This project is co-financed by the European Union and the Republic of Turkey
Bu proje Avrupa Birliği ve Türkiye Cumhuriyeti tarafından finanse edilmektedir

TURKEY in HORIZON 2020
COOPERATION. INNOVATION. COMPETITIVENESS

Technical Assistance for Turkey in Horizon 2020 Phase-II
EuropeAid/139098/IH/SER/TR

Turkey in Horizon 2020 II

‘The Batteries Partnership Calls of 2021’

Dimitrios Papageorgiou// TVP Solar SA

Focus Group Training 12 – BATTERIES| Towards a competitive European industrial battery value chain for stationary applications and e-mobility

14-15 June 2021

REPUBLIC OF TURKEY
MINISTRY OF INDUSTRY AND TECHNOLOGY

COMPETITIVE SECTORS PROGRAMME

TÜBİTAK

Batteries Partnership: 2021 Call in figures

- Call - HORIZON-CL5-2021-D2 Destination - Cross-sectoral solutions for the climate transition
- Call - HORIZON-CL5-2021-D5 Destination - Clean and competitive solutions for all transport modes
- 7+1 topics for the Batteries Partnership (6 RIA; 2 CSA)
- Deadline: 19 October 2021 ?
- Overall indicative budget: 160M€ + 4M€

Note 1: Based on Workprogramme Version Final(?), April 2021. Call to be published around mid-June 2021
Note 2: Applicants should use the official call documents (including Horizon Europe Cluster 5 Workprogramme; Admissibility conditions, eligibility conditions, financial & operational capacity and exclusion, award criteria, etc. This presentation serves informative purposes.

Overview of 2021 Call Topics (1/2)

BEPA Working Group 4
Safety & Reliability

HORIZON-CL5-2021-D2-01-01

Sustainable processing, refining and recycling of raw materials

RIA; TRL4-5; 6-7M€; 3 projects to be funded

BEPA Working Group 1
Raw Materials and Recycling

BEPA Working Group 5 Sustainability

BEPA Working Group 4
Safety & Reliability

HORIZON-CL5-2021-D2-01-02

Advanced high-performance Generation 3b (high capacity / high voltage) Li-ion batteries supporting electro mobility and other applications

RIA; TRL6; 6-8M€; 3 projects to be funded

BEPA Working Group 2
Advanced Materials and Manufacturing

HORIZON-CL5-2021-D2-01-03

Advanced high-performance Generation 4a, 4b (solid-state) Li-ion batteries supporting electro mobility and other applications

RIA; TRL5; 8-9M€; 4 projects to be funded

BEPA Working Group 2
Advanced Materials and Manufacturing

HORIZON-CL5-2021-D2-01-04

Environmentally sustainable processing techniques applied to large scale electrode and cell component manufacturing for Li ion batteries

RIA; TRL5-6; 5M€; 4 projects to be funded

BEPA Working Group 2
Advanced Materials and Manufacturing

BEPA Working Group 5 Sustainability

Overview of 2021 Call Topics (2/2)

BEPA Working Group 4
Safety & Reliability

HORIZON-CL5-2021-D2-01-05

Manufacturing technology development for solid-state batteries (SSB, Generations 4a - 4b batteries)

RIA; TRL5-6; 6-7M€; 4? projects to be funded

BEPA Working Group 2
Advanced Materials and Manufacturing

BEPA Working Group 4
Safety & Reliability

HORIZON-CL5-2021-D2-01-06

Sustainable, safe and efficient recycling processes

RIA; TRL5-6; 9-10M€; 3 projects to be funded

BEPA Working Group 1
Raw Materials and Recycling

BEPA Working Group 5 Sustainability

HORIZON-CL5-2021-D2-01-07

Support for establishment of R&I ecosystem, developing strategic forward-looking orientations to ensure future skills development, knowledge and technological leadership for accelerated disruptive technology exploration and uptake

CSA; 3M€; 1 project to be funded

All BEPA Working Groups

HORIZON-CL5-2021-D5-01-04: LCA and design for sustainable circularity - holistic approach for zero-emission mobility solutions and related battery value chain

CSA; 4M€; 1 project to be funded

All BEPA Working Groups

This project is co-financed by the European Union and the Republic of Turkey
Bu proje Avrupa Birliği ve Türkiye Cumhuriyeti tarafından finanse edilmektedir

Sustainable processing, refining and recycling of raw materials (1/5)

HORIZON-CL5-2021-D2-01-01

RIA; TRL4-5; 6-7M€; 3 projects to be funded

Relevance: *List of Critical Raw Materials*; *Circular Economy Action Plan*; *Cluster 4 RESILIENCE Green and Sustainable Materials topics; European Partnership 'Towards a competitive European industrial battery value chain for stationary applications and e-mobility'*

Outcome

Decreasing dependency of Europe on imported battery chemicals and raw materials

New business opportunities and jobs will be created for the European industry

Sustainable processing, refining and recycling of raw materials (2/5)

HORIZON-CL5-2021-D2-01-01

Project results:

- From low grade to battery grade materials sources of **nickel**, **cobalt** and lithium (innovative, cost-effective & safe extraction technologies)
- Battery grade intermediates (e.g. lithium hydroxide) competitively produced/ refined in Europe (in a sustainable & social acceptable way)
- Reduced CO2 emissions, increased energy efficiency, efficient use of resources (e.g. re-processing recycled lithium from spent batteries)
- New business opportunities & business models (e.g. joint processing, centralized Lithium refinery) creating new jobs

Sustainable processing, refining and recycling of raw materials (3/5)

HORIZON-CL5-2021-D2-01-01

Scope

Competitive battery industry in Europe: innovations in chemical and metallurgical production are required

Covering one or more of the following:

- ❖ Solutions to a sustainable Lithium value chain
  - Novel sorting technologies, new comminution method, alternative energy sources to improve energy efficiency, CO2 emissions and reduce water use;
  - Selective methods for lithium extraction from minerals and refining to battery grade chemicals/ lithium metal. Improved stability of refined LiOH
  - Specification of properties for Lithium deposits, to foresee how the mineral mix could be better processed
- ❖ New refining processes: increased value & yield from European mines and sustainably sourced and imported (nickel and cobalt) raw materials; also from process waste, side streams, recycled materials, mine tailings, etc.

Sustainable processing, refining and recycling of raw materials (4/5)

HORIZON-CL5-2021-D2-01-01

<u>Covering one or more of the following (continued 1)</u>:

- Nickel & cobalt refining: performance and efficiency improvements; e.g. through new CO2 emission reduction methodologies, increasing energy and resource efficiency, raw material flexibility and substitution of fossil fuels.
  - Battery metal leaching and extraction: Development of new recoverable reagents and processes and real-time composition analysis to reduce waste and improve material efficiency and waste management
  - New smelting and slag engineering technologies to address Ni and Co losses in smelting

Sustainable processing, refining and recycling of raw materials (5/5)

HORIZON-CL5-2021-D2-01-01

Covering one or more of the following (continued 2):

- ❖ Development of continuous processes for precursor materials (pCAM) to replace the currently used batch processing, including:
  - Process control solutions for different cathode active material recipes
  - Complete process design concepts including filtration, gas supply, mixing ratios, flow control, fluidised process solutions, and process automation
  - Process optimisation to minimise and/or recover off-specification battery metals and compounds.
- ❖ Zero Liquid Discharge processing in battery chemical and precursor material processing, including energy cascading and waste valorization
- ❖ New business models for co-processing and process integration
- ❖ Process modelling competence combined with environmental impact evaluation for individual primary processes

Advanced high-performance Generation 3b (high capacity / high voltage) **Li-ion batteries** supporting electro mobility and other applications (1/4)

HORIZON-CL5-2021-D2-01-02

RIA; TRL6; 6-8M€; 3 projects to be funded

Relevance: European Partnership on 'Towards a competitive European industrial battery value chain for stationary applications and e-mobility'

Outcome

- Delivering on cost, performance, safety, sustainability and recyclability (large-scale manufacturing and uptake by the mobility & other sectors)
- Increase in energy density (increased driving distance at reduced cost, broader customer's acceptance)
- Broader market penetration, reducing GHG emissions: demonstrated for recyclability

Relevant project: 3beLiEVe

Advanced high-performance Generation 3b (high capacity / high voltage) **Li-ion batteries** supporting electro mobility and other applications (2/4)

HORIZON-CL5-2021-D2-01-02

Project KPIs (impact by 2025):

- Gravimetric and volume energy density at cell level of 350-400 Wh/kg and 750-1000 Wh/l respectively
- Power density at cell level of 700 W/kg, 1500+ W/L
- Operation at 4.7+ Volt (for high voltage application)
- 3000+ & 2000+ deep cycles for high capacity & high voltage applications respectively
- Cost at pack level < 100 euro/kWh

Note: KPIs at TRL6; What about KPIs at large-scale manufacturing?

Advanced high-performance Generation 3b (high capacity / high voltage) **Li-ion batteries** supporting electro mobility and other applications (3/4)

Scope

HORIZON-CL5-2021-D2-01-02

Development of advanced materials enabling **higher energy / power density** thanks to higher capacity (voltage range 4.3-4.5V) **and/or** operating at higher voltage (4.7+V).

Focus on adapting **cathode materials** (high-nickel NMCs for capacity, spinels / Li-rich Mn NMCs for voltage), **anode materials** (graphite-containing Si(Ox)), **electrolytes** (stabilised formulations) and **their interplay**

❖Higher capacity approach:

- Cathode materials operating in 4.3-4.5 Volt range; delivering on cycle life, protective coatings for safety improvements;
- Anodes with advanced graphite & silicon materials (capacities at 1000 mAh/g), - Or, develop complete Si or other nanostructured anode solutions
- Suitable inactive materials (binders, conductive carbons, separators, etc.)
- Electrolytes stable in 4.3-4.5 Volt advanced processing routes for novel materials and advanced electrode and cell/module designs

Advanced high-performance Generation 3b (high capacity / high voltage) **Li-ion batteries** supporting electro mobility and other applications (4/4)

HORIZON-CL5-2021-D2-01-02

❖ Higher voltage approach:

- **High-voltage stable** electrolyte systems (new electrolytes and/or new formulations)
- **High-voltage stable** cathode active materials (e.g. HV spinels, Li-rich Mn NMCs, phosphates, disordered materials etc. with **lowered content in critical and high price elements**, protective coatings)
- Tailoring and **operando monitoring** of the electrochemical interplay between the cathode active material and the electrolyte formation of stable SEI interfaces;
- Advanced **high performance anodes** matching these high-voltage cathodes and electrolytes;
- Structuring of the cathode and anode electrodes for their competition and electric conductivities, etc.

Advanced high-performance Generation 4a, 4b (solid-state) Li-ion batteries supporting electro mobility and other applications (1/5)

HORIZON-CL5-2021-D2-01-03

RIA; TRL5; 8-9M€; 4 projects to be funded

Relevance: European Partnership 'Towards a competitive European industrial battery value chain for stationary applications and e-mobility'; H2020-LC-BAT-2020 projects

Outcome;

- Delivering on cost, performance, safety, thermal stability, sustainability (cost-competitive large-scale manufacturing and uptake by electro mobility sector)
- Increase in energy density (increased driving distance at reduced costs on module and pack level, positive customer's acceptance)
- Broader market penetration, reducing GHG emissions

Relevant project: SIMBA

Advanced high-performance Generation 4a, 4b (solid-state) Li-ion batteries supporting electro mobility and other applications (2/5)

HORIZON-CL5-2021-D2-01-03

Project KPIs (impact by 2025):

- Gravimetric & volumetric energy density at cell level of 400+ Wh/kg & 800+ Wh/l (Gen 4a) progressing to 1000+ Wh/l (Gen 4b)
- Cycle life up to 3000 +; **charging rate** of 3-5C (aviation up to 10C)
- Cost at pack level < 75 euro/kWh.
- High-power variants for fast charging, airborne, heavy-duty, hybrid segments targeting >500W/kg and >700 W/l

Advanced high-performance Generation 4a, 4b (solid-state) Li-ion batteries supporting electro mobility and other applications (3/5)

Scope

HORIZON-CL5-2021-D2-01-03

Development of solid-state electrolytes, cathode materials and anode materials:

- ✓ Enabling higher thermal and electrochemical stability
- ✓ targeting higher energy / power densities, fast charging, cyclability and improved safety.
- ✓ Contributing in the control of thermal runaway at early stage, and create non-propagation designs.

Range: from using conventional materials to using Li metal-based anode materials, aiming at reducing the amount of cobalt used in the production.

Advanced high-performance Generation 4a, 4b (solid-state) Li-ion batteries supporting electro mobility and other applications (4/5)

HORIZON-CL5-2021-D2-01-03

❖ For **Generation 4a** (solid state with conventional materials) **all** bullets:

- Developing low direct current resistance active materials;
- Reducing thickness of the anode;
- Developing thin solid electrolyte with high ionic conductivity;
- Developing concepts/strategies for manufacturing new solid electrolyte interlayers;
- Improving interface design to ensure efficient charge-transfer and electrochemical stability and improved cell mechanical stability;
- Proposed approach is expected to have no negative impact on energy densities, safety, and cyclability;
- Development of coating strategies for current collectors

Advanced high-performance Generation 4a, 4b (solid-state) Li-ion batteries supporting electro mobility and other applications (5/5)

HORIZON-CL5-2021-D2-01-03

❖ **Generation 4b** (solid state with Li metal-based anode materials) **one or several** bullets:

- New materials and/or chemistries to increase energy densities in **electro mobility**
- Anode side: use of lithium metal for increased gravimetric energy density
- Improved reversibility, homogeneity and density of electrodeposition process by doping or coating strategies
- Solutions for **manufacturing** & handling Li metal sheet in dry atmosphere.
- Novel solutions for **low cost manufacturing** strategies such as solvent-free electrode manufacturing and solid electrolyte deposition
- (Anode-less) technology: current collectors for **reversible electrodeposition** of Li Coating strategies regulating lithium deposition and improve cycling performance
- Solid-state electrolytes & lithium metal **anodes for new cathode chemistries** (e.g. lithium-free cathode in combination with lithium metal or Li-excess cathode exhibiting high irreversible capacity in the anode-less configuration)
- Improving interface design to ensure **efficient charge-transfer** and electromechanical stability and improved cell mechanical stability
- Bipolar cell design concepts and processing

Environmentally sustainable processing techniques applied to large scale electrode and cell component manufacturing for Li ion batteries(1/4)

HORIZON-CL5-2021-D2-01-04

RIA; TRL5-6; 5M€; 4 projects to be funded

Relevance: European Partnership 'Towards a competitive European industrial battery value chain for stationary applications and e-mobility'; LiPLANET initiative

Outcome

- European **leadership** in batteries production with lower carbon footprint
- New **sustainable electrode and cell manufacturing techniques** (reduced energy consumption, no VOCs emissions). Scalable, safer, cheaper, cleaner and less energy consuming; reinforcing European internationally competitiveness

Environmentally sustainable processing techniques applied to large scale electrode and cell component manufacturing for Li ion batteries (2/4)

HORIZON-CL5-2021-D2-01-04

Outcome (continued)

- Electrode **coating production eliminating organic solvents** as slurry dispersing media (avoiding large capital costs for solvent recovery system). Dry manufacturing techniques (e.g. 3D patterning of active electrode layers, etc.)
- **Industrialising closed loops and process design** to return low-value chemicals from manufacturing processes to high-value for battery manufacturing

Environmentally sustainable processing techniques applied to large scale electrode and cell component manufacturing for Li ion batteries (3/4)

Scope

HORIZON-CL5-2021-D2-01-04

Industrial scale fabrication of Li-ion battery (LIB) porous electrodes imply casting of a slurry containing **toxic solvent**, expensive to recover. This technology is also applied in Gen3a/b batteries.

Less expensive and environmentally friendly solvents, such as water are already employed for anode manufacturing.

Wet coating technologies can still be further optimised and benefit from reducing the solvent fraction.

Completely **dry processing** techniques could completely remove the need for energy consuming drying

Dry manufacturing techniques can also help new concepts such as 3D patterning of active electrode layers, or hydrophobic surface treatment of electrodes with next generation materials

Environmentally sustainable processing techniques applied to large scale electrode and cell component manufacturing for Li ion batteries(4/4)

Scope (continued 1)

HORIZON-CL5-2021-D2-01-04

- ✓ Process: scalable, safer, cheaper, cleaner, less energy consuming
- ✓ "Design to Manufacture": to reduce production cost and increase battery performance (increased efficiency and better cycle life)
- ✓ Manufacturing tech development, up to **pilot-level** proof of concept
- ✓ Address **digitalization** for the larger production lines
- ✓ Propose innovative tech solutions and/or standardized approaches to ensure workers and users **safety** (**handling new materials** during processing e.g. nano-materials)
- ✓ Proposed for Li-ion up to generation 3

- ✗ Activities related to specific industrial machinery development are **beyond the scope** of this topic

Manufacturing technology development for solid-state batteries (SSB, Generations 4a - 4b batteries) (1/4)

HORIZON-CL5-2021-D2-01-05

RIA; TRL5-6; 6-7M€; 4? projects to be funded

Relevance: European Partnership 'Towards a competitive European industrial battery value chain for stationary applications and e-mobility'; HORIZON-CL5-2021-D2-01-03

Outcome

- **Europe** at the industrial production **lead** for next generation, SSB technologies all through the value chain
- Generation of an **indigenous** technological knowledge portfolio of industrially **scalable** manufacturing solutions for different approaches to SSB (including: electrolytes, anodes –either carbon or Li(m) based - &composites cathodes)
- Contribute to **climate neutral transport** via breakthrough technology in SSB
- Enable cost effective, **low carbon footprint** and low-emission mass production of Gen4 technology in **Europe**

Manufacturing technology development for solid-state batteries (SSB, Generations 4a - 4b batteries) (2/4)

HORIZON-CL5-2021-D2-01-05

Scope

- ✓ Increase **energy densities**; Overcome **safety issues** risen by the utilisation of liquid organic electrolyte, becoming more critical with increased cell voltage and fast-charging rates
- ✓ Development of innovative **scalable** manufacturing technologies based on of new solid electrolytes
- ✓ Combined with metallic lithium at the anode
- ✓ Solid-state electrolytes enable **overcoming** battery cells **limitations in terms of voltage and safety** (reducing dendrites formation risk) leading to and increased intrinsic **thermal and electrochemical stability**

Manufacturing technology development for solid-state batteries (SSB, Generations 4a - 4b batteries)(3/4)

HORIZON-CL5-2021-D2-01-05

Scope (continued 1)

- ✓ To develop appropriate processing techniques for **assemble cells** based on solid type electrolytes (polymer-based, hybrid polymeric, inorganic, gel-like semisolid electrolytes, etc.)
- ✓ To tackle: processing, handling & integration of lithium metal anodes into cells (attention to solid-solid interfaces & protection layers (**Gen.4b**)
- ✓ Alternatively: advanced Si/C composite-based anodes (**Gen.3b**); covering manufacturing approach and interface requirements towards solid state electrolytes
- ✓ To develop processing techniques, optimised, adapted or reinvented for preparing dense electrode and electrolyte layers, to enable scale up of SSB cells (Gen.4a and Gen.4b) towards **GWh mass production**

Manufacturing technology development for solid-state batteries (SSB, Generations 4a - 4b batteries) (4/4)

HORIZON-CL5-2021-D2-01-05

Scope (continued 2)

- ✓ Cathodic electrodes making use of advanced materials (e.g. high Ni content oxides) combined with electrolyte material may pose specific manufacturing challenges
- ✓ New manufacturing techniques should focus on: **cost, performance, safety and sustainability**; cost-competitive large-scale manufacturing and uptake by the **electro mobility sector**
- ✓ Address **digitalization** for the larger production lines
- ✓ Manufacturing tech development, up to **pilot-level** proof of concept
- ✓ Manufacturing and cell assembly processes: more **sustainable** compared
- ✓ Cost reduction and improvement in other parameters: **comparison** with baseline manufacturing techniques
- ✗ Activities related to specific industrial machinery development are **beyond the scope** of this topic

Sustainable, safe and efficient recycling processes (1/4)

HORIZON-CL5-2021-D2-01-06

RIA; TRL5-6; 9-10M€; 3 projects to be funded

Relevance: European Partnership 'Towards a competitive European industrial battery value chain for stationary applications and e-mobility'; Cooperation: HORIZON-CL5-2021-D2-01-01, HORIZON-CL5-2022-D2-01-01, HORIZON-CL5-2021-D5-01-04

Outcome

- Improved access to battery materials & strengthened European raw material **independency** (**circularity** of material flows and use of the **secondary raw materials** in new batteries **produced in Europe**)
- Increased European **competitiveness** (sustainable, safe, energy efficient and low carbon footprint battery recycling technologies and upscaleable solutions)
- Reduced recycling **cost** & **environmental impacts** - very high efficiency recycling
- Improved health and safety aspects of recycling
- Prepared to meet the new regulatory targets for the recycling

Sustainable, safe & efficient recycling processes (2/4)

HORIZON-CL5-2021-D2-01-06

Scope

- ✓ To create innovative **feasible and holistic recycling processes in Europe** (effectively exploit the vast amounts of EV and stationary battery waste & the amounts of scrap from large manufacturing)
- ✓ To develop new recycling processes: more **flexible and adaptive**; meet a **wide variety** of battery waste or production scrap
- ✓ (Desirable) To implement intelligent process design through **integrating** selected fractions into existing industrial infrastructure, or other **innovative integration** of fractions or processes.
- ✓ The recycling processes may partially utilise **existing metallurgical infrastructure** to support feasible processing and support industrial transition towards green technologies

Sustainable, safe and efficient recycling processes (3/4)

Scope (continued 1) HORIZON-CL5-2021-D2-01-06

- ✓ Aim at **recovering** the highest amount of resources (e.g. metals, graphite, fluorinated compounds and polymers, active materials) present **within secondary raw materials** (from spent Li-batteries); focus on the reuse of these materials in batteries
- ✓ Low-value chemicals from manufacturing processes to be returned to **high-value and necessary inputs** for the battery manufacturing industry
- ✓ Focus: on developing materials recycling routes which **target next-generation battery** cathode and anode materials
- ✓ To improve: **Vertical integration** to component/cell manufacturing
- ✓ Proposals to aim at the **outmost recovery rates** and recovered material **purity** (integration in the loop of cell manufacturing, in line with the Partnership Strategic Research Agenda (SRA)

Sustainable, safe and efficient recycling processes (4/4)

Scope (continued 2)

HORIZON-CL5-2021-D2-01-06

- ✓ **Maximised** recovery/re-use/re-purposing/reconditioning of battery materials/electrodes/components; **Minimised** recycling discharge
- ✓ To develop **new unit processes**, or **innovative combinations** of optimised unit processes (including: mechanical pre-processing, leaching, precipitation, solvent extraction, ion exchange, centrifuging, crystallisation, electrowinning, roasting, smelting, pyrolysis, shock wave disruption, direct reuse of materials and components, etc.)
- ✓ Proposals are expected to identify and address **health risks, environmental impacts, safety hazards and new safety practices** related to developed processes.
- ✓ The environmental impacts and benefits are to be quantified through **life cycle thinking** approach

This project is co-financed by the European Union and the Republic of Turkey
Bu proje Avrupa Birliği ve Türkiye Cumhuriyeti tarafından finanse edilmektedir

Support for establishment of R&I ecosystem, … for accelerated disruptive technology exploration &uptake (1/4)

HORIZON-CL5-2021-D2-01-07

CSA; 3M€; 1 project to be funded

Relevance: European, national, regional – HEU Partnerships, IPCEIs, Interregional partnership on advanced battery materials, European Battery Alliance and coordination actions including BATTERY 2030+, LiPLANET; European Partnership on ‘Towards a competitive European industrial battery value chain for stationary applications and e-mobility’

Outcome

Developing strategic forward-looking orientations to ensure future **skills development, knowledge and technological leadership** for accelerated disruptive technology exploration and uptake

Pan-European cooperation on research and innovation

Support for establishment of R&I ecosystem, … for accelerated disruptive technology exploration & uptake (2/4)

HORIZON-CL5-2021-D2-01-07

Outcome (continued)

- Consolidated Battery R&I community across the **EU and associated countries** and across networks, projects and initiatives (3rd country participants **NOT** foreseen)
- Facilitated access to information for all; European "one-stop shop" on Battery R&I info (programmes, events, projects & networks)
- **Reduced time to market** of technologies and improved European **competitiveness** through research-industry collaborations, information sharing and expert group work
- Synergies and research results **efficiently shared** along the whole value chain, thus mobilizing R&I efforts
- Attracted talent and competences
- Provided scientific evidence for policymakers

Support for establishment of R&I ecosystem, … for accelerated disruptive technology exploration &uptake (3/4)

HORIZON-CL5-2021-D2-01-07

Scope

- ✓ Develop, consolidate and communicate a **strategic research approach** for all stakeholders throughout the entire European Battery Value Chain
- ✓ Develop and/or update coherent **Strategic Research and Innovation agenda** (SRIA) & corresponding detailed roadmaps (battery value chain)
- ✓ Facilitate and support work of experts from a different field in a cross-collaboration manner (identify the challenges and opportunities; create guidelines and recommendations on how best to develop synergies)
- ✓ Establish and continuously update **KPI's** values for **current** state-of-the-art; correlated and communicated via SET Plan progress monitoring
- ✓ Establish **Target KPI's** values for **future battery R&I**; correlated and communicated via SET Plan progress monitoring and SRIA

Support for establishment of R&I ecosystem, … for accelerated disruptive technology exploration &uptake (4/4)

Scope (continued) HORIZON-CL5-2021-D2-01-07

- ✓ Implement and foster the adoption of uniform standards and methodologies for the reporting of battery research developments
- ✓ Execute a clear communication plan. Communicate results and progress in Battery R&I on both European and International level
- ✓ Cooperate with ETIPs & similar fora; provide support to SET Plan Implementation Plans; more interconnected activities (HORIZON-CL5-2021-D3-01-17)
- ✓ Promote & facilitate international collaborative actions, where necessary
- ✓ Perform additional activities relevant to reach expected outcomes
- ✓ Ensure high quality coordination and technical outputs (possess both technical and operative expertise)
- ✓ Project's governance is expected to provide involvement of EC services

LCA and design for sustainable circularity - holistic approach for zero-emission mobility solutions and related battery value chain (1/5)

HORIZON-CL5-2021-D5-01-04

CSA; 4M€; 1 project to be funded

Relevance: eLCAr project; "Circular Economy Perspectives for the Management of Batteries used in Electric Vehicles"; "Determining the environmental impacts of conventional and alternatively fuelled vehicles through LCA"; *BRIDGE; 'Towards zero emission road transport' (2ZERO); 'Towards a competitive European industrial battery value chain for stationary applications and e-mobility'*

Outcome

Coordinated activities on LCA & Life Cycle Inventory (LCI) at vehicle and cell levels

Unique and **shared approach with common methodologies** for both zero-emission vehicles and the battery value chain

LCA and design for sustainable circularity - holistic approach for zero-emission mobility solutions and related battery value chain (2/5)

HORIZON-CL5-2021-D5-01-04

Project results

- A consensus concept for a harmonised, robust, transparent and **real-data based LCA approach and tools** (extension to S-LCA), with an emphasis on **light-duty and heavy-duty zero-emission vehicles** (ZEV) and batteries
- New, holistic and applicable **quantitative tools** to drive an approach to the design of ZEV, their components and batteries
- Take into account **uptake of the Renewable Energy** both for manufacturing processes and for information to the end users
- A harmonised strategy for **sustainability by design**
- An **ontology** for a European **LCI DB** for zero emission vehicles & batteries
- Greater environmental sustainability and **lower TCO** (total cost of ownership)
- Standardization; legislation; awareness & acceptance

LCA and design for sustainable circularity - holistic approach for zero-emission mobility solutions and related battery value chain (3/5)

HORIZON-CL5-2021-D5-01-04

Scope

- ✓Screening, collecting and evaluating **existing LCA and S-LCA needs, methodologies, tools datasets and metrics**, to identify and overcome knowledge gaps (to identify development needs & impact reduction potential for ZEV and batteries)
- ✓Elaborate a **consensus LCA (and S-LCA) approach** specific for zero-emission solutions (emphasis on light-duty and heavy-duty ZEV and the related battery value chain); suitable for the full life-cycle (cradle-to-cradle); to assess and compare the impact of solutions in a holistic way, and reflecting the needs of a resource-efficient circular economy
- ✓Elaborate the **baseline for a Europe-wide, commonly accepted, road transport sector LCA approach and LCI database** for ZEV and the related battery value chain

LCA and design for sustainable circularity - holistic approach for zero-emission mobility solutions and related battery value chain (4/5)

HORIZON-CL5-2021-D5-01-04

Scope (continued 1)

- ✓ Taking into account existing and upcoming legislation, define access to the database
- ✓ Promote the uptake of Renewables in manufacturing processes and information on renewables to the end users. It is of **utmost importance** to involve all stakeholders, including the European Commission services, Member States/Associated Countries and standardisation bodies, to ensure the acceptance and succeeding implementation of the LCA approach and LCI database.
- ✓ **Conceptualise** the frontloading of a LCA & S-LCA for ZEV and the related battery value chain, ensuring compatibility & comparability with alternatives

LCA and design for sustainable circularity - holistic approach for zero-emission mobility solutions and related battery value chain (5/5)

HORIZON-CL5-2021-D5-01-04

Scope (continued 2)

✓ Definition of **use cases for ZEV and batteries**, representative of real-world conditions and the exemplary characterisation and calculation of impacts from zero-emission vehicle components

✓ Elaborate the potential and outline the transfer of the consensus LCA and S-LCA for other applications, such as fuel cells or stationary battery systems, or markets such as aerospace or maritime.

Contact:

Office Address

Turkey in Horizon 2020 Project

And Sokak 8/12 Akasya Apt. 06680 Çankaya/Ankara

06520 Çankaya/Ankara,Turkey

Tel: +90 312 467 61 40

http://www.turkeyinh2020.eu/

info@TurkeyinH2020.eu

REPUBLIC OF TURKEY
MINISTRY OF INDUSTRY
AND TECHNOLOGY

TÜBİTAK