



Mgr. Mária Bujnová
5 Február 2026



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Fostering Research Excellence of STU in Digital Twinning for Sustainable and Safe Electric Vehicles

Slovenská technická univerzita v Bratislave

Prehľad

- Programme
HORIZON.4.1
Widening participation and spreading excellence
- Topic
HORIZON-WIDERA-2023-ACCESS-02-02
Twinning Green Deal
- Funding scheme
HORIZON-CSA - Coordination and Support Actions
- Grant agreement ID **101159989**
- 05/2024 - 04/2027 (36 mesiacov)
- EU contribution - **1 467 875,00 €**



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Partneri v konzorciu

**Slovak University of
Technology in Bratislava**

Slovensko



University of Twente

Holandsko

**UNIVERSITY
OF TWENTE.**

Linz Centre of Mechatronics

Rakúsko



ADDSEN

Slovensko





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Partneri v konzorciu

Expertíza:

- Batériové systémy
- Elektronika
- Mechatronika
- Výkonová elektronika
- Multifyzikálne a systémové simulácie
- Digitálne dvojčatá
- Výroba



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Strategické ciele

SO1: INTERNATIONALIZATION AND NETWORKING FOR RESEARCH EXCELLENCE

SO2: ENHANCING RESEARCH EXCELLENCE OF STU

SO3: PROFESSIONALIZATION OF RESEARCH MANAGEMENT AND ADMINISTRATION OF
STU



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Výskumné ciele

Creation of multi-physical models and digital twins of battery systems in cooperation with the research partners

Design of battery multi-physics simulation models and system models

Increasing the accuracy of battery internal states estimation using modelling and digital twinning

Implementation and testing of new estimation methods

Evaluation of the possibility of using intelligent distributed thermal management systems



Work Packages

- WP1 – **Internationalization & Networking** (STUBA)
- WP2 – **Building capacities towards research excellence in sustainable e-mobility** (LCM)
- WP3 – **Digital Twinning for Sustainable and Safer Electric Vehicles** (UTWENTE)
- WP4 – **Upgrading and capacity building of the STU research managers and administrators** (STUBA)
- WP5 – **Dissemination, Communication and Exploitation** (ADDSEN)
- WP6 – **Project management** (STUBA)



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WP1 Internationalization & Networking

Aktivitiy:

- Internationalization strategy for sustainable e-mobility
- Senior researchers knowledge transfer
- Young researchers mobility exchanges





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WP1 Internationalization & Networking

Aktivität:

- Joint Summer school
- Joint HEU proposal preparation and submission
- Audit of existing PhD. study programs





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WP2 Building capacities towards research excellence in sustainable e-mobility

- Strategic research agenda
- Hard skills trainings
- Soft skills trainings





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WP2 Building capacities towards research excellence in sustainable e-mobility

- Collaboration with businesses and national/regional stakeholders incl. Policymakers
- Collaboration with EU platforms and EU partnerships



Academia Meets Industry

Industrial roundtable

The **FreeTwinEV Academia meets industry** event aims to bring together representatives from industry, technology companies, and research institutions to create a space for networking and discussion on current challenges and needs in the field of e-mobility.

The first industrial roundtable Academia meets industry will focus on linking industry to researchers.

The event will be hosted by Slovak university of technology in Bratislava at the University Centre STU in Bratislava.

Registration: [HERE](#)

18th September 2025

University Centre STU
Bratislava



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WP3 Digital Twinning for Sustainable and Safer Electric Vehicles

Task 3.1 – CAD Prototype Design (M1 – M24)

Development of a detailed 3D CAD model of the battery system including module layout, thermal management, and sensing elements.

Task 3.2 – Multiphysics Analysis (M6 – M24)

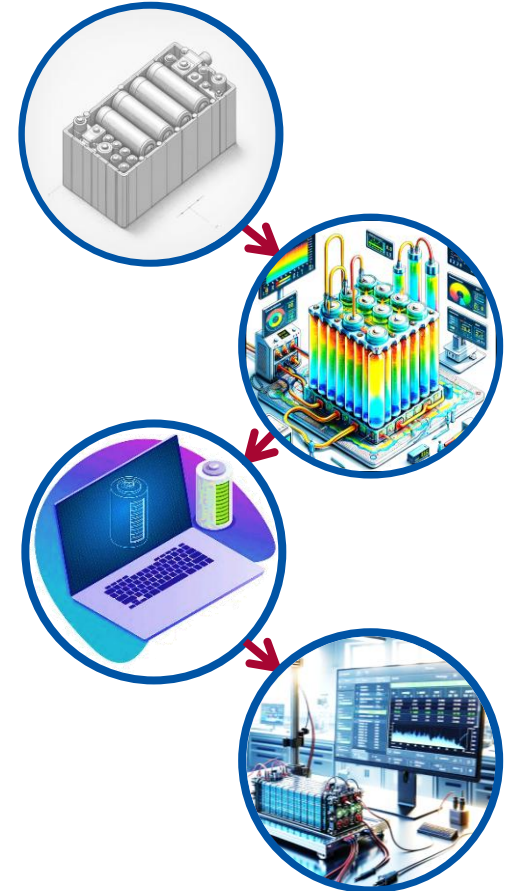
Creation of a multi-physics simulation model covering electrical, thermal, and electrochemical behavior — optimizing the initial design before prototype manufacturing.

Task 3.3 – Digital Twin Development (M1 – M33)

Implementation of the Digital Twin framework for real-time monitoring, adaptive control, and improved prediction accuracy.

Task 3.4 – Experimental Design and Validation (M18 – M33)

Design and execution of lab experiments to validate the models and digital twin results, ensuring alignment between simulation and real-world behavior.



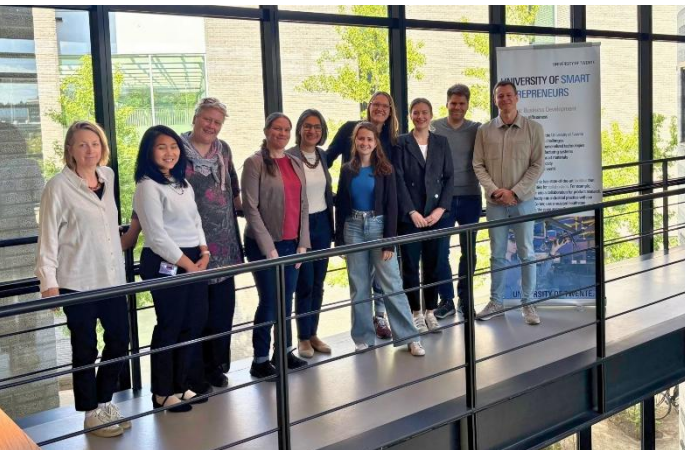


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WP4 Upgrading and capacity building of the STU research managers and administrators

- Audit of STU project administration and cross-faculty cooperation
- Upgrade of STU project offices
- Update of project management and administration processes





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Dissemination activities

Publications – listed on Zenodo, acknowledgement, metadata

FEM simulation of MEMS accelerometer

Hanzalík, Matej; Paulech, Juraj

Analysis of battery module cooler for electric vehicles

Paulech, Juraj; Baťa, Martin

Digital Twin for Battery Systems: Review and Conceptual Hybrid Modeling Framework

Plizák, Milan; Baťa, Martin; Paulech, Juraj; and 4 others

Hydrogen Production Using PVs with MPPT Optimization

Ondrejčka, Kristián; Goga, Vladimír; Berta, Šimon; and 2 others

Impact Analysis of Driving Cycles on Electric Bus Battery Degradation during Lifecycle

Bata, Martin; Majera, Juraj

Multiphysics Model of a Battery Module

Plizák, Milan; Baťa, Martin; Paulech, Juraj; and 3 others

Thermal Performance Analysis of a Single Battery Cell: Experimental and Simulation Approaches with Active Cooling

Ulicny, Michal Miloslav; Bata, Martin; Berta, Šimon; and 4 others

Dissemination activities

Zenodo repository – Shared Datasets

P45B Activation and Impedance Investigation

Mulpuri, Sai Krishna ; Venugopal, Prasanth ; Bañol Arias, Maria Nataly ; and 1 other

This dataset contains impedance and activation measurements of 60 pristine Molicel INR-21700-P45B lithium-ion cells, collected within the FreeTwinEV project. The study investigates the effect of a rapid activation protocol on cell impedance behavior.

Part of [Fostering Research Excellence of STU in Digital Twinning for Sustainable and Safe Electric Vehicles](#)

Uploaded on October 2, 2025

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P45B Cell Internal Resistance Mapping

Berta, Šimon; Plzak, Milan; Baťa, Martin

This repository contains experimental data and documentation from the FreeTwinEV project related to the internal resistance and voltage measurements of 600 Molicel INR21700-P45B lithium-ion cells.

Part of [Fostering Research Excellence of STU in Digital Twinning for Sustainable and Safe Electric Vehicles](#)

Uploaded on October 1, 2025

 43  13

Dissemination activities

Zenodo repository – Shared Design & Dataset

MIMO Cold Plate Design & Dataset

Urge, Andrej

This dataset contains computational fluid dynamics (CFD) simulation results obtained with ANSYS Fluent for several design variants. The purpose of this dataset is to compare the thermal performance of different geometrical configurations of cooling channels in battery cell coldplate.

Part of [Fostering Research Excellence of STU in Digital Twinning for Sustainable and Safe Electric Vehicles](#)

P45B 1s4p Battery Module Measurement

Pizák, Milan ; Berta, Šimon ; Ürge, Andrej ; and 1 other

This repository contains experimental data and documentation from the FreeTwinEV project related to electro-thermal measurements of a battery module composed of four Molicel INR21700-P45B lithium-ion cells connected in parallel (1s4p configuration). The dataset is intended for...

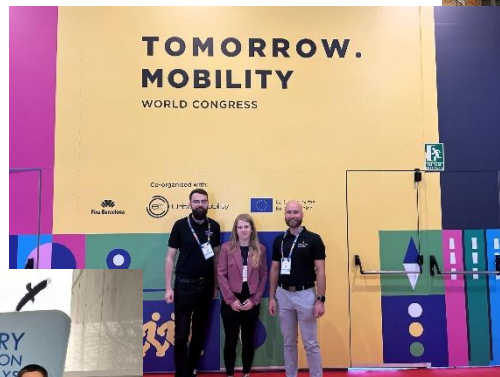


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Diseminačné aktivity

- **Networking and collaboration events:**
 - ***The Battery show Europe*** in June 2025
 - ***European Road Transport Research Opportunities for Slovak Stakeholders*** in November 2024
 - ***Tomorrow Mobility World Congress*** in November 2025
 - ***Battery innovation Days, Graz*** in December 2025



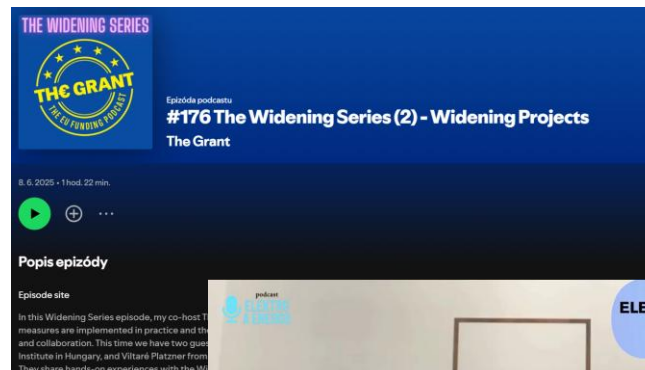
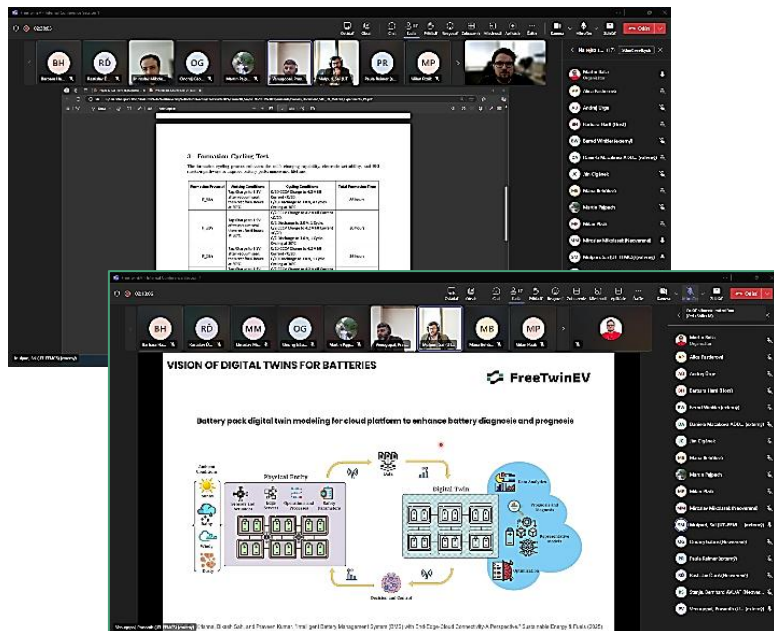


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Komunikačné aktivity

- FreeTwinEV internal conference in March 2025
- Podcasty





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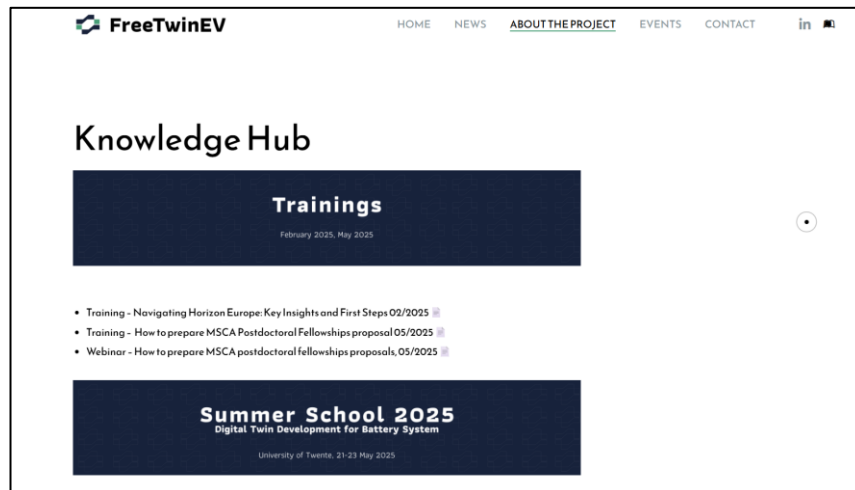
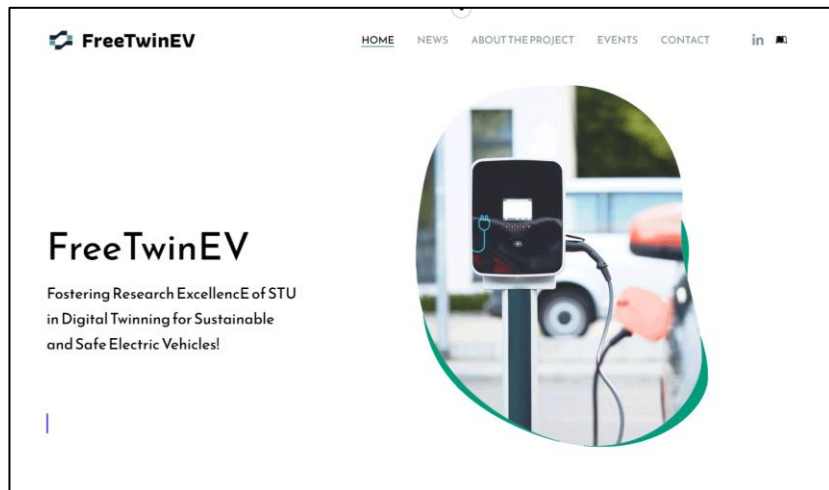
Komunikačné aktivity

- **Project website:**

<https://freetwinev.stuba.sk/>

- **Knowledge Hub**

with resources and publications of the project FreeTwinEV





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Komunikačné aktivity



FreeTwinEV Project





Výzvy a odporúčania

- Konzorcium zostavené z kontaktov výskumníkov
- Dosiahnuteľné KPIs
 - HE výzvy
 - Plánovanie, dosiahnuteľné čísla
- Dostupnosť a ochota výskumníkov cestovať počas trvania projektu
- Zapojenie viacerých výskumných tímov
 - Širšia výskumná téma, väčší dopad
- Myslite na svoju inštitúciu, nie len na svoj výskumný tím

Ďakujem za pozornosť



Mgr. Mária Bujnová
maria.bujnova@stuba.sk

Ing. Gabriel Gálik PhD.
gabriel.galik@stuba.sk

