

# M30-GA

## Opening Event

### Jesse Terry - BEPA

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13/06/2023



**Lightweight Battery System for Extended Range at Improved Safety**



*LIBERTY has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 963522.  
The document reflects only the author's view, the Agency is not responsible for any use that may be made of the information it contains.*

# Outline



- BEPA overview
- Strategic research and innovation agenda (SRIA)
- LIBERTY overview – synergies with BEPA and SRIA
- Open calls 2024
- Open discussion

- BEPA overview
- Strategic research and innovation agenda (SRIA)



## Introduction to BEPA and the Batt4EU Partnership

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*Jesse Terry – Association Officer*

13 June  
2023

# What is the Batt4EU Partnership?

*A co-programmed Partnership for batteries under Horizon Europe*



A co-programmed Partnership under Horizon Europe which gathers – on the public side – **the European Commission**, and - on the private-side – **the Batteries European Partnerships Association (BEPA)** bringing together all the European battery stakeholders interested to get involved in Horizon Europe.



**925 MILLION TOTAL INVESTMENT IN BATTERY R&I**

**BATT4EU**  
Batteries European Partnership  
**Partnership Board**

**925 MILLION TOTAL INVESTMENT IN BATTERY R&I**

**BEPA**  
Batteries European Partnership Association  
**Association Delegation**  
25 members (Inc. Executive Board)

**EC Delegates**  
DG RTD  
DG MOVE  
DG ENER  
DG CNECT  
DG CLIMA

# The Batt4EU vision

*Towards a competitive European industrial battery value chain for stationary applications and e-mobility*

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To establish the **best innovation ecosystem** for batteries in the world in Europe by 2030



Which will boost a **competitive, sustainable and circular** European battery value chain



And will drive the transformation towards a **carbon-neutral society**



# Batt4EU objectives

## *Specific objectives*

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Support the development of **differentiating technologies in battery materials, cell design and manufacturing and battery recycling**, leading to demonstrations of new chemistries, cells, production lines and proof of concept of recycling logistics and methods



Accelerate the development and deployment of **sustainable and affordable battery solutions for clean mobility**, by building a strong innovation ecosystem with downstream partnerships leading to joint demonstrations in different transport modes



Enable a **cost-effective integration of renewable energy sources in the power grid**, by developing affordable batteries for stationary energy storage applications, leading to demonstrations of different scales of storage systems

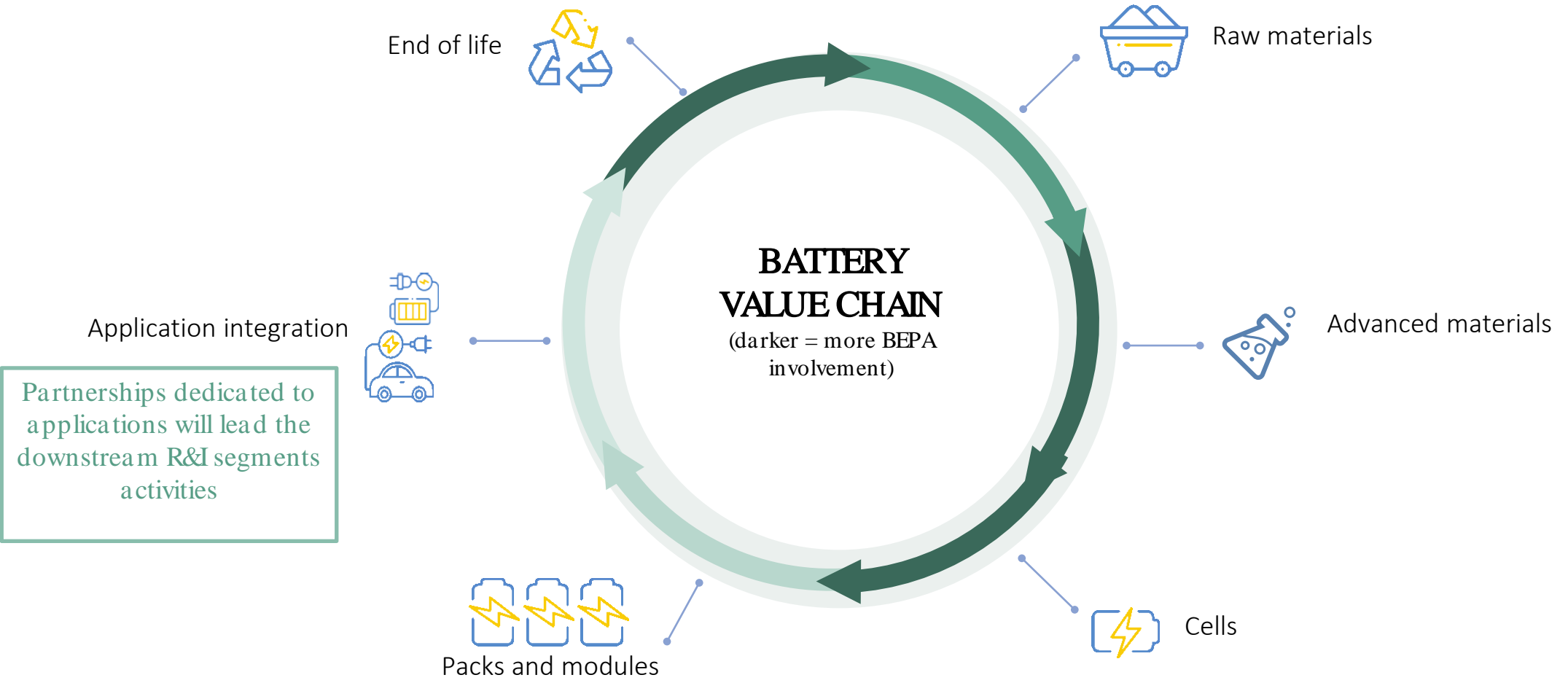
# European networks stimulate Innovation & Growth

## *Structure of the European Battery Ecosystem*





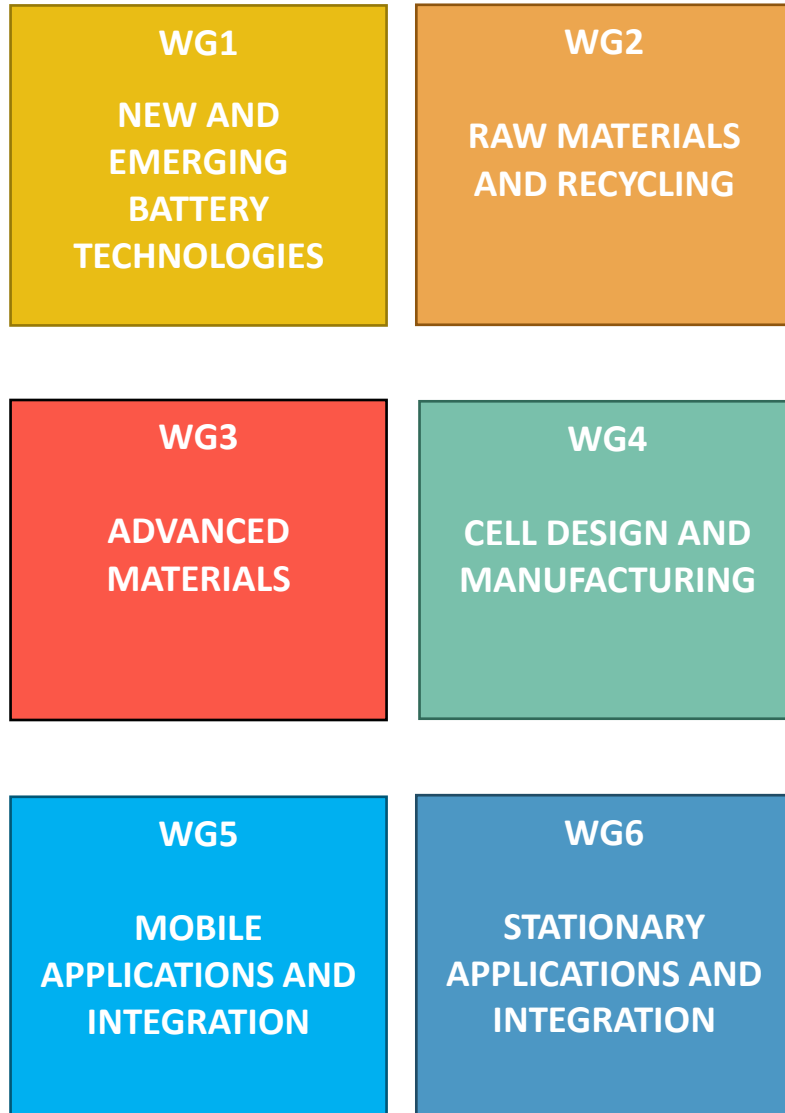
# Scope of the Batt4EU Partnership



# Set the European R&I landscape for the Battery Industry

Covering transversal and non-technical aspects:

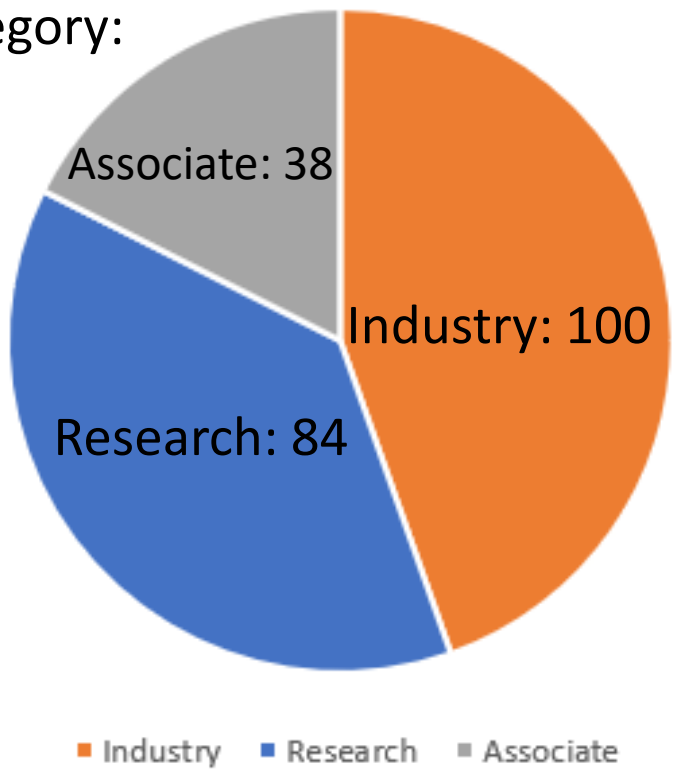
- Task Force Digitalisation
- Task Force Education and Skills
- Task Force Safety
- Task Force Sustainability
- Task Force Social Science and Humanities
- Task Force Standardisation and Hybridisation
- Task Force Innovation Uptake\*



# Industry driven

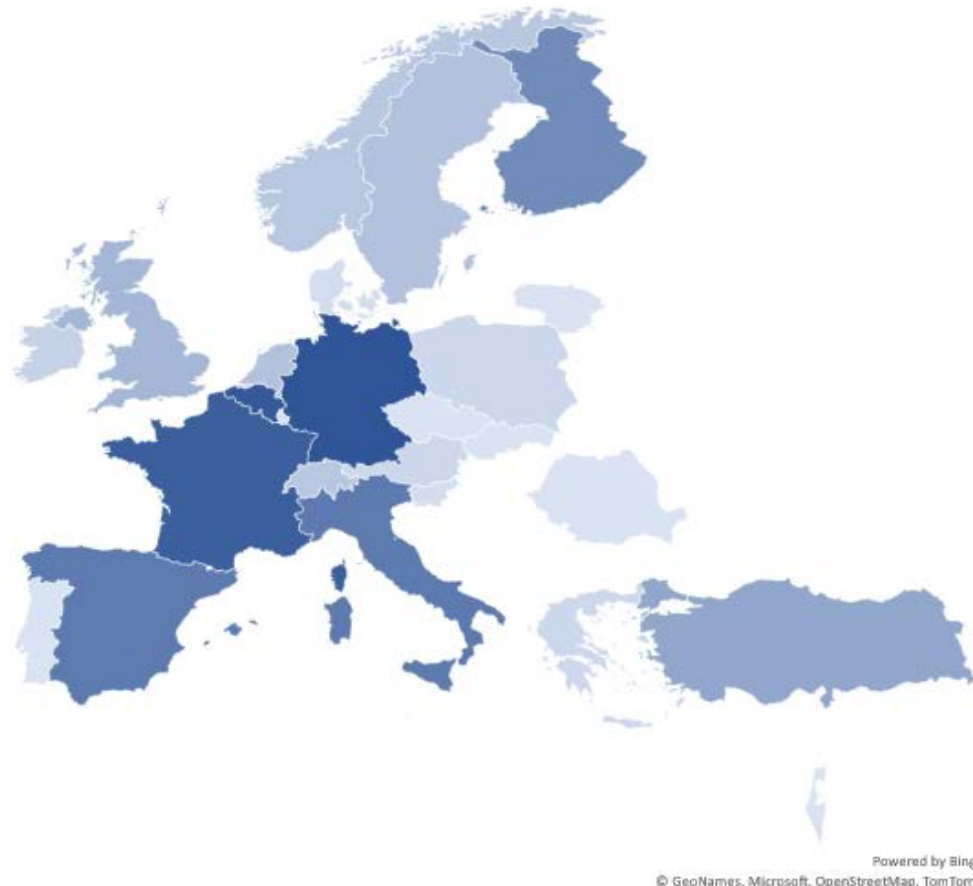
- **Strong industrial network** with a focus on innovation;
- Strong connections **with other relevant European Partnerships**;
- Aligning research and industry priorities for the battery industry

By category:



**222** Members  
**25** Countries

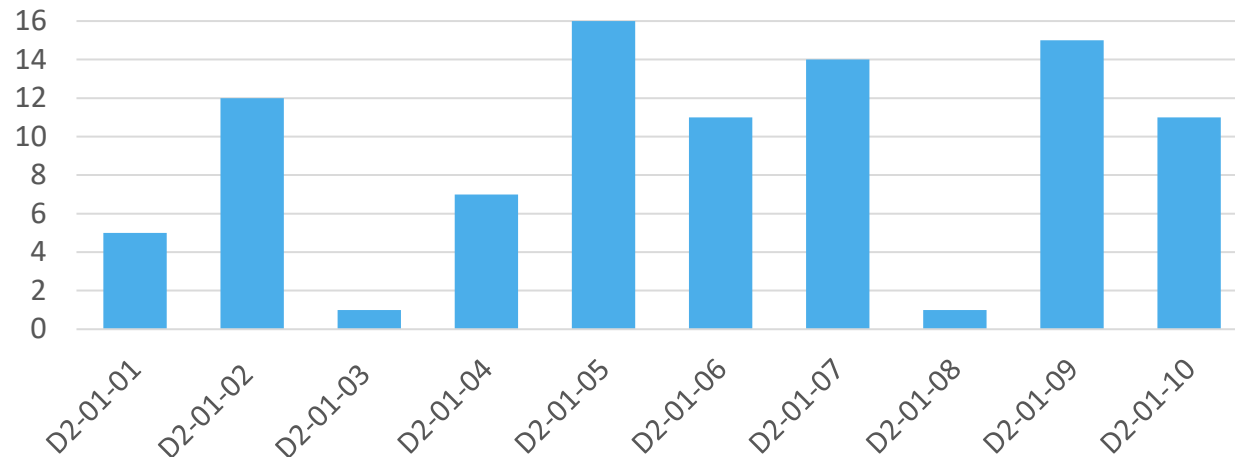
Geographic distribution of BEPA members



# Work Programme 2022 results

*Significant amount of applications, showing appetite for projects being proposed*

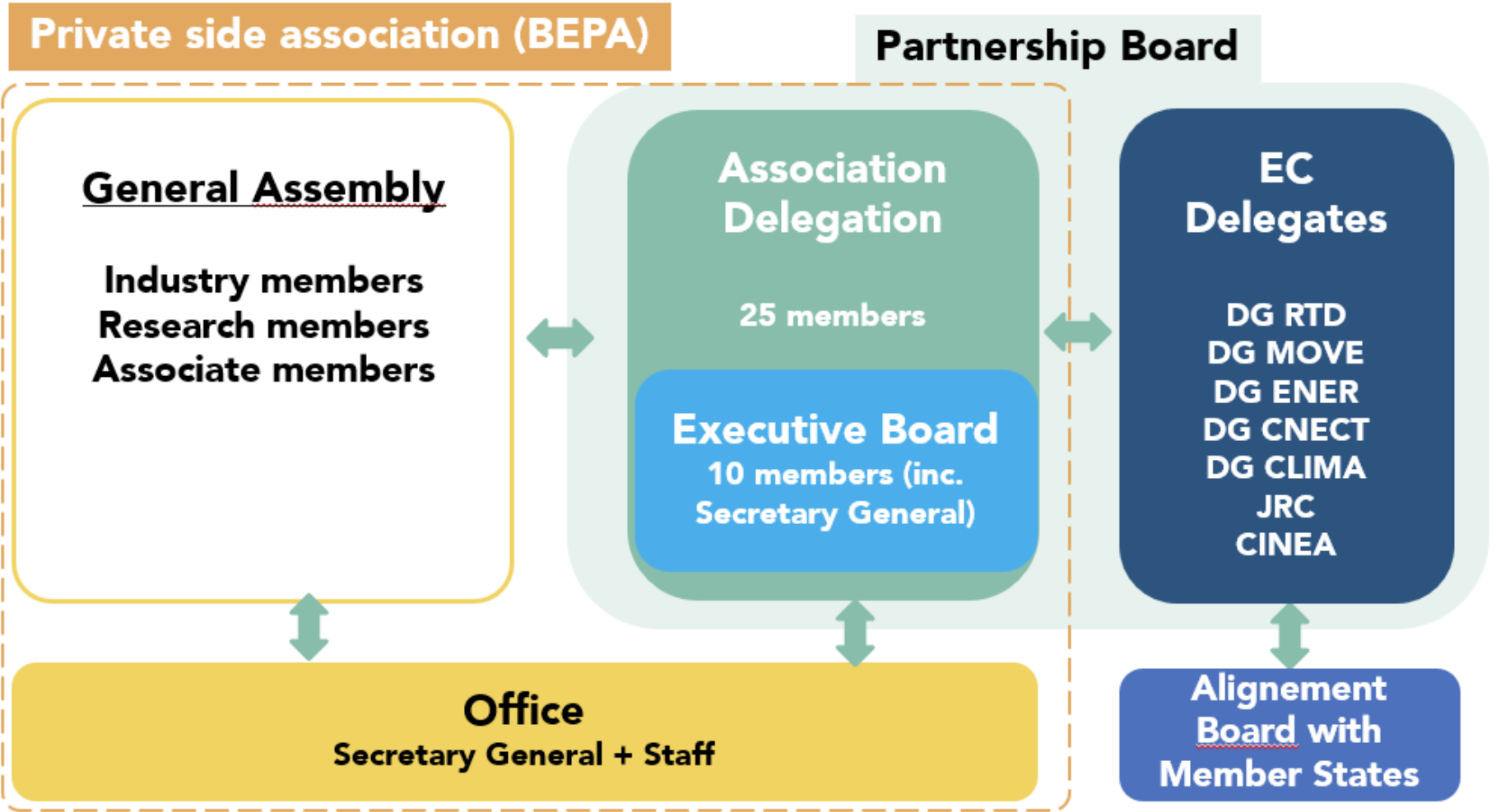
**Applications per topic: WP 2022**



Regarding the funded projects from battery calls in the Work Programme of 2021:

- Of the 170 participants (beneficiaries and associated partners), 64 are BEPA members (38%)
- Of the total funding (€ 150.124.194), BEPA members received (€83.269.372) (55%)
- Of the 22 projects, 19 are coordinated by BEPA members (86%)

# BEPA Governance Structure



# Create synergies in participating in BEPA events

## Battery Innovation Days

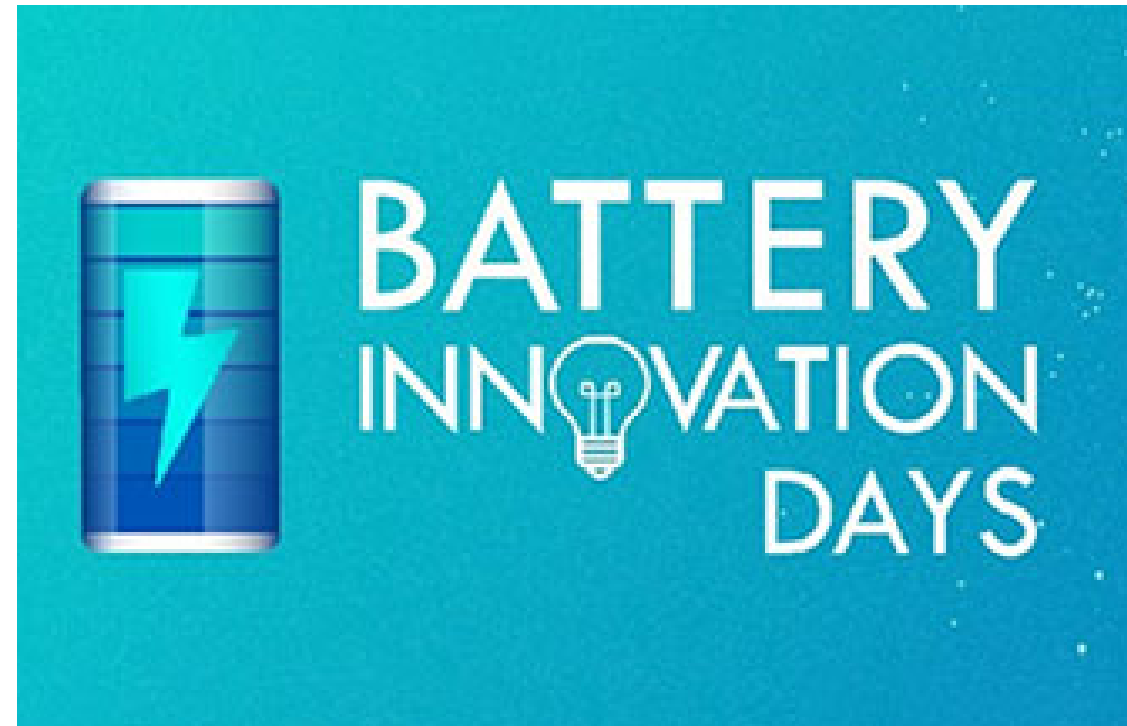
- Annual conference sparking conversations on the latest developments in the European R&I Battery domain, organised by BEPA, Batteries Europe, Battery2030+ and the 1<sup>st</sup> and 2<sup>nd</sup> battery IPCEI's. November 2023.

## Match-making events

- Matchmaking for Horizon Europe calls
- Network with battery stakeholders to find relevant project partners

## Thematic workshops

- Joint workshops with other partnerships
- Workshop on Innovation Uptake





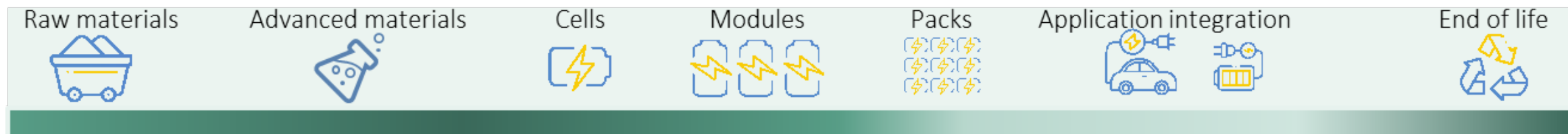
# BATT4EU Strategic Research and Innovation Agenda

## 2021 SRIA and the 2023 Update



# Scope of the 2021 Batt4EU Strategic R&I Agenda

3 focus areas to cover the segments of the value chain and 2 cross-cutting issues



**CROSS CUTTING ISSUE 1 - Safety**

**CROSS CUTTING ISSUE 2 - Sustainability**

**CROSS CUTTING ISSUE 3 - Coordination**

[www.bepassociation.eu/sria](http://www.bepassociation.eu/sria)

# Area 1: Raw materials and recycling

*Transparency, sustainability, cost reduction, safety.*

## Strategic Actions

1.1.1 - Sourcing, sustainability and traceability of raw materials (2023)

1.1.2 – Sustainable processing of battery grade raw materials (2021, 2022, 2023)

1.2.1 – Collection, reverse logistics, sorting and dismantling (2021)

1.2.2 – Metallurgical recycling processes, industrial integration and secondary material-based precursors (2021, 2023, 2024)

## Area 2: Advanced Materials, Cell Design and Manufacturing

*Increasing performance, scaling-up materials and manufacturing capacity, diversifying material solutions, enabling fast charging, light-weighting.*

### Strategic Actions

- 2.1.1 - Generation 3 Li-ion batteries for mobility (2021, 2023)
- 2.1.2 – Generation 4 Li-ion batteries for mobility (2021, 2023)
- 2.1.3 – Generation 5 batteries for mobility (2024)
- 2.1.4 – Li-ion batteries for stationary storage (2023)
- 2.1.5 – Non-Li batteries for stationary (2024)
- 2.1.6 – Advanced materials to reduce weight of cell and battery (2024)
- 2.1.7 – Advanced materials to enable ultra-fast charging
- 2.1.8 – Accelerated battery material discovery and interface engineering (2022, 2022)

## Area 2: Advanced Materials, Cell Design and Manufacturing

*Increasing performance, scaling-up materials and manufacturing capacity, diversifying material solutions, enabling fast charging, light-weighting.*

### Strategic Actions

2.3.1 – Environmentally sustainable processing techniques for Li ion batteries (2021)

2.3.2 – Manufacturing technology development for solid-state batt. (Gen. 4a - 4b) (2021, 2024)

2.3.3 – Towards an integrated manufacturing value chain: from machinery to plant- and site-integrated design (2022)

2.3.4 – Advanced digital twins (DT) for current and next generation cell prod. lines (2023)

# Area 3: Battery end-uses and operations

*Cost-efficient electrification to increase competitiveness, increased safety and reliability*

## Strategic Actions

- 3.1.1 – High-performance and safe-by-design battery systems (2022)
- 3.1.2 – Physics and data-based battery management applied to Gen3-Gen4 tech (2022, 2023)
- 3.1.3 – Digital twins for battery system manufacturing
- 3.1.4 – Digitalization of battery testing (2022, 2024)
  
- 3.2.1 – Modelling and standardisation of second life EV batteries for stationary energy storage (2023)
- 3.2.2 – Innovative battery solutions for stationary medium- to long-term storage (2024)
- 3.2.3 – Advanced battery management for optimized battery utilization (2023)
- 3.2.4 – Industrial upscaling and manufacturing of battery systems applications for stationary energy storage



# Area 4 and 5: Safety and sustainability

*For transversal topics*

## Strategic Actions

4.1.1 – Safety generic methodologies and standards for future batteries technologies

5.1.1 – Design for circularity

5.1.2 – Processes enabling circular value chains & closed loops *(2024)*

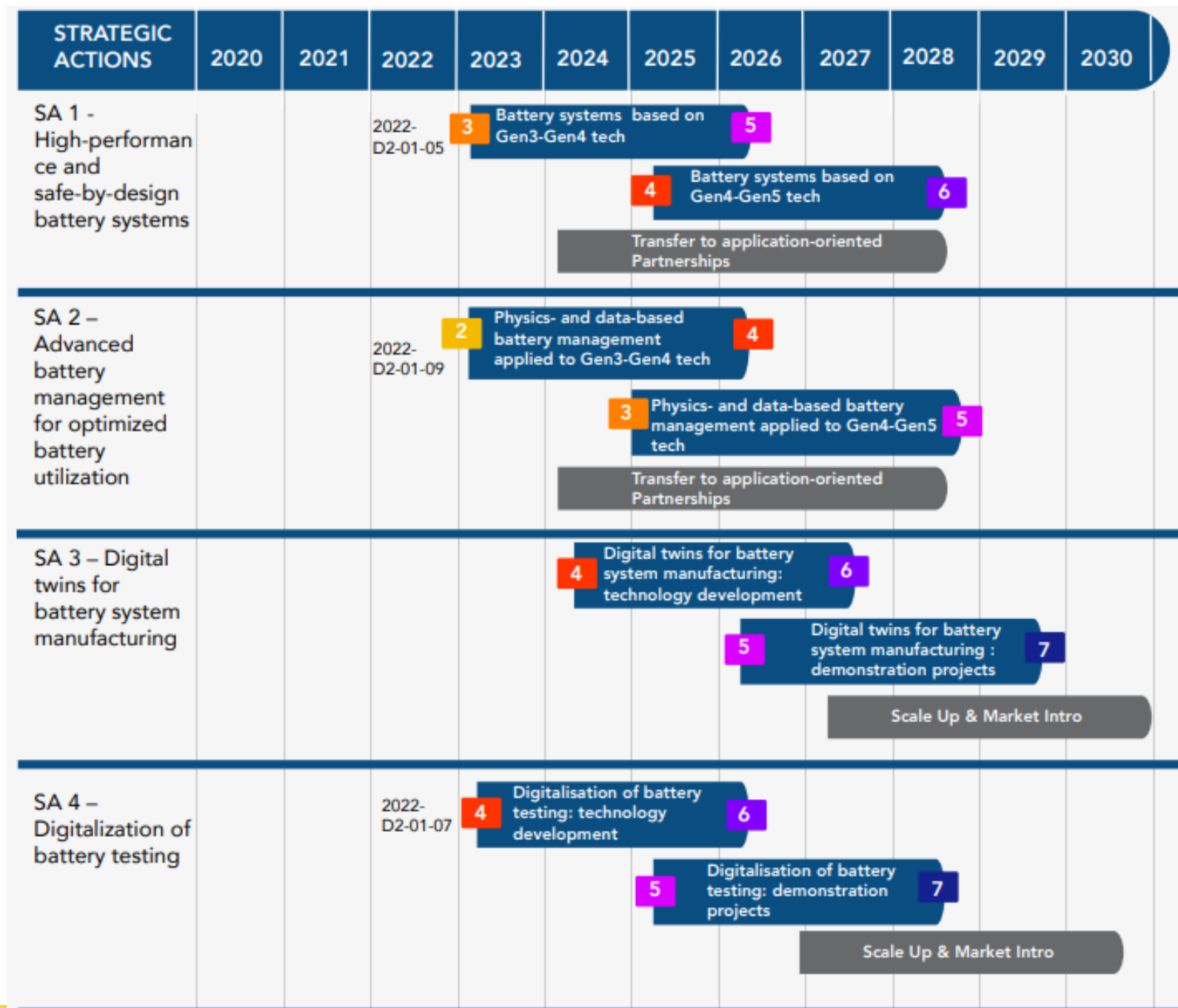
5.1.3 – Traceability and risk assessment *(see Raw Materials and Recycling)*

5.1.4 – Life Cycle Assessment (LCA) *(2022 – with 2Zero)*

5.1.5 – Social Life Cycle Assessment (S-LCA)

## Area 3: Timeline

- Nearly all topics addressed already in Horizon Europe WP21-22 and WP23-24
- Strategic Actions to be updated and re-aligned during update



Gathering all research necessary on batteries in Europe between now and 2030 in broad “Research Areas” in a Roadmap

May



Picking “Strategic Research Actions” which benefit from Batt4EU funding

September

Write Horizon Europe calls



Summer '24

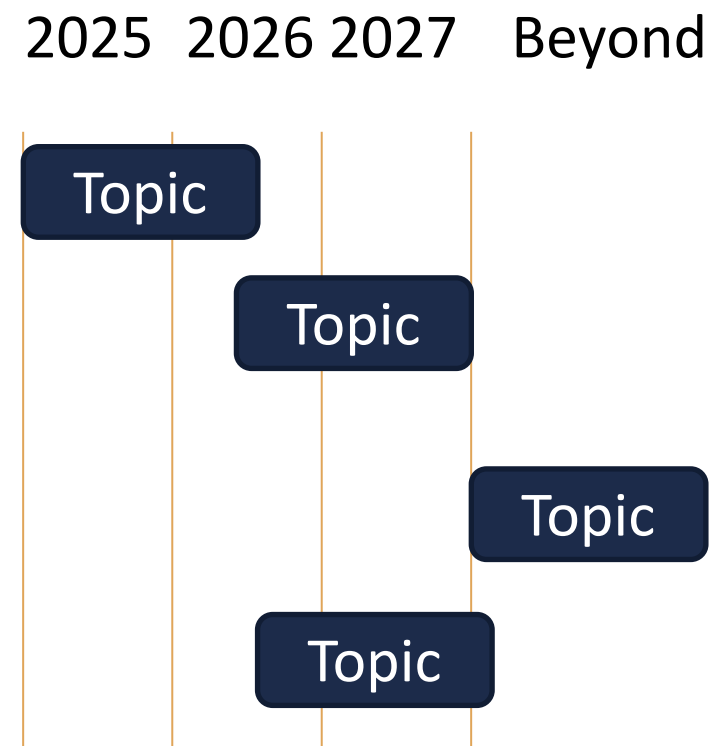
Recommendations for national and regional research funding, or funding from other HEU clusters or EU programmes

# SRIA update development

*Condense the roadmap context for each research area*

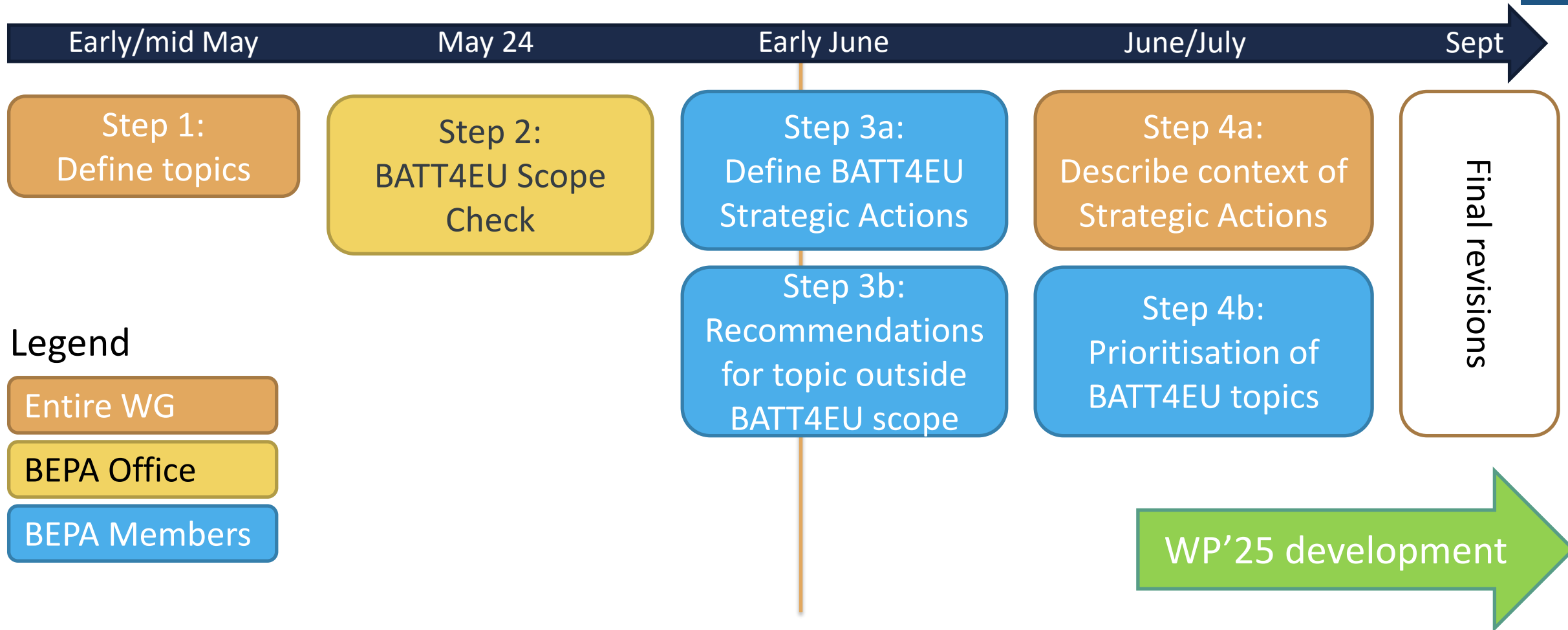


1. Define BATT4EU scope within Roadmap
2. Re-organise Research Areas (if needed)
3. Elaborate Research areas
4. Prioritise topics



# SRIA Update Timeline

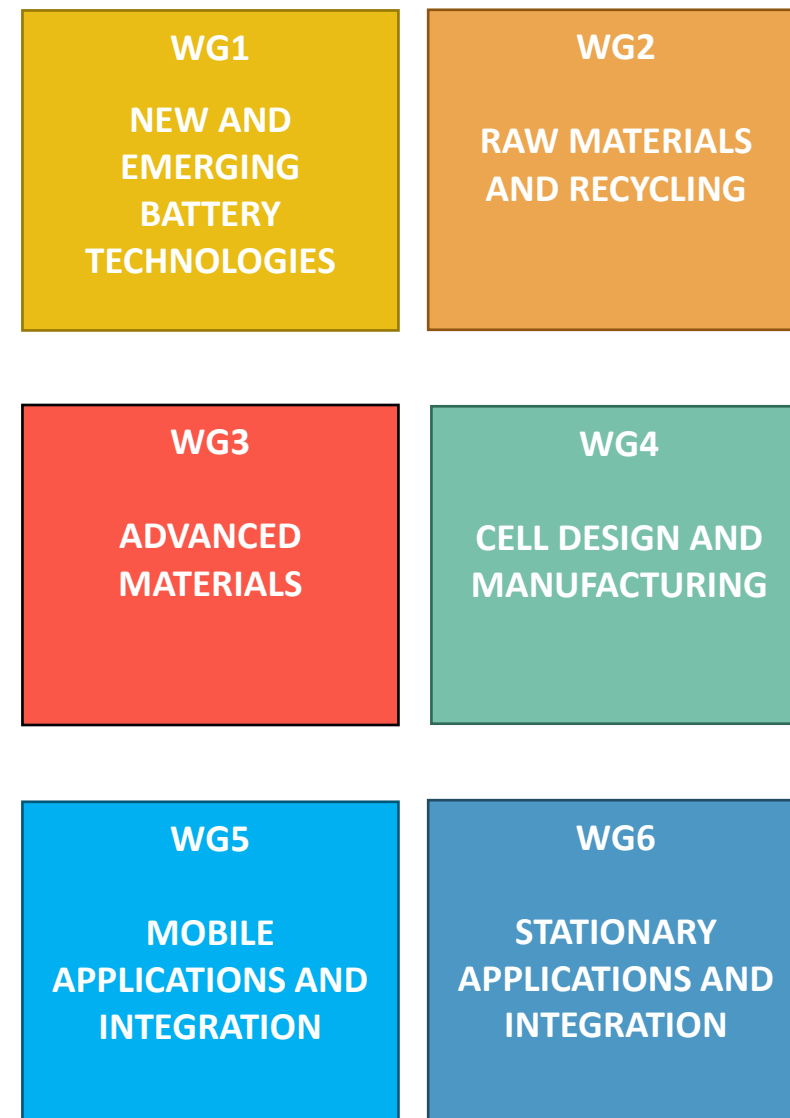
*In short, these are the next steps*



# Help us update the SRIA

Update in January 2023

- Join our Working Groups!
- Operated jointly with the Batteries Europe think tank
- Reflection on the text of the SRIA (state-of-the art, research needs, target KPIs) is **open for all**
- Prioritization is **for BEPA members only**
- [https://ec.europa.eu/eusurvey/runner/BEPA\\_BE\\_Working\\_Group\\_Registration](https://ec.europa.eu/eusurvey/runner/BEPA_BE_Working_Group_Registration)





- LIBERTY overview – synergies with BEPA and SRIA



## LIBERTY Project Intro

Goals

Facts & Figures

WP structure

EU perspective



## Some of our key innovations

Immersion Cooling

Active Safety System

BMS

SOX algorithms

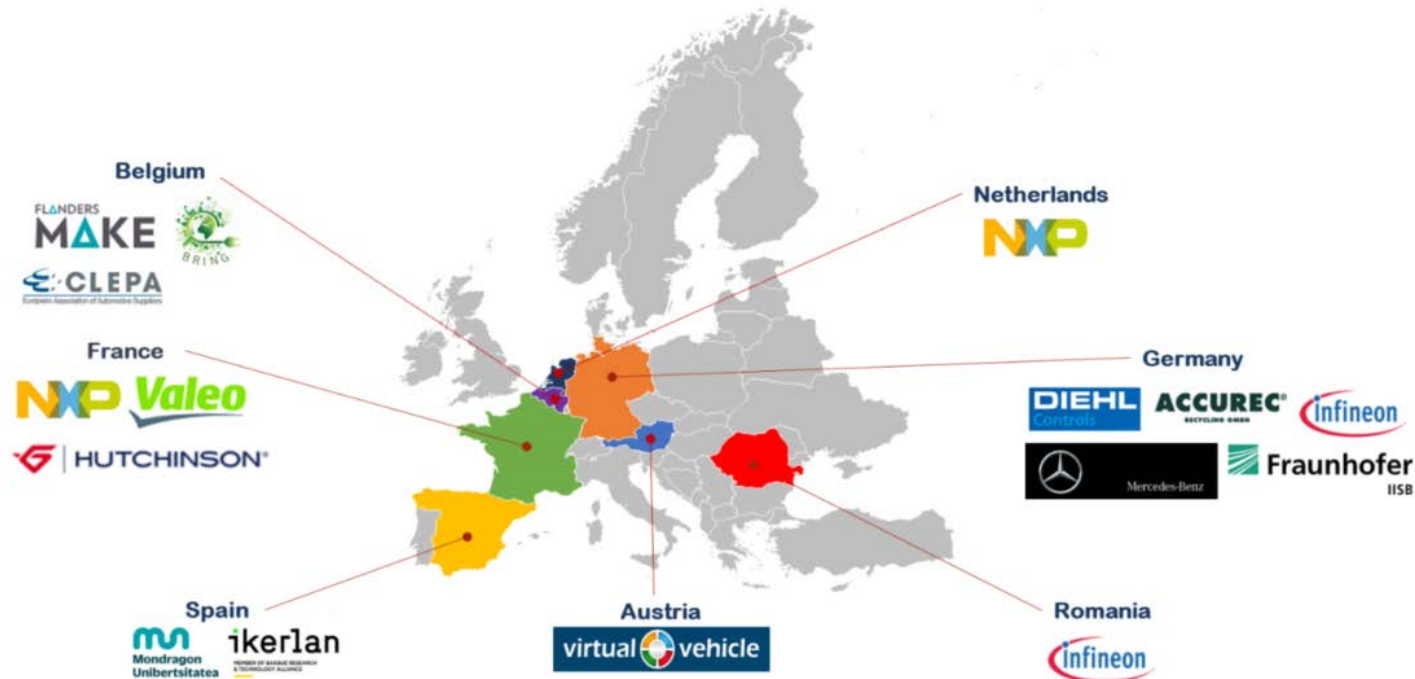
Battery Passport



## COLLABAT cluster

Cluster Introduction

# Facts & Figures



- 16 Partners from 7 countries
- Coordinator: IKERLAN
- Start date: January 2021
- Duration: 42 months
- Budget: 10M

# EU perspective – Horizon 2020 Framework

## ■ LC-BAT-10-2020

- Design of advanced battery packs
  - Lightweighting
  - Crashworthiness
  - Electrical and thermal requirements
- Sustainable dismantling and recycling of battery pack/modules
- Flexible advanced battery management systems
- Remote maintenance and troubleshooting
- High voltage systems compatible with high-power ultra-fast charging
- Future performance-related test procedures
- Development and qualification of future safety related test procedures
- Integration into an existing vehicle

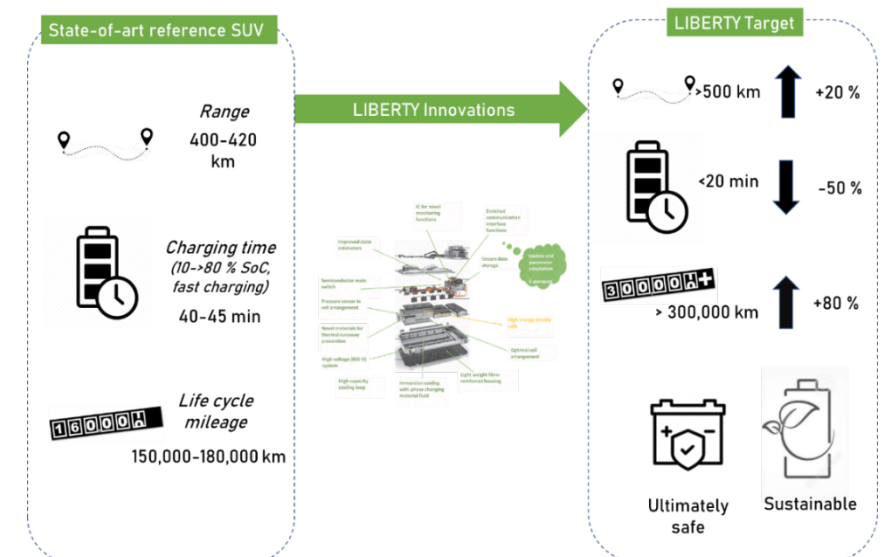


# Project Overview

## ■ Lightweight Battery System for Extended Range at Improved Safety

- Objective 1: To achieve a range of 500 km on a fully charged battery pack
- Objective 2: To achieve a short charging time
- Objective 3: To achieve an ultimately safe battery system
- Objective 4: To achieve a long battery lifetime
- Objective 5: To achieve sustainability over the battery pack entire life cycle

Parameter	Benchmark: EQC 2019	Target: LIBERTY EQC
Battery system capacity [kWh]	80	96
Battery system weight based on 80 kWh battery capacity [kg]	650	520
Max. charging power [kW]	110	350
Charging window 10-80% SoC [min]	40	18
Range (WLTP) [km]	417	500
Battery life (no. of cycles to 80% DoD)	500	1000
Mileage [km]	160,000	>300,000



# Project goals

LIBERTY project will develop a new battery system through smart combinations and implementation of innovations including:

- A compact and safe battery pack based on high energy density cells and lightweight materials housing which is crash resistant
- A versatile battery management system resulting in optimal performance and safety over the system's total lifetime (first and second life)
- High accuracy state estimators allowing fast charging, enhancing range and lifetime, and guaranteeing ultimate safety and diagnostics
- An innovative thermal management system ensuring safety and preventing battery degradation during fast charging
- Design a (semi) automated battery dismantling procedure thereby reducing costs for recycling and reuse
- Development of future-proof testing protocols for standardised EV safety as well as performance testing.



# WP Structure – V Design Methodology

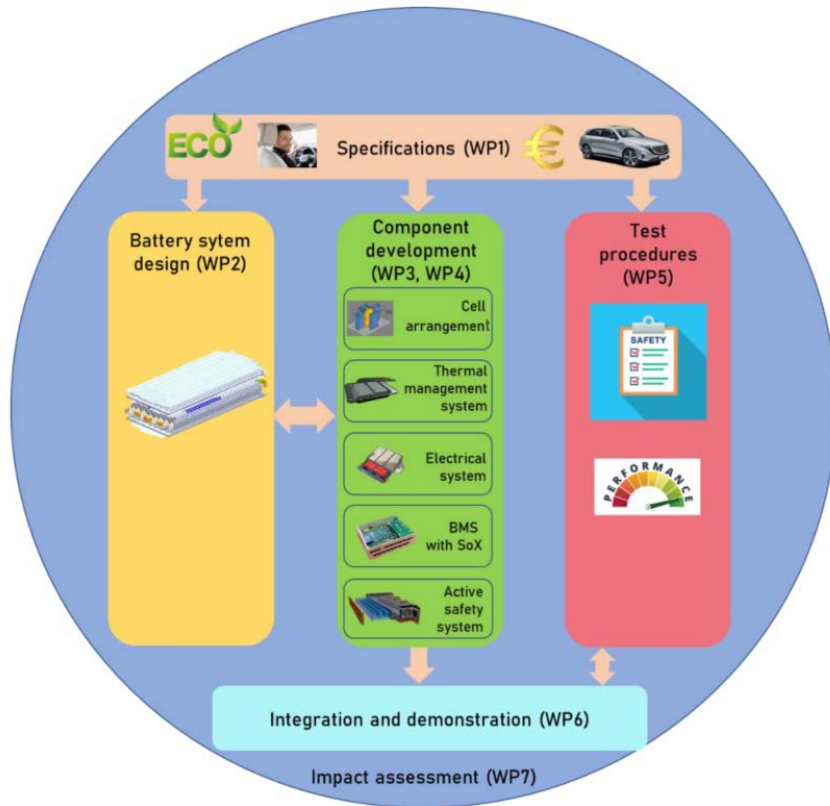
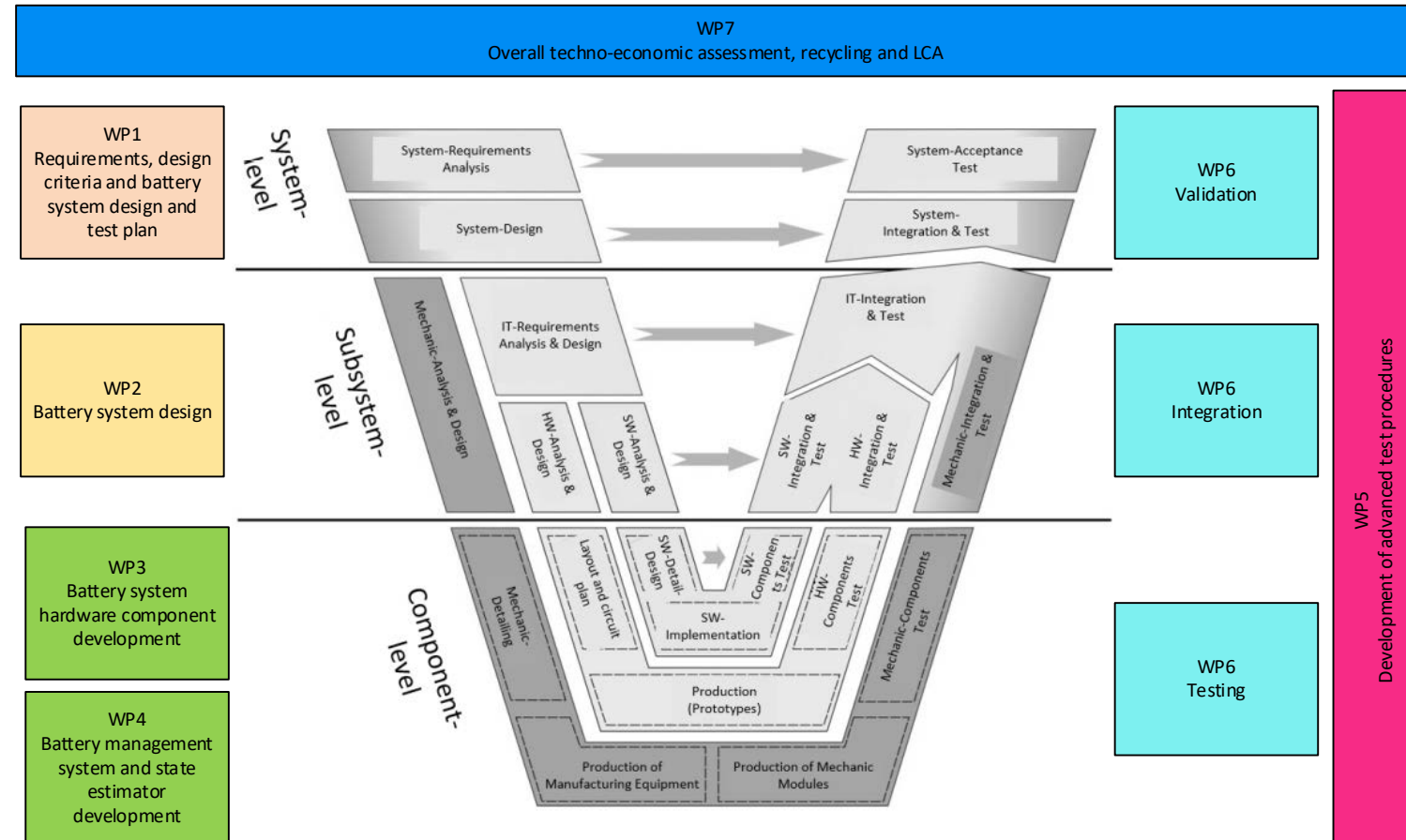


Figure 1-3 Overall approach and methodology of the work plan



V-model by Bender 2005, translated from Bender (2005) –  
 “V-MODELS FOR INTERDISCIPLINARY SYSTEMS ENGINEERING”, I. Graessler, J. Hentze and T. Bruckmann

# Presentation Outline



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SOX algorithms

Battery Passport



## COLLABAT cluster

Cluster Introduction

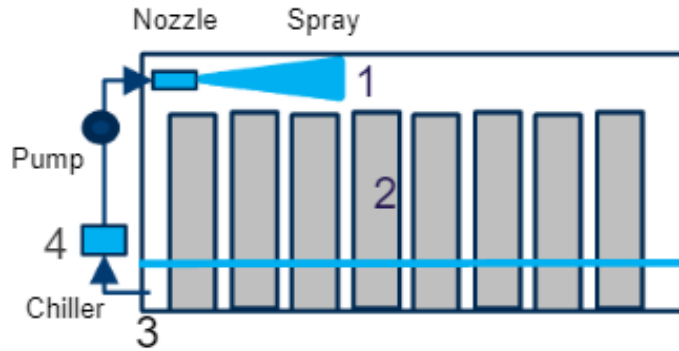
# LIBERTY – Key Innovations

- O1: To achieve a range of 500 km on a fully charged battery pack
- O2: To achieve a short charging time
- O3: To achieve an ultimately safe battery system
- O4: To achieve a long battery lifetime
- O5: To achieve sustainability over the battery pack entire life cycle



# Immersion Cooling based TMS

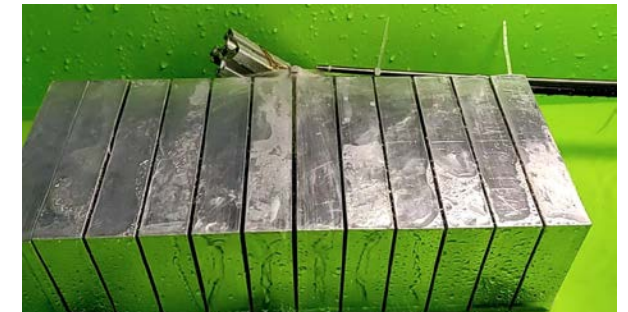
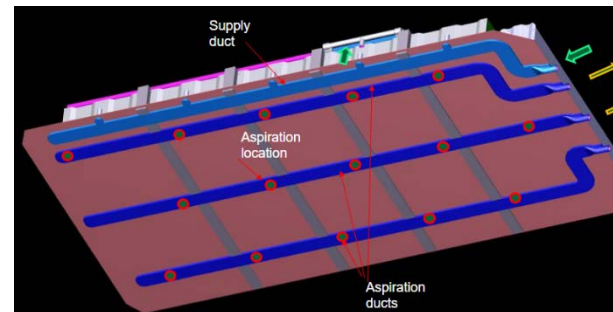
## Conceptual Drawing



- 1- Dielectric liquid is sprayed on the battery surfaces
- 2- Liquid run off over the cells
- 3-The liquid is sucked by the pump
- 4-Liquid is cooled through a chiller to start a new cycle

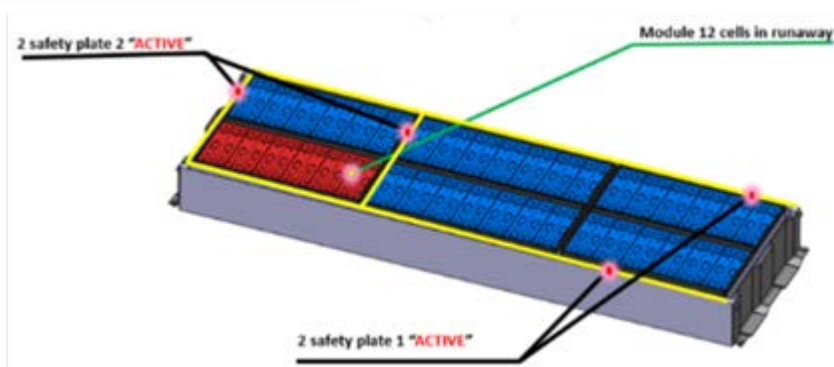
- Monophasic partial immersion
- Nozzles in the upper part to be integrated with the casing
- Collection of the liquid in the down part to drive the fluid to pump and chiller
- Chiller will evacuate heat to vehicle system

## Testing and Integration

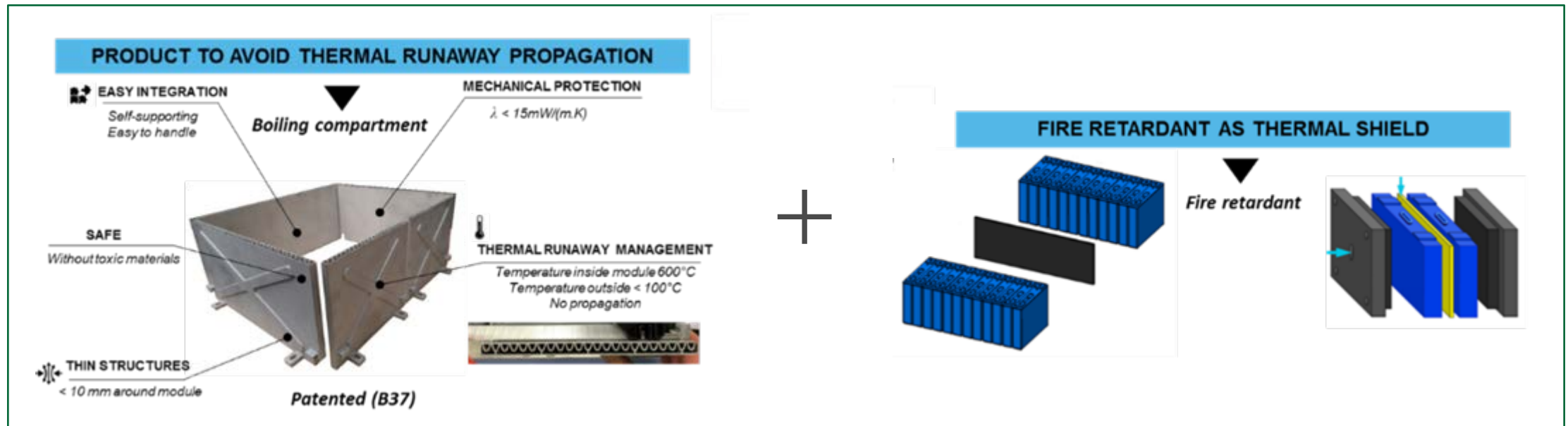




# Active Safety System



- Encapsulation of group of cells to prevent TR propagation.
- Active: 2-phase fluid > boils in case of TR.
- Passive: Fire retardant material – minimize active use system



- Bus bar design integrating BMS slaves.
- Impact of fluid for immersion cooling.  
Tailored solution
- Maximising energy density.
- Based on foxBMS2 open-source BMS.

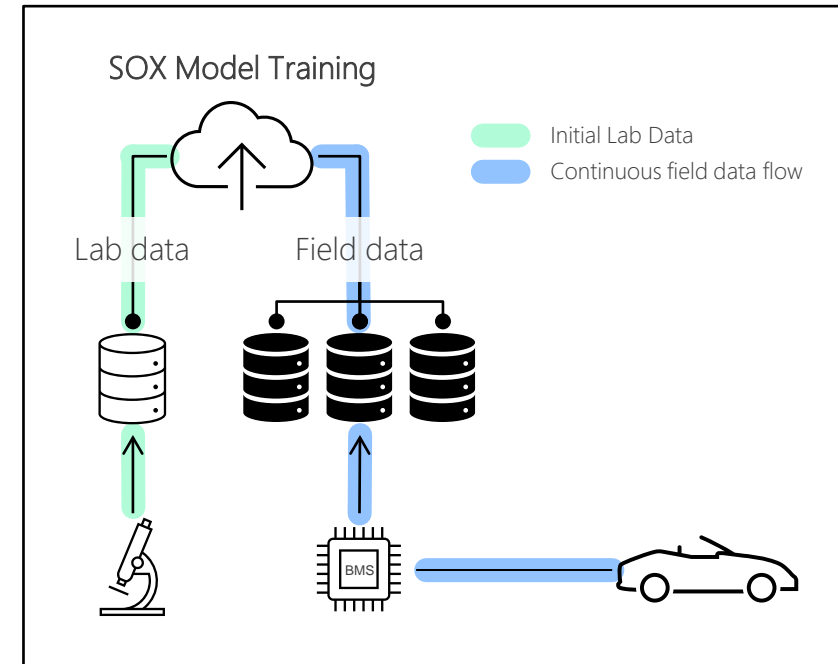
# SOX Estimation Algorithms

## Main Requirements:

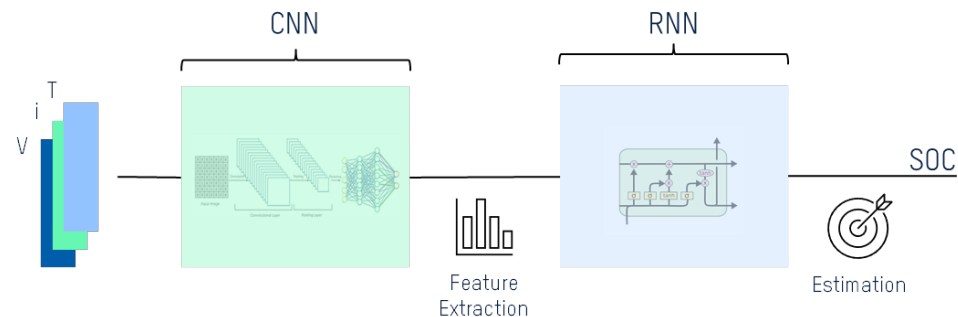
- Quick model development phase
- Reduced experimental burden

## Our solution: Data-driven modelling techniques

- We take advantage of in-field operation data for SoX estimation modelling.



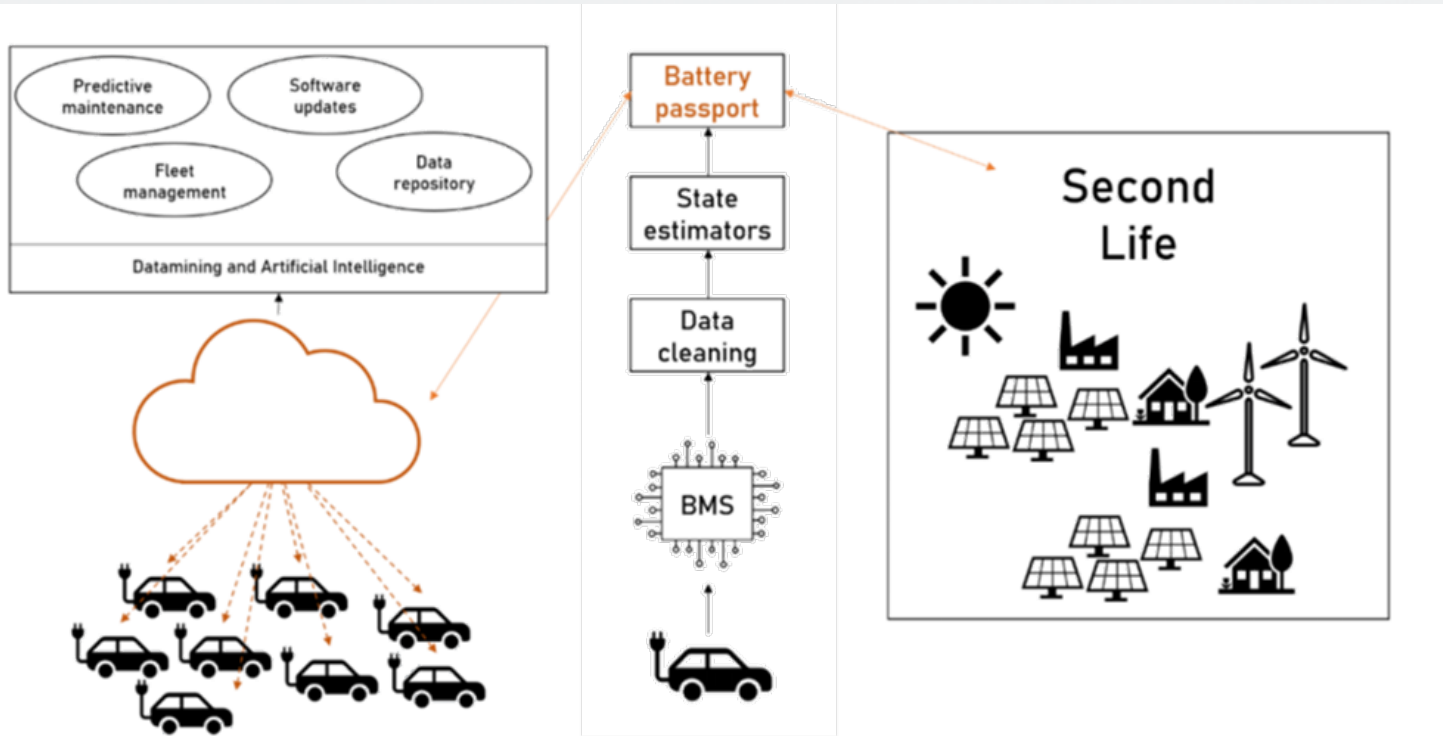
## SOC estimation algorithm structure:



## Outstanding Benefits:

- Increased accuracy and reliability as new data becomes available.
- Improved performance at unobserved conditions.
- Experimental burden can be significantly reduced.

# Battery Passport Concept



- Real-Time battery data processed and stored
- Advanced services
- Enabling a simpler transition to 2<sup>nd</sup> Life.





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## Some of our key innovations

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## COLLABAT cluster

Cluster Introduction





# COLLABAT Cluster

## ■ LC-BAT-10-2020 projects joint Cluster: COLLABAT

- ALBATROSS
- LIBERTY
- HELIOS
- MARBEL



## ■ 4 main subclusters defined:

-  Sub – A: Sustainability
-  Sub – B: Testing
-  Sub – C: BMS
-  Sub – D: Modelling

■ LinkedIn page published soon!

■ Upcoming Events, workshops, whitepapers, etc.

Stay tuned!

## ■ Open calls 2024

# Horizon Europe WP 2023-2024

## BATT4EU topics coming up in 2024



EN

**Horizon Europe**

**Work Programme 2023-2024**

*8. Climate, Energy and Mobility*

*(European Commission Decision C(2023) 2178 of 31 March 2023)*

# BATT4EU Calls coming up in 2024

07 December – 18 April 2024

**HORIZON-CL5-2024-D2-01-01:** Advanced sustainable and safe pre-processing technologies for End-of-Life (EoL) battery recycling (Batt4EU Partnership)

- TRL 5, 2 projects, €8 million.

**HORIZON-CL5-2024-D2-01-02:** Non-Li Sustainable Batteries with European Supply Chains for Stationary Storage (Batt4EU Partnership)

- TRL 6-7, 3 projects, €7 million.

# BATT4EU Calls coming up in 2024

07 December – 18 April 2024

**HORIZON-CL5-2024-D2-01-03:** Development of technical and business solutions to optimise the circularity, resilience, and sustainability of the European battery value chain (Batt4EU Partnership)

- TRL 5, one project, €5 million.

**HORIZON-CL5-2024-D2-01-05:** Furthering the development of a materials acceleration platform for sustainable batteries (Batt4EU Partnership)

- TRL4-5, One project, 20 million.
- Continuation of the BIG-MAP Project

# BATT4EU Calls coming up in 2024

07 May 2024 – 05 September 2024

**HORIZON-CL5-2024-D2-02-01:** Sustainable high-throughput production processes for stable lithium metal anodes for next generation batteries (Batt4EU Partnership)

- TRL 6-7, one project, € 8 million.

**HORIZON-CL5-2024-D2-02-02:** Post-Li-ion technologies and relevant manufacturing techniques for mobility applications (Generation 5) (Batt4EU Partnership)

- TRL 4, 3 projects, € 5 million.

**HORIZON-CL5-2024-D2-02-03:** Size & weight reduction of cell and packaging of batteries system, integrating lightweight and functional materials, innovative thermal management and safe and sustainable by design approach (Batt4EU Partnership)

- TRL 6-7, 2 projects, € 8 million.



# THANK YOU!

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**BATT4EU**   
Batteries European  
Partnership



# Open discussion



THANK YOU VERY  
MUCH