

EUROBAT 

ASSOCIATION OF EUROPEAN AUTOMOTIVE
AND INDUSTRIAL BATTERY MANUFACTURERS

EUROBAT Battery Innovation Roadmap Event

Join us on the 11th December 2024
14h00 - 15h00 - Online



www.eurobat.org



eurobat@eurobat.org

Event Programme

Time	Session	Speaker
2:00 - 2:05 PM	Opening	Simona Romeo, EUROBAT Senior, Communication Manager
2:05 - 2:10 PM	Introduction - Overview of event objectives & Importance of Battery Innovation	Erwin Marckx, EUROBAT Technical Affairs Manager
2:10 - 2:25 PM	Session 1 - Battery market evolution & innovation trends to support the green transition	Dr. Bernhard Riegel, Director Research & Development HOPPECKE
2:25 - 2:40 PM	Session 2 - Supporting EU multi-goals on circularity, energy security and strategic autonomy	Dr. Georg Meckl, Vice President Research & Management Systems EXIDE Technologies
2:40 - 2:55 PM	Q&A (Audience to submit questions)	
2:55 - 3:00 PM	Wrap-up and Conclusion	



Simona Romeo, EUROBAT
Senior Communication Manager



Erwin Marckx, EUROBAT
Technical Affairs & Innovation Manager



Dr. Bernhard Riegel
EUROBAT Task Force Innovation leader
Director Research & Development at
HOPPECKE



Dr. Georg Meckl
VP Research & Management Systems
EXIDE TECHNOLOGIES



EUROBAT 

ASSOCIATION OF EUROPEAN AUTOMOTIVE
AND INDUSTRIAL BATTERY MANUFACTURERS



WHO WE ARE

The leading association for European automotive and industrial battery manufacturers across all battery technologies



WHAT WE DO

We support and facilitate the business of our associates.

What
EUROBAT
is about

HOW WE DO IT



We work with policy and industrial stakeholders to promote the regulatory, commercial and economic interests of the European automotive, industrial and special battery industry.

What you gain as EUROBAT member

- **Advocacy power:** representing your interests at the European level.
- **Policy influence:** shaping regulations that affect the battery industry
- **Networking opportunities:** access to a community of industry leaders.
- **Market insights:** exclusive data, trends, and reports for informed decision-making.



Three types of membership:



- **Regular members – Battery and Cell producers**
- **Associate members – supply industry**
- **System integrators – Battery end-user applications**

Opening – Simona Romeo, EUROBAT Senior Communication Manager

What you gain as a member of the **EUROBAT Innovation TF**

1. Take advantage of getting permanent information on latest regulation in relation to the battery industry
2. Highlights on pressing issues upcoming from Standardization activities under IEC, ISO and CEN/Cenelec and the implementation of the battery mandate M/579 in particular
3. Early information on EC funding opportunities with regards to the Horizon Europe work programme and Innovation funds for batteries.
4. Opportunities to network amongst other organisers, suppliers and system integrators across the battery value chain

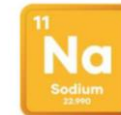
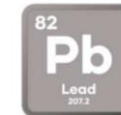


WP Introduction: Overview event objectives & Importance of battery innovation

What?

- Most recent technological innovations and re-assess market evolution with outlook up to 2035

- » Technological review of the four mainstream battery technologies
- » Identification and review of the most promising future battery technologies
- » Sustainability, circularity, and digitalization aspects from the Battery Regulation 2023/1542
- » Evolution of further electrification in end-user battery-operated applications



Main document - addressing Policy Makers

- Blueprint released at the EUROBAT Forum in June 2024

Technical Annex - addressing research communities and industry partners in the value chain

- Released end-Augustus 2024

WP Introduction: Overview event objectives & Importance of battery innovation

Why this update?

1. Compliments the [EUROBAT Election Manifesto Feb 2024](#) with factual information
2. Takes into account new EU policy initiatives shaping R&D needs
 - **RePowerEU**, new **Electricity market Design** and **Clean-Tech Innovation Funds** ► boosting battery demands
 - **Implementing of the New Battery Regulation ongoing** ► addressing new challenges related to sustainability, circularity and digitalization (Battery Passport)
 - **Net-zero Industrial Act (NZIA)** and **upcoming Innovation Funds** ► upscaling domestic battery manufacturing capacities
 - **Critical Raw Material Act (CRMA)** ► addressing new challenges securing the supply chains, making Europe's economic more resilient

WP Introduction: Overview event objectives & Importance of battery innovation

Importance of Battery Innovation

1. EU Battery Manufacturing Industry committed & has a central role to achieving the EU's multi-goals transition
2. New R&D needs necessary to achieve the EU's multi-goals
3. Need for dialogue and cooperation among all stakeholders to increase investments in innovation and scaling up battery production.

Session 1: Battery market evolution & Innovation Trends to support the green transition – by Dr. Bernhard Riegel, Director R&D HOPPECKE

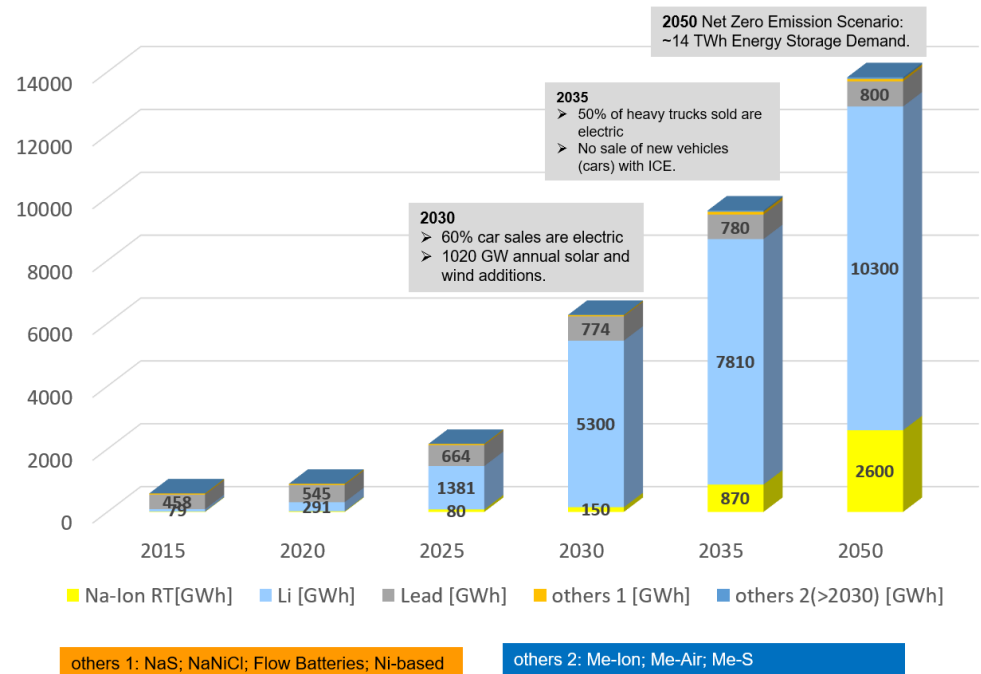
Session 2: Supporting EU goals on circularity, energy security and strategic autonomy - By Dr. Georg Meckl, VP Research & Management Systems EXIDE



Session 1: Battery Market Evolution & Innovation trends, Dr. Bernhard Riegel / HOPPECKE

Global level playing field

Global battery market evolution across technologies until 2050



By 2050 Net Zero Emission Scenario: expect Total Storage Demand to reach 14 TWh

- Lead: stable at 800 GWh with resilient raw material supply chain & full established circular economy
- Lithium: ramp up to 10,300 GWh, mainly due to BEV & BESS increase sales
- Na-ion RT: Market uptake to 2,600 GWh, competing with Li and Pb in certain applications



Session 1: Battery Market Evolution & Innovation trends, Dr. Bernhard Riegel / HOPPECKE

Technologies considered in the roadmap

Besides the 4 Mainstream technologies



Identification of most promising future technologies, based on sustainability aspects (reducing carbon footprint etc...) and Technology Readiness Level (TRL). Not all are on the same level of maturity:

- Advance Lead-based battery technologies
- Sodium-ion Room Temperature battery technologies
- Post Li-ion battery technologies (Li-ASSB Gen 4b & 4c, Li-Sulfur, Li-Air (Gen 5))
- Redox flow battery systems



Session 1: Battery Market Evolution & Innovation trends, Dr. Bernhard Riegel / HOPPECKE

Drivers for battery innovation: End-user market demand and policy support to further electrify all sectors

R&D area - Motive power material handling and logistics

- ▶ Different vehicle categories and wide variety of forklift types with distinct applications

R&D area - Motive power off-road transportation applications

- ▶ Off-road multi-purpose industrial vehicles
- ▶ Motive power batteries in railway applications
- ▶ Motive power batteries in marine applications
- ▶ Motive power batteries in aviation applications

R&D area - Stationary Energy Storage applications

- ▶ Uninterrupted Power Supply (UPS Batteries)
- ▶ Telecommunication Power Supply (TLC Batteries)
- ▶ Residential & Commercial Storage behind the meter (BTM Batteries)
- ▶ Utility Grid-scale Storage in front of the meter (FTM Batteries)
- ▶ Stationary – Off-grid applications

R&D area - Automotive mobility applications

- ▶ 12V Auxiliary Batteries
- ▶ 12V Start-Lighting-Ignition Batteries (SLI batteries)
- ▶ Heavy Commercial Stand-by Batteries (HCV Stand-by batteries)
- ▶ Mild and Full Hybrid Vehicle Batteries (HEV batteries)
- ▶ Battery Electric Vehicles (BEV batteries)



Session 1: Battery Market Evolution & Innovation trends, Dr. Bernhard Riegel / HOPPECKE

Drivers for battery innovation: R&D Area Motive Power

► Motive Power – Material handling and logisticals landscape by 2030

European market to increase with CAGR +5,1% (GWh), due to further replacement ICE-powered forklifts - total market estimated at 19 GWh -
Two dominant technologies each around half of the market

- Lead – fostering its position and continuation to serve the AM
- Lithium – double digit growth, replacement ICE
- Nickel – small but substantial for niches (freezers...)
- **Landscape in 2035:** Sodium-ion RT to play a certain role:



50%



50%



Niche

► Motive Power Off road Industrial Vehicles – Traction Battery landscape by 2030

Lead to remain dominant technology and lithium successfully entering the market, each may share half of the market

- Lead – remaining dominant
- Lithium – to replace larger ICE, ex. in construction/demolition
- Nickel – to serve niches for extreme environment
- **Landscape by 2035:** Sodium-ion RT to play a certain role:



50%



50%



Niche

► The EUROBAT WP covers also motive power batteries in railway, Marine and Aviation applications

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June 2024



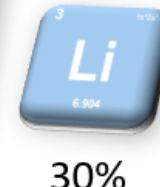
Session 1: Battery Market Evolution & Innovation trends, Dr. Bernhard Riegel / HOPPECKE

Drivers for battery innovation: Stationary Energy Storage UPS & TLC

► Stationary Energy Storage UPS Mainstream Battery Technology landscape by 2030

European market:

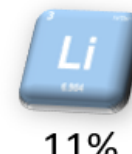
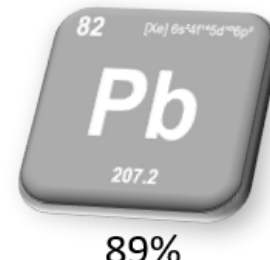
- Lead - dominant technology to maintain stable market (VRLA mainly)
- Li-ion - to take the growth of the market with LFP, LMP and NMC
- NiCd - with minor share to serve niches
- **By 2035:** Expected considerably growth of market, sodium-ion RT likely to take part in the market



► Stationary Energy Storage Telecom Mainstream Battery Technology landscape by 2030

European market:

- Lead - strongly dominant technology:
 - In reliable grid: VRLA with absorbent glass mat (AGM)
 - In poor or off-grid: VRLA with gelled electrolyte (GEL)
- Li-ion - entering the market with LFP and NMC
- NiCd - to serve niches
- **By 2035:** Sodium-Ion RT likely to take part in the market



Session 1: Battery Market Evolution & Innovation trends, Dr. Bernhard Riegel / HOPPECKE

Drivers for battery innovation: Stationary Energy Storage BTM & FTM

► Stationary: Residential & Commercial Battery Storage Behind-the-Meter by 2030

European market:

- Li-ion – dominant technology in Europe (but different picture outside Europe in regions with weak grids)
- Lead-based – should be kept in the loop, depending on further R&D results
- **By 2035:** Sodium-ion RT will also play a role in this market



99%

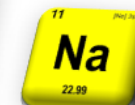
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World market: Pb Home storage well represented and increasing in lower-income countries with weak grids: India, China, Brazil, due to low TCO

► Utility grid-scale Energy Storage - Mainstream Battery Technology landscape by 2030

European market - multitude of grid functionalities suitable for batteries

- Mainly Li-ion technologies
- Sodium-based: Na-ion HT technologies
- Lead- and Nickel-based: for niches
- **By 2035:** Sodium-ion RT to maintain substantial share of the market



90%

< 10%

Niches

Niches

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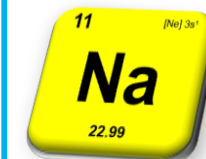
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Session 1: Battery Market Evolution & Innovation trends, Dr. Bernhard Riegel / HOPPECKE

Technology Trend - Concluding remarks

Through 2035, mainstream battery technologies will continue to undergo incremental improvements to meet evolving market requirements across numerous end-user applications:

State of the Art				
	Flooded & VRLA, Pb-C, Thin Plate Pure Lead	NCM, LFP, LMO, NCA, LCO (C; LTO; Si/C)	NiCd, NiMH	NaS, NaNiCl (Hightemp.)
> 2025	Embedded BMS & software	Semi Solid State		Na-Ion (RT Room Temperature)
> 2030		Li-Sulfur, All Solid State		Semi → Solid State All Solid State
> 2035		Li-Air		

- **Lithium-ion:** diversity of technologies provides a wide range of KPIs that can be improved upon
- **Lead-based:** branching into digital avenues: BMS, software, digital twins, something that was never done before and likely to generate new opportunities, also for the integration
- **Sodium-ion RT:** Offering a sustainable alternative, maturing faster with performance competing in specific markets, thanks to further R&D making it more competitive



Session 1: Battery Market Evolution & Innovation trends, Dr. Bernhard Riegel / HOPPECKE

Technology Trend - Concluding remarks

- Future most promising technologies identified are **not all at the same technology readiness level**. We consider **sodium-ion room temperatur** as ‘most promising’ in terms of earliest entry in the market
- **Li-ion and Lead-based batteries will remain the dominant technologies in the coming years**, considering the projected timeline for innovations to enter the market, upscaling of production capacities, as well as the market projections for different credible sources?
- With focus on **time horizon of 2035**, both **Lithium- and lead-based batteries will remain dominant technologies** in the European and worldwide markets. However, **Na-Ion Room temperature (RT)**, will take over substantial market share in specific markets



Session 2: Supporting EU's multi-goal objectives by Dr. George Meckl

Industry commitment

- The European Battery Manufacturing Industry, encompassing all mainstream technologies, is committed to
 - Aligning with the EU's carbon-neutral objectives and sustainability goals
 - Make EU resilient - by opening up technological evolutions in all battery technology
 - Strengthening Europe's competitiveness - while ensuring a global level playing field
 - Contribute to Europe's transition - to achieving a sustainable and circular economy
- This commitment entails
 - Increasing investments in innovation
 - Scaling battery production to fit future demand
 - Fulfilling stringent requirements related to performance, safety & circularity

Session 2: Supporting EU's multi-goal objectives by Dr. George Meckl

Drivers for Battery Innovation

Electrification in end-user applications: Example Automotive mobility

- Road transport sector is responsible for +20% of EU's CO2 emissions*, so a strong potential to contributing to the net-zero emission target
- Batteries are key enablers for increasing energy efficiency for all drive trains (Start/stop, mild, full HEV, plug)in HEV and BEVs.
- Apart from consumer pressure, legislation and incentives are also drivers, forcing changes in the vehicle technology, pushing to further electrify all vehicle architectures.

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Drivers for Battery Innovation

Electrification in end-user applications: Example Automotive mobility

- Current road transport tax incentives has strong focus on battery electric vehicles (BEVs)
- Also wide potential for the role of batteries to evolve further to increase the energy efficiency in different degrees of hybridization, from start/stop to mild, full and plug)in HEVs (xHEVs)
- The Worldwide Harmonized Light Duty Vehicles Test Procedure (WLTC), a shift to real driving data to assess fuel consumption and emissions from these vehicles, with the main challenge for automotive batteries to capture the car's kinetic energy

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Drivers for Battery Innovation

Electrification in end-user applications: Example Automotive mobility

5 distinctive end-user innovation areas, all contributing to Europe Green Deal Objectives

- ▶ 12V Auxiliary Batteries
- ▶ 12V Start-Lighting-Ignition Batteries (SLI batteries)
- ▶ Heavy Commercial Stand-by Batteries (HCV Stand-by batteries)
- ▶ Mild and Full Hybrid Vehicle Batteries (HEV batteries)
- ▶ Battery Electric Vehicles (BEV batteries)

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Drivers for Battery Innovation

Automotive mobility market trends

► 12 V Auxiliary Battery landscape - by 2030

European market estimated at 8 GWh

2 dominant technologies serving, each around half of the market

- Advanced lead, AGM & EFB further taken over from flooded
- Lithium-ion, LFP & LTO
- **By 2035:** Evolution of the technology shares depending on R&D progress on both technologies



50%

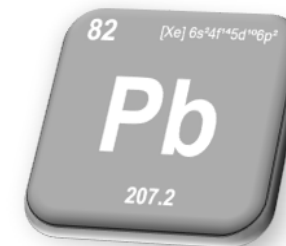


50%

► 12 V SLI Battery landscape - by 2030

European market estimated around 50GWh with 1 dominant technology serving the market. Stable market as impact due to ban of automotive IECs

- Lead-based, mainly AGM & EFB but flooded to remain a substantial share
- Lithium-ion to compete, but remain small penetration
- **By 2035:** Sodium-ion RT potentially to take 25% market share from Li



96%



4%

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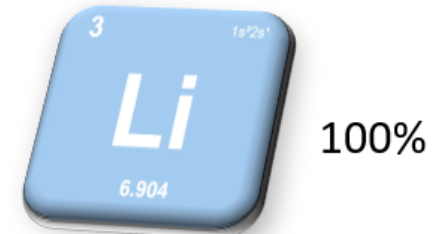
Drivers for Battery Innovation

Automotive mobility market trends

► Mild and Full Hybrid Electric traction Battery landscape by 2030

European market estimated around 7GWh with a dominant technology to remain in Europe

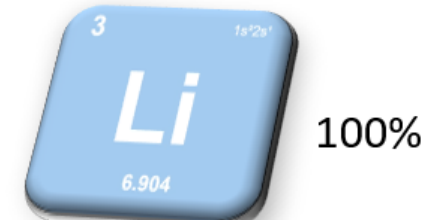
- Dominant lithium based: NMC mainly and LFP penetration after 2030
- Landscape by 2035: impact due to ban of automotive IECs in EU



► Battery Electric Vehicle (BEV & pHEV) Traction Battery landscape by 2030

European market estimated over 800 GWh

- Dominant lithium based, NMC & LFP-LMFP
- By 2035: we expect sodium-ion RT to play a certain role



* Large majority of the mild, full HEVs and EVs need 12V auxillary batteries

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Drivers for Battery Innovation

Sustainability and circularity as laid down in the Battery Regulation

- Not all mainstream technologies are at same level of maturity
- Industry recognizes the need for further innovation on all chemistries, R&D areas identified:
 - **The design:** reduce hazardous substances, increase energy throughput, increase recycling rates, repair, refurbish and re-use (2nd life)
 - **The production:** reduce carbon footprint by using energy from RES, less water, water treatment, increase use of recycled content
 - **Information provision:** Carbon footprint, recycled content declaration, minimum information requirement on performance and durability

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Drivers for Battery Innovation

Sustainability and circularity as laid down in the Battery Regulation

- R&D on recycling and recovery: high priority with the purpose to destress and create stable and diverse supply chains
- To strengthen EU's strategic autonomy, EU should continue to
 - Invest in innovation to **diversify the supply chain** for raw materials (all technologies)
 - Encourage domestic manufacturing facilities to **expand horizontal & vertical**
 - **Recognize key role of standards** to implement requirements from the BR (M/579)
 - While striving for autonomy, engaging in collaboration with international standard partners*

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Drivers for Battery Innovation

Digitalization and Implementation of the Battery Passport

R&D&I need for

- Collaboration across the entire management of the battery supply chain
- Integration with International standards and regulatory frameworks
- Further developing the BMS, hardware and software
- Developing blockchain or similar technologies to secure operability
- Define the level of the information to include and the access rights to attribute
- Greater transparency and integration with little IT infrastructure investment

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2035

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Session 2: Supporting EU's multi-goal objectives by Dr. George Meckl

Drivers for Battery Innovation

Digitalization and Implementation of the Battery Passport

Smooth implementation of the Battery Passport to

- Facilitate the circular economy by
 - Make recycling and recovering of materials more efficient
 - Allow smooth repurposing in less-demanding applications (2nd life)
- Help manufacturers to demonstrate compliance with the requirements by providing accessible, verifiable data and through standardization
- Enhance consumer confidence and business partners allowing to differentiate their products based on sustainable credentials.

EUROBAT
2035

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Session 2: Supporting EU's multi-goal objectives by Dr. George Meckl

Conclusions - Recommendations towards policy makers

- A. **Make Europe resilient** by opening-up technological evolutions in all battery technologies to maximize contributions EU's decarbonization objectives and strategic autonomy
- B. **Strengthening Europe's competitiveness**, while ensuring a global level playing field
- C. To contribute to Europe's transition to achieving a **sustainable and circular economy**

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Session 2: Supporting EU's multi-goal objectives by Dr. George Meckl

Conclusions - Recommendations towards policy makers

A. Make Europe resilient by opening up technological evolutions in all battery technologies

- **Boost financing innovation** in all mainstream electrochemical technologies to support the transition to a circular economy will make the EU industry more resilient and will contribute to Europe's strategic autonomy in battery materials.
- **R&D on high-TRL** promising technologies should also be further conducted, such as on sodium room temperature (Na-ion RT), which represents the most promising technology in the near future
- **R&D related to all technologies** to increase recycling, use of recycled content, or to reduce the use of critical substances, will support the objectives of EU's Critical Raw Materials Act (CRMA) in response to escalating demand for raw materials critical to Europe's economic stability



Session 2: Supporting EU's multi-goal objectives by Dr. George Meckl

Conclusions - Recommendations towards policy makers

B. Strengthening Europe's competitiveness, while ensuring a global level playing field:

- Ensure a **level playing field** for all battery technologies, recognizing their complementary nature and essential role in transforming the EU into a resource-efficient and competitive economy
- The **Net-Zero Industrial Act (NZIA)**, supporting the domestic battery manufacturing industry and deployment of markets in Europe, should be pursued to ensure its success
- Building on the **existing European domestic manufacturing capacities** and their expertise will accelerate the transition as it will bring academic innovation faster to the production lines to successfully scale up

Session 2: Supporting EU's multi-goal objectives by Dr. George Meckl

Conclusions - Recommendations towards policy makers

C. To contribute to Europe's transition to achieving a sustainable and circular economy

- Not all mainstream technologies are at the same level of maturity. Each technology will **need different R&D efforts** to make progress on different aspects of the circular economy's key sustainability performance indicators.
- **The four pillars of the Green Deal Industrial Plan**—(1) simplifying permitting, (2) enhancing skills, (3) facilitating open and fair trade, and (4) grants and loans—should be pursued to target the entire battery manufacturing industry value chain.
- Europe should facilitate the further **build-up of local production capacity of batteries**, to be produced with less hazardous substances and with the lowest carbon footprint



Q&A Session

The chat is now open – we are taking your questions



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EUROBAT
2035

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Session 2: Supporting EU's multi-goal objectives by Dr. George Meckl

Wrap up and concluding remarks

Market Evolution

- Delay in the market uptake, particularly the BEV market is uncertain. However, Industry is committed and at the end we will have to reach the 14 TWh by 2050 to meet the EC's zero-emission targets

Technology Trends

- New R&D needs necessary to achieve the EU's multi-goals will be needed.
- All mainstream battery technologies need additional funding to undergo improvements to meet evolving market requirements across numerous end-user applications

Remarks / recommendations towards policy makers

- Make Europe resilient by opening-up technological evolutions in all battery technologies
- Strengthening Europe's competitiveness, while ensuring a global level playing field
- Need for dialogue and cooperation across the entire value chain to increase investments in innovation and scaling up production.

Battery Innovation Roadmap 2035

Battery Innovation
Roadmap 2035



Batteries Transport

Charge the Future

Lead Battery 360°

FREE4LIB

WP Batteries Innovation Roadmap 3.0 Presentation event

Wrap up and concluding remarks

- The **WP Battery Innovation Roadmap and its Technical Annex** can be downloaded from the EUROBAT website [here](#)
- The recording of the Event will be made available on the website soon