



CONSORTIUM FOR
BATTERY
INN⊕VATION⊖

Future opportunities for lead batteries

Pb2023
June 2023

Presented by:

Dr Alistair Davidson, Director, Consortium for Battery Innovation



**INCREASE SPEED OF
RESEARCH**



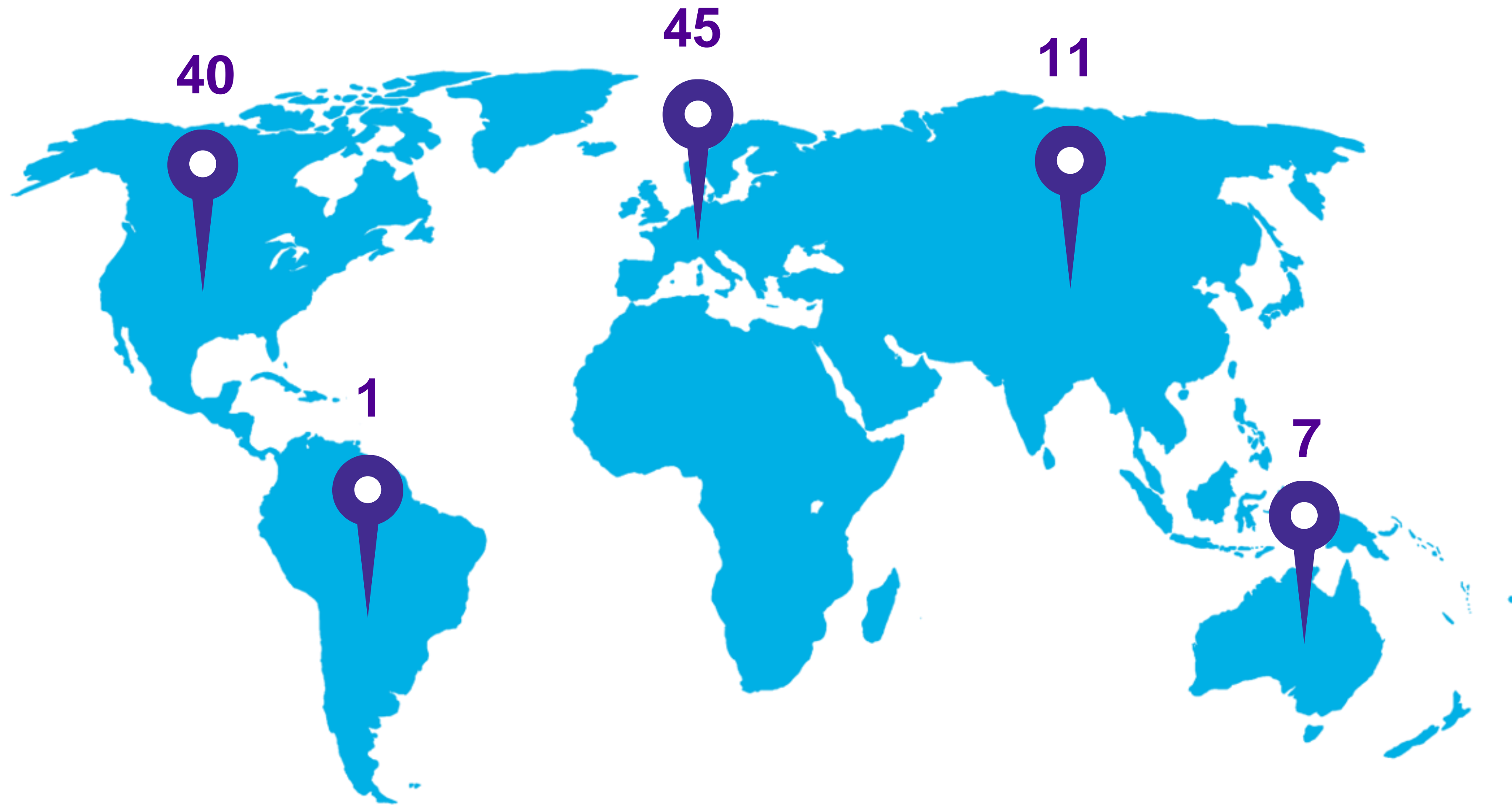
**INCREASE GOVERNMENT
FUNDING**



**PROMOTE LEAD BATTERY
FUTURE OPPORTUNITIES**



Map of Members and Partners



CBI member representation



- Battery manufacturers
- Industry suppliers
- Research & testing institutes, universities, end users
- Lead producers



CBI Members

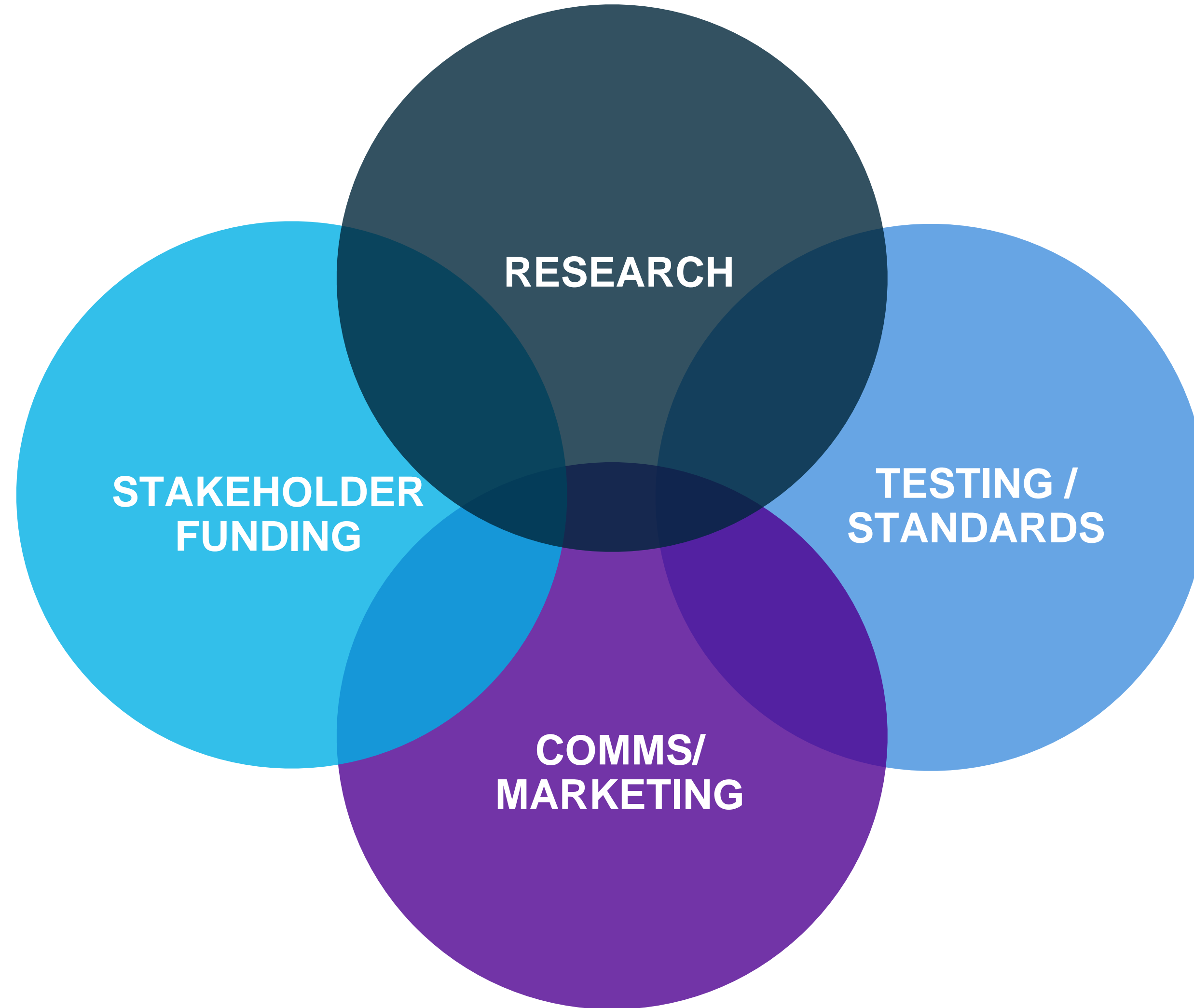


CBI Partners





CBI areas of work





01.

Technical Program

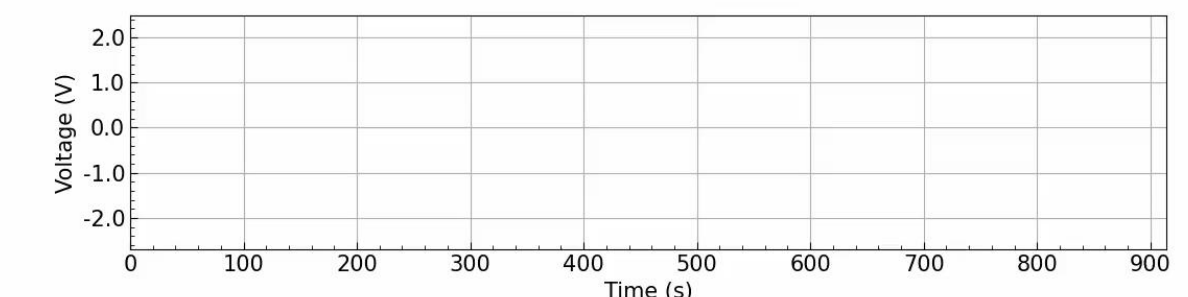
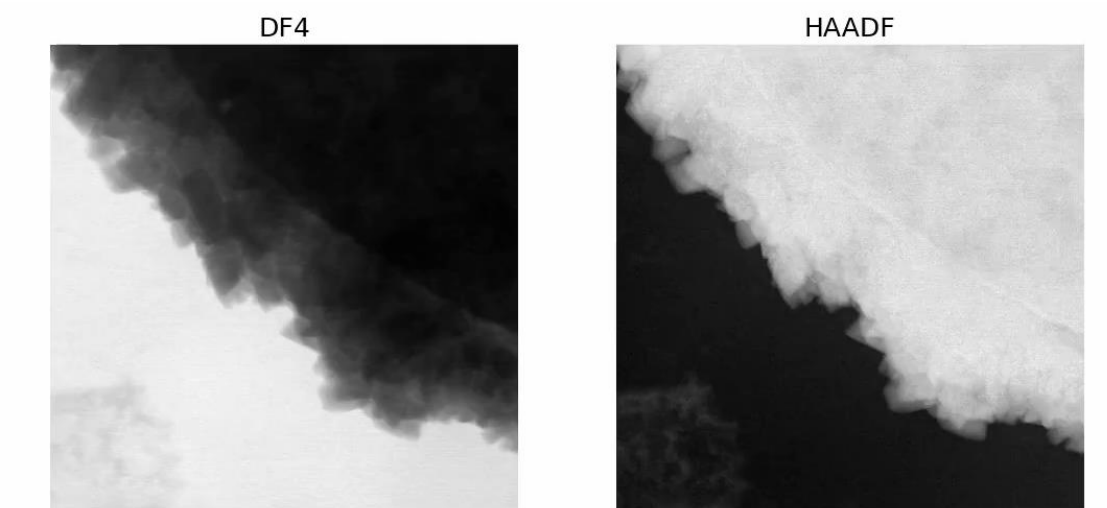
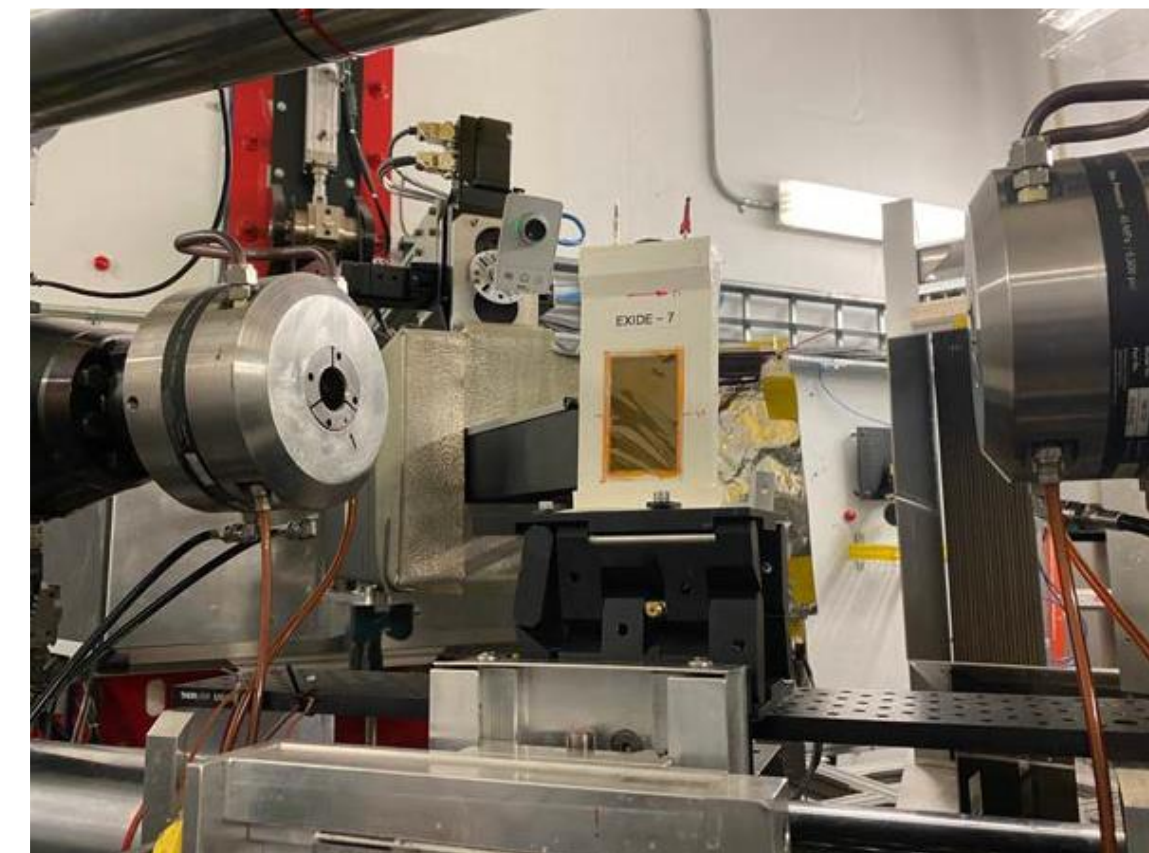
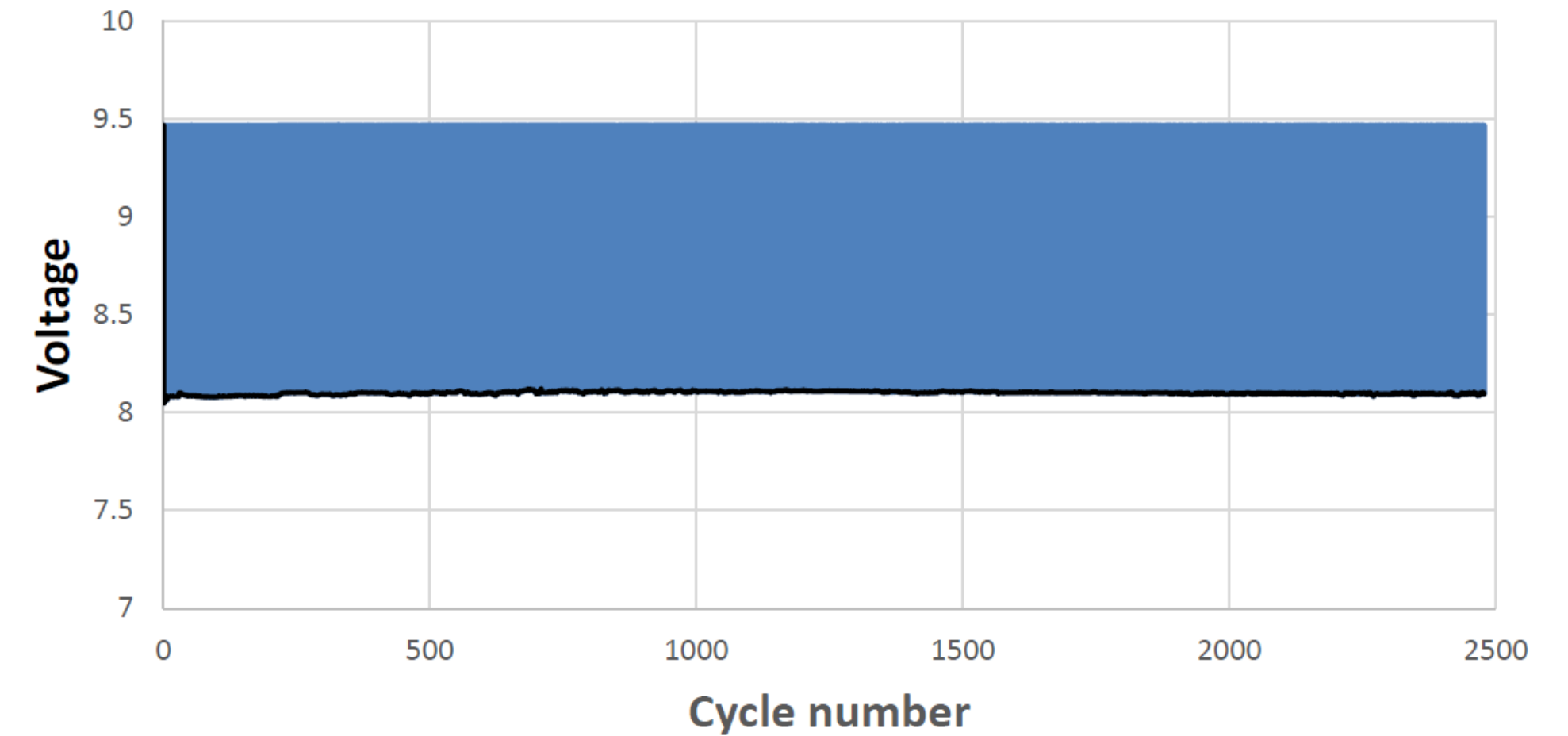
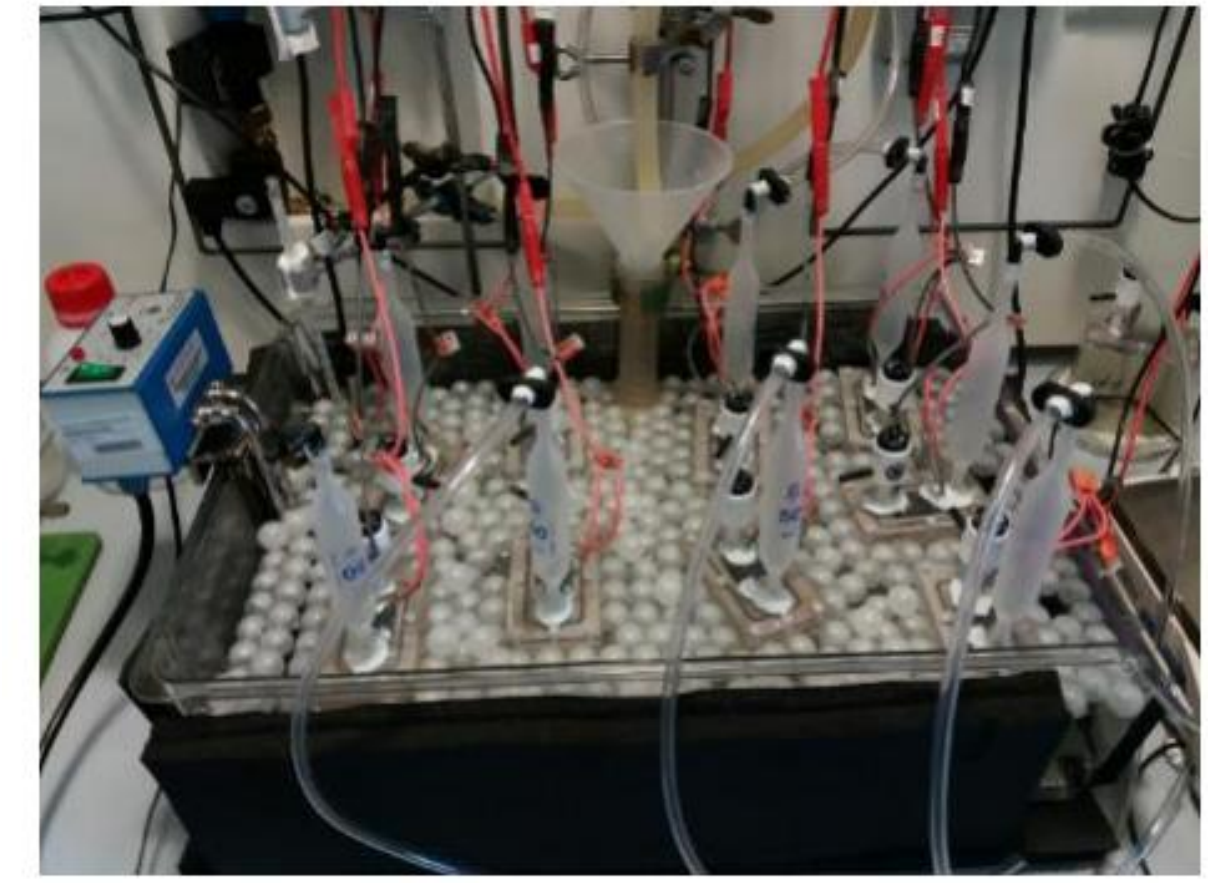
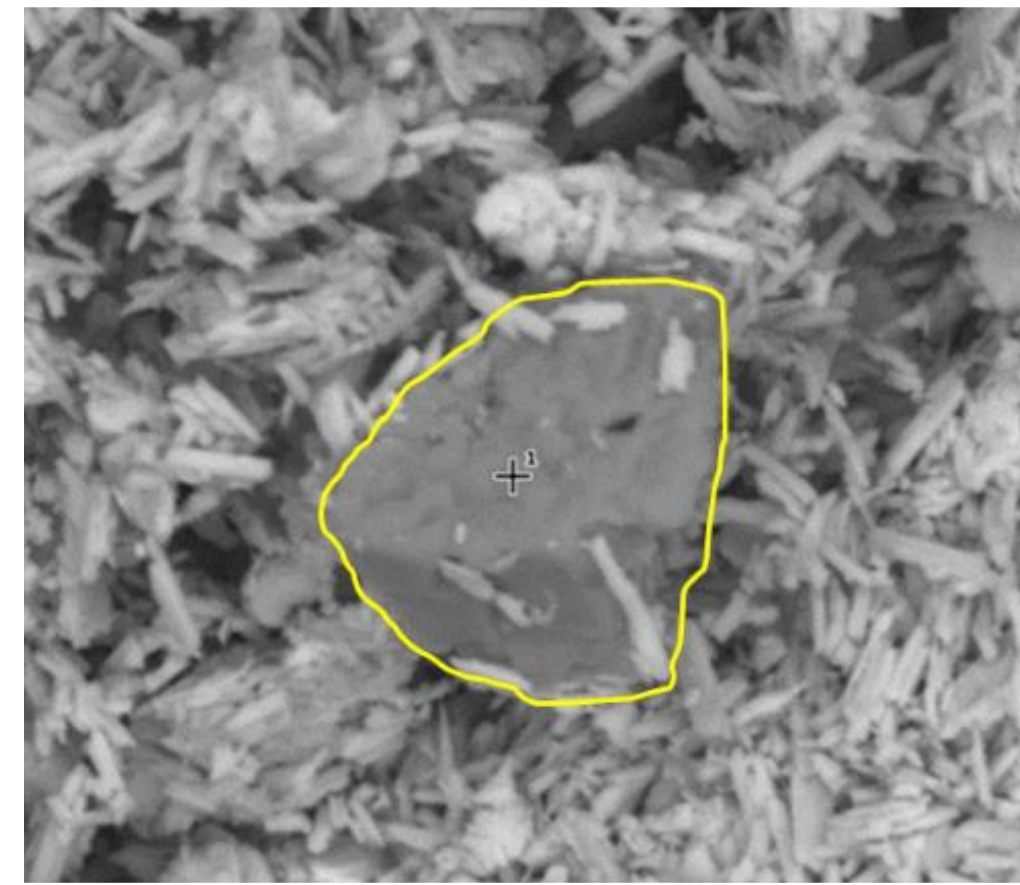


**LEAD BATTERIES
CONSTANTLY INNOVATING**



CBI Technical Program

- **CBI with its membership sets specific goals and targets for lead battery research**
 - CBI Technical Roadmap
- **Projects that the membership believe are most likely to deliver on the research goals are funded by CBI**
 - Typically projects are with Universities, Members and Research Institutes
- **The results of these projects are then shared with the membership**
 - Significant advantage compared to companies not in membership





CBI's 2021 Technical Roadmap



Technical Roadmap

Research and innovation pathways for next-generation advanced lead batteries

September 2021



5

Advanced Lead Battery Research and Innovation

“Demand for high-performing and sustainable batteries is driving research and development across the globe.”

3

Advanced Lead Battery Research and Innovation

Foreword

A Golden Age for Battery Research

As global warming continues to have a dramatic impact on the world's climate, the imperative for decarbonization is greater than ever.

Battery energy storage is a key pillar in the move to electrification and supporting innovation and performance improvements is the highest priority. Soaring demand for battery technologies across all applications has ushered in something of a golden age for batteries. From clean energy storage to hybrid and electric vehicles, demand for high-performing and sustainable batteries is driving research and development across the globe.

Analysts predict a spike in demand for a range of battery technologies, each of which display different strengths and are designed to support a range of applications. Combining pioneering research with the latest market insights, the Consortium for Battery Innovation is leading the way by ensuring advanced lead

batteries continue on their innovation journey supporting ambitious climate goals set out by policy makers.

Building on the Technical Roadmap launched in 2019, the new and updated roadmap reflects the performance improvements achieved to date and sets out new goals designed to tap the unlimited potential of advanced lead battery technology. With continued performance improvement and technological advances, the opportunities for the global lead battery industry to provide cost-effective and reliable energy storage solutions remain very positive.

Economies need batteries and lots of them. It is clear through intensive market-driven analysis that end-users across the automotive, energy storage, industrial and motive power sectors want greater performance from all battery technologies.



CBI 2021 Technical Roadmap



Automotive

(start-stop/micro-hybrid)

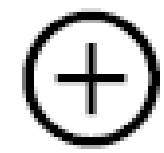
Ensure that recent improvements in Dynamic Charge Acceptance (DCA) are maintained, whilst improving high-temperature performance and ensuring no trade-offs in key parameters such as Cold Crank Amps (CCA) and water loss.



Automotive

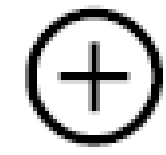
(low-voltage EV)

Improve DCA and charge acceptance, whilst increasing charging efficiency and lifetime.



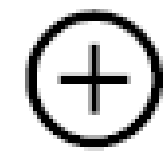
Energy Storage Systems

Improving cycle life, calendar life and round-trip efficiency whilst reducing acquisition and operating costs.



Industrial applications

Improving cycle and calendar life, whilst reducing battery costs.



Motive Power

Lowering TCO by increasing cycle life, recharge time, and producing maintenance-free batteries.



Other applications

(including e-bikes)

Improving gravimetric energy density, recharge capability and service life.

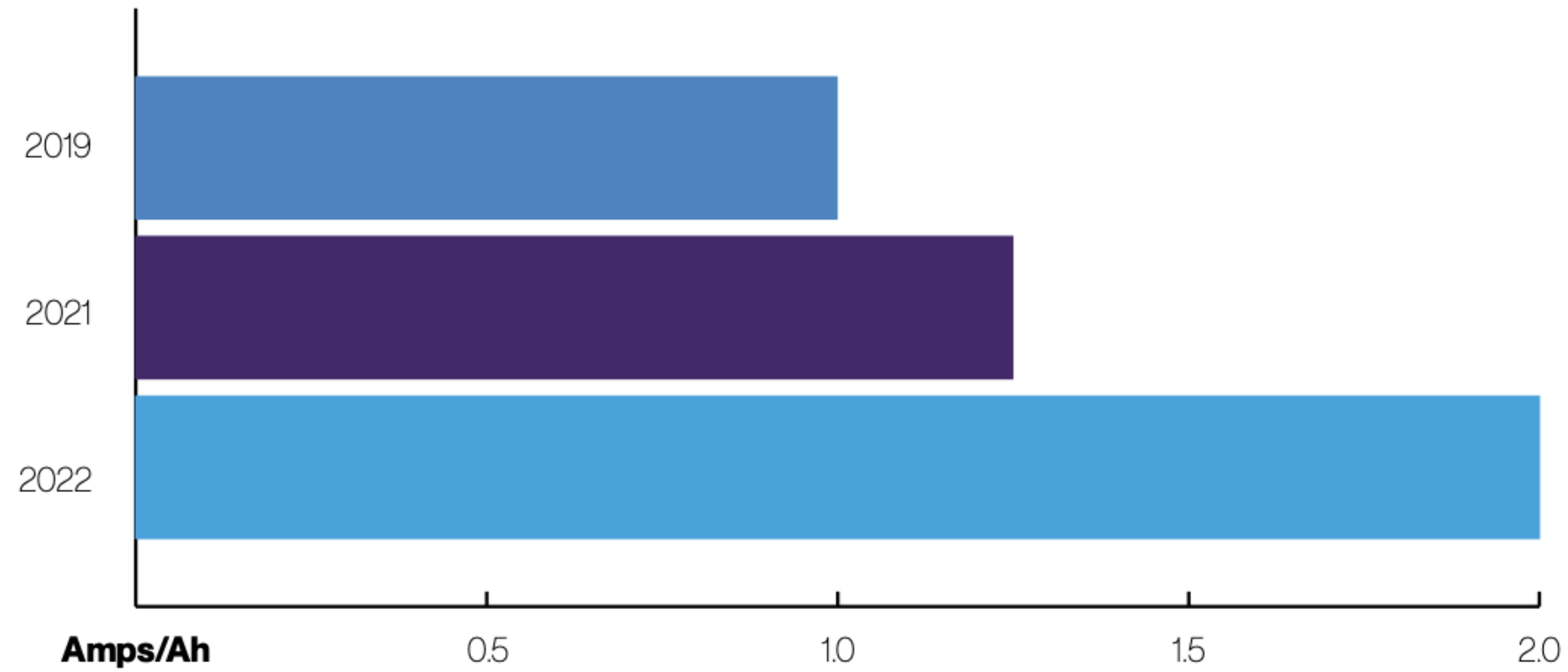




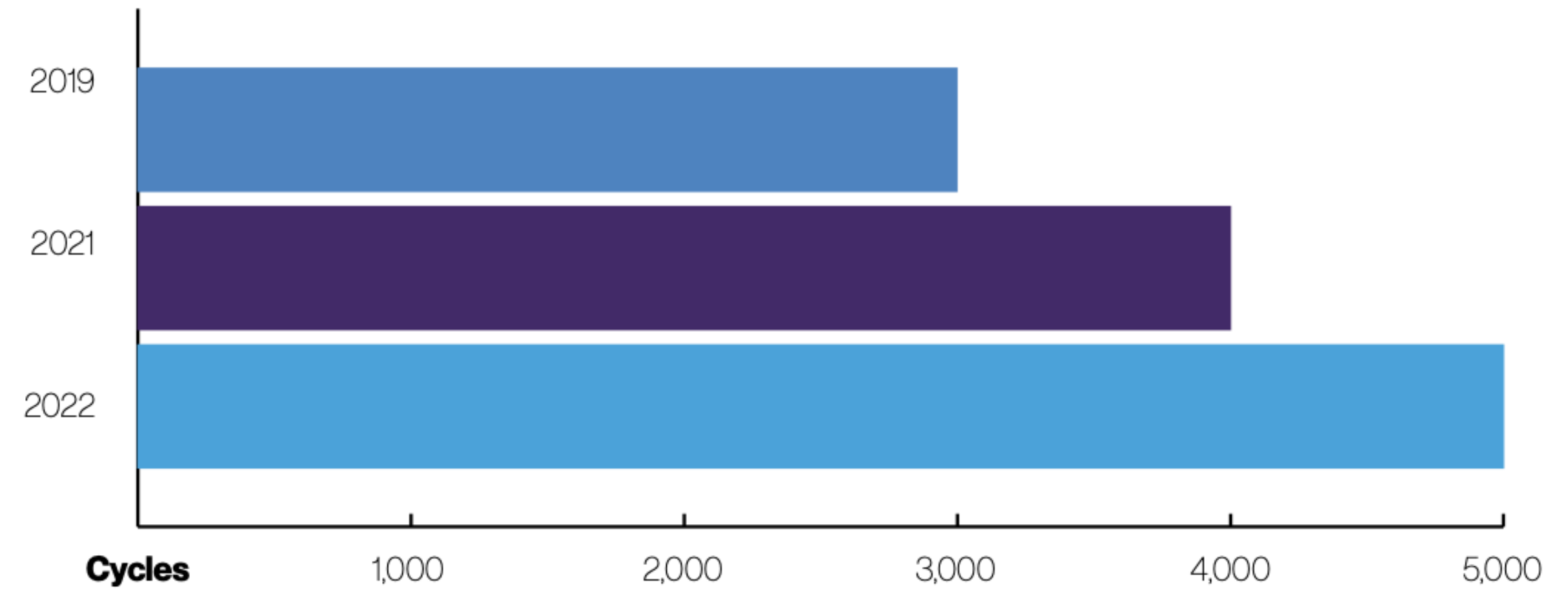
Progress since last CBI's 2019 Technical Roadmap



Auto
Dynamic Charge Acceptance



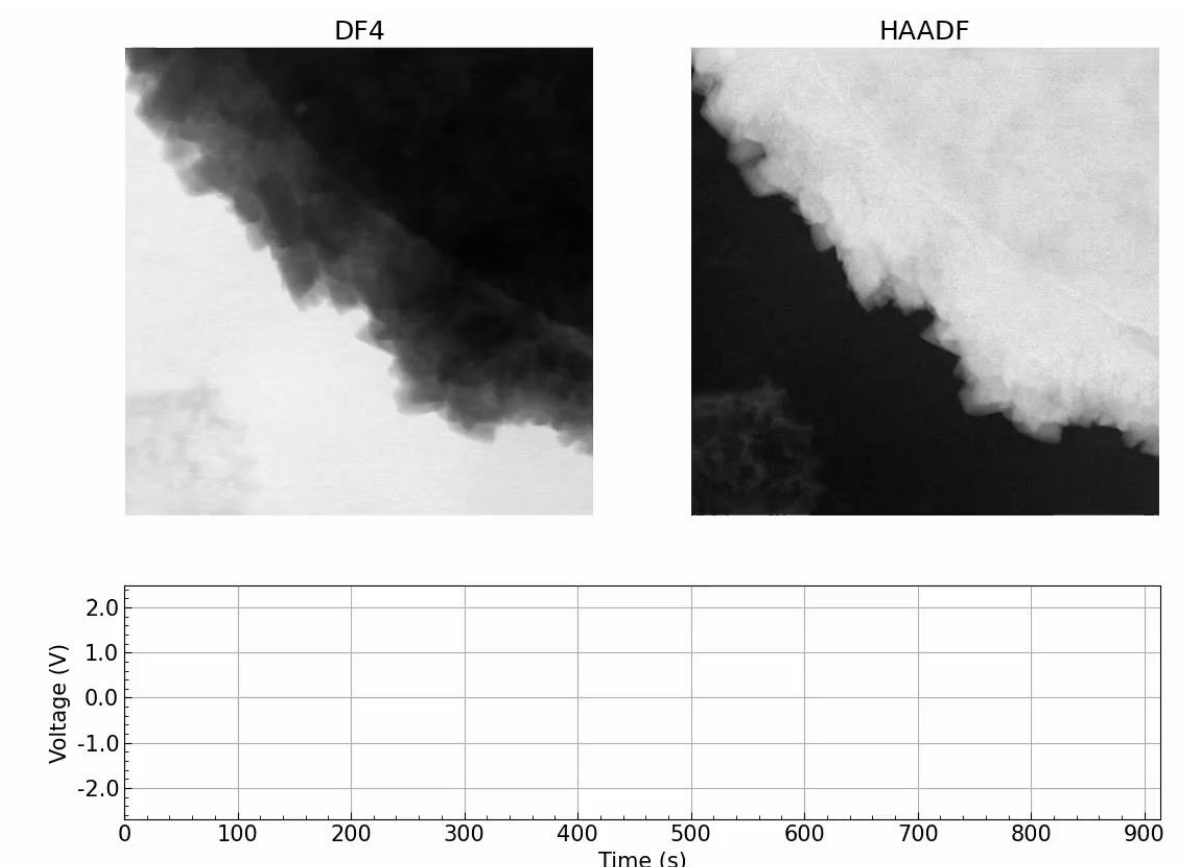
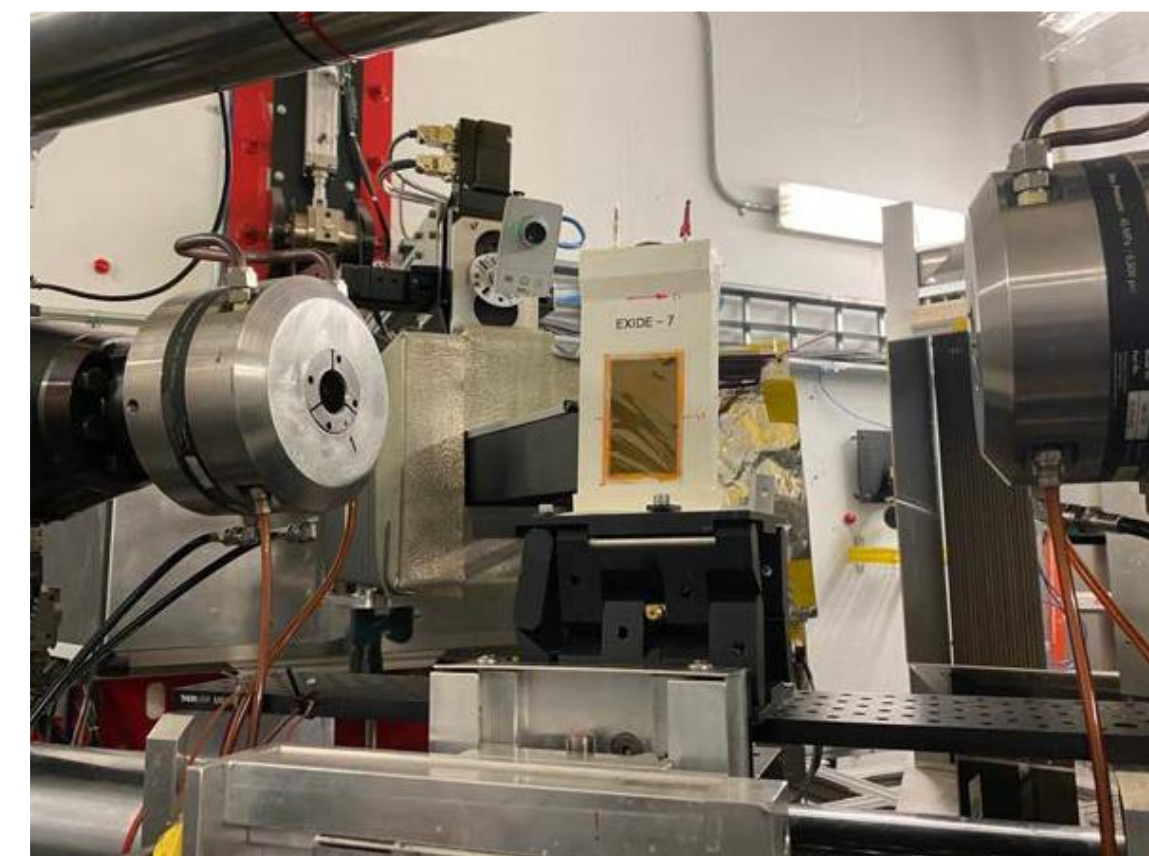
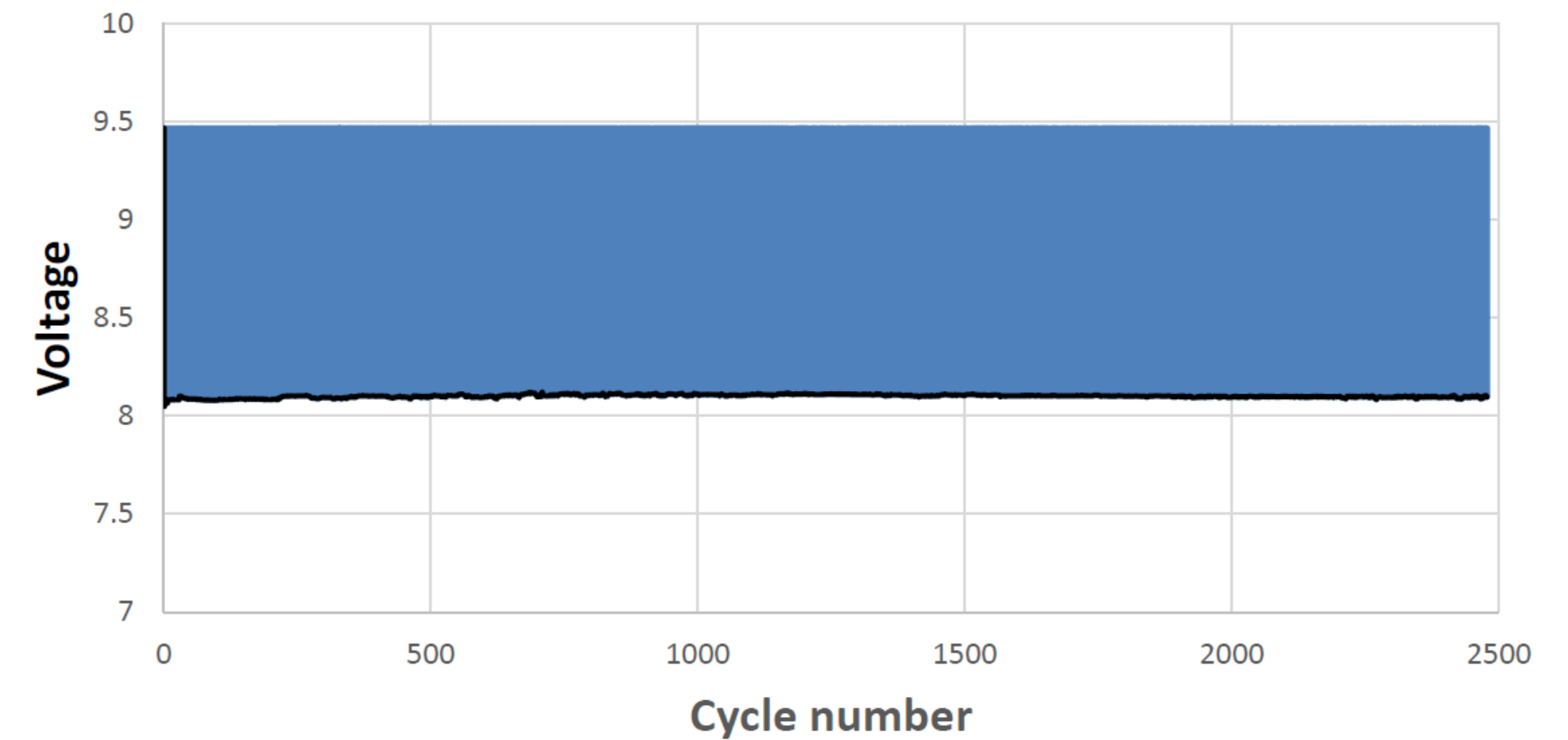
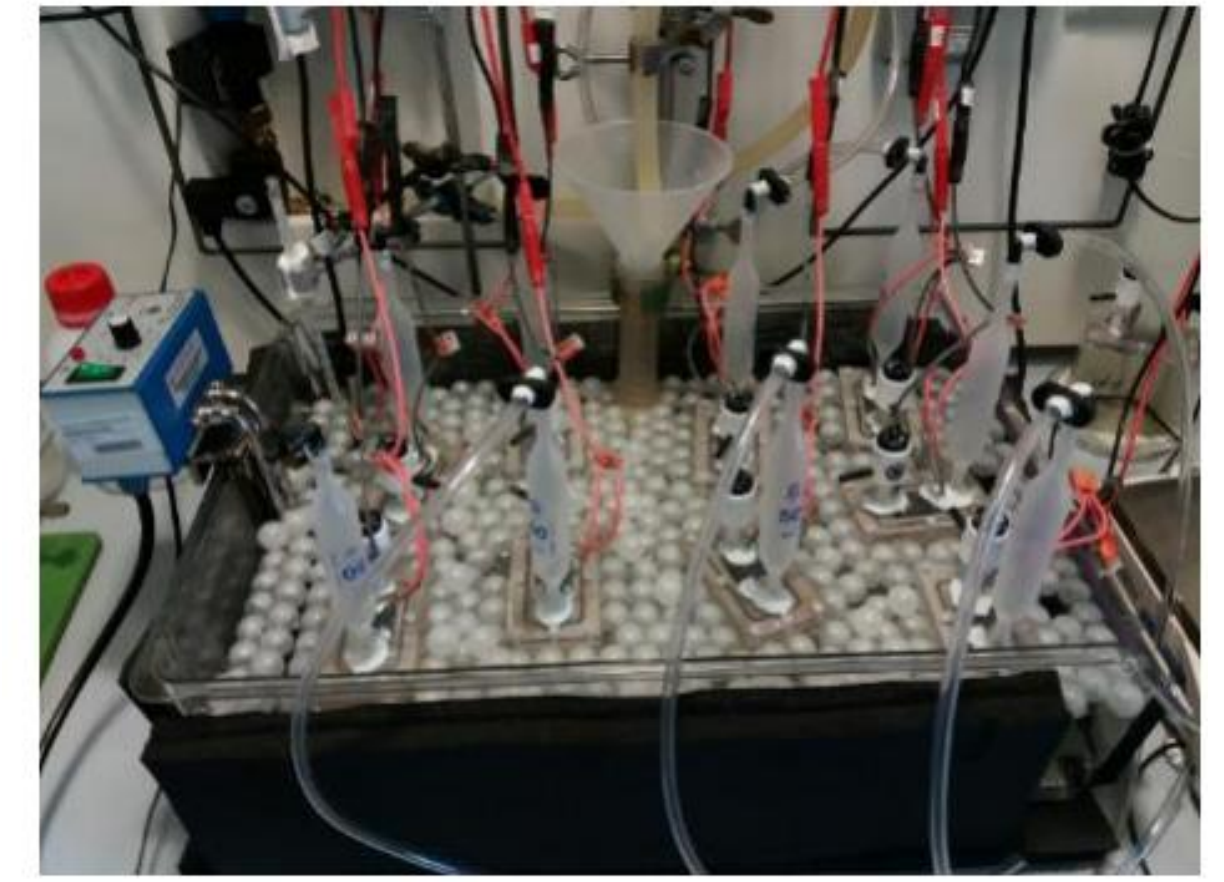
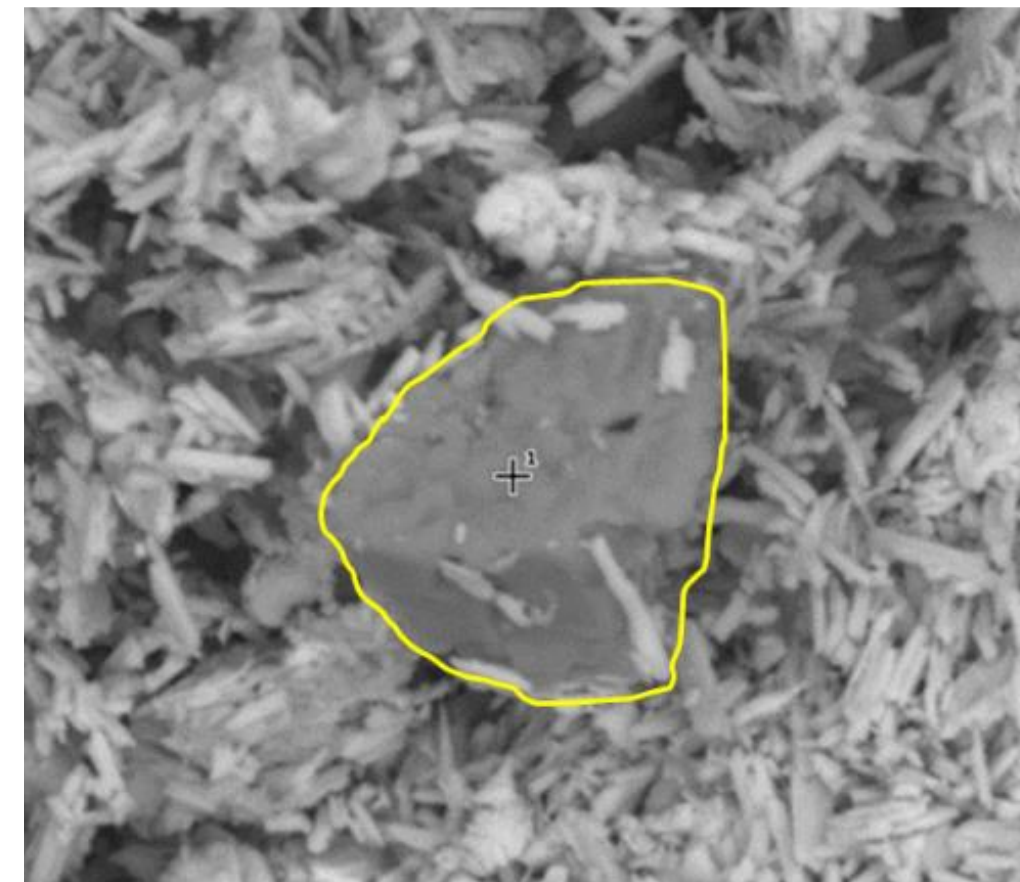
80% DOD
Cycle life





CBI Technical Program Key Results

- **DCA – up to 100% improvement**
 - By optimization of additives (carbon/lignin)
 - Using carbons with functionalization that balances water loss and DCA
- Supporting research in member laboratories by defining and solving issues in testing and cell manufacturing
- Novel techniques for understanding battery fundamentals – Neutron Diffraction and EIS
- **Cycle life - on target to deliver 5,000 cycles**
 - New understanding on failure modes
 - Controlled overcharging – reaching **100% increases in energy throughput** in current commercially available products
 - Dynamic BMS methods governed by machine learning





02.

Government funding work



Worldwide funding for batteries

U.S. Government Pledges \$45 Million to Develop Better EV Batteries

The Department of Energy has set up a new program that will fund the domestic development of batteries for electric vehicles that can charge faster and last longer.

US Department of Energy announces \$45Mn in battery funding

State aid: Commission approves €3.2 billion public support by seven Member States for a pan-European research and innovation project in all segments of the battery value chain

ENERGY STORAGE

EU boosts battery R&D funding

US government announces \$3.1 billion of funding for battery manufacturing, processing, recycling

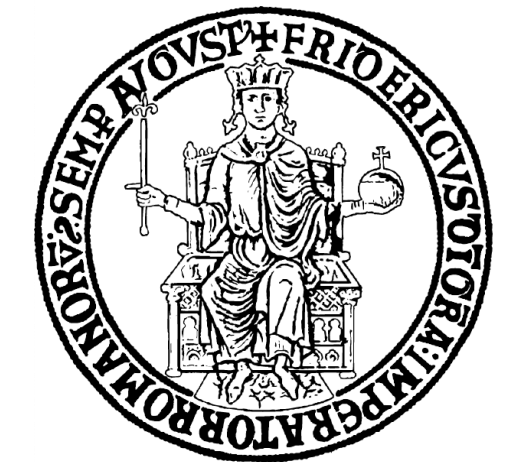
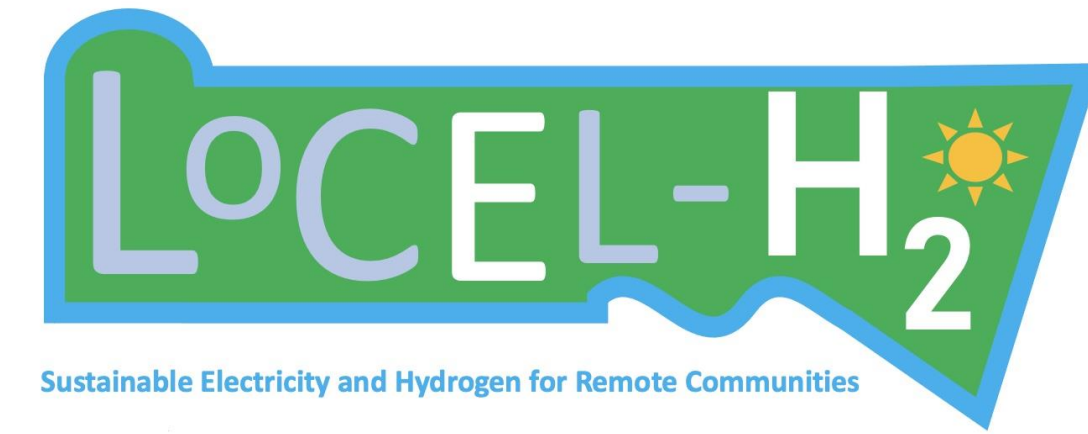
Brussels approves €2.9 billion investment into battery innovation



LoCEL-H2 Consortium



European Commission



US Military Microgrid Project



US Army Corps
of Engineers®



CONSORTIUM FOR
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INNOVATION



PARAGON
SOLUTIONS, INC.



Advanced
Battery Concepts
Better Batteries, Better World®



EnerSys
Power/Full Solutions



EASTPENN



Electric
Applications
Incorporated



AfTrak – Micro Electric Agriculture

✓ **Congratulations, your application has been successful**
Scores and written feedback from each assessor can be found below.

Competition name:
Energy Catalyst Round 9 – Early Stage

Application name:
AfTrak - Micro Electric Agriculture for Africa

When do you wish to start your project?
1 February 2023

Project duration in months:
12 months

Is this application a resubmission?
No



Coming soon to a field near you...



Designed to improve farmer livelihoods

- Helping to break the hardpan and build contour ridges
- Facilitation conversion of fields to Deep Bed Farming
- Electricity for lighting, cooking or charging your phone





European Government Funding: Two projects ongoing, 3+ submissions likely in 2023

ACTIVITY	Project (Instrument)	Description	Size	Submission
Won	LoCEL-H2 project (Horizon Europe)	Distributed microgrid with hydrogen; lead battery technology	4-year €10m program	Won & ongoing
	AfTrak project (Innovate UK Energy Catalyst)	Lead-battery Africa Tractor & solar power system	1-year £300k program	Won & ongoing
New Concepts	MESCH project (Resubmission, Innovate UK)	Novel ESS featuring lead batteries & hydrogen	3-year, £1m programme	Due June 2023, decision Sept 2023
	Circular Battery Project (Horizon Europe)	Framework for circular batteries - CBI wrote the Horizon call	3-year, €5m programme	Due end of 2023, decision April 2024
	BEV Charging Buffer (TBC - most likley Horizon)	Using Lead batteries as a buffer for EV charging systems	Likley 3-4 year, ~€millions	TBC but likely to open Q3 2023
	<i>New concept (before Q4 2022)</i>	<i>TBC</i>	<i>Likely €500k-5m</i>	Before end of 2023
Other	Milken-Motsepe prize application (AftTrak concept)	International competition (entered)	\$1m opportunity	Submitted March 2023, decision June 2023



United States Government Funding: One project ongoing, four in the pipeline

ACTIVITY	Description	Size	Submission
Won	Diesel powered microgrid using three different Pb batteries, Plug-and-Play unit	530 kWh	Won & completed
Ongoing	Improved design of Plug and Play unit	50 kWh	Due July 2023, decision September 2023
	Create battery research site at CBITEC site, supported by CERL	750 kWh + 250 kWh test bed	Due September 2023, decision November 2023
	Based demand reduction unit	1.6 MWh	Pre-proposal submitted, Due August 2023, decision Q4 2023
	Buffer systems for EV fast chargers	~1 MWh	TBD
	Rural electrification – no cost share	2 MWh	Preproposal due July 13



03.

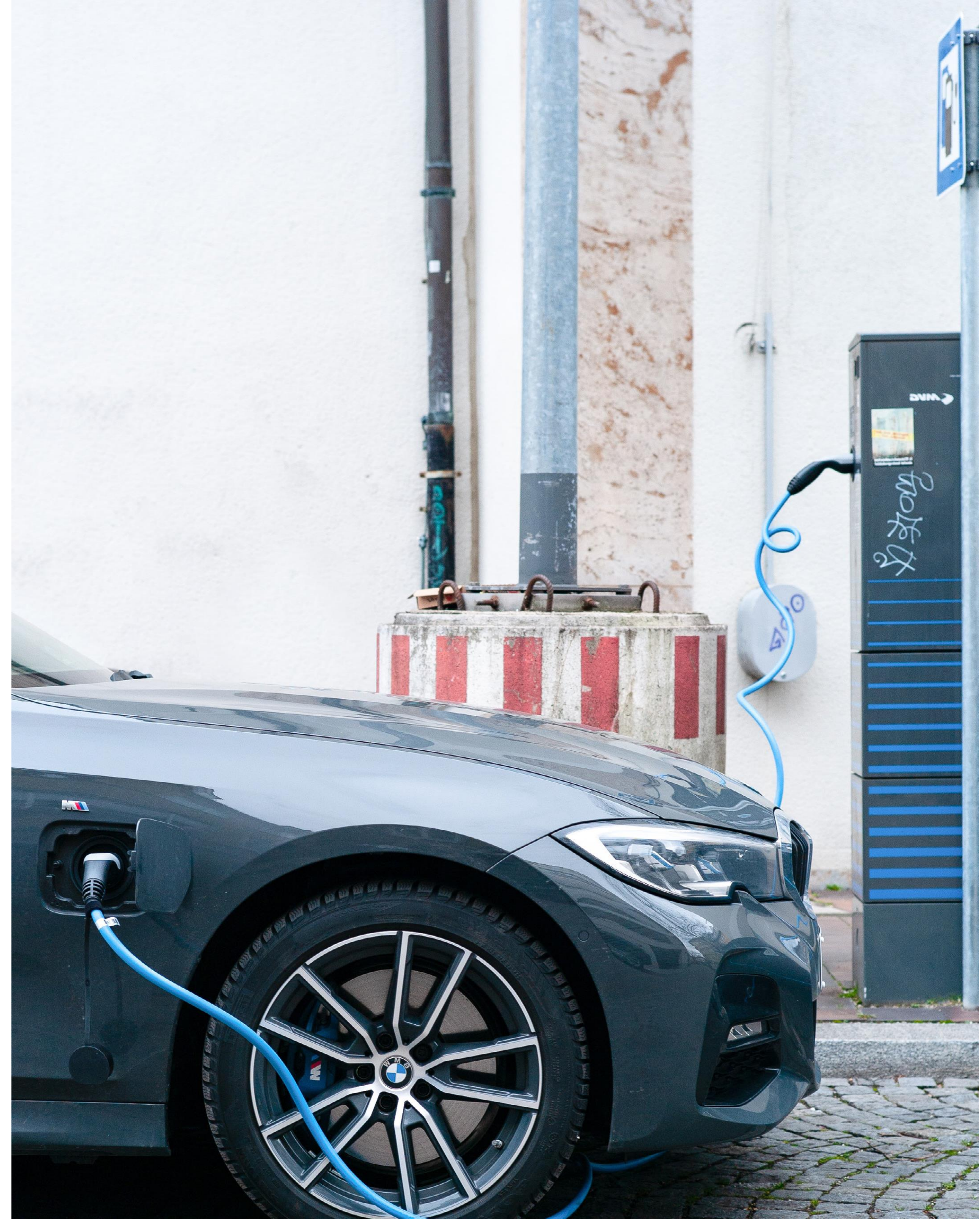
Energy Storage Opportunities



ESS Market Opportunity

- Total ESS (incl EV) battery market worth in region of \$30 Billion in 2030 (all technologies)
- Opportunities for lead batteries to take a significant portion
 - Only 10% would result in \$2billion lead battery sales and additional lead tonnage of 750k
 - Significant opportunity to take much bigger share in applications where duty cycle of lead batteries similar to current uses - such as EV charging back up.

50% of this EV back up market + 20% of remaining ESS could be \$9 Billion lead battery sales over 2 million tonnes of lead demand





FOUR MAIN AREAS FOR ACTION



**LEAD BATTERY
PERFORMANCE**



PRODUCTISATION



GOVERNMENT FUNDING



MARKETING



04.

Communications Program



Communications

Highlights from across the globe

MINING dot COM NEWS MARKETS INTELLIGENCE CAREERS EDUCATION

Consortium for Battery Innovation calls for boost to climate-friendly technologies

MINING.COM Staff Writer | January 21, 2021 | 6:10 am Battery Metals Europe USA Lead Lithium



PROJECT UPDATE:
HALO-SMART-ESS-LAB (HEALTH AND LIFESPAN OPTIMIZATION WITH SMART MANAGEMENT ALGORITHMS)

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Battery research critical in battle to reverse climate change, says new consortium chairman

to reducing carbon emissions and boosting electrification, according to the battery research hub the Consortium for Battery Innovation (CBI).

Dr Christian Rosenkranz is calling on governments and industry to work more closely to help accelerate the development of advanced battery technologies.

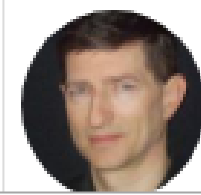
"We need to see... get anywhere ne... Rosenkranz, who... mber and bat... we should b... and existing

BEGÜM BOZKA
TECHNICAL MAN...
CBI

Forbes

EDITOR'S PICK | 14,166 views | Oct 27, 2019, 05:55pm

The Lead-Acid Battery's Demise Has Been Greatly Exaggerated



Robert Rapier Senior Contributor @ Energy

How lead batteries could make EVs safer



Lead batteries are highly safe and reliable.

Image: Unsplash/ Andrew Roberts

This article was originally published by the Consortium for Battery Innovation

Battery Industry

HOME NEWS PRODUCTS EVENTS DIRECTORY BATTERY GUIDE VIDEO NEWSLETTER

Home > Home batteries > Hi-tech batteries support boost in demand for household solar energy

Hi-tech batteries support boost in demand for household solar energy

26 February 2021

CONSORTIUM FOR BATTERY INNOVATION

elEconomista.es Aragon

Innovación para mejorar la vida útil de las baterías

Datasite en colaboración con elEconomista.es

DEBATE VIRTUAL

Oportunidades en sectores clave para el M&A en España

Jueves, 13 de Mayo 2021 - 10h

Regístrese

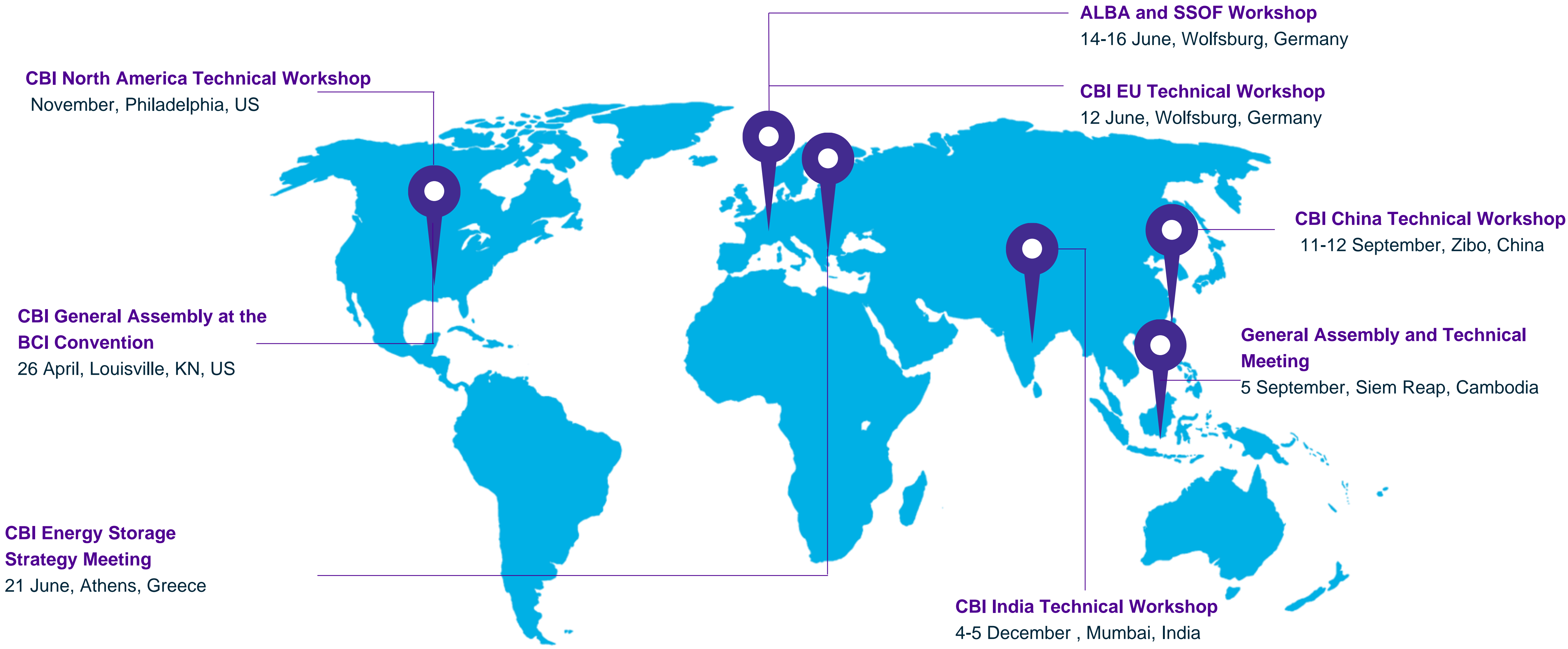
Anuncio



These interactive meetings feature battery companies, car companies, industry suppliers and researchers to foster discussion about



CBI Meeting Schedule - 2023





CONSORTIUM FOR
**BATTERY
INNOVATION**

Thank you!

For information, please contact

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