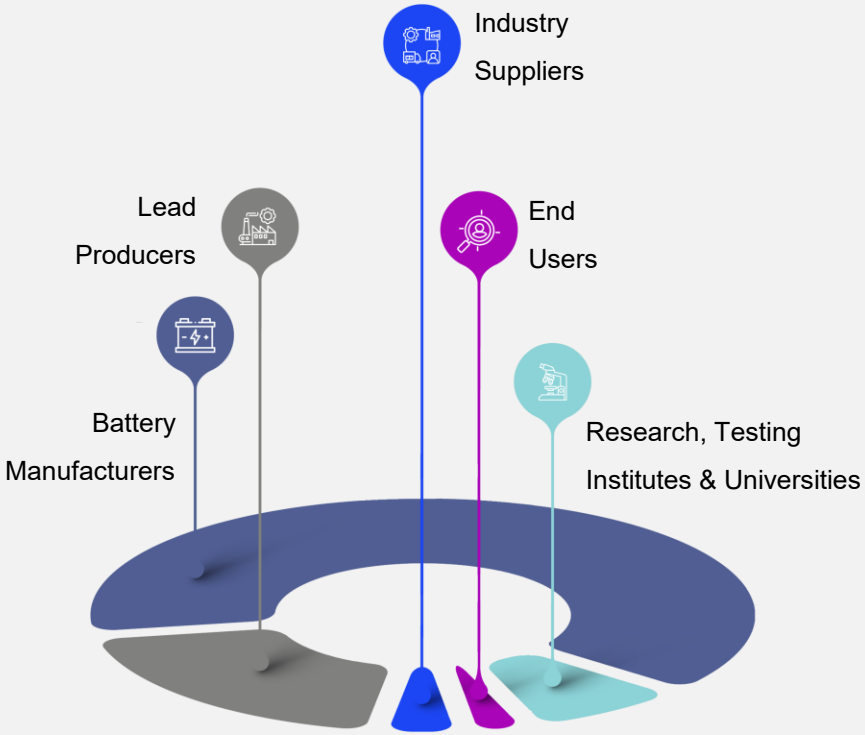
CONSORTIUM FOR BATTERY INNOVATION

FUTURE MARKETS FOR LEAD AND LEAD BATTERIES

Dr. Alistair Davidson

Executive Director, Consortium for Battery Innovation

Map of Members and Partners



CBI MEMBERS

ABERTAX TECHNOLOGIES
ACE Green Recycling
Addenda Corporation
Advanced Battery Concepts
Better Batteries, Better World
AHLSTROM MUNKSJÖ
AMARA RAJA
AMER-SIL
ArcActive
apg
Aurubis Metals for Progress
BAE Reliable Energy
Banner Batterien
Batt-Tek Consulting, LLC
Battery Consultants Limited
battery energy
BLACK DIAMOND STRUCTURES
BOLIDEN Metals for modern life
Borregaard LignoTech
C&D TECHNOLOGIES
CABOT
CAMEL 骆驼股份
Campine
CLARIOS
CROWN BATTERY
CSB
DARAMIC
DIXON PREMIUM BATTERIES
EASTPENN
Electric Applications Incorporated
ecobat
EnerSys
ENTEK
enviro wales
EXIDE
EXIDE TECHNOLOGIES
FENIX METALS LIMITED
FOCUS
Fraunhofer ISC
GLENCORE
GLOBAL LEAD Technologies
Gopher Resource
GRAVITA INDIA LIMITED
GRIDTENTIAL
GS YUASA
Creating the Future of Energy
Hakurnas Lead Works Ltd.
HAMMOND
Hecla MINING COMPANY
NIEHOFF GRUPPE HFSAB
HV Hollingsworth & Vose
HOPPECKE POWER FROM INNOVATION
HYUNDAI MOTOR GROUP
JLC EV
KCM 2000
KGHM POLSKA MIEDŹ
Korea Zinc
KOVOHUTĚ Příbram
LEOCH BATTERY
Livguard
LUMINOUS
MAC ENGINEERING & EQUIPMENT
MOLL BATTERIEN
MONBAT GROUP
MOURA Batteries
MPI reciklaža
Newmont
OKAYA
PENOX
RAMCAR TECHNOLOGY INC.
Rolls BATTERY ENGINEERING
金科力 JINKELI
SEBANG SEBANG INDUSTRIAL
solveteq
SORFIN YOSHIMURA
SOUTH32
STRYTEN ENERGY
SUNLIGHT POWER IS KNOWLEDGE
TBS ENGINEERING
Teck
terrapure
The Graphene Council
TRAFIGURA
TROJAN BATTERY COMPANY
VILLANOVA UNIVERSITY
WAVETECH
WIRTZ
GORE Creative Technologies Worldwide

CBI WORK PROGRAM

RESEARCH

Better batteries

Facilitate improvements in battery and systems performance.

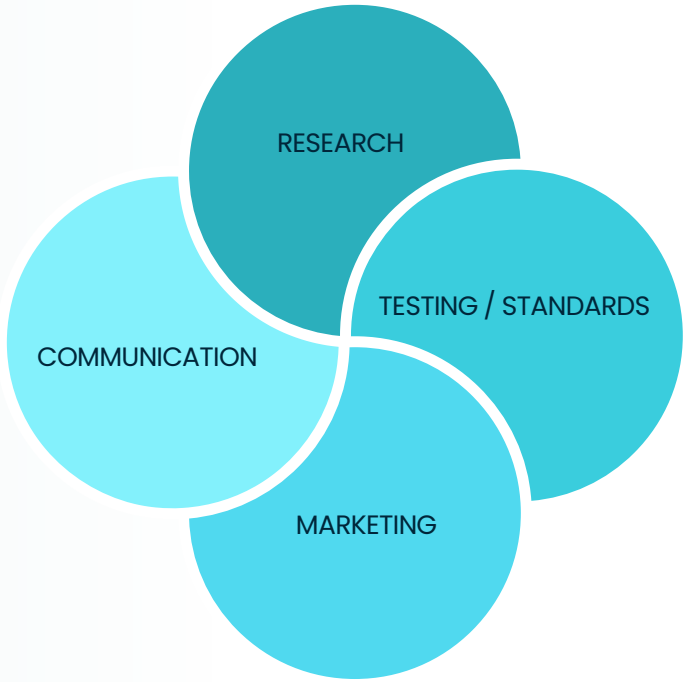
- Market analysis
- New technical roadmap
- New RFP
- Core research program
- Government & other funded research Technical exchange

COMMUNICATION

Better recognition (non-user stakeholders)

Communicating innovation in lead battery performance and applications

- Demonstrate lead batteries technology of future-change perception.
- Direct stakeholder engagement (MEPs, Commission, DOE, Governments)
- Media Narrative (Social Media, articles, videos, PRs, blogs etc.)
- Lead battery information hub (website-technical data, market information etc.)



TESTING / STANDARDS

Better recognition (industry/legislative standards)

Tests and standards that recognize lead battery benefits.

- Test method development
- Technical exchange on testing
- Linking research to standards
- Coordination of industry input into
- standards committees

MARKETING

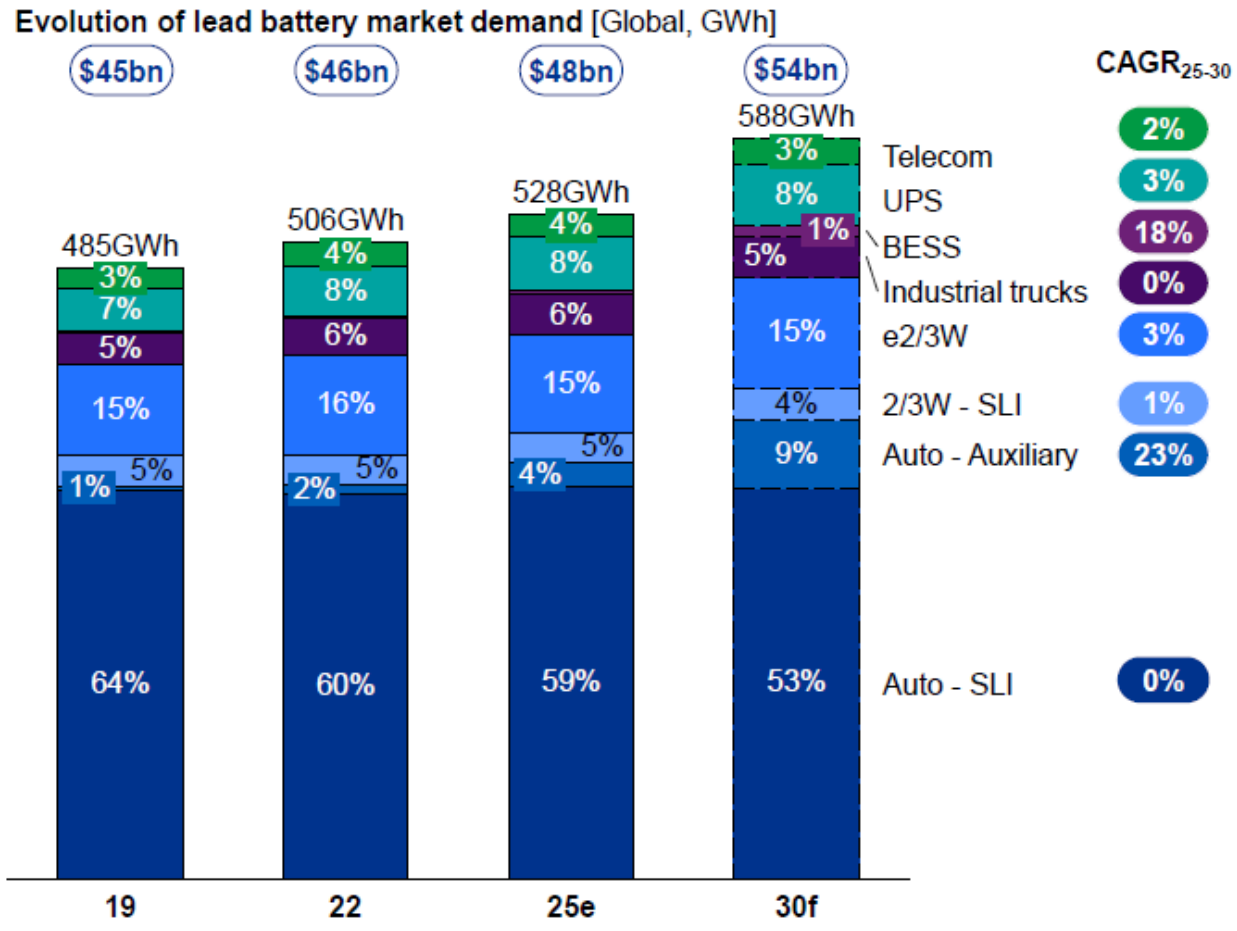
Better recognition (end users)

Improve end user recognition of lead battery benefits.

- Workshops
- Interactive Map
- Case studies and videos
- Battery Match
- Target industry media
- Demo projects
- Conferences and exhibitions
- Technical papers and publications
- Lead battery resource hub (website)

We see the lead battery market continuing to grow at a 2% CAGR over the next five years, fueled by applications such as auxiliary batteries for EVs

Lead battery market



Sources : KPMG research and analysis

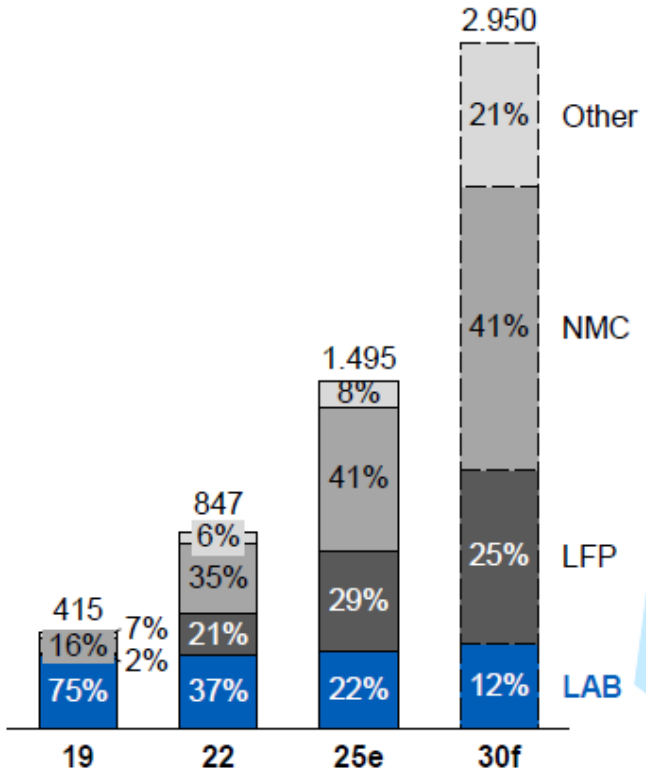
KPMG Insights

- At a global level, demand for key battery applications will **remain heavily concentrated in China** (~35% of demand), primarily driven by the country's dominant position in electric vehicle (EV) manufacturing. China's continued investment in EV infrastructure, supply chain localization, and policy support further **cements its leadership in this space**
- Lead batteries are expected to maintain **a steady presence across multiple industries** worldwide. As OEMs evolve and diversify their offerings, **lead batteries will continue to play a vital supporting role**—particularly in applications where cost efficiency, reliability, and established infrastructure outweigh the push for next-generation chemistries

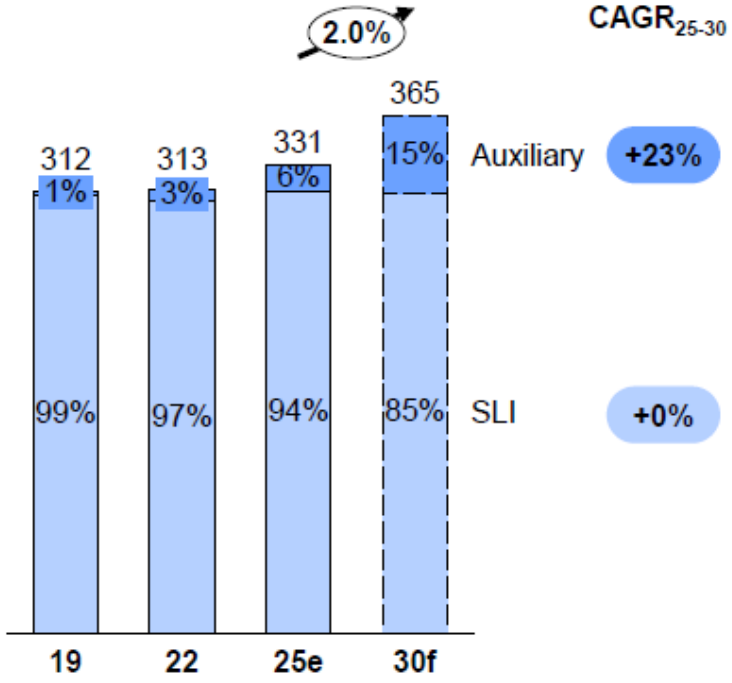
As a result, despite losing market share, we expect lead battery demand to continue growing at a 2% CAGR between 2025 and 2030

Battery demand for the automobile industry [GWh, Passenger & Commercial Vehicles]

Battery demand for passenger and commercial vehicle [Global, GWh]



Lead battery demand for passenger and commercial vehicle [Global, GWh]



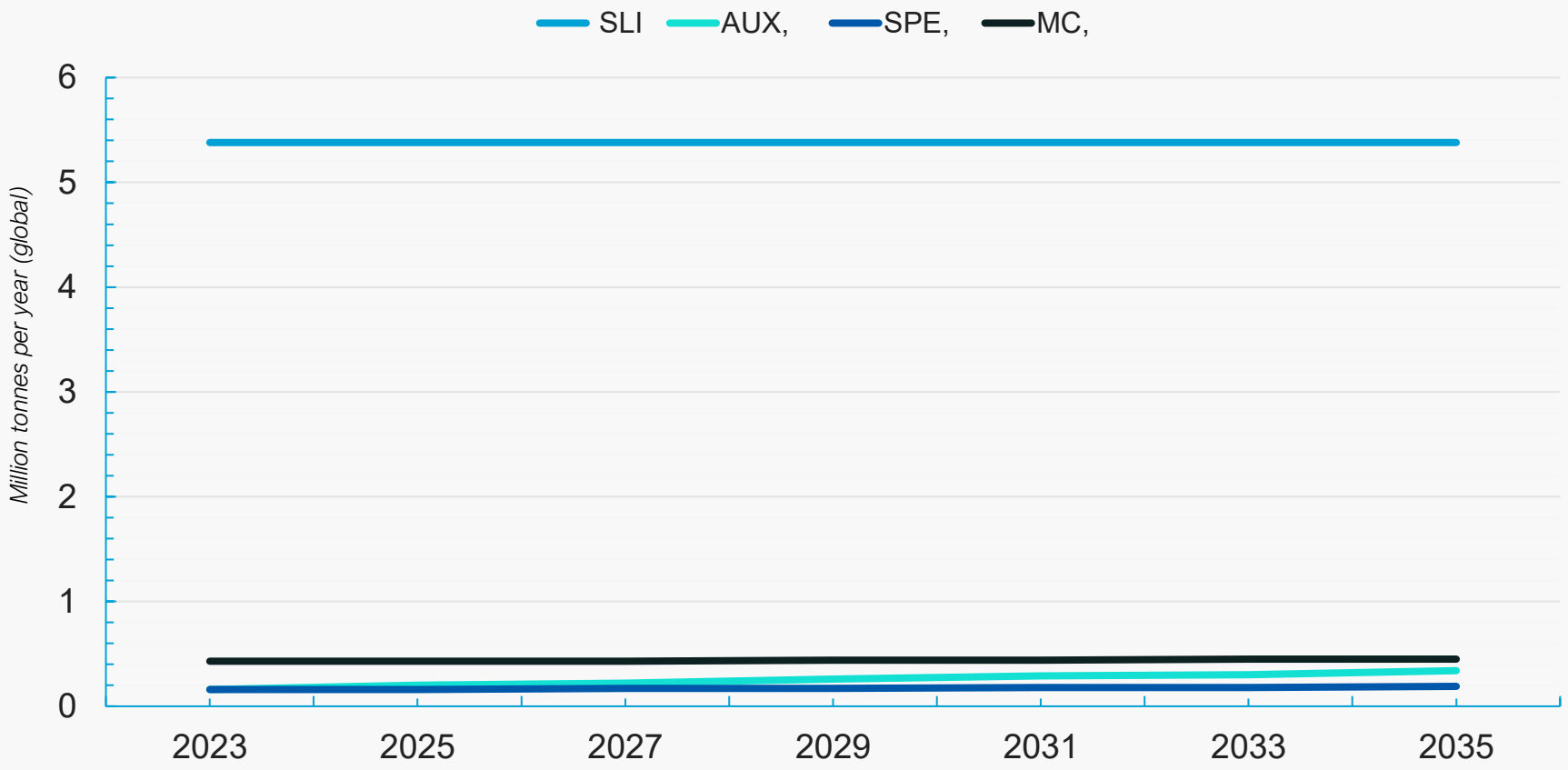
KPMG Insights

- The **electrification of vehicle systems** is significantly **increasing battery content per car**, with examples like Mercedes integrating up to three batteries in some of its latest luxury sedan models
- Amid uncertainty around Trump's tariffs, auto **OEM are actively revisiting lead-based technologies** to **diversify supply risk**
  - Industry leaders report renewed interest from auto OEMs in lead solutions, particularly for auxiliary applications, where we estimate lead could account for 80-85% of future demand

Sources: KPMG research and analysis

AUTOMOTIVE

Impact on lead market



Data source: AVICENNE Energy 2025, FOCUS Consulting

AUTOMOTIVE

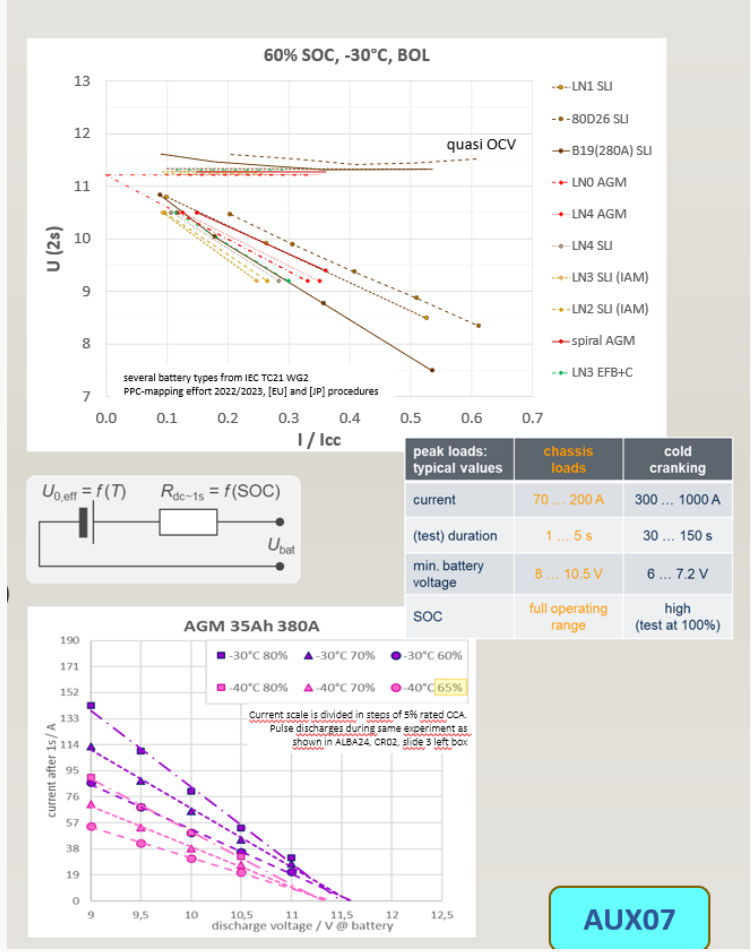
CBI Program

12V ICE (conventional/SS/Hybrid)

- Market still growing in markets such as:
- India, Africa and South America due to micro-hybrids being key markets
- CBI provide technical expertise and knowledge transfer to members in these regions

12V AUX

- ALBA/SSOF workshops-developing new standards, and collecting technical information about Pb for AUX applications
- Educating OEMs about lead batteries
- New automotive specific projects called ALBA plus launched 2025
- Research program aimed at improving performance for Pb in AUX applications-new projects launched in 2025

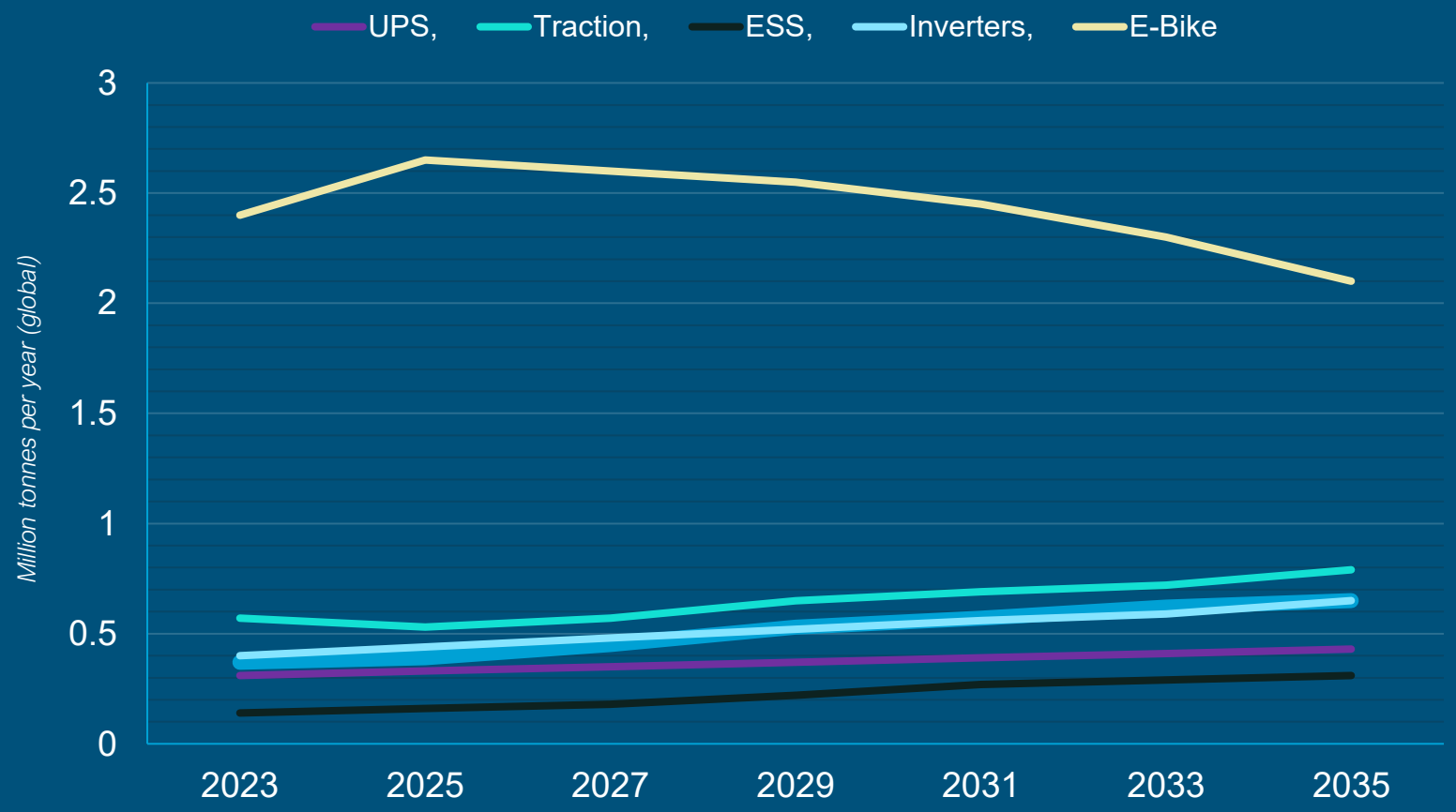


ALBA

Automotive Lead Battery Advancements

- Turin, Italy 20-22 May 2025
- Kuta, Kimbalu 1-2 September 2025
- Great way to interact directly with OEMs
- Develop automotive lead batteries for the future
- Demonstrates OEM commitment to using Pb Batteries in future

INDUSTRIAL AND MOTIVE OUTLOOK



Data source: AVICENNE Energy 2025, FOCUS Consulting

INDUSTRIAL AND MOTIVE

CBI Program

Industrial

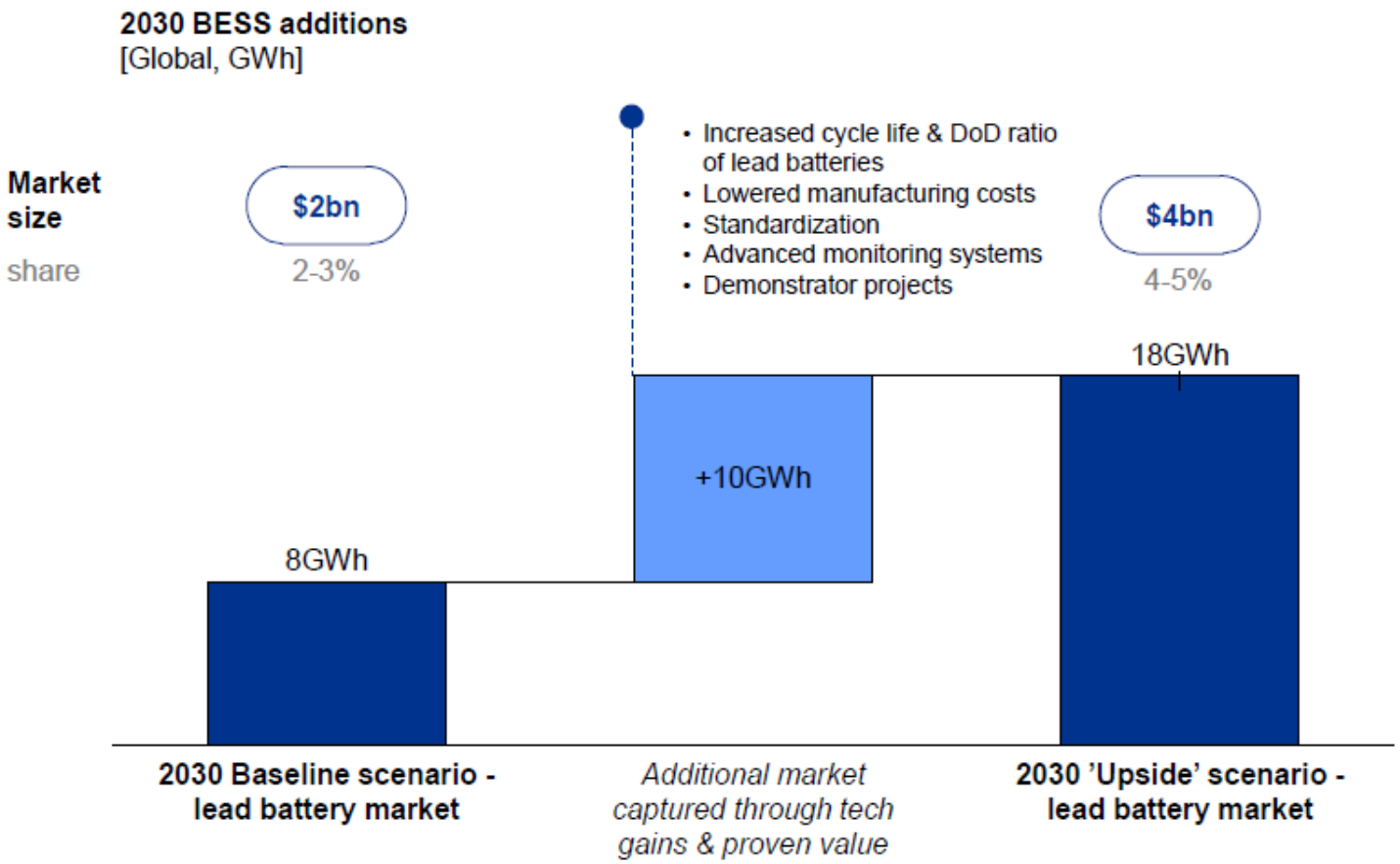
- CBI Research program
- Marketing program
- BATTCON
- ELBC
- Standards support (NFPA 855, IFC)

Motive (including Golf carts)

- CBI Research program
- ELBC
- Marketing program

Through industry-wide LCoS reductions, lead batteries could significantly expand their market share and represent a 18GWh market by 2030

Two forecast scenarios for lead-based BESS deployments

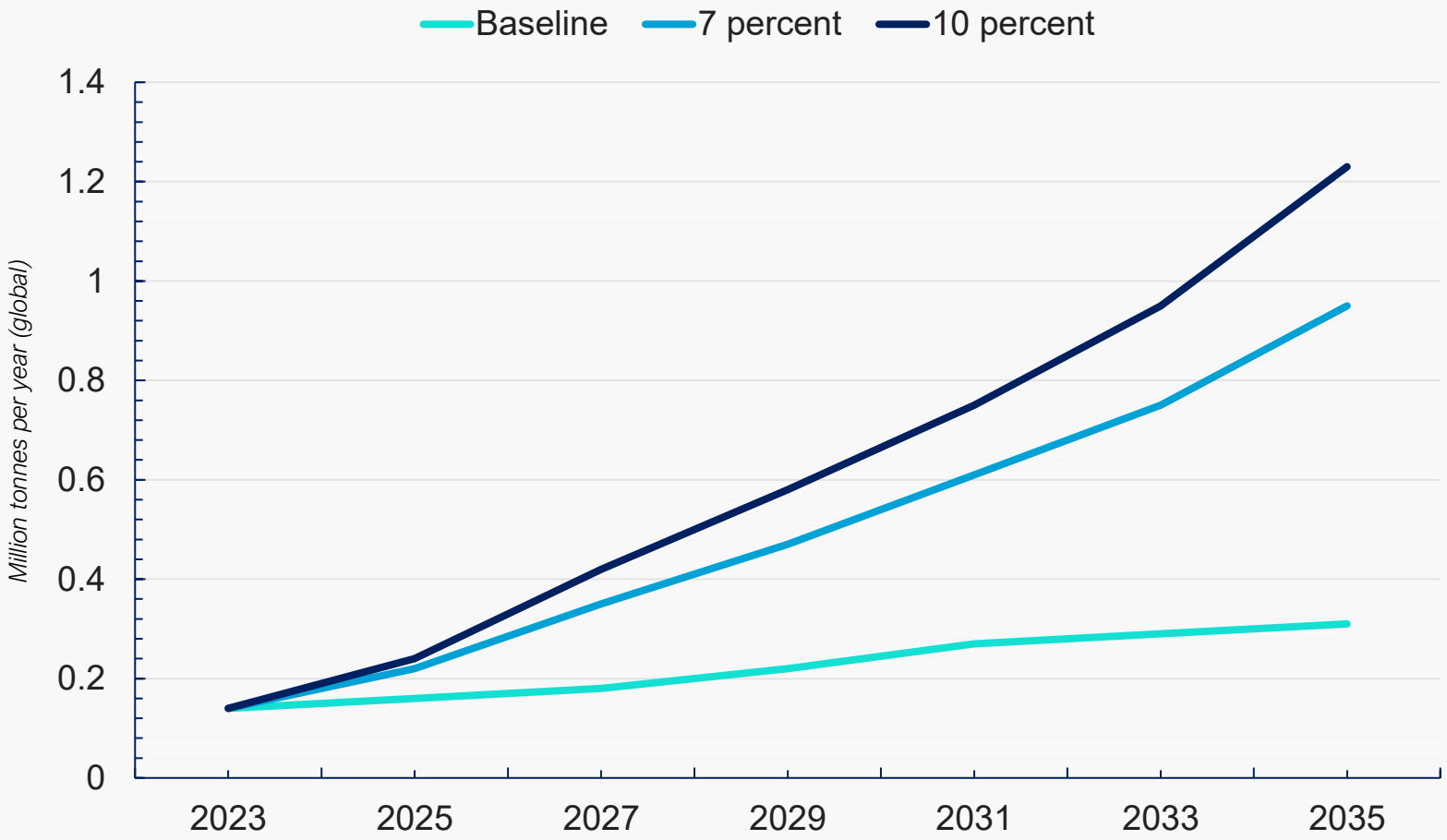


Sources: expert interviews, KPMG analyses

KPMG Insights

- **By 2035, we estimate that lead batteries could make up to [6-7]% of the market**, by securing the right positioning on key markets:
  - **BTM**, particularly in **EV infrastructure**, lead batteries can take their place as genuine market competitors
  - In emerging economies, particularly India, lead batteries can be adopted to support the deployment of utility-scale RE against a backdrop of rising temperatures
- **The Upside scenario presupposes these prerequisites across the entire lead industry**:
  - Secure R&D investment to achieve Long-Duration Energy Storage systems
  - Secure R&D investment to achieve extended cycle life, with deep discharge cycles
  - Deploy demonstrator projects to prove lead's viability to project developers

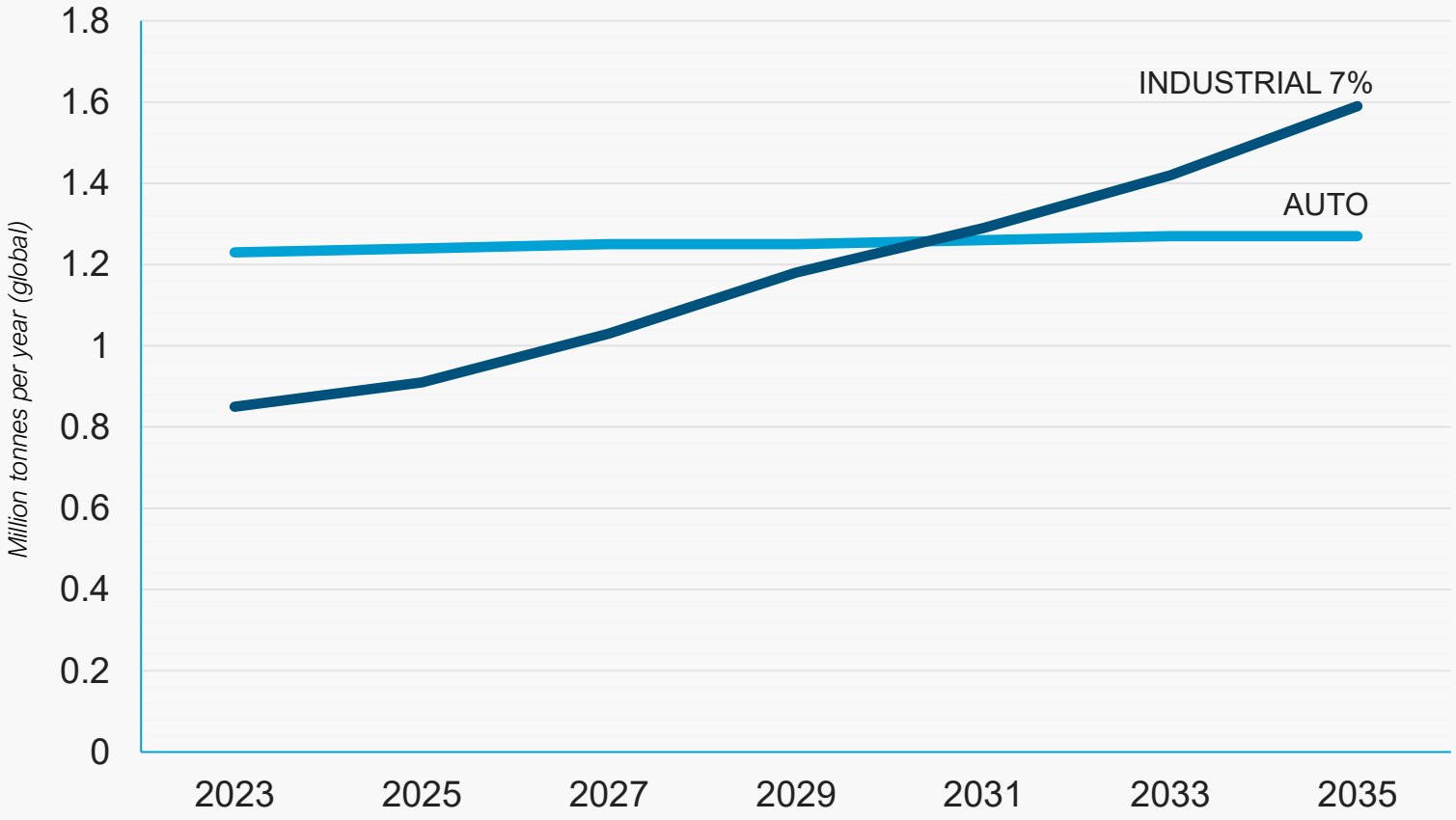
ESS SIGNIFICANT FUTURE MARKET FOR PB BATTERIES



Data source: AVICENNE Energy 2025, FOCUS Consulting

INDUSTRIAL AND AUTOMOTIVE OUTLOOK

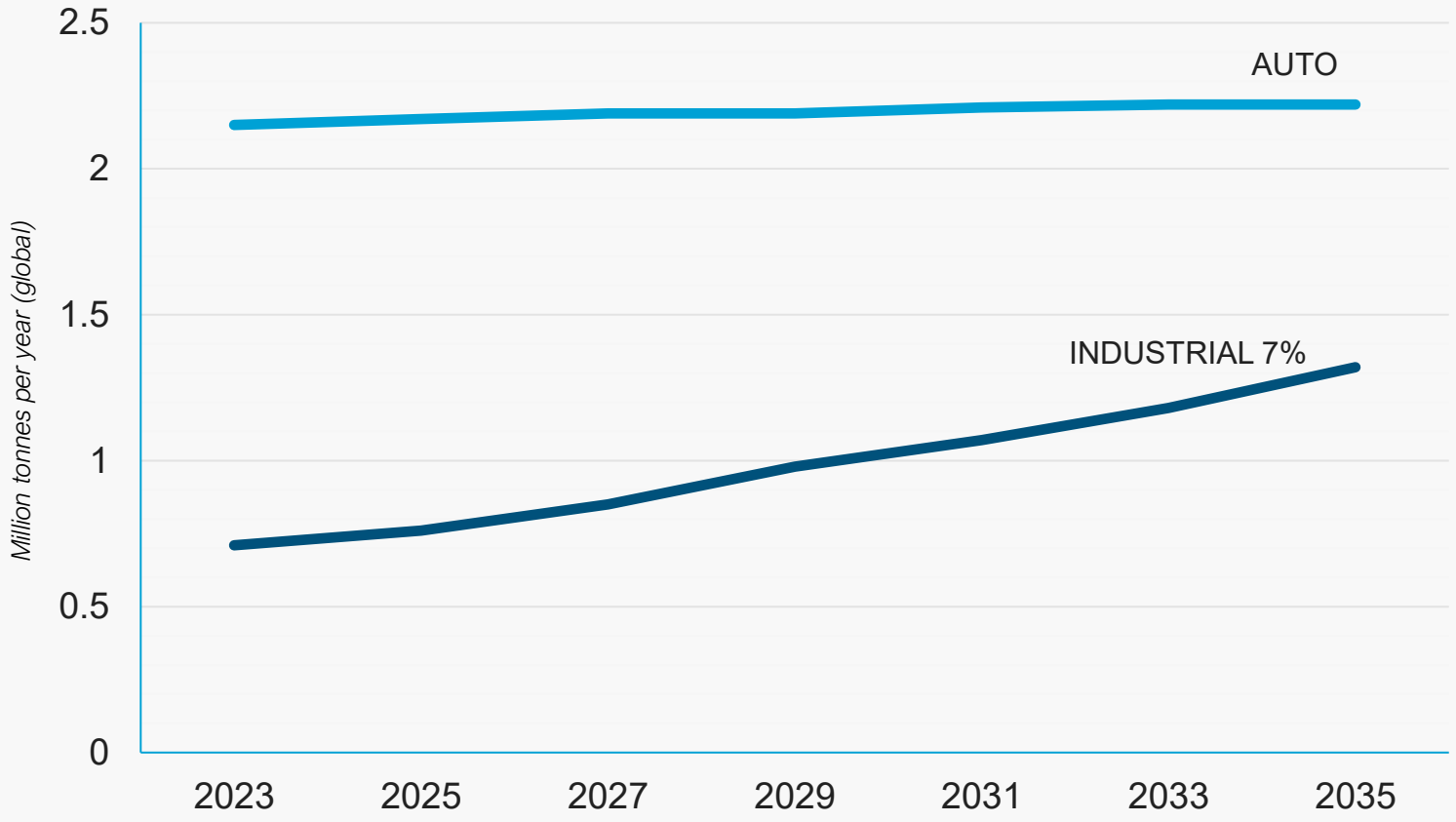
Europe



Data source: AVICENNE Energy 2025, FOCUS Consulting

INDUSTRIAL AND AUTOMOTIVE OUTLOOK

North America



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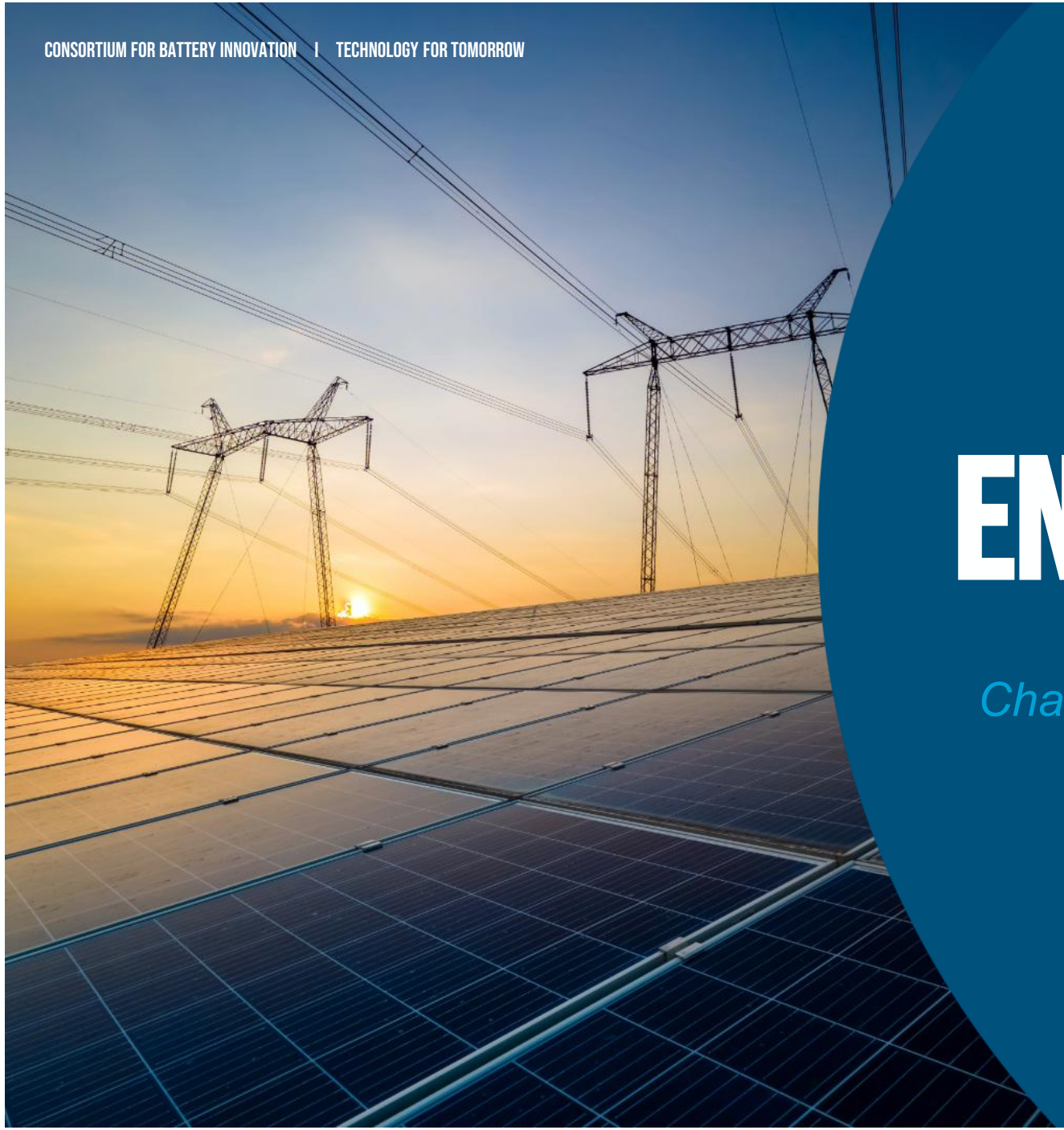

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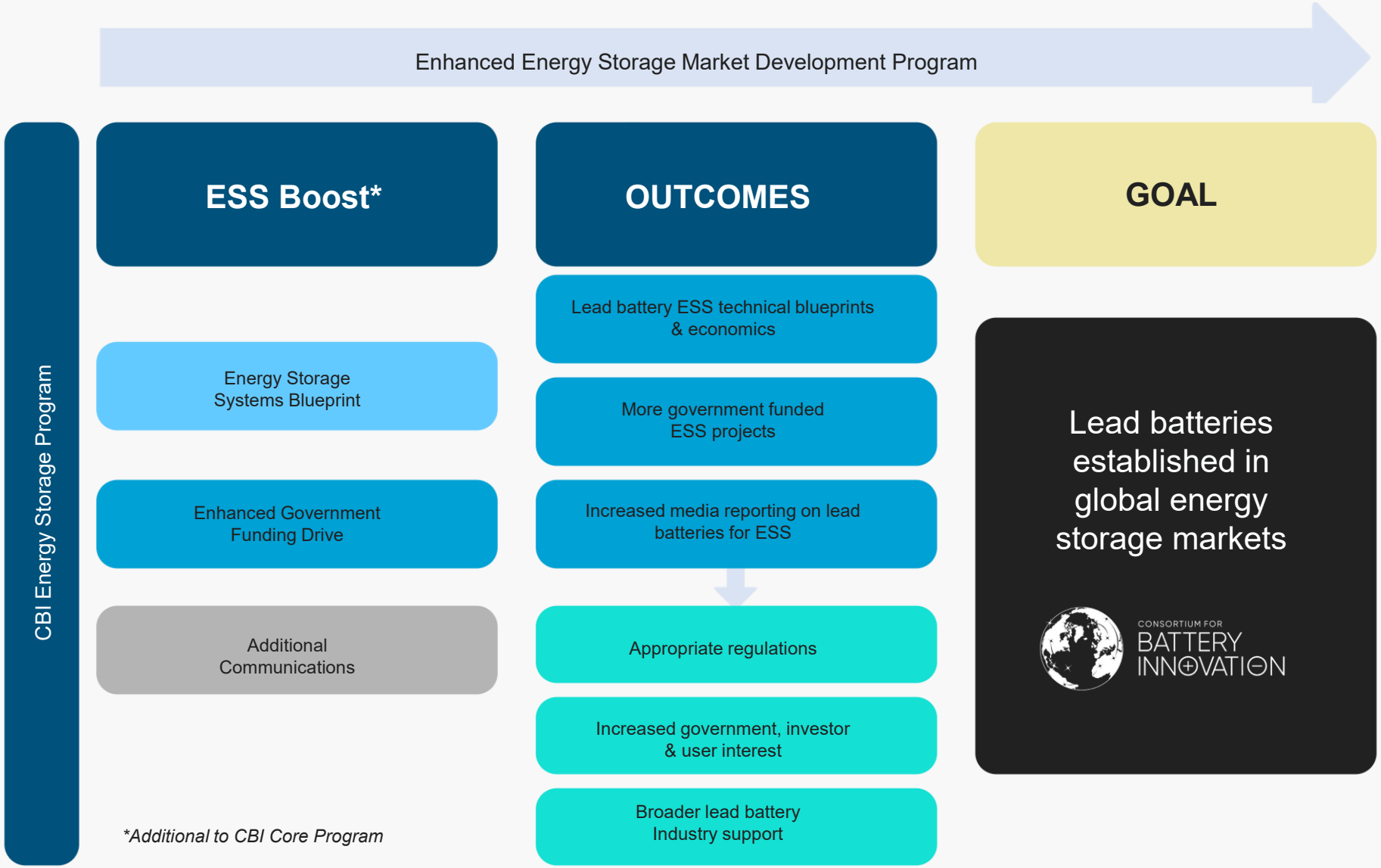
ENERGY STORAGE

Challenges

ENERGY STORAGE

Challenges

- Most projects currently use Li batteries
- Other technologies have much larger marketing voice
- Governments more focused on other technologies
- Need to improve cycle life and TCO of lead batteries
- Some Pb Battery companies still need convincing of opportunity in ESS
- Pb battery companies need to understand how to put their batteries in ESS


Enhanced Energy Storage Market Development Program
CBI Energy Storage Program
ESS Boost*
Energy Storage Systems Blueprint
Enhanced Government Funding Drive
Additional Communications
*Additional to CBI Core Program
OUTCOMES
Lead battery ESS technical blueprints & economics
More government funded ESS projects
Increased media reporting on lead batteries for ESS
Appropriate regulations
Increased government, investor & user interest
Broader lead battery Industry support
GOAL
Lead batteries established in global energy storage markets
CONSORTIUM FOR BATTERY INNOVATION

OVERVIEW OF ESS ACTIVITIES

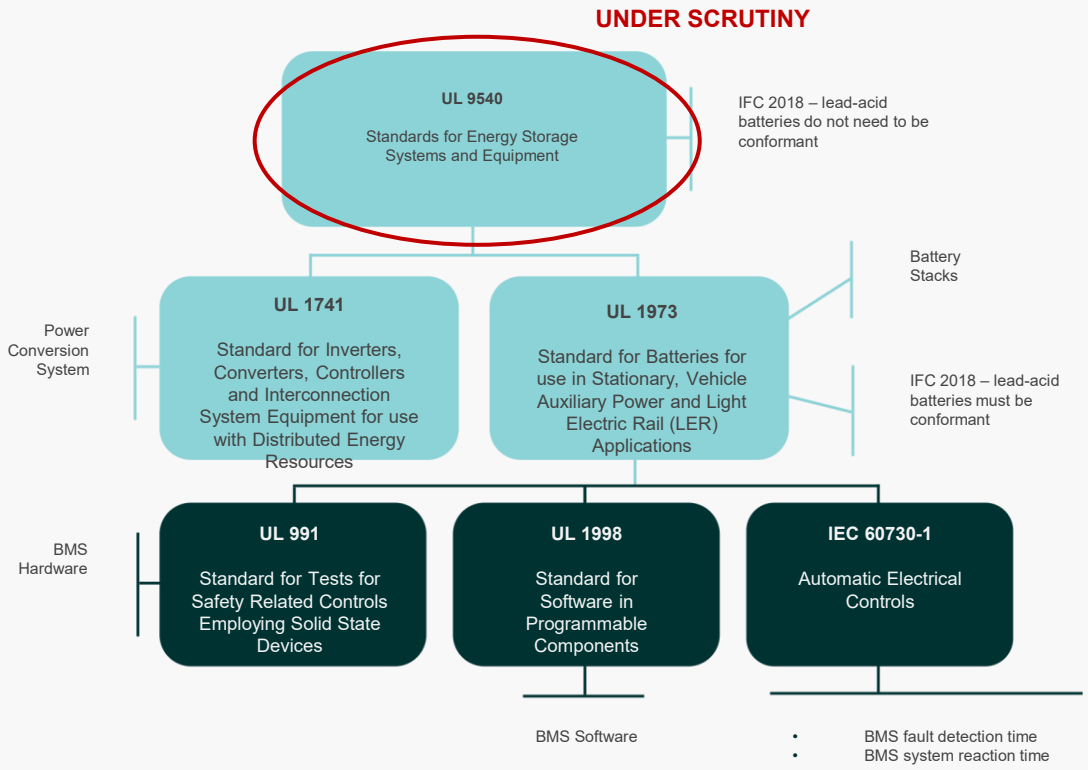
CBI ESS-related activities since 2019

- CBI has attended and spoken at and attended **+30 ESS related events** (ESA, IESA, EASE, and many others). **Have a major event for stationary batteries called Battcon!**
- Have held 10 ESS specific events, over a dozen webinars
- We have **completed 5** ESS related technical program projects and currently **have 5 ongoing**.
- Government and other funded research:
    - EU Project aimed at securing EU/National lead battery funding
        - LOCEL H2 Microgrid Project Horizon Europe WON
        - AFTRAK Innovate UK WON
        - Milken-Motsepe Magnification of 1 millions USD WON
        - MESCH WON
    - US Project aimed at securing US lead battery funding
        - Energy Storage Grand Challenge WON
        - Ameren EV fast charging microgrid COMPLETED
        - Nuclear Regulatory Commission VRLA Project WON
        - Continuation of Military Micro-grid project IN PROGRESS
- Incredible amount of comms material (case studies, blogs, articles, videos, social media)
- Market reports (KPMG, EV charger buffer market report)
- Direct assistance to members in developing systems for LDES, residential, and BTM
- Strategic partnerships with LDES consortium, IESA, EASE, and others
- Represent the industry on key standards and code bodies, relay info into the membership.

PROTECTING THE ADVANTAGES OF LEAD BATTERY ESS

Informing and representing the technology for fire and ESS-related codes and standards

- UL 9540 (in NFPA 855) and UL 1973 consequently are of interest.
- Overheating and off-gassing must be managed and place burden on flooded lead batteries.
- Swiftly becoming mandatory in specific states (California, New York).
    - IFC and NFPA are mandatory in some way in all of the US, spreading to Europe.
- IEEE (including many representatives from the industry) are working with UL to make exclusions for UL 9540A.
- The current thinking is if systems with lead batteries pass UL 1973, then the system will be excluded from further testing UL9540A
- Appendix H is currently out!



CBI BLUEPRINT PROJECT

Lead battery ESS to back up EV fast charging

CONSORTIUM FOR BATTERY INNOVATION

- Using advanced lead batteries from:

C&D TECHNOLOGIES · TROJAN BATTERY COMPANY · CLARIOS · STRYTEN ENERGY · EAST PENN · CROWN BATTERY

- Supported by:

ecobat · lundin mining · Teck · Hecla MINING COMPANY · Gopher Resource · terrapure · KOVOHUTĚ Příbram · GLENCORE · KIIM 2000 · Campine · NEW BOLIDEN

- In partnership with:

SEL SCHWEITZER ENGINEERING LABORATORIES · IntraPack INDUSTRIES · epcpower excellence in power conversion

CBI BLUEPRINT PROJECT

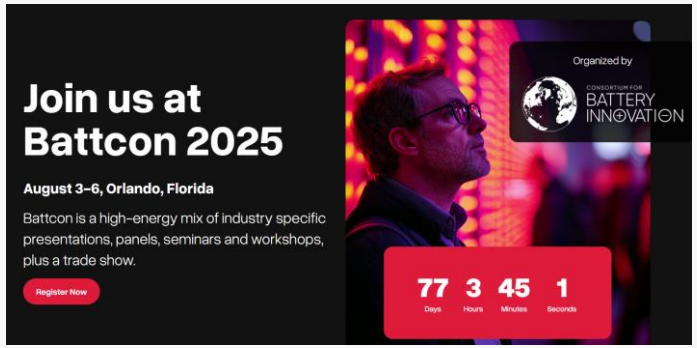
Lead battery ESS to back up EV fast charging

- This project is focused on designs (electrical layout and physical designs) for these Energy Storage Systems (ESS).
- The project is funded by contributions from CBI members across the lead battery supply chain
- The objectives of the project can be summarized below:
  - Design documentation, including a bill of materials calculator, allowing for each member to provide an estimate on future bids for EV fast charge back-up
  - Forming key partnerships with vendors for ESS, like controls and battery management systems providers, allowing for effective procurement of needed components.
  - Develop a model focused on demonstrating the value proposition for using back-up for EV fast charging, specifically lead battery ESS back-up.

END-USER ENGAGEMENT: AS MUCH AS WE CAN

Utilities, Telecommunications Firms, Cable Companies, Data Centers

- CBI has interacted as much as possible with end-users, forming the beginnings of a framework for stationary, filtering it toward our forums like ELBC and Battcon.
- We are more than happy to speak to any and all end-users (customer or desired customer!)
- Extremely important not only for developing markets but for regulatory and advocacy efforts, road mapping, and technical development.



Opportunities for ESS, Examples Around the World

Microgrids and BTM

- ArcActive, Gridtential, ABC, GS Yuasa, Stryten, East Penn, and others have projects underway:
  - DC Microgrid with Comcast
  - BTM use cases across the US
  - EV fast charge backup
  - Stackable utility BTM
  - Residential
- The most important thing now is follow-through and good partners, which CBI is helping on both fronts.

Solar Time of Use (Bipolar) – Michigan, US

42 MWh for solar fields owned by utilities

- The up and running ABC BoxBe product line is being shipped out to supply ESS for a large solar installation in Michigan.
- Uses 48V bipolar blocks, all products are made in Clare, MI.
- Tender was picked up in 2024, underway now.

Solar Microgrids – All over Brazil

Moura BESS represents away for farmers and remote communities to get rid of diesel gensets

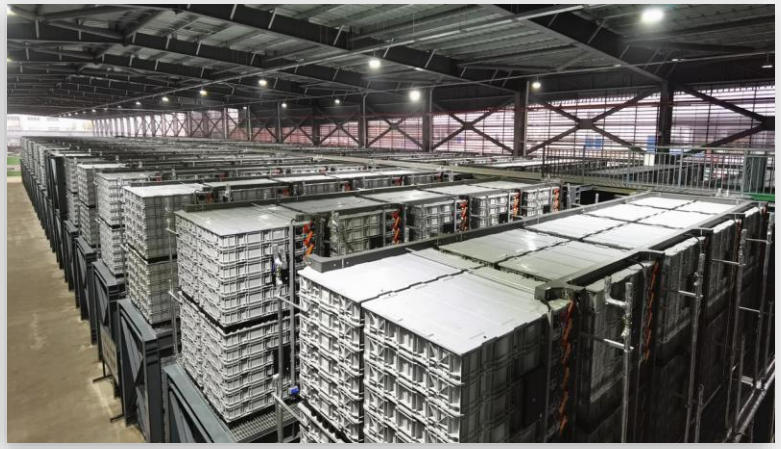
- Dozens of systems with Pb have been set up in BTM microgrids, allowing communities near the Amazon to be less reliant on expensive diesel energy sources.

- Prime example of robust microgrids in harsh environments.

LDES – Huzhou City, Cina

Massive system for industrial center established in March 2023

- High performance PbC batteries (small e-bike type battery) have been utilized.
- 1.1 GWh, 100 MW, this system cost 140 million. An additional 60 million was also used to update the AC side. $127/kWh…
- Started as demo unit, 10 MWh in September 2021.
- Tianneng perfected the product in this time, total construction and commissioning took ~3 months for the expansion.
- Have a 10 GWh tender underway.



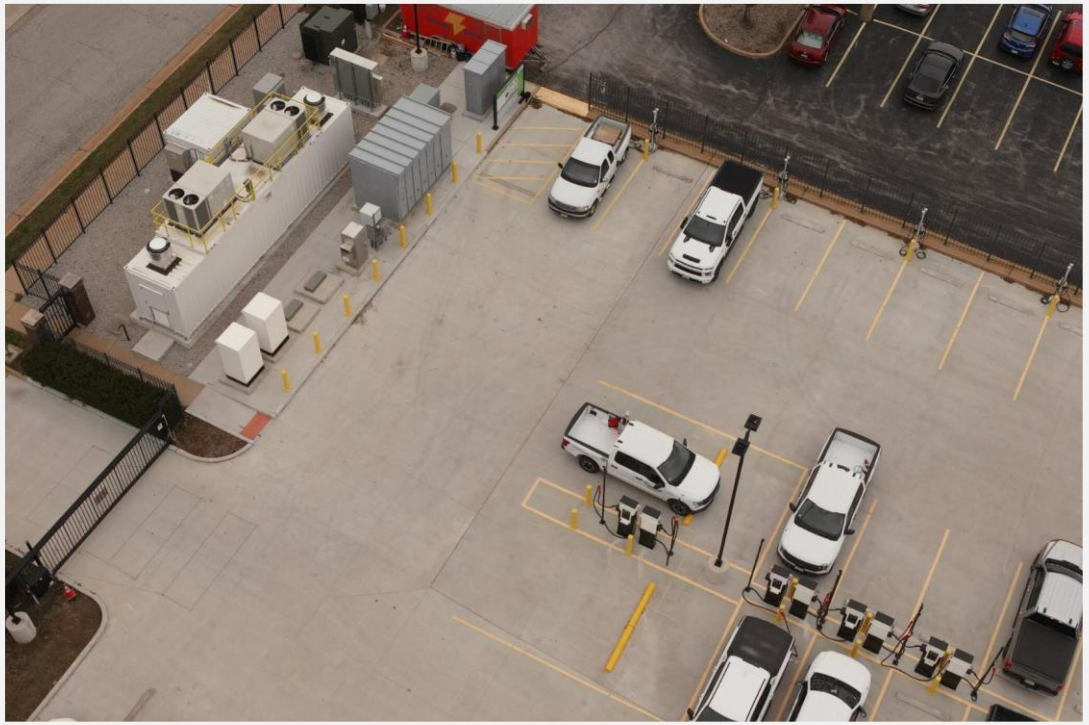
https://cn.chinadaily.com.cn/a/202303/24/WS641d60f2a3102ada8b2352a0.html

EV Fast Charge Backup – St. Louis, Missouri

Example of EV fast charge backup

- GS Yuasa, answering a call setup by CBI and Ameren, provided a state of the art battery ESS using advanced PbC AGM products.

- Plans are moving forward for more opportunities, with more systems underway.



Critical Hybrid Backup – Midwest, US

Resilient Hospitals in the US

- Stryten this past year has been involved with lead battery ESS (and other chemistries).
- This 0.5 MWh product is something Stryten has evolved out of the Blueprint and their own internal efforts.
- A prime example, and one that makes a lot of sense for lead, is providing backup and demand reduction to critical facilities like hospitals.
- This also aligns well with BTM buildout from GS Yuasa and others in the US.

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THANK YOU!