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WORKSHOP NAME: Workshop 4 – Smart Mobility

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FEV



**Your engineering and consulting partner
– strong, competent and reliable**



7,000 employees globally

>740 M€ Total output (2023)

>250 Test cells for engines, T/M, e-drives, fuel cells & batteries

200 Patent applications per year

70% Academics

>45 Years of experience

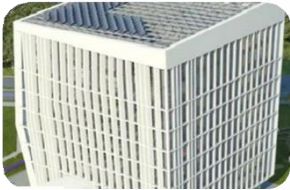
>45 Subsidiaries on six continents

>50 Different nations

Largest Engineering Service Provider in Türkiye



İstanbul
İTÜ Arı
Teknokent



İstanbul
Teknopark İstanbul



Ankara
ODTÜ Teknokent



Gebze
Bilişim Vadisi



İstanbul
Yıldız Teknopark



İzmir
Teknopark İzmir



Bursa
ULUTEK Teknopark

2011 Founded

450+ Highly skilled and
globally experienced employees

7 Offices in 5 cities

25 Test benches with local partners,
test cells for e-mobility, vehicle and
powertrain

5 Labs - HiL lab, power electronics
lab, ADAS ViL, vehicle workshop

We are the innovation powerhouse for mobility, energy and software that fosters sustainability and a greater quality of life for all

BUSINESS AREAS



- Chassis
- Cab
 - Body in White
 - Ext. & Interior
 - Lighting
- Architecture
- Performance
- NVH
- Integration
- Simulation & CAE



- System Eng
- FUSA
- Cyber Security
- ADAS / AD
- Connected Mob.
- Infotainment
- SW & E/E platforms



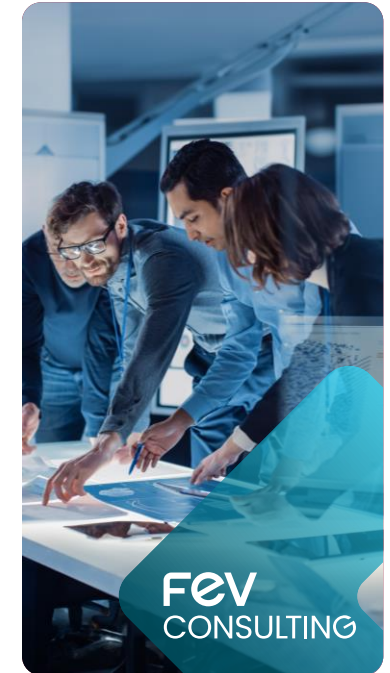
- ICE
 - Gasoline
 - Diesel
 - Gas
 - H2
- Gearbox & Axles
- Battery
- EDU & e-Axle
- Inverter
- Fuel Cell



- Fuel Cell / H2 (direct burn)
- Battery (dev. & testing)
- SAF
- HV systems
- SW Solutions
- Cyber Security
- MBSE



- Energy plants
 - Wind
 - Solar
 - H2
- Energy storage



- Market studies
- Benchmarks
- Roadmaps
- Concept studies
- Modularization
- Sourcing strategy
- Cost reductions
- Value chain optimization

FEV propulsion

- Electric, Hybrid & Fuel Cell Powertrains
- Battery & BMS Development
- EDU & Transmission
- E-Drive & Power Electronics
- Internal Combustion Engine Development
- Controls & Calibration



FEV vehicle

- Styling, Surfacing & Vehicle Architecture
- Body in White
- Doors & Closures
- Exterior & Interior
- Powertrain, Chassis & Vehicle Integration
- Vehicle Performance (Simulation & Validation)



FEV.io

- Systems Engineering
- Vehicle Electronics & E/E Integration
- Software Development
- Functional Safety & Cyber Security
- ADAS/AD & Connected Mobility
- E/E Testing for Software & Vehicle Validation



FEV aerospace

FEV
aerospace



- The Propulsion System: fuel cell, H2 storage, battery, high voltage system, power electronics, combustion engine



- Controllers: software for propulsion, fuel cell, battery, E/E



- Software: requirements and systems engineering, functional safety, cyber security, virtual twin, HIL, AI



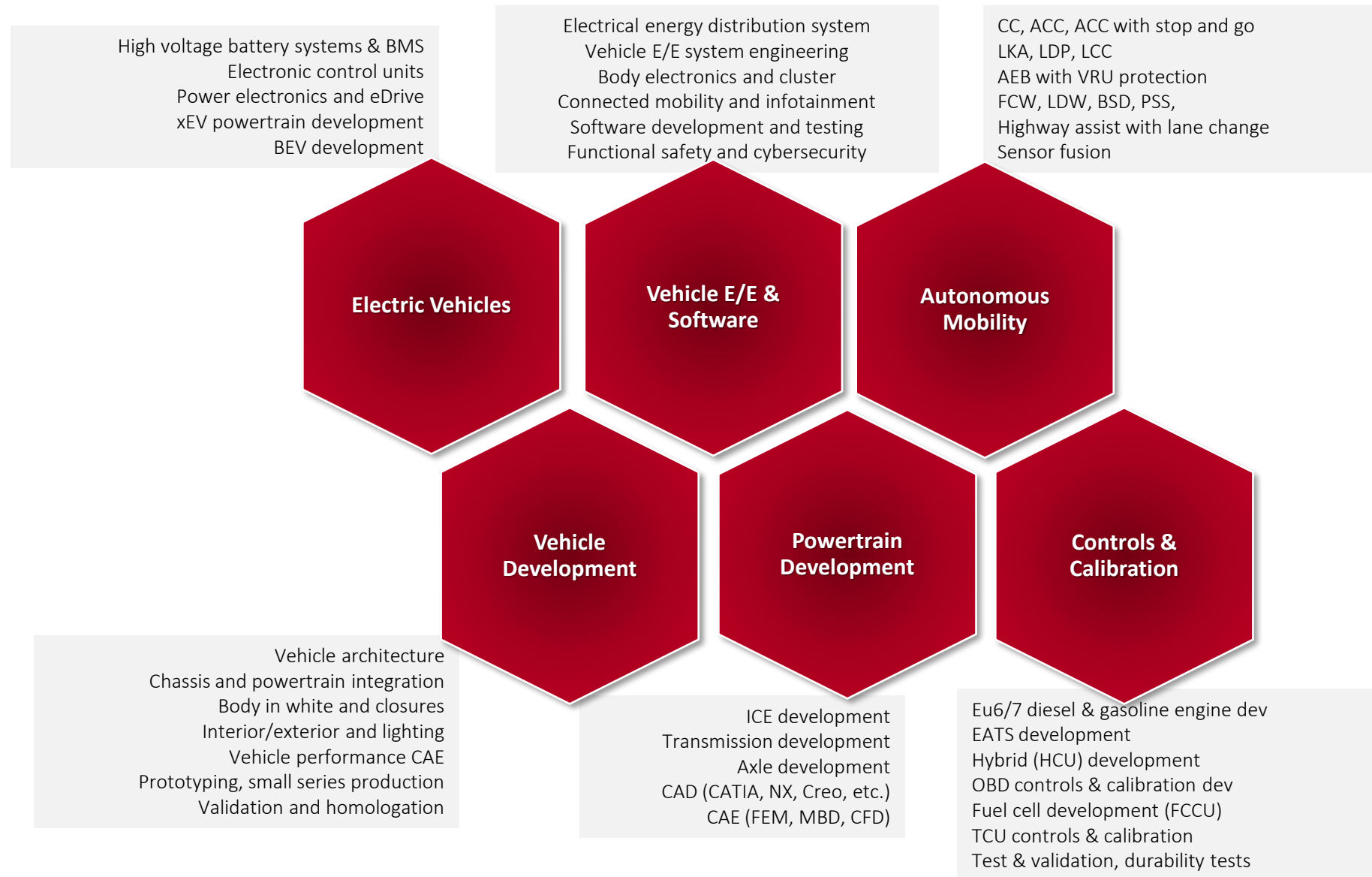
- Emissions: Acoustics, NVH for props

- Technical services: thermal management, mission analysis incl. space

- Consulting: benchmarking, strategy, cost, production, certification & standards support

FEV provides the thrust.

FEV Turkey serving across all disciplines



Horizon Projects:
#3 in Turkish Automotive Sector,
#9 in Turkish Industry



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Horizon Europe Projects

Ufuk Avrupa (2021-2027)

Won Amount of Public Funds

2.24 M€

FEV

LONG RUN

ALBATROSS

CoachHyfied

SELFY

ESCALATE

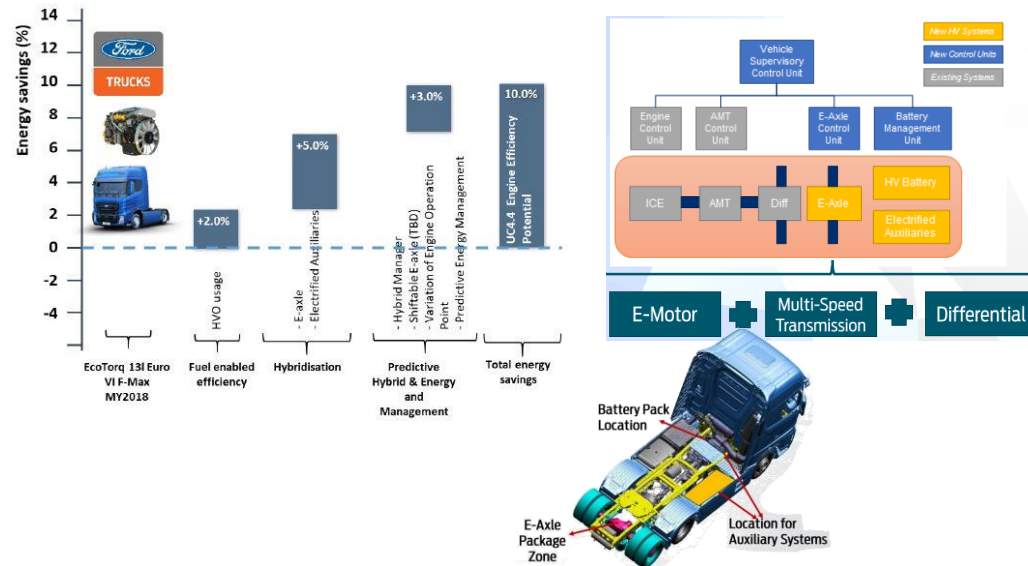
ZEV-UP

ecohydro

LONGRUN Development of efficient and environmental friendly Long distance powertrain for heavy duty trucks and coaches



LOW-EMISSIONS PROPULSION FOR LONG-DISTANCE TRUCKS AND COACHES



Project objectives

- Development of efficient and environmentally friendly long distance powertrain for heavy duty trucks and coaches
- FEV EU & FEV Turkey together with FORD OTOSAN will develop and demonstrate an e-axle (electrified power pack) which ensures 10% energy saving by incorporating connected & predictive technologies for a hybrid tractor use case

Project Description

Project Data

- Partners: FEV Europe (& **FEV Turkey**), DAF, IVECO, Volvo, Ford Otosan, VDL, Irizar, AVL, Idiada, Technalia, .. (30)
- Planned cost/funding **FEV Turkey**: 426k€/298k€
- Total Budget/funding : ~30.5/25mio€
- Project Timeline: 1/20–6/23 (42M)
- Involved WP: WP 6 «Hybrid vehicle ICE fueled with HVO and electrical axle»
- WP 6 Labor (MM): FEV (65), **FEV Turkey (46,5)**
- WP Partners: FORD OTOSAN

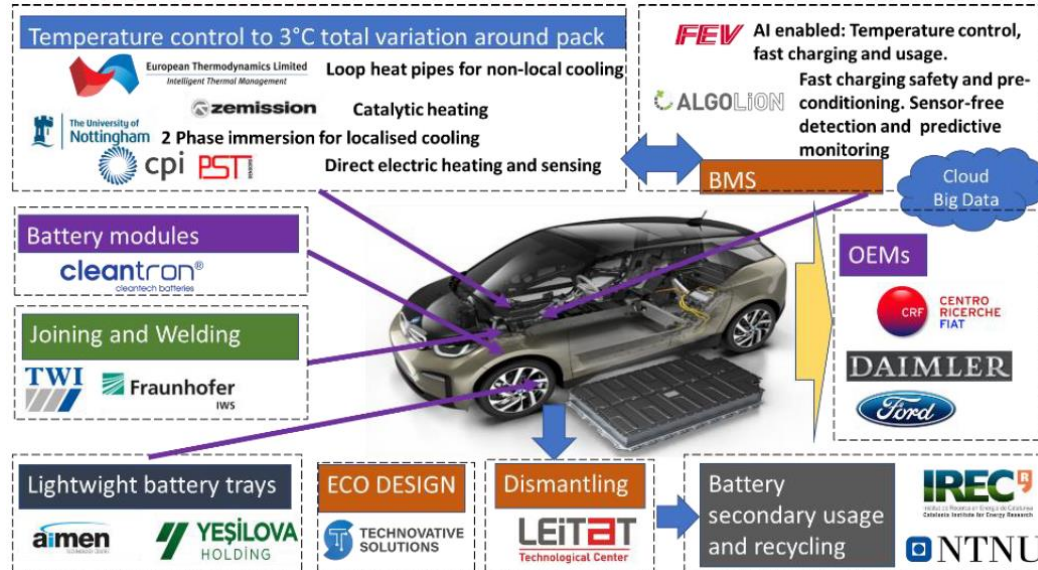
Project scope

- Engine efficiency increase (target 50%)
- E-Axle development
- Future fuels combustion
- Thermal barrier coating

ALBATROSS Advanced Light-weight Battery systems Optimized for fast charging, Safety, and Second-life applications



NEXT GENERATION AND REALISATION OF BATTERY PACKS FOR BEV AND PHEV



Project objectives

- To contribute **reducing costs over the full lifetime of the battery**, while greatly increasing the value for second-life applications
- To realize battery ranges better than those of the best-in-class through allowing for **effective fast-charging** without sacrificing lifetime and utilizing advanced battery management systems
- To achieve reduction in weight by **20%**, charging time **by 25%**

Project Description

Project Data

- Partners: **FEV Turkey**, Yeşilova, TWI, Mercedes-Benz Türk, Ford Otosan, CRF (Fiat), Fraunhofer, IWS, IREC, CIDETEC, ... (21)
- **FEV Turkey** cost/funding 1.15mio€/800k€
- Total Budget/funding : ~11.8mio€/10mio€
- Project Timeline: 48M
- Involved WPs: «Lead: WP4:BMS and Thermal Management» & «all WPs except WP5»
- WP4 Partners: Algolion, ETL, Zemotion, UoN

Project scope (FEV Turkey)

- Develop novel BMS and thermal management system including AI and Remote functions
- Contribute to designing in terms of cooling, packaging, module design
- Integrate developed technologies into the demonstrator vehicle (will be a BMW i3)
- Support validation tests and demonstration

CoachHyfied Coaches with hydrogen fuel cell powertrains for regional and long-distance passenger transport



DEMONSTRATION OF FC COACHES FOR REGIONAL PASSENGER TRANSPORT



Project objectives

- An entirely new Fuel Cell system design specific to coaches to be validated considering the completely different driving pattern, power demand and space constraints whilst utilizing learnings and experiences from the FC city buses
- First time in EU that FC coaches will be demonstrated fulfilling the criteria requested in call like net power, fuel cell durability, max. driving speed, range between refueling, weight and size, H2 fuel consumption...

Project Description

Project Data

- Partners: **FEV (coord.) & FEV Turkey (as 3rd linked party)**, BALLARD, Coventry Uni., RWTH Aachen / VKA, ElringKlinger, Ford Otosan, Otokar, ... (14)
- **FEV** cost/funding: 936k€/625k€
- **FEV TR** cost/funding: 81.5k€/57k€
- Project cost/funding: 7.3mio€/5mio€
- Project Timeline: 60M
- **FEV TR** Involved WPs: «WP1:FC coach operation and management system» & «WP6:Long distance FC coach demonstration»

Project scope (FEV)

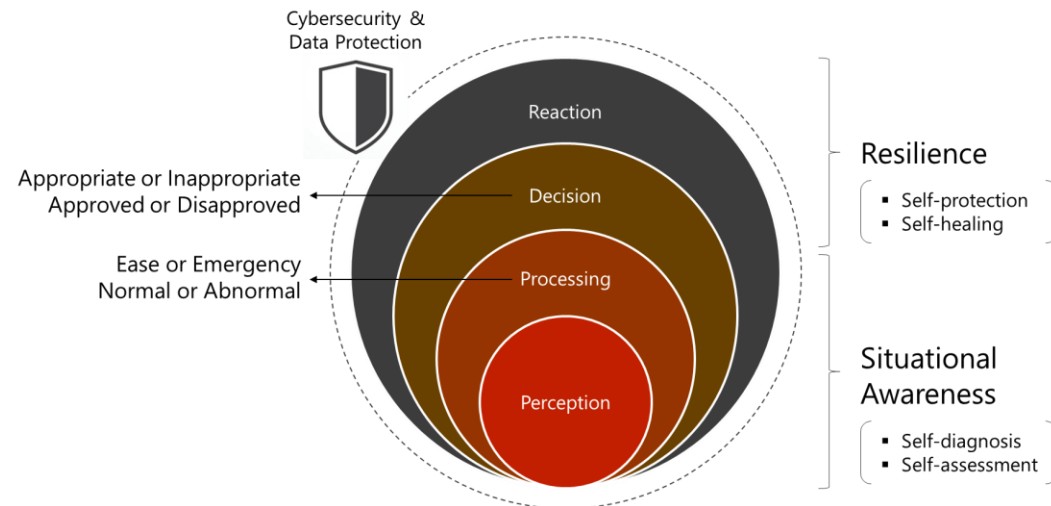
- Developing a hybrid control system (**FEV TR supports FEV**)
- Incorporating predictive maintenance and diagnostic functions
- Establishing a data collection & data management backbone
- Contributing in H2 fuel system concept
- Giving support to the integration studies (**FEV TR supports FEV and Otokar**)

Self-assessment, protection & healing tools for a trustworthy and resilient CCAM

CYBERSECURE AND RESILIENT CCAM

MOTIVATION

- Development of software tools on distributed and decentralized instruments for detection, defense, and response to cyber-attacks or malicious physical actions
- Development of a vehicle security operation center by integrating and cooperating with the different tools developed



DESCRIPTION

Scope

- Establish the system architecture & requirements (FEV TR & FEV EU)
- Build an AI-based system for continuous self-assessment and diagnosis as well as detection of anomalous situations (FEV TR)
- Develop linguistics based/inspired assessment and decision-making methodologies to train AI for resilience mechanisms (FEV TR)
- Develop security methods to protect the communication paths in CCAM from cyber-attacks, and establish countermeasures to ensure integrity, confidentiality and authenticity of data (incl. OTA updates) (FEV EU)

Benefits for FEV

- Create important know-how over Autonomous Driving, Perception and Situational Awareness, Resilience Mechanisms, Cybersecurity, Security by Design

Data

- Planned Cost / (Funding) k€: FEV TR: 500 k€ / (416 k€)
- BUs / (ext. Sponsor): BI / (EU)
- Involved subsidiaries: FEV Turkey (lead), FEV Europe (linked 3rd Party)
- Project Timeline: 6/22 – 5/25 (36 M)

Powering EU Net Zero Future by Escalating Zero Emission HDVs and Logistic Intelligence



MODULAR MULTI-POWERTRAIN ZERO-EMISSION SYSTEMS FOR HDV



MOTIVATION

- Development and demonstration high-efficiency long-haul FC-HDV at a minimum GVW of 40t with 800km single fuelled range under real-world operational conditions.
- Development and demonstration of cost-effective standardised modular electric multi-powertrains in real-world conditions for a minimum 500 km daily operation under full load for 6 months.
- Development of Modular Digital Twins of demonstrator vehicles for early identification and continuous optimisation.

DESCRIPTION

➤ Scope (FEV TR)

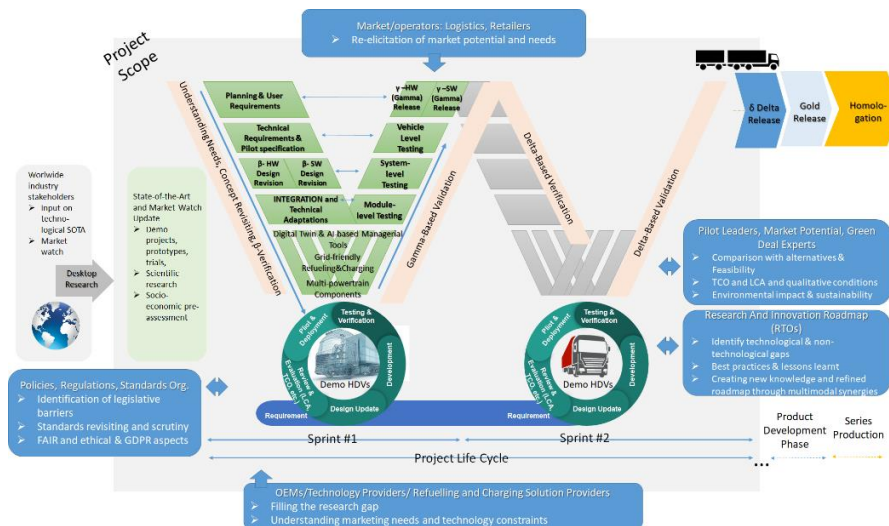
- Modular FCEV Electric Powertrain Architecture scalable from Heavy duty down to light commercial vehicles
- Overall control concept and component requirements for the hybrid operation of the FC system, electric motor, battery and auxiliaries according to the demands and vehicle targets
- Intelligent energy management functions/algorithms employing genetic algorithms and machine learning
- Modular digital twin of demonstrator FC HDV
- Testing and Validation Plans, Route generation for various driving & consumption conditions

➤ Benefits for FEV

- FEV will extend its knowledge on FC applications to HDVs, will have an intelligent energy manager software and a digital twin of a FC-HDV

➤ Data

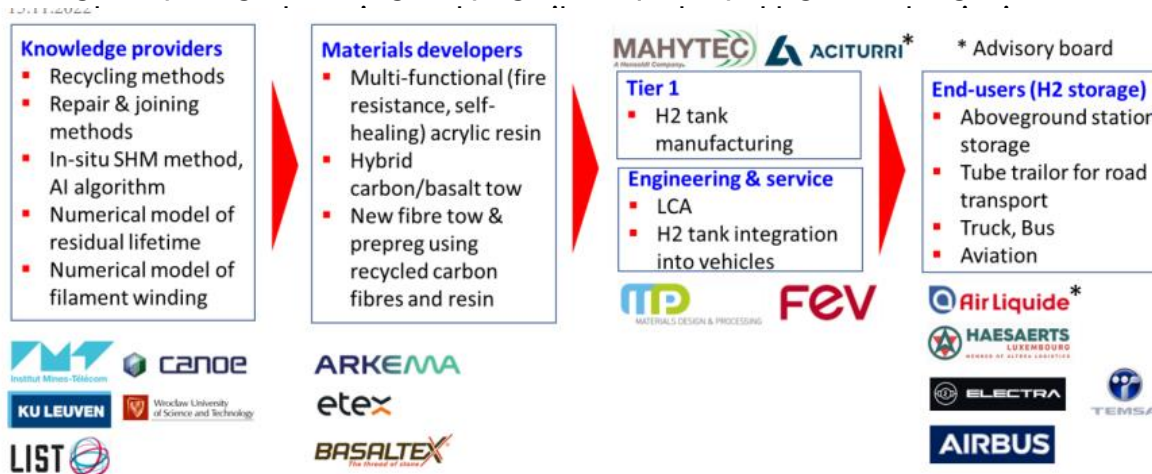
- Planned Cost / (Funding) k€: FEV TR: 1.30 M€ / (650 k€)
FEV EU: 1.51 M€ / (726 k€)
- BUS / (ext. Sponsor): BE, BM / (EU)
- Involved subsidiaries: FEV Turkey (beneficiary), FEV Europe (beneficiary)
- Project Timeline (Estimated...): 1/23 – 6/26 (42 M)



ECONOMIC MANUFACTURING PROCESS OF RECYCLABLE COMPOSITE MATERIALS FOR DURABLE HYDROGEN STORAGE

MOTIVATION

- ▶ ECOHYDRO will develop support key elements leading to the reduction of whole lifetime costs of hydrogen storage technologies, the development of environmentally sustainable and circular storage systems, all the while ensuring the safety of the innovative hydrogen storage technologies.
- ▶ The developed technologies will be validated by four different types of industrial demonstrators (TRL4) using either compressed gas hydrogen storage cryogenic liquid hydrogen storage, such as



DESCRIPTION

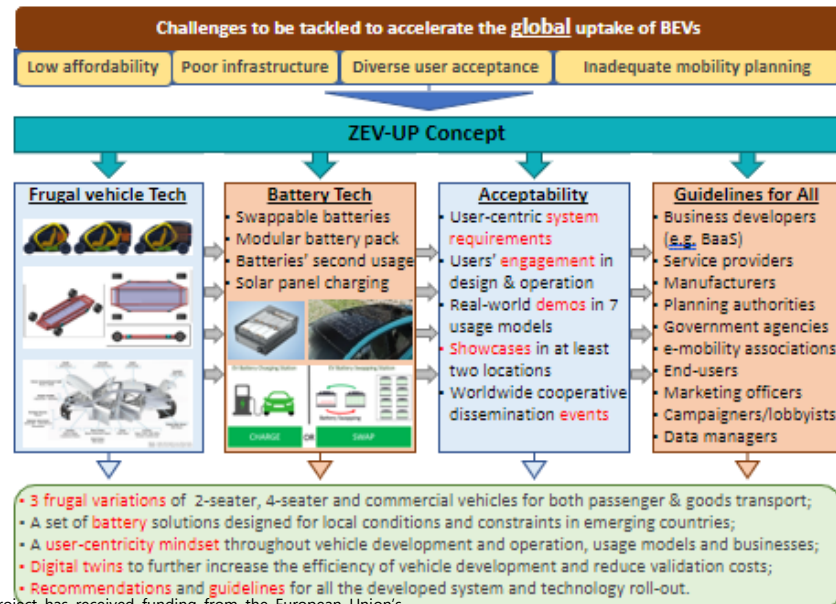
- ▶ **Scope (FEV TR)**
 - Co-definition of concepts, systems and requirements in this project;
 - Contributing to the design according to the needs of the four usage scenarios in the project,
 - Co-creation of a higher TRL development plan (TRL4 to TRL8) with partners
- ▶ **Benefits for FEV**
 - FEV will extend its knowledge on clean and competitive solutions for all transport modes,
- ▶ **Data**
 - Planned Cost / (Funding) k€: FEV TR: 325 k€ / (325 k€)
 - Project Timeline (Estimated...): 1/24 – 1/28 (48 M)

ZEV-UP – frugal Zero-Emission Vehicles for the Urban Passenger challenge

FRUGAL ZERO-EMISSION VEHICLES CONCEPTS FOR THE URBAN PASSENGER CHALLENGE

MOTIVATION

- ▶ Develop vehicle prototypes incorporating frugal ZEV-UP technologies and market landscape analysis of Frugal BEVs
- ▶ Develop a modular, scalable platform and a user-centric top hat for a frugal BEV and then validate ZEV-UP Prototypes through Real-World Testing and User Feedback
- ▶ Assess User Acceptance and Performance of ZEV-UP Solutions in Diverse Markets and Usage Models thus empower Decision-Makers for Accelerated Market Uptake of ZEV-UP Vehicles



DESCRIPTION

▶ Scope

- Responsible of vehicle top-hat's body-in-white (BiW) and exterior design and corresponding simulations, as well as contributor to suspensions, brakes and steering design on the chassis domain.
- Lead virtual and physical integration and implementation, as well as exploitation and business models tasks

▶ Benefits for FEV

- Extend cooperation with key account FORD Otosan, as well as establish new ones with Aspilsan and Coskuno
- Develop new engineering design services: (a) Monocoque composite upper body design for goods transport or urban passenger L7e vehicles (b) Topology optimization suitable for additive manufacturing
- Accumulate new know-how on natural fiber composites and topology optimization topics

▶ Data

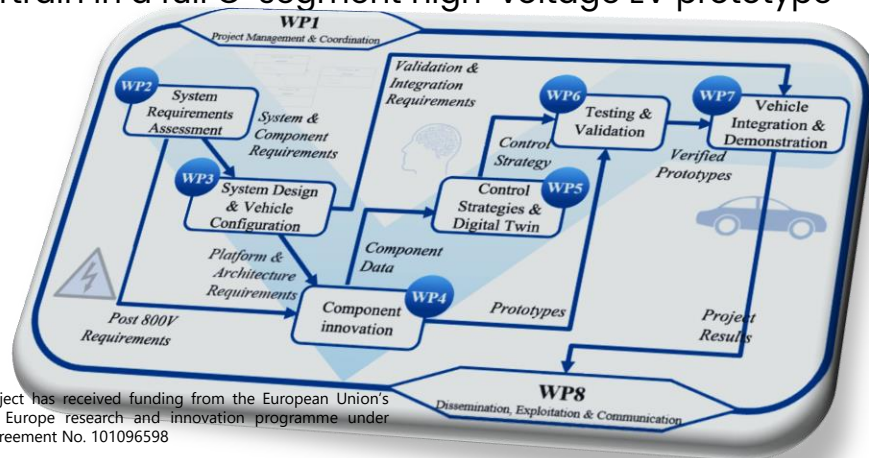
- Planned Cost / (Funding) k€: FEV TR: 1.151 k€ / (672 k€)
- BUs / (ext. Sponsor): BV (EU – Horizon Europe)
- Involved subsidiaries: Turkey
- Project Timeline: 01/24 – 06/27 (42 M)

Next-generation E-powertrains Utilizing Voltages Of Well Above 800V By A Holistic Approach



MOTIVATION

- ▶ Highly optimized post-800V electric powertrain architecture for C-segment vehicles, integrating innovative e-machine, inverter, charger and battery
- ▶ 20% cost reduction in GaN/SiC-based power electronic modules & inverters (for rated voltage of 1200V) and 20% at powertrain-level compared to the best technologies in 2024
- ▶ Ultra-fast charging capabilities (< 10 min) and backward compatibility
- ▶ Significant efficiency gains through loss reduction of 26% in comparison to the State-of-the-Art for mass market C-segment Evs
- ▶ Validated reliability, robustness and safety of modules through extensive test-bench testing as well as of the integrated powertrain in a full C-segment high-voltage EV prototype



Scope

- Provide input to system requirements and system voltage studies
- Concept design, design, modelling and virtual integration of a 1200V multilevel SiC inverter including App-SW and controls
- Develop a full-sized MLI prototype targeted for final integration into the demonstrator vehicle

Benefits for FEV

- Implementation of post 800V knowledge
- Know-how on integrated DC on-board charger for 400V/800V backward compatibility using additional switches for AWR module
- IP over modular & scalable multi-level inverter (MLI) architectures from a common core power electronics module utilizing highly efficient lower blocking voltage and low cost WBG semiconductor devices

Data

- Planned Cost / (Funding) k€: FEV TR: 213 k€ / (175 k€)
- BUs / (ext. Sponsor): BE, (EU)
- Involved subsidiaries: Europe GmbH (Beneficiary), FEV UK (Beneficiary), Türkiye (Affiliated Entity to FEV Europe).
- Project Timeline (Est.) : 2/25 – 07/28 (42 M)

Interested Calls (CCAM)

Call ID	Call Name	Type of Action	Budget (EUR million)	# of projects expected to be funded
HORIZON-CL5-2025-04-D5-02	Cybersecure and resilient road e-mobility ecosystem (2ZERO Partnership)	IA	10 M€	1
HORIZON-CL5-2025-04-D6-01	Advancing remote operations to enable the sustainable and smart mobility of people and goods based on operational and societal needs (CCAM Partnership) – Societal Readiness Pilot	RIA	12M €	2
HORIZON-CL5-2025-04-D6-12	Safe Human-Technology Interaction (HTI) in the vehicle systems of the coming decade – Societal Readiness Pilot	IA	8M €	2
HORIZON-CL5-2026-01-D6-03	Next-generation environment perception for real world CCAM operations: Error-free and secure technologies to improve energy-efficiency, cost-effectiveness, and circularity (CCAM Partnership)	RIA	8M €	2
HORIZON-CL5-2026-01-D6-04	Integration of human driving behaviour in the validation of CCAM systems	RIA	5M€	1
HORIZON-CL5-2026-01-D6-05	Approaches, verification and training for Edge-AI building blocks for CCAM Systems	RIA	4M€	1
HORIZON-CL5-2026-01-D6-14	Predicting and avoiding road crashes based on Artificial Intelligence (AI) and big data	RIA	10M €	2

HORIZON-CL5-2025-04-D5-02 (4 Sept 2025)

Cybersecure and resilient road e-mobility ecosystem (2ZERO Partnership)

Interested in the call and/or expertise to be brought into a consortium:

- Develop a **Trusted ECU** that meets the security standards required by the e-mobility ecosystem, ensuring that all the vehicle's communication with external components (charging stations, service providers, etc.) is secure and tamper-proof
- Advanced cryptographic protocols, including post-quantum algorithms, will be supported by the Trusted ECU to ensure that both vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communications will be protected against quantum threats.
- A cyber-secure OTA platform for HPC and Zone Controller Configuration. The platform will be tailored for systems with HPC/Zone Controllers and will be compatible with existing E/E architectures.
- Develop digital twins to define vulnerable infrastructure elements and identify risk mitigation measures, using combined analysis of environmental conditions and driving parameters to simulate crash scenarios.

HORIZON-CL5-2026-01-D6-03 (20 Jan 2026)

Next-generation environment perception for real world CCAM operations: Error-free and secure technologies to improve energy-efficiency, cost-effectiveness, and circularity (CCAM Partnership)

- ▶ A Low-Cost ECU will be developed that is compatible with Service Oriented Architecture and optimized for environment perception systems in vehicles. The ECU will be designed with a focus on energy efficiency, circularity, eco-design, and cost reduction while performance is enhanced.
- ▶ By focusing on improving decision-making efficiency, we will enhance the overall sense-control-act process by ensuring that the system can make faster, safer, and more trustworthy decisions in real-time, and effectively handle disruptions. This will directly contribute to the safety, efficiency, and scalability of CCAM systems, making them more viable for widespread implementation.
- ▶ Predictive maintenance can provide insights that remote assistance teams can use to understand the vehicle's health, potentially preventing an issue from escalating. Remote operators can help take control of certain tasks (e.g., re-routing the vehicle, controlling specific functions remotely) or provide instructions to the driver to mitigate an issue, thus transition to higher levels of autonomy will be supported.

HORIZON-CL5-2025-04-D6-12 (04 Sept. 2025)

Safe Human-Technology Interaction (HTI) in the vehicle systems of the coming decade – Societal Readiness Pilot

Interested in the call and/or expertise to be brought into a consortium:

- ▶ FEV HMI target to develop the design with research based on critical cases, most faced user experiences such as maintenance and failure use case scenarios, interaction with driver assistance systems, driving with difficult road conditions (light, weather, intense curved roadlines), multitasking while driving. The solution shall provide output that meets user profile need and pain points such as attention and stress management, cognitive load management by using contextual contents and adoptable user interfaces displayed based on driving scenarios, driver preferences and driving habits by data collected from hardware equipments in vehicle systems to make driving experience more pleasant and safer.

Interested Calls (Batteries)

Call ID	Call Name	Type of Action	Budget (EUR million)	# of projects expected to be funded
HORIZON-CL5-2026-01-D2-05	Accelerated multi-physical and virtual testing for battery aging, reliability, and safety evaluation	IA	15	2
HORIZON-CL5-2026-01-D2-01	Development of sustainable and design-to-cost batteries with (energy-)efficient manufacturing processes and based on advanced and safer materials (Batt4EU Partnership)	IA	24	3
HORIZON-CL5-2026-01-D2-04	Integrating advanced materials, cell design and manufacturing development for high-performance batteries aimed at mobility (Batt4EU Partnership)	RIA	30	3
HORIZON-CL5-2025-01-Two-Stage-D2-02	Cost-effective next-generation batteries for long-duration stationary storage (Batt4EU Partnership)	RIA	15	3

Interested Calls (2ZERO)

Call ID	Call Name	Type of Action	Budget (EUR million)	# of projects expected to be funded
HORIZON-CL5-2025-04-D5-01	Efficient wireless stationary bidirectional charging solutions for road Light Duty Vehicles (2ZERO Partnership) – Societal Readiness Pilot	IA	20M €	2
HORIZON-CL5-2025-04-D5-02	Cybersecure and resilient road e-mobility ecosystem (2ZERO Partnership)	IA	10 M€	1
HORIZON-CL5-2025-04-D5-03	Safe post-crash management of road Light Duty Battery Electric Vehicles (BEVs) (2ZERO Partnership)	IA	5M€	1
HORIZON-CL5-2025-04-D5-04	Extended lifetime of road Battery Electric Vehicles (BEV) (2ZERO Partnership)	RIA	7 M€	1
HORIZON-CL5-2025-04-D5-05	Road Battery Electric Vehicles (BEV) optimised user-centric solutions for energy efficiency design and consistent range throughout weather conditions (2ZERO Partnership)	IA	12M €	2
HORIZON-CL5-2025-04-D5-10	Innovative solutions for energy conversion and safety of low and zero-carbon fuels in waterborne transport (ZEWT Partnership)	IA	22.5M €	2
HORIZON-CL5-2025-04-D5-11	Demonstration of battery energy storage systems in existing and new vessels via novel energy storage and ship design concepts (ZEWT Partnership)	IA	15M €	2



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