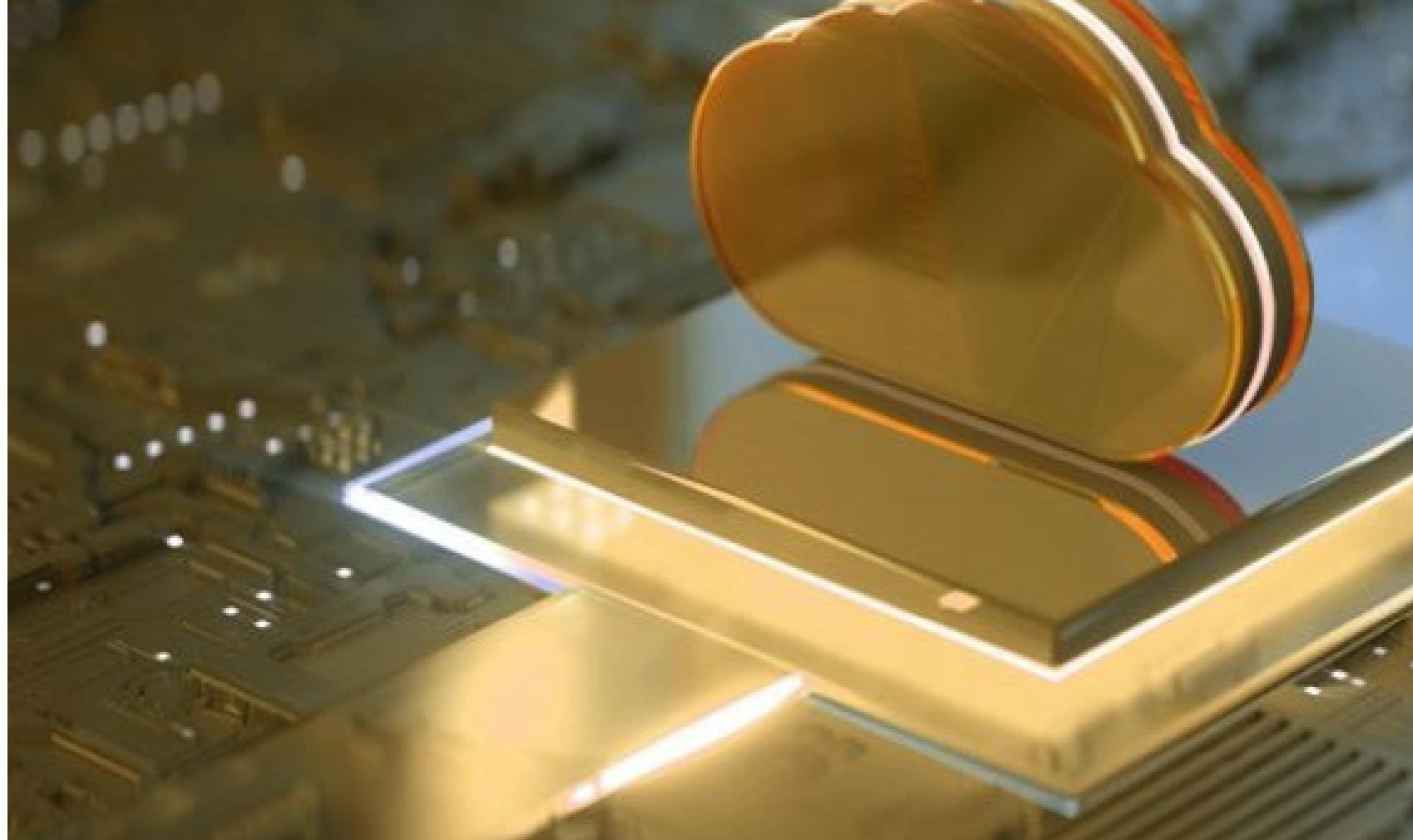




Advanced physics and data-based BMS for optimal battery utilization

Newsletter | March 2024

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Dear reader,

Welcome to the NEXTBMS community and to the first newsletter update. We are excited to bring you the latest news on the pioneering EU project NEXTBMS! This ambitious initiative is set to boost next-generation battery management systems to achieve optimal utilization of battery systems in Europe through the development of physiochemical processes of lithium-ion batteries to significantly enhance current modelling approaches and achieves optimal utilization of the battery system.

NEXTBMS has formed a formidable consortium comprising 12 partners covering an essential part of the battery value chain.

The NEXTBMS project aims to surpass contemporary Battery Management System (BMS) limitations by introducing physics-based and data-driven models and algorithms to the BMS itself. This technology has the potential to boost the European battery chain and clean energy transition.

Join us on this exciting journey and explore all the possibilities that NEXTBMS is set to unlock.

Subscribe to the [newsletter](#) to stay tuned for more NEXTBMS updates.

Welcome by the coordinator!



The Austrian Institute of Technology (AIT) is very proud to be the coordinator of the NEXTBMS project. The goal of this highly innovative and exciting project is to efficiently improve the electrical and lifetime performance of current and future battery systems through innovative physics- and data-driven approaches. NEXTBMS develops scalable, physics-based models for battery management with data transferability between detailed electrochemical models and computationally efficient equivalent circuit models. These modeling approaches will be further improved by optimizing sensors and measurement techniques. The accuracy of cell measurements (temperature, voltage, current, battery states) will be increased by combining information from physical sensors with virtual sensors. This will allow advanced battery states, such as SoC, SoH, SoF, and SoP, to be accurately estimated, which can be used to improve (Li) battery utilization for higher performance, safety, and longer battery cell lifetime.

The NEXTBMS consortium is well-balanced with 8 industrial (including 3 SME's and 1 OEM) and 4 research partners and very well experienced in running these kind of EC projects. In the next three years, the NEXTBMS project will disseminate its results through its website and newsletter. Therefore, stay tuned to NEXTBMS!

With kind regards,

Hansjörg Kapeller

NEXTBMS General Assembly #2

The NEXTBMS consortium met on Wednesday 24 January 2024 to hold its second General Assembly. The GA was hosted by the Vrije Universiteit Brussel (VUB) and included a full day of work package update presentations, breakout sessions and a tour across the VUB-MOBI labs.



Please check the website for more information: nextbms.eu.

The first results – D1.1 & D2.1

In M9 (February 2024) of the project, the first results of the NEXTBMS project were delivered in the form of two deliverables.

D1.1 Report on stationary and mobile use cases
 This deliverable addresses the derivation of most relevant mobile and stationary use cases. The use cases are linked and translated to technical KPIs. These KPIs are the basis for the following hardware (HW) and software (SW) related requirements and engineering steps within the NEXTBMS project.

For more information, please click [here](#) and check the entire deliverable on the website.

D2.1 – Characterisation test results of physics-based cell models
 The goal of the NEXTBMS project is to enhance the performance contemporary BMS limitations by introducing physics-based and data-driven models and algorithms to the BMS itself. To train, validate and analyse the performance of these models and algorithms a complete set of data is required consisting of beginning of life characterisation data and extensive ageing testing. This deliverable describes the acquired data, explains why this exact data is required and outlines detailed planning of the to-be-acquired ageing data.

For more information, please click [here](#) and check the entire deliverable on the website.

NEXTBMS project @ ModVal 2024

Dominik Dvorak (AIT) will present a poster on the NEXTBMS project at the ModVal 2024, the 20th Symposium on Modeling and Validation of Electrochemical Energy Technologies, which will be held on 13-14 March 2024 in Baden, Switzerland.

THE NEXTBMS PROJECT: IMPROVED BATTERY MODELS FOR ENHANCED UTILIZATION, SAFETY AND PERFORMANCE OF BATTERIES

The NEXTBMS project
Overview
 The overall aim of the NEXTBMS (NEXT-generation physics and data-based Battery Management Systems for optimized battery utilization) project is to develop an advanced battery management system built on fundamental knowledge and experience with the physiochemical processes of lithium-ion batteries, which will enable the significant enhancement of current modeling approaches, including the readiness for upcoming lithium-ion battery material developments. These modeling approaches will be further improved by optimizing sensors and measurement techniques. Finally, the accuracy of cell measurements (temperature, voltage, current, battery states) will be increased by combining physical sensor information with virtual sensors (model outputs). This will enable to accurately estimate advanced states of the battery, such as SoC, SoH, SoF and SoP, which can be used to improve battery utilization in terms of higher performance, safety, and longer lifetime of the battery cells.

Sensor improvements
 NEXTBMS will develop synchronized voltage and current measurements at a frequency range up to 10kHz for enabling on-board impedance measurements. Therefore, a frequency generator-sensor system network will be established. In addition, advanced fiber-optical sensors will be developed and implemented for advanced thermal measurements on cell- and module level.

Model improvements
 NEXTBMS will develop scalable physics-based models for battery management. These models will, for the first time, feature physiochemical consistency in terms of performance and degradation, which enables direct mapping between model parameters and intrinsic material properties as well as geometric parameters of the cell. The physics-based models require less effort for parameterization, ensure that model parameters and states have a physical meaning, have high levels of prediction capability, and have a (more) straight forward and consistent integration of degradation models.

Physio-chemically consistent equivalent circuit models
 The poster shows a detailed flowchart of the modeling process, from 'Detailed physics-based models' to 'Physio-chemically consistent equivalent circuit models'. It highlights 'Consistent computational optimization' leading to 'Performance- and aging-relevant phenomena', and 'Computationally optimized physics-based models'. A central box indicates 'Transferability / identical parameters' between the two model types. A 'LOAD' diagram is also shown.

Overvoltage Test 4.97V
 The poster includes a graph showing overvoltage test results with labels for 'Overvoltage', 'Current', and 'Voltage' over time.

Project objectives
 Within the NEXTBMS project a number of activities for the optimization of physics-based models in battery management will be addressed:
 (i) comprehensive sensitivity (S) characterisation of model parameter estimation and adapting the model to different cell characteristics and cell degradation; (ii) state of use of models; (iii) advanced sensor technologies of electrochemical models; additionally, the cell features sufficient physiochemical consistency to substantially model all relevant ageing processes and thus enable accurate state estimation of (S) performance and (S) degradation-relevant states.

Electro-thermal characterization
 Temperature: 20°C, 25°C, 30°C, 35°C, 40°C, 45°C, 50°C, 55°C, 60°C, 65°C, 70°C, 75°C, 80°C, 85°C, 90°C, 95°C, 100°C
 Frequency (10Hz - 10kHz)
 Temperature (0°C, 10°C, 20°C, 30°C, 40°C)
 SoC (10%, 50%, 90%)
 SoH (10%, 50%, 90%)

Ageing experiments
 Temperature (0°C, 20°C, 40°C, 60°C)
 SoC (10%, 50%, 90%)
 SoH (10%, 50%, 90%)
 Time (10h, 100h, 1000h, 10000h)
 Charge/discharge (0.1C, 0.5C, 1C, 2C, 3C)

Start date 1 June 2023	Duration 42 months
Funding by the EC 4,900,000 Euro	GA number 101103898

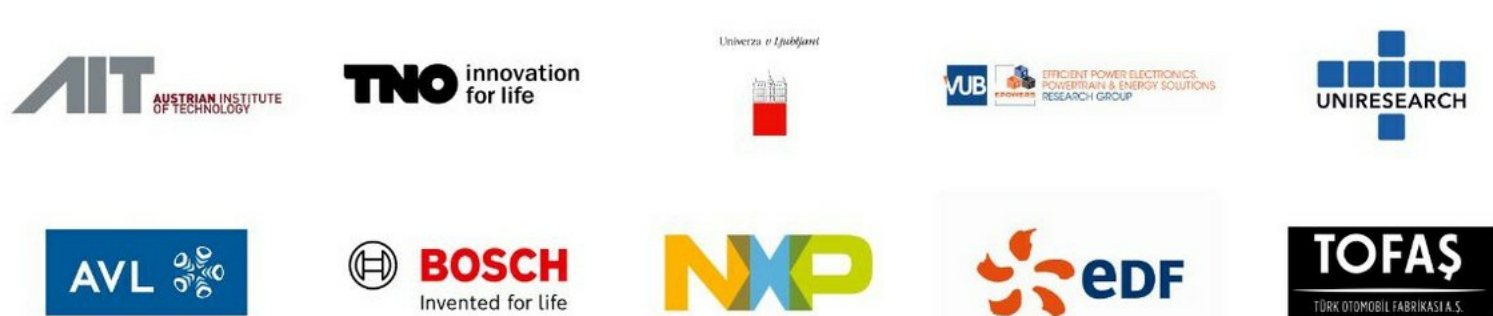
Facts and figures

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