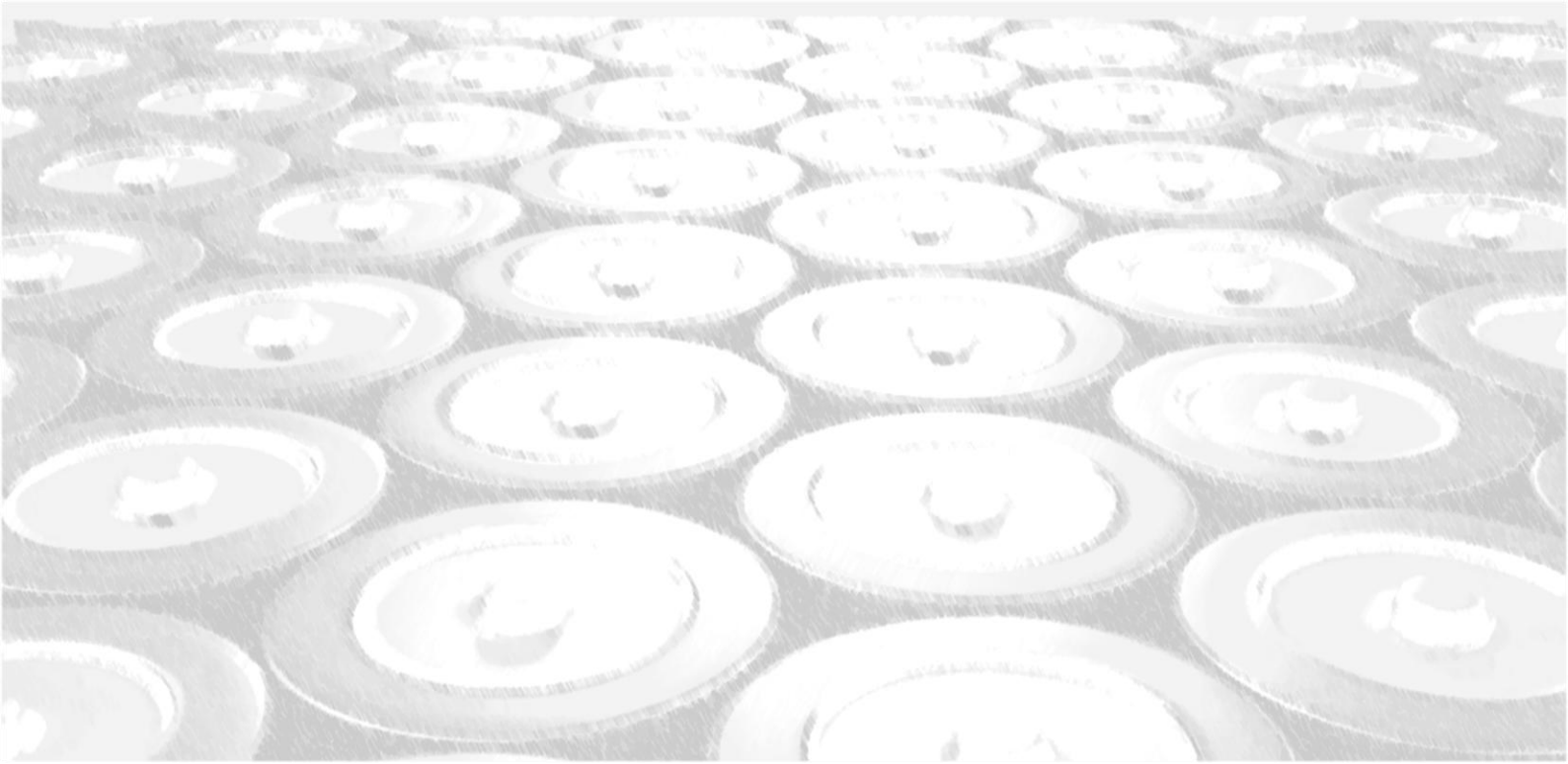
In addition to multi-physical effects, the focus is on suitable methods for quantifying uncertainty in both set-based and stochastic form in order to reliably verify functionality and safety properties. The range of applications includes energy informatics issues (e.g. control of electrochemical energy

converters, validation of battery management systems and control of power electronic actuators), applications in robotics and interfaces to the use of control algorithms in human-machine interaction.

Experimental platforms are available both for research and teaching purposes which comprise lab-scale robotic manipulators, battery testing equipment on the level of individual cells, as well as an innovative hybrid energy system platform, integrating a polymer-electrolyte-membrane fuel cell with an electrolyzer, photovoltaics-based electricity production, and a controllable electric load. This hybrid energy system is especially designed for the development of novel state estimation and control techniques in modern, highly flexible electricity supply grids requiring to operate the aforementioned components in a transient regime.

Role in the Project

Control-oriented modelling of different production stages of battery manufacturing, system identification, control optimization, as well as uncertainty quantification of identification and control procedures



Arts et Métiers Institute of Technology (ENSAM)

Main Contact in the Project

Nathalie Klement
Email: nathalie.klement@ensam.eu

Richard Béarée
Email: richard.bearee@ensam.eu

www.artsetmetiers.fr/en

About us

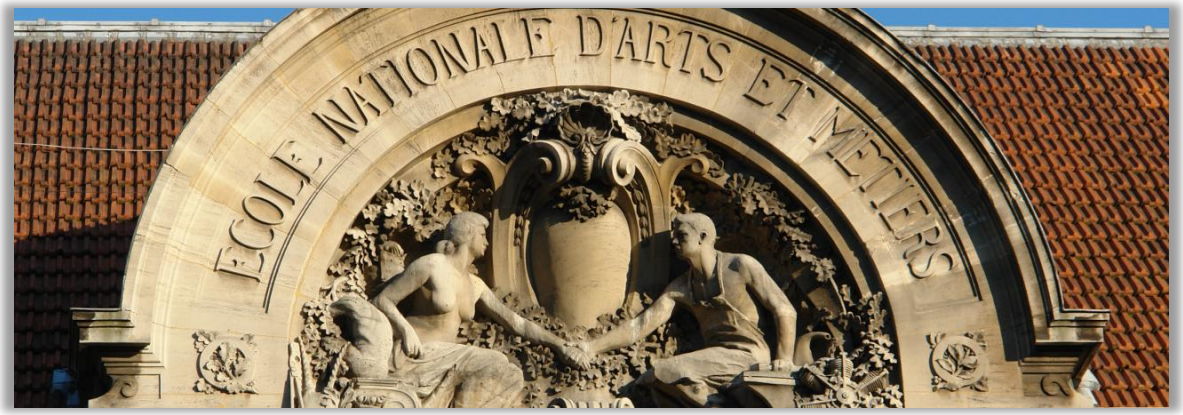
A leading science & technology Grande École in France with an international reputation in education and research, Arts et Métiers (ENSAM stands for Ecole Nationale d'Arts et Métiers) is one of France's oldest and best engineering schools specializing in mechanical, industrial and energy engineering. Arts et Métiers has more than 250 years of tradition in technical innovation and industrial engagement.

We strive to educate Europe's future engineers to face global challenges, particularly those linked to the industry of the future, with programs at the Bachelor, Master & PhD levels.

Industry is set for a real revolution. Technological change is creating historic shifts in industry footprints. Advanced technology adoption will be at the heart of future competitiveness.

Digital technologies and connectivity, collaborative robotics (cobotics), virtual reality and additive manufacturing will change fundamentally the way industrial processes work. The relationship between man and the production process will radically change.

Arts et Métiers, founder member of the French Alliance for Industry of the Future, is a key player in accompanying French and European industry, through its high level academic programs and its cutting edge research activities in the major fields of Industry 4.0, mainly corobotics, advanced manufacturing systems, production systems, virtual & augmented reality.



Our Products & Services

ENSAM has 3 main objectives:

- Through its traditional close links with industry, the Arts et Métiers community, students, professors, researchers strive to anticipate and accompany industry to face the major challenges of the industry of the future.
- Arts et Métiers will be a driving force in transforming society tomorrow, for developing and sharing knowledge, for developing innovation and entrepreneurship and for improving the human condition.
- Building international partnerships in research and education is part and parcel of the Arts et Métiers strategy, and our aim is that international activity will become an integral part of the culture of the whole Arts et Métiers community.

Role in the Project

ENSAM develop a decision support system to manage the production system of battery cells. This DSS will help humans to take decision on the system according to assignment and scheduling problems. Several objectives can be considered: quality of the production system, environmental and economic criteria. This DSS will be connected to the digital twin to manage the system.

CESI School of Engineering

Main Contact in the Project

Belgacem Bettayeb
Email: bbettayed@cesi.fr

David Baudry
Email: dbaudry@cesi.fr

www.cesi.fr
https://lineact.cesi.fr/en/

About us

With 25 campuses around France, CESI supports engineering students through a customizable five-year education leading to the Master's-level Engineering Degree accredited by the French state. Students can enroll after high school to start their academic career with two years of undergraduate studies. After these first two years, they continue on to complete their graduate studies in one of our four majors: Industrial engineering; Civil engineering and construction; IT – Computer science; Embedded systems.

CESI LINEACT (Digital Innovation Laboratory for Companies and Learnings at the service of the territories competitiveness) is the CESI laboratory whose activities are implemented on CESI campuses. CESI LINEACT anticipates and accompanies technological changes in sectors and services related to industry, construction and digital technology. CESI's historical proximity to companies is a determining factor for our research activities, and has led us to focus our efforts on applied research close to the company and in partnership with them. A human-centered approach coupled with the use of technologies, as well as the territorial network and the links with training, have made it possible to build a transversal research. The specificity of CESI LINEACT lies in its cross-disciplinary approach and the organization of its research into 2 research teams:

- Team "Learning and Innovating" is mainly concerned with Cognitive Sciences, Social Sciences and Educational Sciences, with the aim of studying, designing and evaluating learning and innovation ecosystems in training and the workplace, in their socio-technical, economic and human dimensions,
- Team "Digital Engineering and Tools", whose main scientific fields are Digital Sciences, Industrial Systems Engineering, Operations Research and Engineering Sciences. The main scientific objectives of this team relate to the modeling, simulation, optimization and data analysis of industrial or urban systems. The research work also focuses on the associated decision support tools and on human-machine interaction through the study of digital twins coupled with virtual or augmented environments and applied robotics.

The two teams develop and cross-fertilize their research in the 3 application areas of Industry 5.0, Construction 4.0 and Sustainable City, as well as Digital Services.

Our Products & Services

The main missions of the CESI LINEACT laboratory are to:

- Anticipate and support technological change in the industrial, construction and digital sectors, focusing on industry 5.0, sustainable cities, digital services and the training of the future.
- Conduct applied research activities in partnership with companies, to meet their concrete needs and foster innovation and competitiveness in the region.
- Develop new training methodologies and integrate research findings into teaching content, particularly for CESI curricula.
- Enhance the value of research through technology transfer and collaboration with industrial players of all sizes.
- Support technological sovereignty and the development of dual-purpose platforms (training and research), based on an approach cantered on human and the uses of technology.

Role in the Project

CESI LINEACT engages in the research and development of simulation and multi-objective production system optimization (WP4: Task 4.5 and Task 4.6). We are also involved in a research action in collaboration with ENSAM focused on the production control of an intelligent, reconfigurable and environmentally-friendly battery manufacturing system by modeling and optimizing the production system through the digital twin capabilities (WP5: Task 5.5 and Task 5.6). This project will reinforce our expertise in industrial digital twins and in the fields of digital and energy transitions.

Conservatoire National des Arts et Métiers

Main Contact in the Project

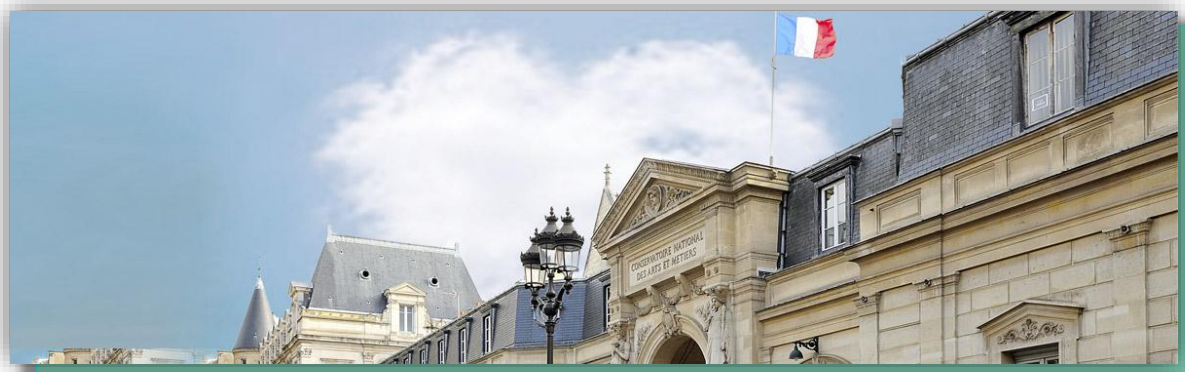
Prof. Samia Bouzefrane
Email : samia.bouzefrane@lecnam.net

Nada Mimouni
Email: nada.mimouni@lecnam.net

www.cnam.eu

About us

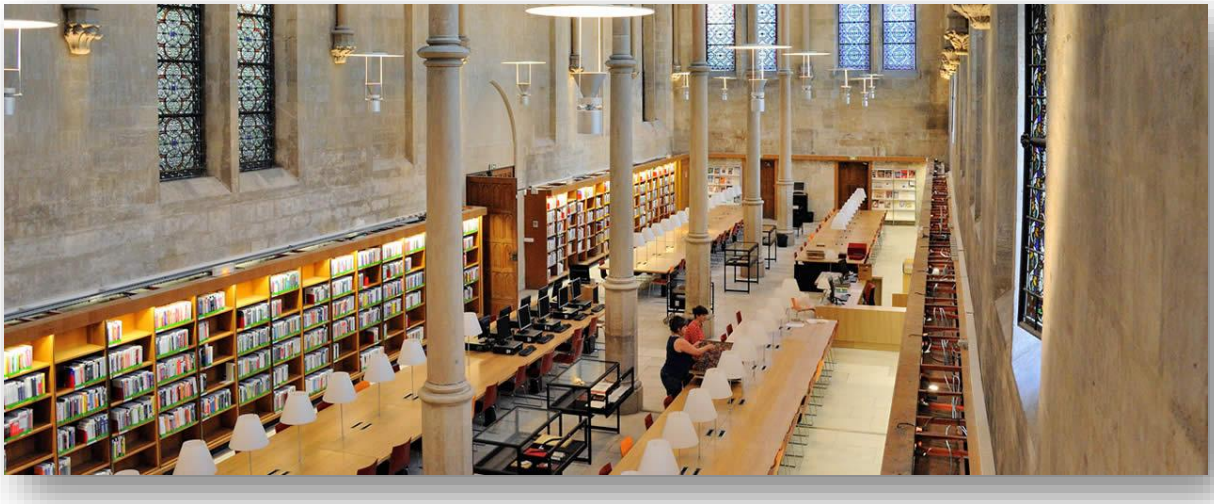
The Conservatoire national des arts et métiers (Cnam) is a leading institution, and the foremost higher education one, dedicated to lifelong learning in France. Cnam was founded in 1794 by Abbé Grégoire to improve national industry. Today, it is a public institution of a scientific, cultural and professional nature under the supervision of the Ministry of Higher Education and Research. It is where the worlds of academics and professional activity come together.
The Cnam proposes study courses which are developed in close collaboration with companies and professional organizations in order to respond to their needs and to those of their employees. The Cnam has grown considerably both nationally and internationally and now has 20 French regional and overseas centers. It also has an extensive number of partner institutions around the world. The Cnam's staff in Paris, Ile de France and other regions includes permanent teaching and non-teaching members. It also welcomes visiting scholars including those from the business world.
Cnam is also home to the Musée des Arts et Métiers, located in the heart of Paris, which houses the oldest industrial and technological collection in the world.



Our Products & Services

The Cnam has three main missions:

- Learning: provide lifelong learning opportunities to all;
- Research: develop excellence in technological research and innovation;
- Expertise: disseminate scientific and technical knowledge.



Role in the Project

Cnam aims to identify potential cybersecurity risks that could impact cyber-physical systems in battery manufacturing, specifically focusing on threats to production process machines that are enhanced by digital twin models and their control actions.

Verkor SA

Main Contact in the Project

Donia Marzougui –
Open Innovation Project Manager
Email: donia.marzougui@verkor.com

www.verkor.com

About us

Verkor is a young French industry founded in 2020 focused on accelerating the production of low-carbon batteries for electric vehicles and large-scale stationary storage. They are based in Grenoble and are building their gigafactory in Dunkirk which will have an initial production capacity of 16 GWh per year. The company aims to contribute to sustainable mobility and the energy transition in Europe.

Our Products:

Verkor is producing:

- Pouch cells: they are flexible and can be used in a variety of applications, including electric vehicles and stationary storage systems.

Role in the Project

Verkor plays a significant role as a use-case provider, focusing on the downstream processes, from notching the formation and aging. The Battwin's digital twins will be tested and validated in Verkor's pilot line. A positive outcome would validate a mix of process/machine and system level digital twin solutions which provide a reduction of scrap rate, increase in production yield and production rates, as well as improved traceability in view of future introduction of the DBP.

COMAU SPA

Main Contact in the Project

Daniela Fontana
Email: daniela.fontana@comau.com
Tel: +39 335 653 0497

www.comau.com/en/

About us

Comau is a global leader in advanced industrial automation solutions and products, with its headquarters in Italy and a presence spanning over 14 countries. Comau boasts decades of experience in designing, manufacturing, and deploying automated systems for the automotive, manufacturing, logistics and energy sectors. The company is recognized for its commitment to innovation, technology and sustainability, providing tailored solutions that enhance productivity, flexibility and efficiency for clients worldwide.

Our Products & Services

Comau offers a comprehensive portfolio that includes:

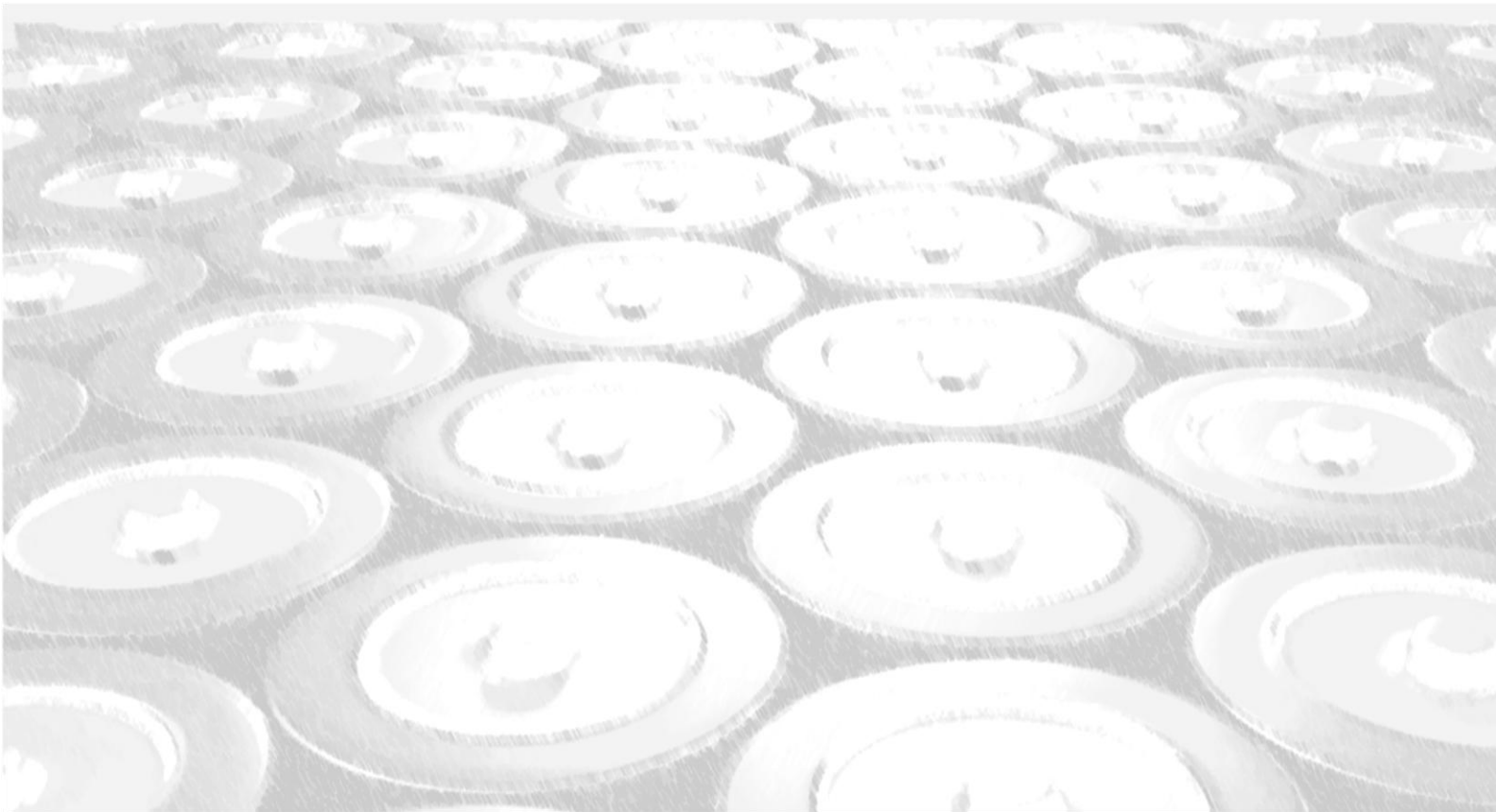
- Industrial Automation Systems: Turnkey solutions for automotive manufacturing, electrification, and general industry, including body assembly, powertrain and battery module lines.
- Robotics: A wide range of industrial robots and collaborative robots (cobots) for various applications such as welding, painting, handling and assembly.
- Digital Solutions: Proprietary software platforms and tools for manufacturing process control, predictive maintenance and data analytics (e.g., in.Grid and MI.RA).
- Electrification Solutions: Specialized systems for battery manufacturing, e-mobility assembly and maintenance services.
- Aftermarket and Training: Lifecycle support, technical assistance and training programs through the Comau Academy to upskill client teams.

Comau is also involved in research, development, and application of artificial intelligence and IoT (Internet of Things) to create smarter, more sustainable production environments.

Role in the Project

Comau plays a central role in the BATTwin project, a European initiative aimed at developing next-generation battery manufacturing technologies. Within BATTwin, Comau leverages its expertise to design and implement advanced automation systems for battery cell, module and pack production.

Specifically, Comau leads the development of a Digital Platform for innovative assembly lines that maximize efficiency, flexibility and quality in battery manufacturing. This includes deploying digital monitoring tools and modular production platforms capable of handling different battery formats and chemistries. Comau's involvement ensures that the BATTwin project meets its objectives for scalable, sustainable, and high-performance battery production, which is vital for the growing electric vehicle (EV) and energy storage markets.



The Royal Institute of Technology (KTH)

Main Contact in the Project

Professor Carlo Fischione
Email: carlofi@kth.se

www.kth.se/en

About us

The KTH group leads the research within Wireless Internet of Things in the School of Electrical Engineering and Computer Science at KTH. The group brings together expertise in control theory, signal processing and wireless systems to develop scalable, resilient solutions for wireless IoT infrastructures. The group has a strong track record in distributed optimization, wireless systems, real-time data analytics and Industry 4.0 applications, collaborating closely with both academic and industrial partners to push forward Europe's leadership in high-tech manufacturing.

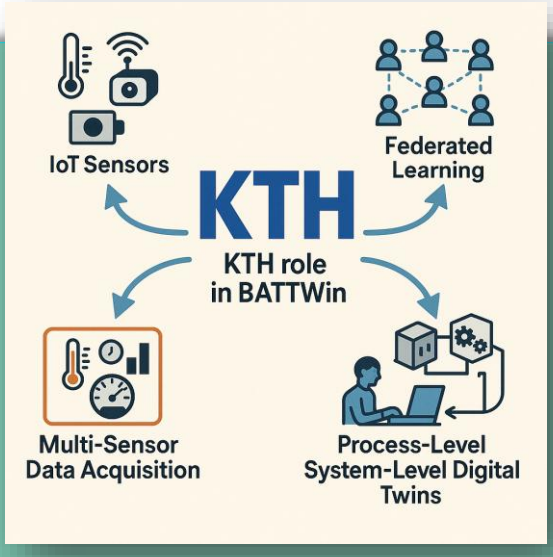
Our Products & Services

Research in Wireless IoT and Federated Learning

The group focuses on harnessing the Wireless Internet of Things for large-scale monitoring and control, and on novel distributed machine-learning paradigms. The group's work on federated learning enables multiple edge devices or manufacturing stations to collaboratively train predictive models—such as for equipment fault detection—while keeping raw data localized. This approach not only preserves data privacy and reduces communication overhead, but also enhances learning robustness in geographically dispersed production lines.

Role in the Project

In BATTwin, KTH is the technical lead for the distributed ML and IoT work package. KTH is responsible for designing and implementing the federated-learning framework and the multi-sensor data-acquisition layer that feed the process- and system-level digital twins. His contributions will underpin the project's goal of achieving Zero-Defect Manufacturing by enabling real-time fault prediction and adaptive control across Europe's emerging gigafactories.



Upcell Alliance - European Battery Manufacturing Alliance

Main Contact in the Project

Claudia Lung
International Projects Leader
Email : claudia.lung@upcell.org

https://upcell.org/

About us

Upcell Alliance is a purpose-driven organization focused on accelerating growth & innovation in the global battery manufacturing industry. By helping to solve the critical challenges facing the sector through collaboration, innovation, and entrepreneurship, Upcell is working to improve long-term energy resiliency and enable a more sustainable future.
Our alliance is an independent association of 120+ battery manufacturers, machine builders, chemicals & materials suppliers, universities, research centers, and public institutions around the world, encompassing the entire value chain for battery manufacturing.

Our Products & Services

At Upcell Alliance, we are committed to strengthening the battery value chain through three core pillars that define our activities : Networking, Operational Research Solutions, Promotion and Knowledge Sharing.

Networking: Building Strong Connections

The alliance serves as a dynamic platform for industry leaders, policymakers, and innovators to connect and collaborate. We foster engagement through:

- Monthly Newsletters – Delivering key updates, funding opportunities, upcoming events, and exclusive member benefits.
- Bi-Monthly Webinars – Offering new members a stage to present their expertise, discuss project expectations, and engage with guest speakers on crucial topics such as investment trends, battery policies, and government support.
- Annual Live Events – Bringing together over 200 stakeholders in past editions in Copenhagen, Barcelona, Milan, and Paris. These highly interactive gatherings feature discussion panels, workshops, and keynote sessions with C-level executives, government representatives, and policymakers.
- Member Space – An online hub for members to share company details, foster partnerships, and streamline collaboration.

Operational Research Solutions: Driving Collaborative Research & Development

Innovation is the key to Europe's competitiveness in the battery sector. Upcell actively supports its members in securing funding and forming strategic partnerships. As such, the alliance identifies and selects relevant European, national, and regional funding opportunities, while offering guidance and hands-on support throughout the application process. As part of its activities, Upcell further fosters collaborations with governments to establish new projects through funded MoUs.

Promotion and Knowledge Sharing

The alliance actively promotes members' solutions and local partnerships to end-users, leveraging established partnerships with industry fairs and strategic events in Europe and North America, to boost visibility within the industry and generate increased business opportunities.

Role in the Project

Within BATTwin, Upcell Alliance is task leader for communication, dissemination, and public awareness. In this capacity, the alliance is responsible for ensuring that the project's objectives, advancements, and results are effectively shared with key stakeholders, including industry professionals, policymakers, and the general public, to maximize impact and foster engagement. Additionally, Upcell leads efforts to identify industrial use cases, notably in the battery sector, for the further adoption of the BATTwin solution, ensuring that the innovations developed within the project can be adapted and scaled.

Cambridge Nanomaterial s Technologies Ltd.

Main Contact in the Project

Dr Bojan Boskovic
Cambridge Nanomaterials Technology Ltd
Email: Bojan.Boskovic@CNT-Ltd.co.uk

www.cnt-ltd.co.uk
www.nanomatexpo.net

About us

Cambridge Nanomaterials Technology Ltd (**CNT Ltd**) is an innovation management and nanotechnology consulting company based in Cambridge, UK, with a sister company CNT Innovation based in Brussels, Belgium.
The **CNT Ltd** helps companies, academic and government institutions to develop world-class innovative solutions for nanomaterials related R&D and IPR strategy, partnership, products, technologies, funding and markets. CNT Ltd is specialised in carbon nanomaterials R&D consulting and collaborative R&D project management, including exploitation and dissemination management, consortium and supply chain building. **CNT** has done several patent landscaping and market research analysis studies regarding production and use of various nanomaterials helping to link inventors and technology developers with end-users and investors. The CNT Ltd is a leader of two private consortiums: **Novel Concepts for Enhanced Materials (NCEM)** and the **Advanced Materials for Additive Manufacturing (AMAM)** with members coming from leading multinational companies and research institutions. Through both private consortiums NCEM and AMAM, as well as private and public contracts, CNT Ltd has established strong relations to the aerospace, automotive, construction, electronics, materials development, biomedical and chemical industry.

Products and Services

- Consulting and an expert advice related to nanomaterials regarding their production, composites, applications, key players, funding and market. Experts with more than 20 years of experience in commercialisation of carbon nanomaterials (graphene, carbon nanotubes, carbon nanofibres, etc.).
- Innovation management and technology transfer support related to R&D of novel nanomaterials & composites.
- Advice and support related to development of Intellectual Property (IP) Strategy – patent landscaping reports, due diligence, invention and protection.
- Market Research and Strategy - market research reports, consulting and advice about innovation, new product strategy and development, proof-of-concept, market and funding.
- Organisation of nanomaterials and nanotechnology application related conferences, workshops and customised training, seminars and support multinational companies and research institutions.
- Management in collaborative R&D projects, such as EU Horizon 2020 projects: n-TRACK (www.n-track.eu); Oyster (www.oyster-project.eu); M3DLoC (www.m3dloc.eu); Genesis (www.genesis-h2020.eu); Repair3D (www.repair3d.eu), Carbo4Power (www.carbo4power.eu), APOLO (https://project-apolo.eu/), DOME (www.dome40.eu), TriAnkle (www.triankle.eu), and NanoMECommons (www.nanomecommons.eu), as well as Innovate UK projects: HiBarFilm 2 (www.hibarfilm.co.uk GRAPHOSITE (www.graphosite.co.uk); and Horizon Europe collaborative projects such as: AM4BAT Project (www.am4batproject.eu) and BATTwin (www.battwin.net).
- Consortium set-up, grant proposal writing support; exploitation and dissemination management; liaising with EU officials.

Role in the BATTwin Project

Cambridge Nanomaterials Technology Ltd. (CNT) is at the forefront of leading the IP and technology monitoring and exploitation activities for the BATTwin project. Additionally, CNT is responsible for managing the project website (www.BATTwin.net), creating the project logo, leaflets, organising 2 Open Day workshops, formulating the Intellectual Property (IP) strategy, and preparing patent landscaping reports. We also play a significant role in market research, business development, and shaping the project's exploitation strategy.

HUN-REN SZTAKI

Main Contact in the Project

Gergely Horváth
Research fellow
Email: horvath.gergely@sztaki.hun-ren.hu

www.sztaki.hun-ren.hu

About us

HUN-REN SZTAKI is a research institute, governed by the Hungarian Research Network (HUN-REN).
SZTAKI is the acronym of the Hungarian name of the institute, while its full English name is "Institute for Computer Science and Control".
The Institute was founded in 1964. Its staff consists of more than 300 full-time employees, more than 200 with university diploma and more than 70 with scientific degrees.
The fundamental task of the Institute is to perform basic and application-oriented research in an interdisciplinary setting in the fields of computer science, engineering, information technology, intelligent systems, process control, wide-area networking and multimedia.
Contract-based target research, development, training and expert support for domestic and foreign industrial, governmental and other partners are important activities at the Institute.
The mission of HUN-REN SZTAKI includes the transfer of up-to-date research results and state-of-the-art technology to university students. The Institute is very active in graduate and postgraduate education, co-operating with most technical universities in Hungary and operating common chairs, postgraduate programs with them. More than 40 members of the Institute's researchers conduct regular lectures/classes at graduate and postgraduate levels, and senior researchers hold part-time positions as university professors. 20-30 Ph.D. students and 20-30 graduate students participate in the work of the Institute.
The department participating in BATTwin is the Research Laboratory on Engineering & Management Intelligence (EMI). The main research activities of the Laboratory center around cyber-physical production systems and are aimed at developing such models, methods and techniques that are capable of handling complex production and business systems working in an uncertain, changing environment. Seeking a balance between the aspects of optimization, autonomy and co-operation, this research necessitates an interdisciplinary approach with special emphasis on computer science, operation research, manufacturing science and technology, as well as artificial intelligence.

Our Products & Services

Hence HUN-REN SZTAKI has been active in several subfields of applied and basic research in the last six decades with countless results in a wide range of scientific areas, we are only going to list services and products that are currently relevant to the EMI lab, and thus the BATTWin project.

LinkageDesigner is an add-in application package to Wolfram Mathematica. The application is designed primaly to support the design of multy-body mechanisms. The application introduce 300+ new

functions that supports the whole life cycle of the mechanism's design process starting from the sketch design till kinematic and dynamic analysis of the fully elaborated CAD mechanism. LikageDesigner is written completely in Wolfram language and available on all platform where Mathematica can run. LinkageDesigner is compatible with Mathematica 11.x versions. https://linkagedesigner.com/

ProSeqqo is a sequencing tool over Google-OR-Tools, task representation for industrial robot applications based on GTSP. It acts as a generic task sequencer that captures typical sequencing problems encountered in robot applications. https://github.com/sztaki-hu/ProSeqqo

Roboprog is a high-level library for general and real-time programming of robotic arms, developed by HUN-REN SZTAKI. The principle is similar to that of ROS and RoboDK, but instead of writing hardware drivers, it relies on the scripting language of the robot to control the hardware components, and form an remote procedure calls (RPC) proxy-like bridge between the robot's script and a high-level language. This allows RPC to access more complex functions, such as movement in joint space or in an arbitrary orthogonal coordinate system, beside the robot's own script language instructions. Furthermore, grippers can be controlled and the force/torque values of external sensors can be queried. The number of supported robots is limited but expending constantly.

Role in the Project

HUN-REN SZTAKI is capitalizing on its manufacturing experience and expertise within the BATTwin project. Our responsibility is inspecting, modeling, analyzing and improving the various handling tasks surfacing throughout the battery manufacturing line. Also, HUN-REN SZTAKI is coordinating the effort of the process-level digital twin development of the various partners.

Sunlight Group Energy Storage Systems

Main Contact in the Project

Konstantina Giakoumi
Project Manager, Lithium R&D
Email: k.giakoumi@sunlight.gr

www.the-sunlight-group.com/en/global/

About us

Sunlight Group Energy Storage Systems is a world-leading technology company and provider of energy storage solutions with decades of experience. We specialize in the development, production, and dissemination of lead-acid and lithium-ion batteries for industrial mobility and Energy Storage Systems. We also offer a complete range of chargers and IoT solutions for the monitoring and management of batteries, and consider Recycling a vital and indispensable part of our operation. Our innovative products are manufactured and assembled in 35+ state-of-the-art facilities across four continents and distributed to more than 115 countries. Sunlight Group is a global leader in motive power batteries for the intralogistics sector and in Energy Storage Systems for on-grid, off-grid, and residential applications.

Our Products & Services

- Lithium-ion batteries
- Lead-acid batteries
- IoT solutions
- Chargers

Role in the Project

Sunlight Group is one of the two use cases providers for the BATTwin project, focusing the on upstream processes (mixing, coating calendering, and slitting for LFP cells) of its lithium cells pilot line.

Ansys UK Ltd., part of Synopsys

Main Contact in the Project

Günther Hasna
CTO
Email: guenther.hasna@ansys.com

Edward Carman
System Simulation and Digital Twin
Email: Edward.Carman@ansys.com

www.ansys.com

About us

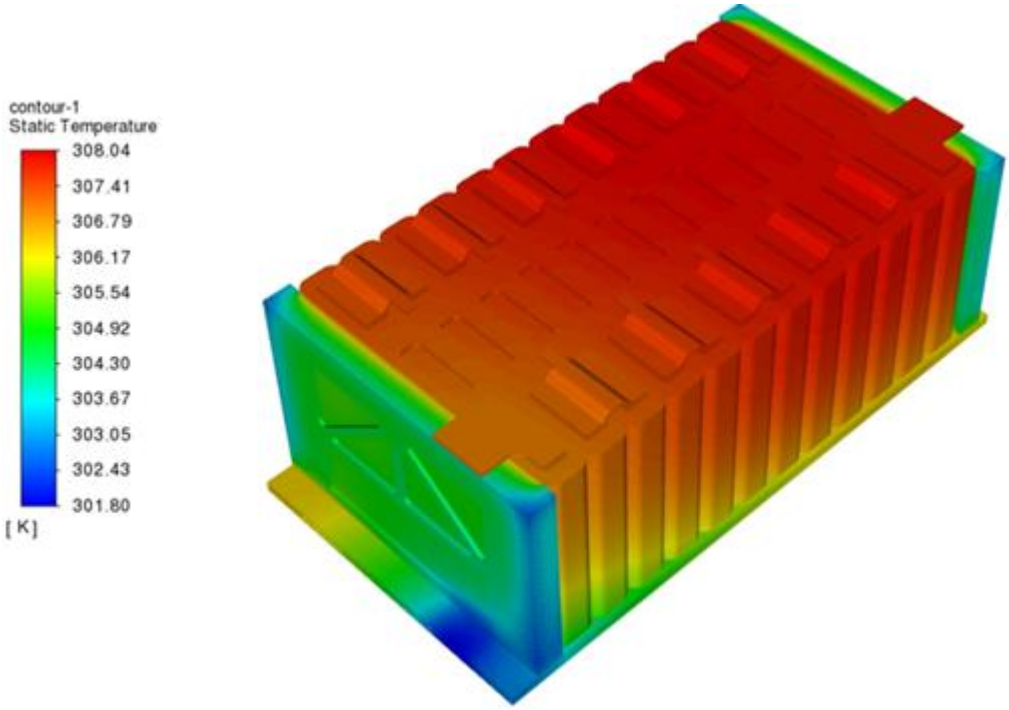
Our Mission: Powering Innovation That Drives Human Advancement

When visionary companies need to know how their world-changing ideas will perform, they close the gap between design and reality with Ansys simulation. For more than 50 years, Ansys software has enabled innovators across industries to push boundaries by using the predictive power of simulation. Ansys offers a comprehensive software suite that spans the entire range of physics, providing access to virtually any field of engineering simulation that a design process requires. Our open ecosystem connecting computer-aided design, computer-aided manufacturing, and computer-aided engineering providers means Ansys software integrates seamlessly into existing platforms. Organizations around the world trust Ansys to deliver the best value for their engineering simulation software investment.

Our Products & Services

Ansys, part of Synopsys, provides comprehensive simulation solutions for electric vehicle (EV) battery modeling and manufacturing, enabling cell suppliers, original equipment manufacturers (OEMs), and system integrators to address critical stages of battery development, from design to production and integration through multiphysics simulation and model-based methodologies. Key offerings include:

- Battery cell-to-pack: electrode performance, thermal management, material selection, mechanical abuse and durability
- Battery management system-vehicle integration: BMS architecture and model-based development, design safety analysis, predictive battery aging
- Battery manufacturing process and production: Fluid dynamics, particle dynamics and multibody dynamics, structural finite element analysis, process integration, design optimization

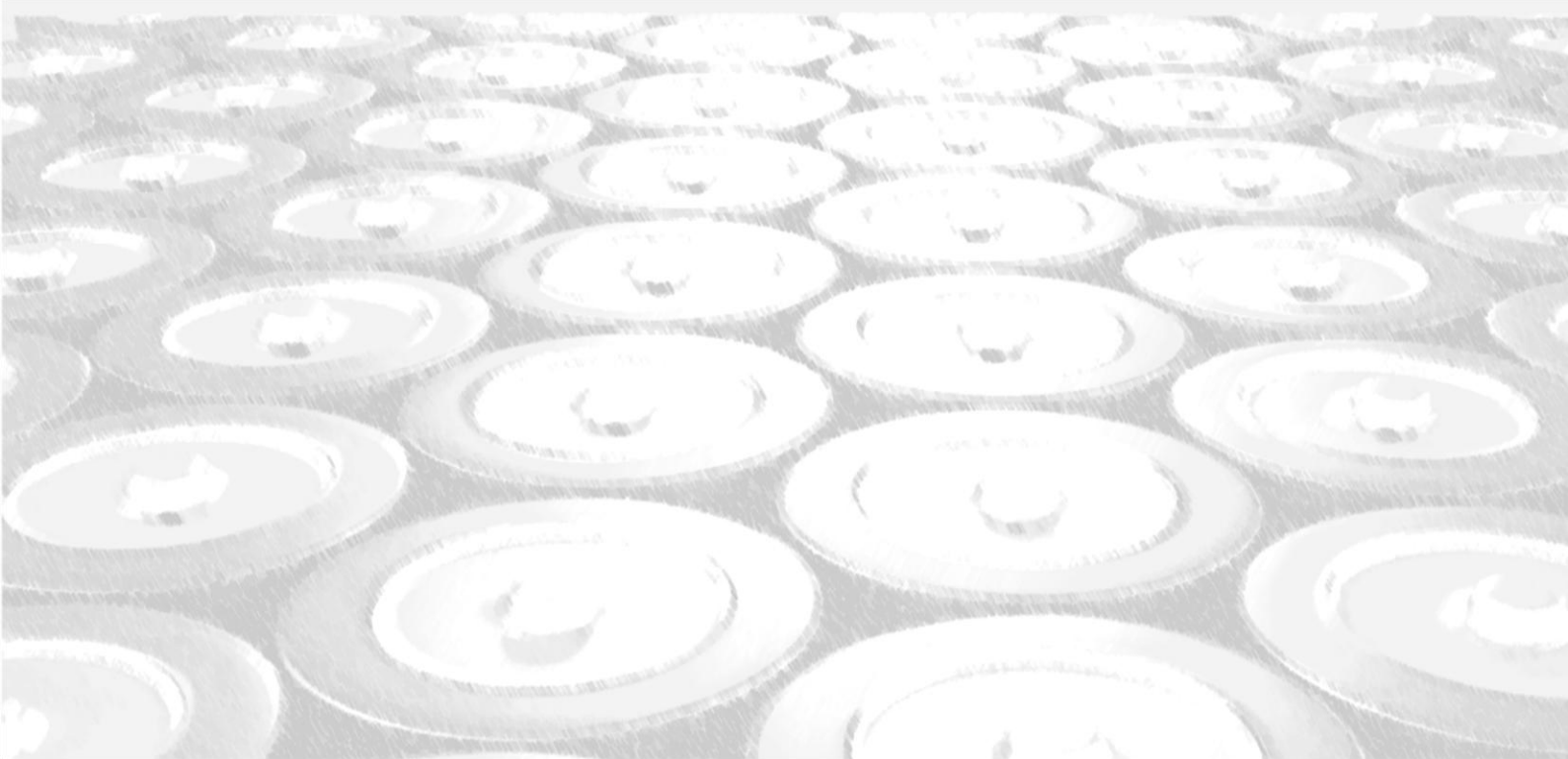


Consider all critical design goals, such as damage vibration, thermal runaway, and crash safety, simultaneously using Ansys multiphysics simulation to find the best possible structural design for a battery.

Ansys simulation workflows help optimize manufacturing processes and determine optimal operating conditions, increasing yield, reducing manufacturing testing processes, and producing high-quality uniform electrode parts.

Role in the Project

Selected project partners are provided access to Ansys simulation and modelling software, along with support guidance, and training on its use. This includes guidance on techniques for the deployment of these models into a digital twin environment.



Sivas University of Science and Technology

Main Contact in the Project

Prof. Dr. Emre Biçer
Vice Rector
Sivas University of Science and Technology
Email: emre.bicer@sivas.edu.tr

www.sivas.edu.tr

About us

Sivas University of Science and Technology (SBTU) is a dynamic and research-oriented public university located in central Türkiye. The university is committed to excellence in engineering, natural sciences, and agricultural sciences, with a strong focus on applied research. Within this framework, the university hosts a multidisciplinary Battery Research Team, which is actively involved in both computational and experimental research related to Li-ion battery manufacturing processes.

Our Products & Services

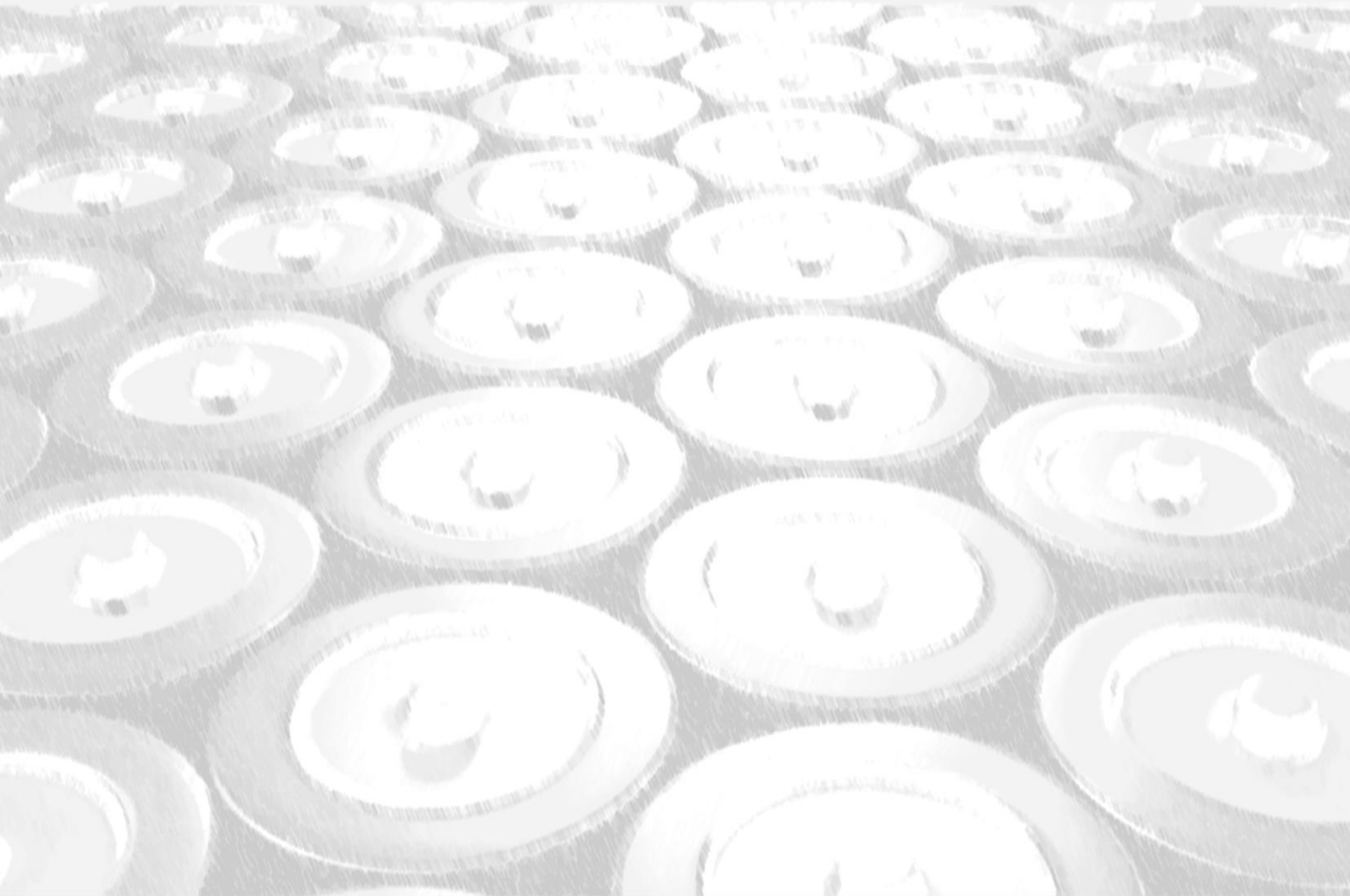
Sivas Energy Storage Research and Application Center at SBTU provides advanced research capabilities in the following areas:

- Advanced Battery Materials Synthesis and Characterization - (development of anode, cathode, and solid-state electrolyte materials; structural, thermal, and morphological analyses)
- Comprehensive Electrochemical Performance Evaluation - (capacity, lifetime, and safety assessment through techniques such as CV, EIS, cycling, and advanced diagnostic testing)
- Modeling and Simulation of Battery Manufacturing Processes - (molecular dynamics, multiscale simulations, and digital-twin approaches for electrode preparation, cell assembly, and battery performance prediction)
- Electrochemical Process Modeling and Optimization - (formation, aging, and degradation studies using multiphysics simulation tools and data-driven methods)
- Training, Consulting, and Industry–Academia Collaborations - (capacity building for graduate students and professionals, technology transfer, joint R&D projects with industrial stakeholders)

Role in the Project

Within the BATTwin project, Sivas University of Science and Technology is contributing to the development of data-driven and physics-based digital twin models for Li-ion battery electrode fabrication. Our team focuses on modeling key manufacturing stages—mixing, coating, drying, calendering, and slitting—using molecular dynamics (MD).

In addition to electrode production modeling, we also work on the formation and aging processes of Li-ion batteries using COMSOL Multiphysics. These models aim to capture the evolution of electrochemical behavior during early cycling and long-term usage. By integrating both materials-level and cell-level simulations with experimental data, we support the creation of robust digital twins for the entire battery manufacturing and performance chain..



Syxis Vsi

Main Contact in the Project

Sara Pozzi
Project Manager
Email: sara.pozzi@syxis.eu

Alessandra Sala
Communication team
Email: alessandra.sala@syxis.eu

https://syxis.eu/

About us

Syxis is a European Innovation Hub which aims to enable a systemic transformation through digital, circular and collaborative innovation. With a Cross-sectoral approach (in Construction, Buildings, Neighborhoods, Textile and Manufacturing), Syxis has a vibrant portfolio of EU project participations and a core mission to support and connect SMEs, organizations and research centers across Europe, providing them with methods, tools and technologies to strengthen their innovation capacity. Syxis is an active member of ECTP and ETP, B4PIC perspective partner and hosts the AI4manufacturing community, consolidating its role as a catalyst for innovation and cooperation at European level.
With a network of more than 4000 contacts and long-term partnerships, Syxis co-creates concepts, incubates solutions and brings innovation to reality.

Our Products & Services

Syxis focuses on three key areas: Circular Economy Ecosystem (all its activities aim to provide sustainable solutions for the future of the environment, the economy and the people), Digital Solutions (Syxis creates technological platforms based on the power and importance of data), and Network Awareness (Syxis promotes relationships and collaboration among entities within the same ecosystem, encouraging the co-creation model as a new business strategy).

We write and manage EU Founded project's proposals (brainstorming meeting, consortium creation, writing & collecting, EU Portal submission); we provide digital tools&platforms and methodologies (like Data Requirements Gathering, Software Validation, Data Model Design, Platform Design), to support the sharing of data and information (DPP, Data Space, Digital Twins, IoT, etc), the engagement of workers and citizens, the upskilling of competences and sharing of knowledge, the matchmake and cocreation of concepts and new value chains. We manage dissemination&communication activities and Open Calls, circular exploitation strategies, tourism and citizens engagement strategies, policy making and roadmaps. We deal with Innovative Pathway (Business and Circular Model Design, Social & Ethical Impact Analysis, Legal Impact Analysis, Urban Participative Innovation Ecosystem). We prototype and validate practical and digital solutions developing and applying them in specific or cross-sectorial context; we incubate market-relevant solutions.

Role in the Project

In BATTwin project, SYXIS will work on design and development of user-oriented GUIs supporting DT workflows. The requirements for these GUIs will be extracted from the outcomes of WP1 and will be consolidated by an extensive user analysis activity, also involving specific questionnaires proposed to the Upcell Alliance Members, the BATTwin end-users, and other selected stakeholders in Batteries Europe and BEPA. At the end of the project, SYXIS will have a product - ready to use and validated GUIs for enhanced user interaction with the developed workflows, to be exploited in battery industry.

N-ABLE

Main Contact in the Project

Erwan Le Bourhis
CFO
Email: Erwan.LeBourhis@n-able.io

Emmanuel Boudard
COO
Email: Emmanuel.Boudard@n-able.io

https://n-able.io/

About us

N-ABLE aims to accelerate sustainable innovation investments. Our experts are active in natural assets with distinctive experience in raw materials, ranging from resource-efficient mining to circular raw materials across various application areas.

Circular economy is at the core of our activities: we coordinated partnerships such as the European Industrial Circular Economy Investment Alliance (ICEI-A), the European Advanced Materials for Batteries Partnership (AMBP) on behalf of the European Commission, and are a partner of the RISE Consortium funded by the Commission under the I3 to initiate and develop circular investments in raw materials and bioeconomy (lead by Cleantech Bulgaria). We supported several countries with the design of their circular strategy (e.g., Slovenia, Bulgaria) and facilitated the financing of various circular investments with special emphasis on raw materials (e.g., I4GREEN), batteries (e.g., BATMASS). We also designed the industrial symbiosis guidelines of the EREK (JRC) platform and are currently carrying out the EIB analysis of investment prospects in EU raw materials resilience.

Our experts focus on accelerating the development and deployment of new technologies, solutions, and business models. We advise private sector, intermediaries, and Governments (European Commission, World Bank, European Investment Bank, etc.) across the globe. Among others, we coordinated the European Commission Pilot Actions on Interregional Innovation Investment and Industrial Transition (SI) as well as the Swappable Batteries Motorcycle Consortium (on behalf of Yamaha, Piaggio, KTM, Honda, etc.). We are also currently partners of BATMASS and PERMANET (raw materials recovery and resource efficiency in the battery, and permanent magnet sectors on behalf of a wide range of EU industrial leaders).

Our Products & Services

N-ABLE Experts only provide one service: innovation investment acceleration.

Our role is to enable and speed up the commercialization, monetization and deployment of new products, services, processes and business models. Our experts will tailor their approach according to your needs, whether you are:

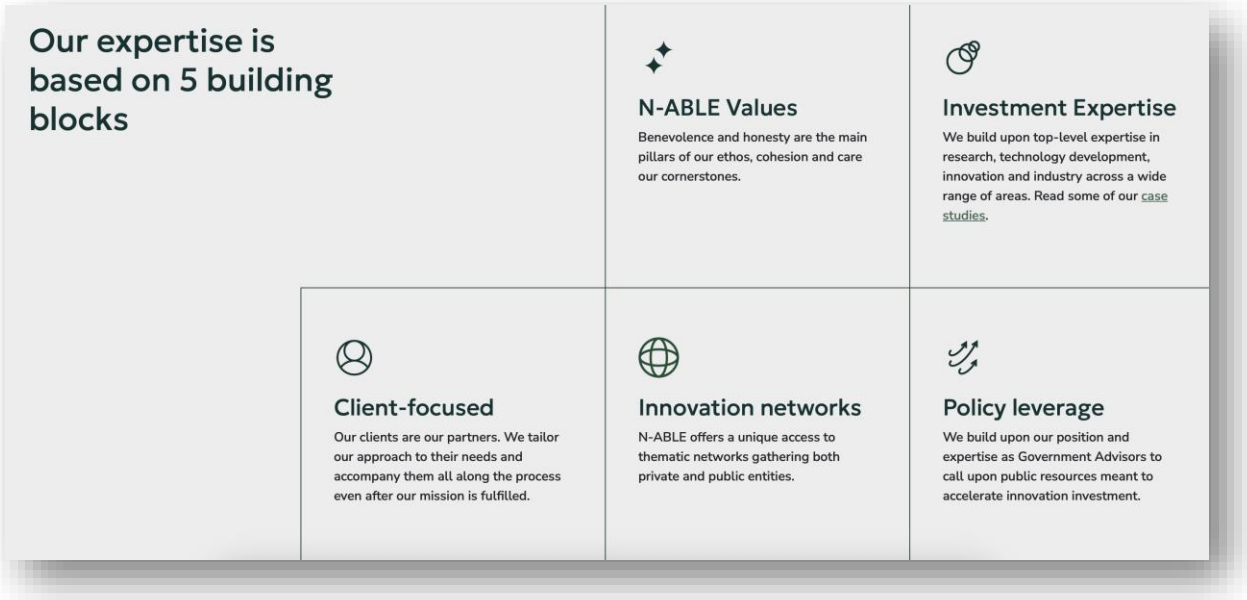
Year	Description
2021-2026	**Support to the 73 Green Deal Projects selected by the EC** As the Green Deal Call (GDC) of 1-B€ supports a wide variety of important topics and respective projects, the primary aim of the contract, is to increase the impact and the coordination among the different topics and projects funded under the GDC. This contract aims at establishing a secretariat that will set up and moderate a central networking hub connecting projects covered by the GDC with each other as well as with relevant activities supported. In details: - Provision of dedicated coordination and technical but also financial expertise to build capacity across GDC projects - Collaboration of GDC projects with clear common interests to fully develop synergies also across topics - Elaboration, analysis and evidence base for R&I policies produced in the GDC projects - Creation and management of topic specific project clusters and their link to the other clusters - Networking with similar actions from member states and/or associated countries **N-ABLE expertise will focus on accelerating the maturity of Green Deal projects toward bankability, enabling the development and deployment of new technologies, solutions and business models:** - Analysis of green business and investment models; - Support to project promotors with technical and financial expertise; - Process management for the selection of leading business cases; - Animation of collaborative "clusters" across Green Deal priority areas; - Coordinate the implementation of capacity building activities on investment project and business/financial modelling.
2024-28	**PERMANET - PERMANENT MAGNET NETWORK FOR THE EUROPEAN TRANSITION** - is a Sustainable REE Innovation and Supply Network covering the full Rare Earth Elements (REE) Permanent Magnet (PM) value chain made of 32 partners including OEM and big manufacturers. It is structured upon 5 layers: 1) Three Sustainable, Connected Tech 'Hubs' segmented along the full REE PM value chain and organizing thematic collaborative R&D and supply ecosystems 2) 13 fully Scalable Innovations to reach TRL7 and expand in scale and deployment range along the entire value chain 3) A structural layer of R&D infrastructure, equipment and services to fuel Pilot and Demonstration activities 4) Five Enabling "Engines" addressing the key conditions for sustainable and competitive REE supply 5) All embedded within a single PERMANET Network Infrastructure with its own, sustainable organizational model. The Network accelerates leading-edge innovations, from REE extraction from mining tailings and hydrometallurgical processes to oxide reduction and innovative production processes, all the way to the production of innovative PM and their testing by end users in industrial environment across 1/ E-Mobility 2/ Energy 3/ Industrial Equipment. PERMANET also secures key sources of REE such as leading mining projects from the EU and Partner Countries, as well as End of Life (EoL) sectors (WEEE, EV, etc.). The project relies on enabling activities ranging from strategic venturing to investment support to build sub-optimal EU REE PM Segments. The project unlocks viable reserves of REE including unconventional sources and will demonstrate novel, cost-effective, and environmentally sound REE extraction, processing, and separation routes, as well as demonstrate the first EU hub for PM boosting circular PM technologies to deploy at market scale. **N-ABLE expertise will focus on financial advisory for the process and for scaling these very large investments**

2023-26	**Investment and Financial Advisory of BATMASS - EU circular BATtery valley for second life, recycling, and re-manufacturing of materials and black MASS** BATMASS offers a portfolio of investments in TRL6+ innovation investments in circular technologies and processes for battery materials. BATMASS mobilizes a fully comprehensive interregional ecosystem around 4 Demonstrators (or 'Demo lighthouses') meant to scale up, commercialize and deploy breakthrough GreenTech. **N-ABLE expertise will focus on financial advisory for scaling these very large investments (gigafactory/hydrometallurgical plant-scale).**
2024-25	**Framework Agreement to support the advisory activities of EIB.** The European Investment Bank has mandated N-ABLE and its partners (E&Y and Cambridge Econometrics) to conduct an assignment supporting its investment strategy in Strategic Raw Materials (SRM). The aims of the study can be summarized as follows : 1) To analyse needs, obstacles, and opportunities in Strategic Raw Materials (SRM), with the overarching ambition to strengthen the resilience of the European Union in SRM. 2) Identify potential SRM investment leads/prospects along the full value chain (mining, processing, refining, recycling, etc.) that could possibly be relevant to the financial instruments offered by the EIB.

Role in the project

N-ABLE provides financial advisory for scaling BATTwin very large investments:

- Analyzing value drivers and strategic mechanisms underlying each BATTwin solutions;
- driving business and financial modelling of each business solution;
- Collaborating with specialized teams of deployment partners to build financial models for
- each solution;
- Generating financial plans and leading a strategy design process for optimal capital
- structure and financing strategy. A high attention is directed to project/company risk profiles and
- possible venturing formats;
- Investment and Investors Mapping: Focusing on battery and digital twin segments;
- Consulting with lead investors and capital providers on investment banking and private spheres;
- Accounting for corporate investors who have voiced in the sector over the past decade;
- Using Pitchbook data for modelling and investor mapping; and combining analysis of barriers and drivers to Battery Digital Twin investment using survey tool.



Schneider Electric Automation GmbH

Main Contact in the Project

Moritz Scholz
Email: Moritz.scholz@se,com
Tel: +49 160 545 3358

www.se.com

About us

Schneider's purpose is to create Impact by empowering all to make the most of our energy and resources, bridging progress and sustainability. At Schneider, we call this Life Is On.
Our mission is to be the trusted partner in Sustainability and Efficiency.
We are a people company with an ecosystem of 150,000 colleagues and more than a million partners operating in over 100 countries to ensure proximity to our customers and stakeholders. We embrace Inclusion and Care in everything we do, guided by our meaningful purpose of a sustainable future for all.

Our Products & Services

We are a global industrial technology leader bringing world-leading expertise in electrification, automation and digitization to smart industries, resilient infrastructure, future-proof data centers, intelligent buildings, and intuitive homes. Anchored by our deep domain expertise, we provide integrated end-to-end lifecycle AI enabled Industrial IoT solutions with connected products, automation, software and services, delivering digital twins to enable profitable growth for our customers.

Role in the Project

Schneider Electric contributes to the BATTwin project on several levels. In a first step, Schneider helps to outline the technical requirements and concrete business needs with regards to the future twin-solution, leveraging both internal expertise and external partner's feedback. Furthermore, Schneider Electric plays a crucial part by providing the environment to virtually integrate the works of the Consortium Members in our existing, and within the BATTwin project advanced, digital twin software solution.

Bureau Veritas Italia Spa

Main Contact in the Project

Simone Dore
Bureau Veritas Italia Spa
Email: simone.dore@bureauveritas.com
www.bureauveritas.it/contatta-bureau-veritas-automotive

www.bureauveritas.it

About us

Bureau Veritas - A business to business to society company
Bureau Veritas is a world leader in laboratory testing, inspection and certification services. Created in 1828, the Group has more than 83,000 employees located in more than 1,600 offices and laboratories around the globe.
Thanks to our unrivalled expertise, independence and worldwide presence, we support our clients to navigate technological and societal changes to transform and perform sustainably.
Our testing services offer state-of-the-art laboratory equipment and field-specific technical expertise to verify that products and commodities are compliant with regulations and specifications. Leveraging on-site inspections, we aim at making sure products, services, assets and installations are manufactured or operating as intended. Moreover, as an independent third party and accredited certification body, we attest that management systems, services and people comply with specific standards, allowing companies to access new markets, fortify their brands or simply operate.
We therefore help organizations manage quality, safety, health and sustainability risks, endeavouring to shape a world of trust, to the benefit not only of businesses, but of society as a whole.

Products & Services

Powering the green transition - Bureau Veritas' expertise in sustainable automotive and battery solutions

In a market landscape increasingly focused on sustainable practices and environmentally conscious offerings, our services help clients demonstrate the impact of their ESG actions by making them traceable, visible and reliable.

This is reflected in our vital support role in the field of new mobility, where we have developed a complete portfolio of services, covering the full lifecycle of electric vehicles and of charging stations. In this regard, we offer second and third-party audit services, targeted at organizations that wish to gain visibility and control over environmental and social risks of their supply chain. We can assist in verifying the compliance and homologation of components and, through our experts, we certify the correct functioning of used and repaired vehicles, ultimately favouring the circular economy.

In this context, recognizing the pivotal role of batteries in the green transition, we have tailored our service offerings to build trust and confidence within the growing battery industry.

Lithium-ion technologies, which nowadays dominate the EV batteries landscape, are indeed surrounded by safety risks which can be mitigated only through specific tests. Moreover, numerous performance criteria like energy capacity, charging rates and thermal management standards must be validated, while stringent regulatory requirements are making independent compliance processes more and more complicated. Our battery testing, quality assurance, consultancy and training services are specifically designed to address all these aspects.

Role in the Project

Our specialized capabilities for assisting manufacturers in navigating new regulatory requirements - Bureau Veritas'

With the publication of the Battery Regulation in July 2023 the EU has made a clear commitment to improve the sustainability, safety and management of batteries, but the new requirements bring significant challenges for industry players.

For the first time, indeed, aspects strictly related to sustainability, like product carbon footprint performance or minimum amount of recycled content, will be made mandatory for placing a product on the European market. Among these, though, the necessity to associate a digital product passport (DPP) with each product is likely the most innovative aspect of the entire regulation. This instrument is to be understood as a digital registry that aims to enable the collection and sharing of detailed information about a product throughout its entire lifecycle to foster more sustainable product management.

However, despite the mandatory introduction of DPPs in 2027 is fast approaching, there is still not much clarity around the topic. Manufacturers know that they will be responsible of issuing the DPP, but need guidance on what precisely they are supposed to do.

This is exactly the reason why we at Bureau Veritas have been called to participate in the BATTwin project. Thanks to our expertise in traceability and battery-related regulations and standards, we work to identify the key data to be retrieved from the cell manufacturing process to ensure that the BATTwin platform is already prepared for future obligations.

More in detail, our objective is to contribute to the first pillar of the BATTwin solution, the data acquisition and management layer, by developing the digital battery passport-compliant data model. In this way, we aim to ensure that all the necessary information to certify the compliance of the batteries is correctly collected and easily made available to the verification authorities. We therefore provide transparency and traceability to the production process, bringing reliability to the information that in the future will need to be shared with all the actors in the value chain.

We shape a world of trust in support of the sustainable transition of the battery industry.

The University of Warwick

Main Contact in the Project

University of Warwick
Email: WMGbusiness@warwick.ac.uk

www.warwick.ac.uk/fac/sci/wmg

About us

The University of Warwick is one of the UK's leading academic institutions, known globally for research excellence, impact, and industrial collaboration.
Warwick Manufacturing Group (WMG), a department within the University of Warwick and a founding member of the UK's High Value Manufacturing Catapult, is a world-leading research and education group. Established in 1980, WMG brings together academic expertise with industrial relevance to deliver transformational innovation across manufacturing, mobility, digital technologies, and sustainability.
At WMG, our purpose is clear: "**to deliver the technologies, knowledge, and people needed by the industries of today and the future.**" And in the context of BATTwin, WMG's research, particularly the AMPS (Advanced Materials and Processes) and Battery Systems Research Groups, provide deep technical expertise in intelligent process control, manufacturing scale-up, and system integration, ensuring research translates into practical, industrially relevant solutions.

Our Expertise

WMG supports industrial partners through research, innovation, and technology development across the product lifecycle. Key capabilities include:

- **Manufacturing Process Scale-Up**: Transitioning from lab-scale to full-scale industrial systems.
- **Closed-Loop Quality Control**: Using in-line sensors, AI, and data mining to detect and resolve defects in real time.
- **Predictive Modelling & Digital Twins:** Physics-based and hybrid models to simulate and optimise manufacturing processes.
- **Laser Systems & Optics**: Advanced tools for structural joining of battery and vehicle components.
- **Tooling Optimisation & Process Simulation**: Supporting design, testing, and integration across production systems.
- **Six-Sigma Quality Analysis**: Root cause diagnostics and variation reduction in high-precision manufacturing.

Our capability

- Laser systems and optics for thin foils and structural parts
- Tooling optimisation, digital twinning and process simulation
- Quality control enabled by in-line and in-situ sensors
- AI-Enabled Digital Twin (AI-DT) to optimise manufacturing processes
- Quality improvement and six-sigma variation root cause analysis
- Advanced manufacturing solutions from concept through industrial deployment
- Creating scalable methodologies and tools for production systems, including hybrid modelling and quality optimisation
- Leading large-scale, interdisciplinary, international R&D programmes (over €35M in funded research)

Notable Successes

- Remote laser welding solutions adopted by major OEMs, including the UK's first aluminium automotive door production.
- EU 'Factory-of-the-Future' RLW Navigator recognised as an EC success story.
- Development of BIW Analyser software and 6-sigma methodologies implemented across global OEMs.
- Battery enclosures manufactured using recycled materials, showcased at industry events (Cenex-CAM, Cenex-LCV).

Role in the Project

WMG leads the development and integration of Digital Twins (DTs) that enhance decision-making and enable zero-defect manufacturing in battery production.

Key roles include:

- Multi-Physics Modelling Platform: Consolidating key input/output relationships across process chains to inform model architecture.
- Reduced Order Model (RoM) Development: Co-created with end-users such as Verkor and Sunlight to support scalable DT workflows.
- Data Fusion & Interoperability: Defining I/O protocols for seamless integration with IoT systems and digital battery passports.
- User-Centric DT Workflows: Embedding KPIs, security, and reusability to support robust analytics and visualisation.
- Workflow Orchestration: Applying tools like OptiSlang for sensitivity analysis, optimisation, and bottleneck detection across manufacturing stages.

WMG's contribution ensures that digital twins in BATTwin are modular, interoperable, and directly applicable to industrial use cases, accelerating Europe's battery manufacturing capability.

Contact us

Project Management

Prof. Marcello Colledani

Politecnico di Milano

Email: marcello.colledani@polimi.it

Exploitation and Dissemination Management

Dr Bojan Boskovic

Cambridge Nanomaterials Technology Ltd.

Email: bojan.boskovic@cnt-ltd.co.uk

Claudia Lung

Upcell Alliance

Email: claudia.lung@upcell.org

www.BATTwin.net