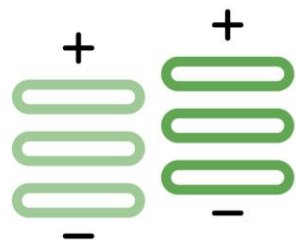


# Watt4Ever

Watt4Ever: transforming end-of-life EV batteries  
to assets for the energy transition

ALBATTIS Webinar 27/01/2023



**WATT4EVER**  
BATTERIES FOR LIFE

**GOLD AWARD WINNER**  
BELGIAN  
**BUSINESS AWARDS**  
FOR THE **ENVIRONMENT**  
2021-2022



The future of the  
**battery** is **circular**.

We help you **power** it.



# Massive influx of EV batteries: what to do?

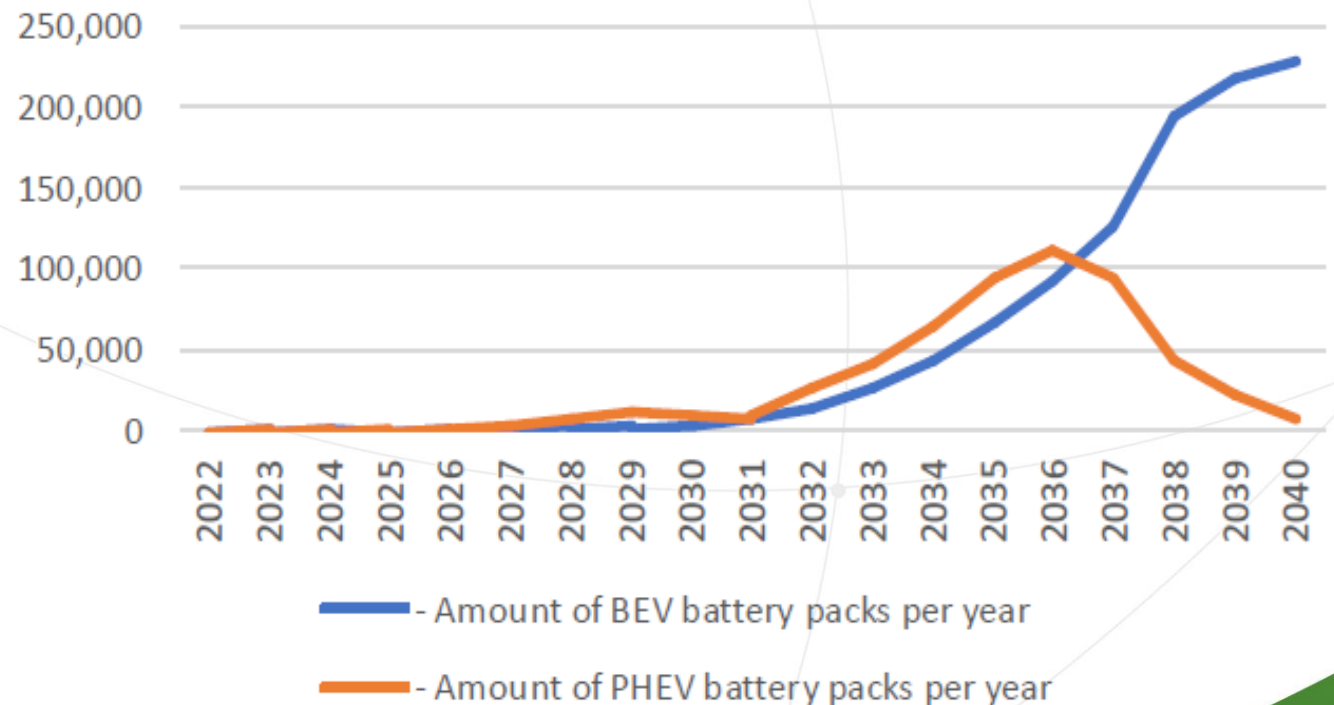
## A challenge...

Need for services to ensure sustainable & circular end-of-life chain  
(remanufacture/reuse/recycle)

## ...and an opportunity

Need for affordable stationary batteries in industrial buildings for backup, renewable energy, grid services, etc.

Amount of EOL batteries per year



# A battery pioneer dedicated to circular economy

Sustainable, affordable, and tailor-made BESS solutions,  
from Belgium, for circular economy driven entities.



SL batteries built from  
used EV batteries



Repair/  
Reman/ Refurbish



Engineering,  
Monitoring,  
Optimization  
services







# Watt4Ever Facilities

- **HQ: Brussels, BE**
  - **Factory: Limburg, BE** (presently)
  - Storing
  - Testing
  - Dismantling
  - Assembly line for new batteries
- 
- ✓ Storage of batteries
  - ✓ Trained HV technicians
  - ✓ Minimum waste approach

# Final products: battery modules, battery packs & battery systems





# Modules in all types & sizes



## **LG Chem 6S2P**

Pouch cell 24V  
module with  
2.86kWh capacity  
with internal BMS

1st life:  
Porsche Taycan



## **Samsung SDI 12S1P**

Prismatic cell  
48V module with  
2.07 kWh  
capacity.

1st life: Ford Kuga  
PHEV



## **Samsung SDI 16S1P**

Prismatic cell  
48V module with  
1.55 kWh  
capacity.

1st life: BMW  
PHEV



## **CATL 26S**

Prismatic cell  
94V module with  
17.94 KWh  
capacity.

1st life: MB EQC



## **Panasonic 12S1P**

Prismatic cell  
48V module with  
1.55 KWh  
capacity.

1st life: Audi  
PHEV



**WATT4EVER**  
BATTERIES FOR LIFE

# Safety

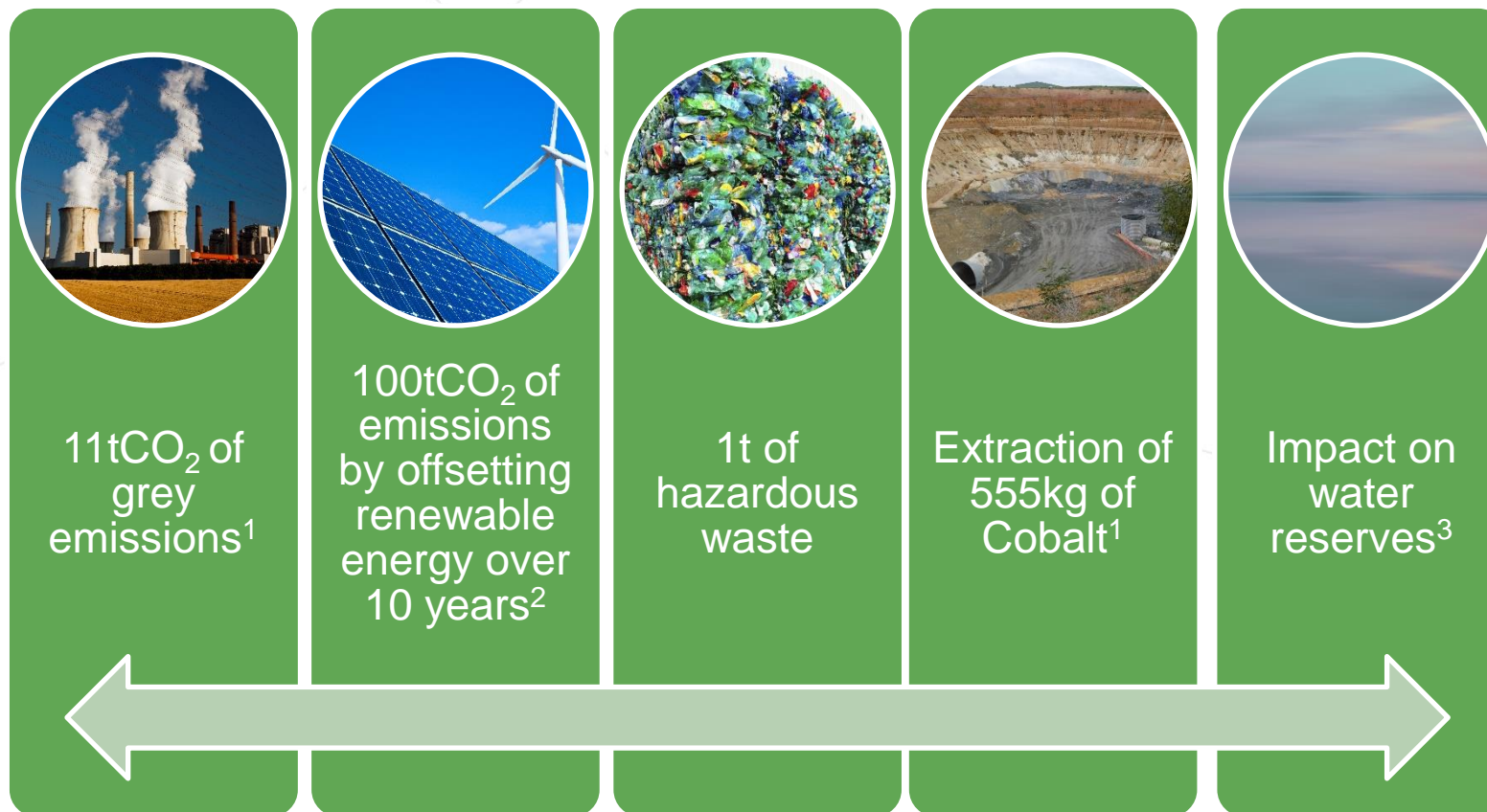
- Cells and modules are tested under IEC 62619 and IEC 62485-2 international safety protocols
- Electric safety design of our systems audited by Vinçotte for electric safety conformity
- Incoming and finished batteries undergo testing and control under a strict quality control procedure
- Storage is done according to national environmental norms





# Environmental gains from second-life batteries

For a typical battery of 100kWh, society avoids:



Incl. avoided grey emissions and expected life-cycle emissions over 10 years versus no battery scenario

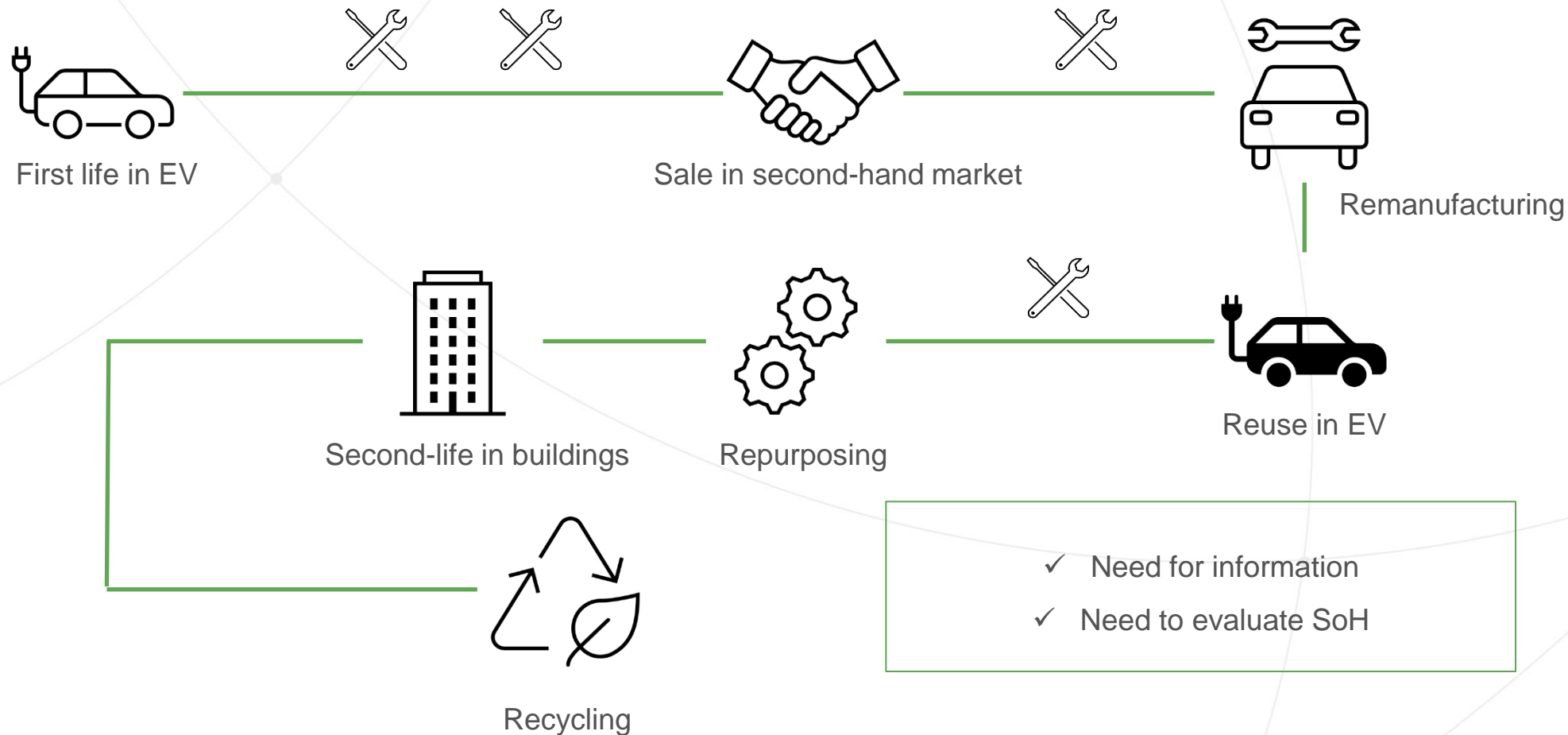
Source 1: [EU Eco-design study for batteries](#) for NMC 111 chemistry

Source 2: [EU Joint Research Centre, Sibelga](#)

Source 3: [Coolproducts](#)

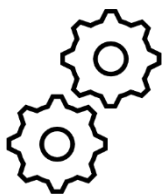
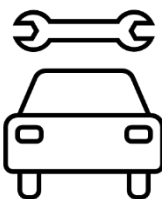


# Extended life cycle of a battery



# What are necessary skills to maximize battery life?

Stage	Tasks	Skillset categories	Specific training
<b>First life in EV</b>	Battery diagnostics & repair	Blue-collar	HEV 4, battery pack dismantling, training in SoH testing tools
<b>Sale in second-hand market</b>	SoH estimation	Blue-collar	Training in SoH testing tools
<b>Remanufacturing</b>	Dismantling, SoH estimation, new system design, new system assembly	Blue-collar & white-collar	HEV 4, battery pack dismantling, battery pack assembly, safety & performance standards
<b>Repurposing</b>	Dismantling, SoH estimation, new system design, new system assembly	Blue-collar & white-collar	HEV 4, battery pack assembly





# Different types of blue-collar trainings

- Besides standard academic trainings, a series of other industry trainings are required for blue-collar personnel.

## Battery skills

- Training on battery dismantling & repair (regulated?)
- OEM-specific training

## Logistics

- Safety for transport trainings (IATA certification, UN38.3)
- Handling of forklifts & other field equipment
- ...

## Safety

- HEV4
- Design for safety industry trainings

## New battery assembly

- Trainings in norms & standards (IEC standards, UL standards)
- Trainings on power electronics

# Need to scale-up training offer!



- Battery dismantling & reuse



- HEV 4, various



- Various white-collar & blue-collar trainings



- UL standards



- Safety for air transport

- **Very limited availability!!!**
- **Example: 4-5 months waiting time for HEV4 training**



# White-collar education on batteries

- Very good offer for post-graduate curricula in batteries, mostly at PhD level.
- However, battery courses still largely eluding undergraduate curricula

Shout-out to Belgian academia & industry for very advanced offer in post-graduate education, PhD and post-doc programs!



Still painfully missing: trainings on norms & standards (IEC, UL, UN38.3, national standards etc.)

# Not to forget: significant need for research to progress!!!

**Worst case scenario:** SoH  
evaluation through  
characterization/ageing tests,  
dismantling

€ € €

€

**Best case scenario:** Retrieval of  
information from BMS, direct reuse



## Significant need to progress in several areas:

- New SoH estimation methods
- Automated dismantling
- New-gen BMS's & EMS's
- Design for recycling & reuse



**Great expectations from  
academia & research  
funding!**







We're hiring! Want to join us?



BATTERIES FOR LIFE



# Interested? Contact us to know more!

## Contact

info@watt4ever.be

WATT4EVER BV - SRL

Woluwedal 46 b.13 Blvd de la Woluwe

BE-1200 Brussel / Bruxelles

[www.watt4ever.be](http://www.watt4ever.be)







## Importance of standards in recycling batteries in the context of an European circular economy

**Iuliana CHILEA**

**General Director ASRO**

# Content

**Standardization System**

**Standards & Regulations**

**The importance of Standardization**

**Current status and initiatives**

**Recommendations**



# Who we are

- private organization association of members
- of public interest
- non-governmental & non-political

*recognized as the*

## **National Standardization Body:**

- *National Standardization Law 163/2015*
- *EU Regulation 1025/2012*
- manage the national standardization activity in Romania (160 Technical Committees)
- disseminate information about standardization
- sale standards



## Member of:



International Electrotechnical Commission – since 1927



International Organization for Standardization – since 1950



European Committee for Standardization – since 2006



European Committee for Electrotechnical Standardization – since 2006



European Telecommunications Standards Institute – NSO Member



# The European Standardization System



International

European

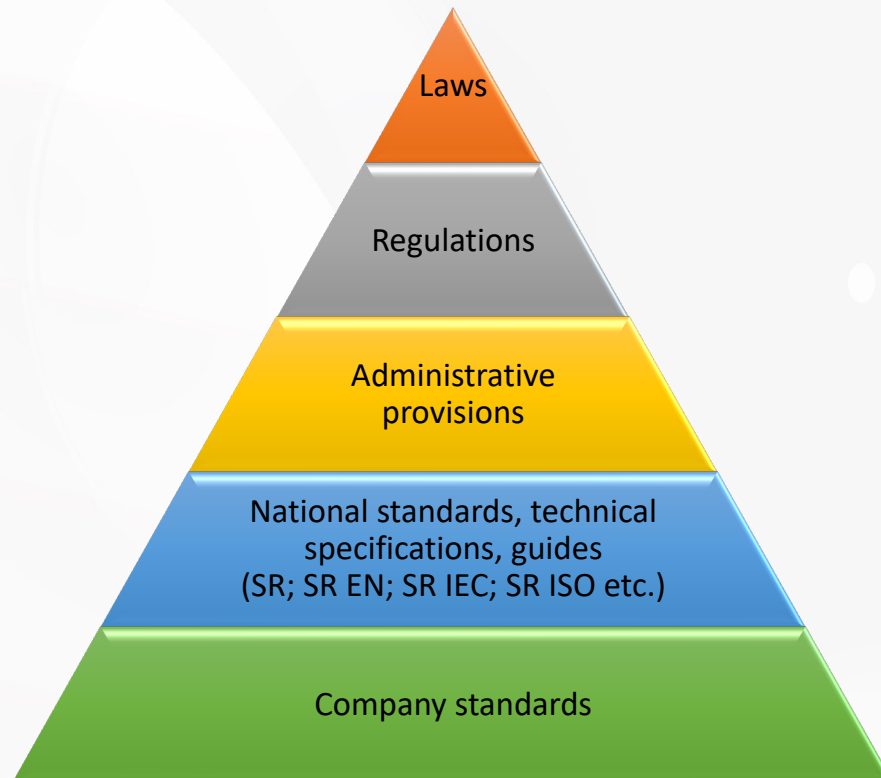
National



National Standardization Body in Romania

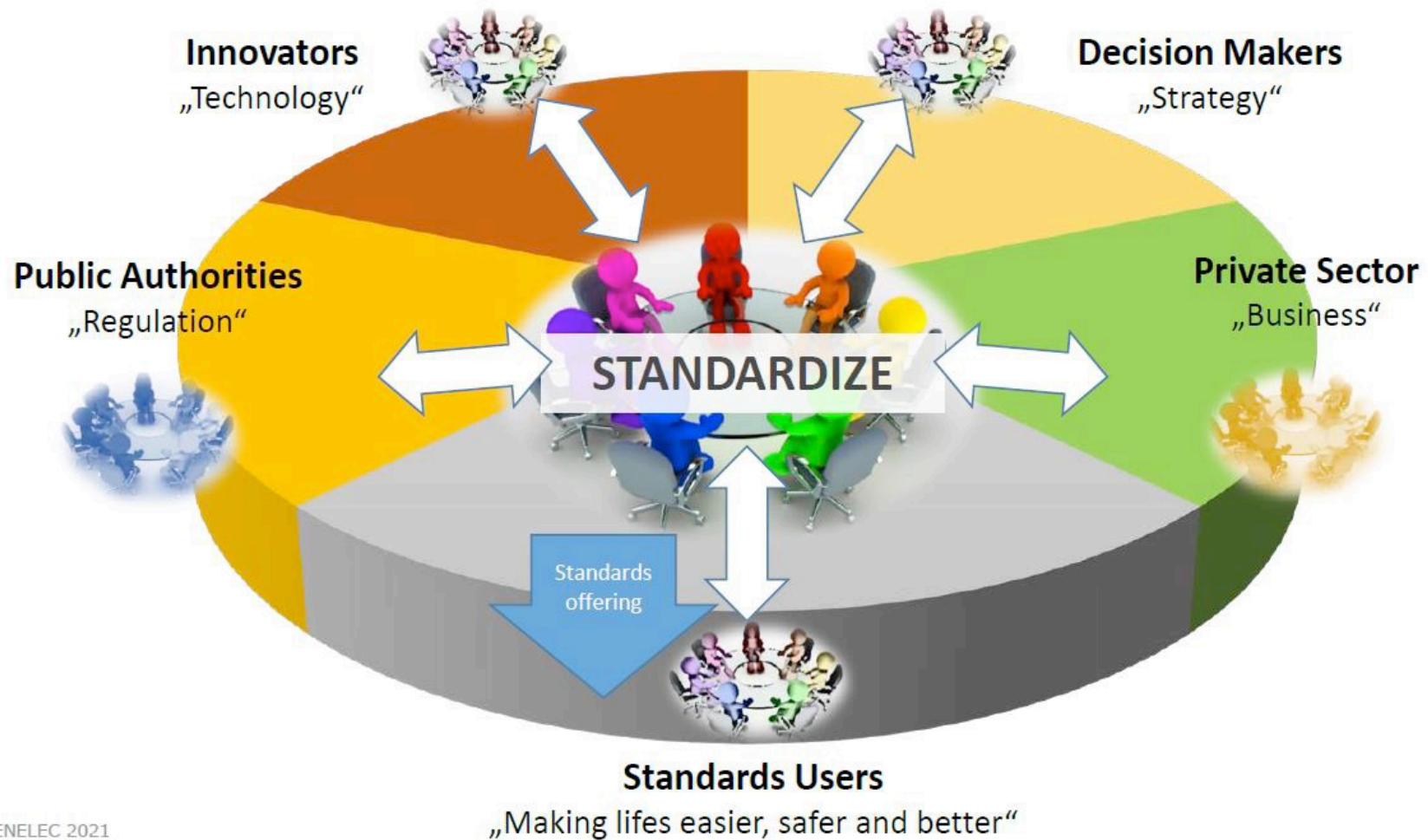
# Standards and regulations

- Hierarchy of regulatory documents

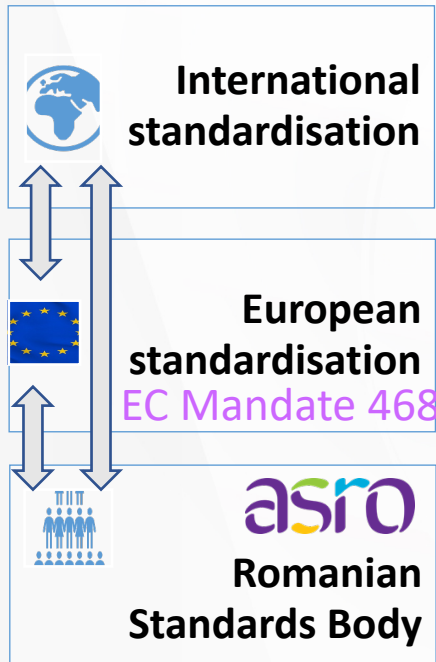











- Using of **standards in all domains**
- Ensuring the implementation of technical regulations;
- Industry - all industrial sectors;
- Design, research and construction;
- Product certification;
- Management systems;
- Public services – healthcare, education, public safety, etc.
- Public procurement and as basis for contract negotiation, etc.

# Importance of standardisation



# Standardisation in automotive industry



Automotive engineering	Electric road vehicles	Charging infrastructure	Charging interface for wired charging
 ISO/TC 22 Road vehicles	<div>  IEC/TC 69 Electric vehicles                     </div> <div>  ISO/TC 22/SC 32 ISO/TC 22/SC 37                     </div>	 IEC/TC 64	 IEC/TC 23
 CEN/TC 301	 CLC/TC 69X	 CLC/TC 64	 CLC/TC 23
ASRO/CT 78 <ul style="list-style-type: none"> <li>• Manufacturing;</li> <li>• Vehicle to grid communication interface:</li> </ul> <b>SR EN ISO 15118</b> series	ASRO/CT 333 <ul style="list-style-type: none"> <li>• Safety requirements related to the electric vehicles and charging stations:</li> </ul> <b>SR EN 61851</b> series	ASRO/CT 136 <ul style="list-style-type: none"> <li>• The electrical installations in buildings and metering system interface:</li> </ul> <b>SR HD 60364-7-722</b>	ASRO/CT 11 <ul style="list-style-type: none"> <li>• Charging connectors: <b>SR EN 62196</b> series</li> <li>• Charging cables: <b>SR EN 62752</b></li> </ul>



# Standardisation activities concerning the charging of electric vehicles

- **CEN, CENELEC and ETSI develop standards for the electric vehicles and charging infrastructure** - Mandate M/468 concerning charging of electric vehicles and M/579 concerning performance, safety and sustainability requirements for batteries
- **CEN-CENELEC eMobility Coordination Group** was created as a result of the need to coordinate the activities carried out by the involved technical committees by M/468
- **CEN-CENELEC eMobility Coordination Group coordinates** its work program with:
  - CEN-CENELEC-ETSI Smart Grid Coordination Group - M/490
  - CEN-CENELEC-ETSI Smart Metering Coordination Group - M/441
  - CEN-CENELEC Smart and Sustainable Cities and Communities

# Standardization for a Circular Economy



## ISO/TC 323 Circular economy

**Scope:** Standardization in the field of Circular Economy to develop frameworks, guidance, supporting tools and requirements for the implementation of activities of all involved organizations, to maximize the contribution to Sustainable Development.

**Excluded:** Aspects of Circular Economy already covered by existing committees.

**Secretariat:** AFNOR, France

**SUSTAINABLE DEVELOPMENT GOALS**

This committee contributes with 4 standards to the following Sustainable Development Goals:



# Standardization for a Circular Economy



**6 ISO standards under development  
under the direct responsibility of  
ISO/TC 323 - Circular economy**

**[ISO/CD 59004](#)** –

Circular Economy – Terminology, Principles and  
Guidance for Implementation

**[ISO/CD 59010](#)**

Circular Economy — Guidance on the transition  
of business models and value networks

**[ISO/CD 59020](#)**

Circular Economy — Measuring and assessing  
Circularity

**[ISO/WD 59040](#)**

Circular Economy — Product Circularity Data Sheet

**[ISO/CD TR 59031](#)**

Circular economy – Performance-based approach – Analysis of  
cases studies

**[ISO/CD TR 59032.2](#)**

Circular economy - Review of business model implementation



# Standardization for a Circular Economy



## CEN/CLC/JTC 10 – Material efficiency aspects for products in scope of Ecodesign legislation

**Scope:** Material efficiency aspects for products in scope of the Ecodesign Directive 2009/125/EC and its future revisions.

Producing generic and horizontal CEN-CENELEC publications covering aspects such as assessment methods, design rules, dematerialization, digitalization and transfer of information on a variety of material efficiency topics, in particular (but not limited to):

- Extending product lifetime
- Ability to reuse components or recycle materials from products at End-of-Life
- Use of reused components and/or recycled materials in products.

\* Includes coverage of the European Commission defined list of Critical Raw Materials (CRM).

**Secretariat:** NEC (CENELEC)





# Standardization for a Circular Economy



## **CEN/CLC/JTC 10 – Material efficiency aspects for products in scope of Ecodesign legislation**

EN 45552:2020 General method for the assessment of the durability of energy-related products

EN 45553:2020 General method for the assessment of the ability to remanufacture energy-related products

EN 45554:2020 General methods for the assessment of the ability to repair, reuse and upgrade energy-related products

EN 45555:2019 General methods for assessing the recyclability and recoverability of energy-related products

EN 45556:2019 General method for assessing the proportion of reused components in energy-related products

EN 45557:2020 General method for assessing the proportion of recycled material content in energy-related products

EN 45558:2019 General method to declare the use of critical raw materials in energy-related products

EN 45559:2019 Methods for providing information relating to material efficiency aspects of energy-related products

CLC/TR 45550:2020 Definitions related to material efficiency

prEN 45560 Method to achieve circular designs of products (Under Drafting)

# Other relevant technical committees



## ISO/TC 298 Rare earth

**Scope:** Standardization in the field of rare earth mining, concentration, extraction, separation and conversion to useful rare earth compounds/materials (including oxides, salts, metals, master alloys, etc.) which are key inputs to manufacturing and further production process in a safe and environmentally sustainable manner.

**Secretariat:** SAC – China



This committee contributes with 8 standards to the following Sustainable Development Goals:



# Recommendations

- All stakeholders obtain benefits by the involvement in standardization work carried out within technical committees;
- National Regulators should maintain close collaboration with Standardization Technical Committees according to their competence domains, having in view that the standards shall be prepared to be used as technical basis for regulations;
- Participation in the standards development process of all national representatives of the industry, regulators, equipment manufacturers, professional associations, consumers, universities, etc. in the European and international technical committees.
- Close collaboration between all representatives of automotive industry, manufacturers of Electric Vehicles batteries and the waste recycling industry (electronic and electrotechnical equipment, including EV batteries) as well as regulators in order to contribute, within the international and European technical committees (e.g. ISO TC 298, IEC TC 111, CLC/TC 111), to the development process of suitable standards for recycling of vehicles, their batteries and the other electronic components in order to meet the environmental and health requirements provided by relevant European policies.





## Q & A

MAGAZIN.ASRO.RO



WWW.ASRO.RO



ROSTANDARD







@ ALBATTIS

# Safe recycling and secondary use of EV batteries: Required Skills and Competencies from a AI-driven Company perspective



**120 GWh**  
USED BATTERIES  
IN 2030

**Gigantic & Overlooked Market Opportunity**

Electric vehicles (EV) are coming — by the millions. But what will happen to the batteries after use in the car? Used battery volumes will grow faster than newly produced batteries in 2030 (40x vs. 10x). 120 GWh (= 2 million EV battery packs) of used electric vehicle batteries could be re-used for energy storage in 2030 in Europe. Still, there is currently no infrastructure to make this happen in reality.

**AI-  
Driven**  
ANALYTICS AND  
MARKETPLACE

**Unique Technology & Offering**

Circunomics' AI-powered battery marketplace allows OEMs access to a quality-checked service network that collects, remanufactures, and recycles used batteries at scale. Circunomics analytics are best-in-class in simulating the performance of second-life batteries. Our unfair advantage is access to battery cells, second-life data, and in-depth recycling know-how.

**13 FTE**  
9 NATIONS, ELITE  
UNIVERSITIES

**Experienced Team, Investors & Advisory Board**

Leadership team that developed intelligent platform solutions, digital services for tier 1 automotive OEMs, and analytics tools for battery producers. Investors with NASDAQ IPOs and advisory board with DAX C-level managers.

**€ 1.4m**  
PROJECTED  
REVENUE 2023

**Commercialization**

Currently, 50 MW is on the platform, and an additional 50 MW supply is incoming. MoUs with ESS Manufacturers and multiple Recyclers, starting pilots with several OEMs. Together with Shell, we signed a Co-Sales agreement to tackle the enormous Automotive OEM and energy sector.



# Memberships & Associations



# What makes a battery truly sustainable?

The battery is responsible for 50% of the cost of an electric vehicle or energy storage and almost 70% of its lifecycle carbon emissions. The most powerful lever to reduce the carbon footprint and increase the profitability of a battery is a second life/use.

**The world needs circular batteries.**

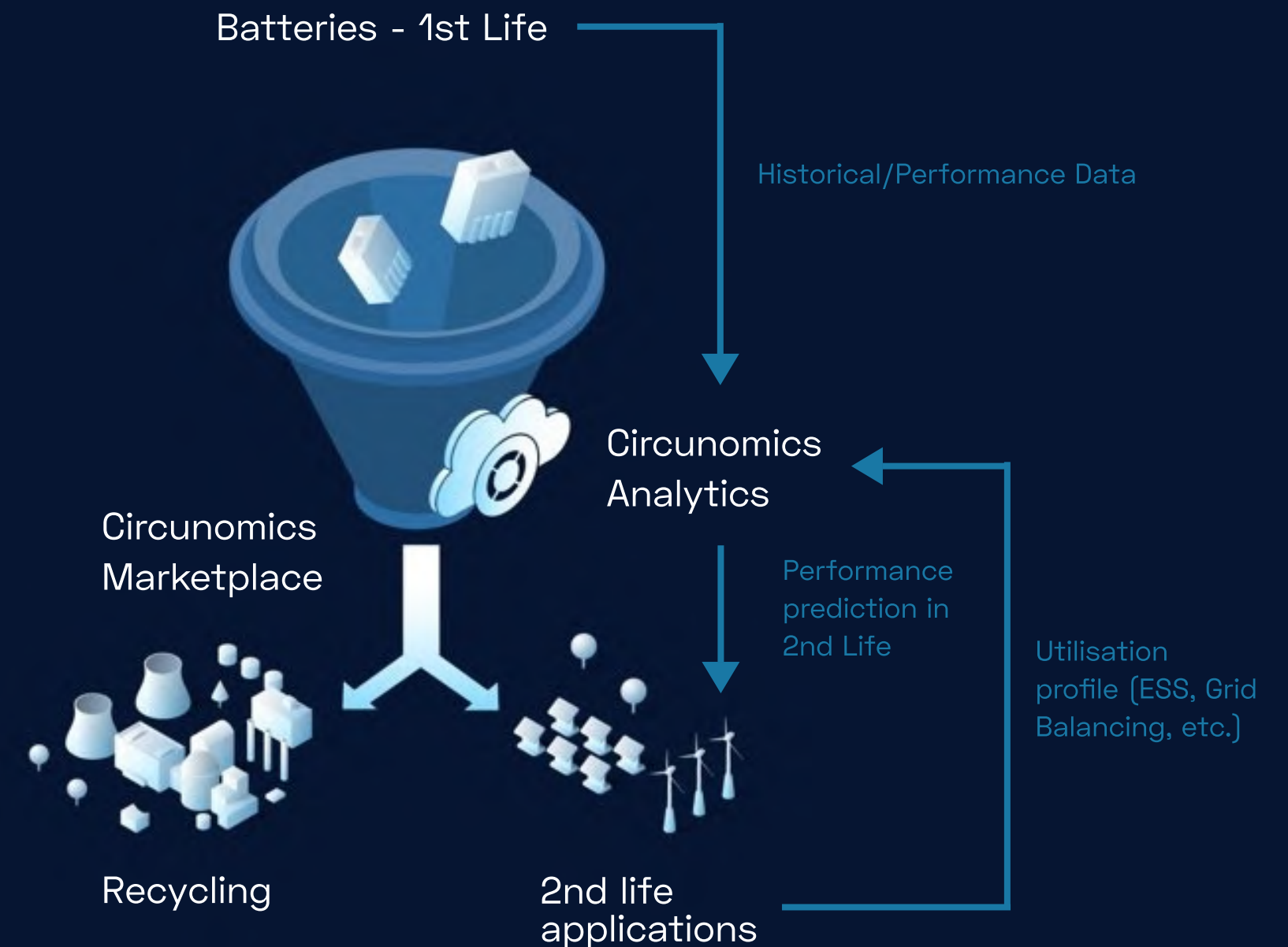
To make this a reality, OEMs and energy companies need a partner to manage millions of used batteries. They have no partner to transport, test, dismantle, remanufacture, and recycle tens of thousands of used batteries.

**This is what Circunomics is changing.**



# How Circunomics can help generating maximum value from batteries

Circunomics is based on two main components. Circular Analytics (1st life analytics & 2nd life simulations) and a marketplace for trading batteries into a second life. Deciding whether a battery is suitable for second life can be complex, especially for large volumes, and buyers want to know how well these batteries will perform in their application. Circunomics helps battery owners (OEMs) and buyers take those decisions at scale.





# Essential Competencies for AI Deployment

1

## Ability to Learn

AI deployment requires continuous monitoring and modification, so one of the critical competencies for our team members is the ability to learn. AI engineers and data scientists may require as much training as their models because the AI field is rapidly evolving, with new algorithms appearing frequently.

2

## Relevant Technical Knowledge

One primary requirement for the AI engineer or data scientist is solid technical knowledge. Technical members of our deployment team need to be familiar with neural networks, deep learning, algorithm development, software development, programming, data science, statistics, and other AI fundamentals.

3

## Understanding of Security and Data Privacy

Team members also need to consider whether data privacy issues are involved, as this may affect the design and implementation of the AI model. That's because several applications for artificial intelligence involve sensitive assets or data.

**And with the overarching  
competencies and skills already  
mentioned, the most important  
thing is!**

# Do Know Exactly What You're Looking For

## DATA SCIENTIST

- Uses data to build algorithms or machine learning models, that answer business questions or address business needs

## MACHINE LEARNING ARCHITECT

- Maintains resources needed to ensure a scalable and flexible environment for machine learning model pipelines
- Also introduces new technologies when appropriate that improve machine learning model performance in production

## DATA LEADER / MANAGER

- Ensures work being done aligns with business goals and that, teams have the necessary tools and resources to build the best solutions

## DATA ENGINEER

- Responsible for developing and maintaining analytics structures and data pipelines, including discovering new sources of data and recommending ways to improve data accuracy and quality

## ANALYST

- Generate baseline insights for a specific team or line of business and collaborate with data scientists to build larger business-impacting solutions



# What challenges do we face as a facilitator (SaaS Provider) of secondary use and safe recycling of EV Batteries?

## As a Battery Engineer

- Lab testing, design, and supervision of data quality
- Fast, cheap, and accurate SoH, SoC estimation from the field, historical, and lab data
- Anomaly detection and batteries security

## As a Data Scientist

- Developing AI and physics-based models
- Capturing non-linearities (especially when SoC is near the extrema 0% or 100%, the effect of temperature, high C-rates, aging phenomena...
- Optimizing the parameters, model validation, and testing.

## As an Analyst

- Analyzing, Cleaning, exploring and get insight from data and design impactful KPIs

# What challenges do we face as a facilitator (SaaS Provider) of secondary use and safe recycling of EV Batteries?

## As a Data Engineer/Architect

- Design resilient and scalable architecture and infrastructure
- Developing Data Pipelines
- Cybersecurity and data privacy

## As a Software Engineer (different roles with different competencies)

- Frontend-Development (Development of User Interfaces)
- Backend-Development (Development of server-side applications and API's)
- Software-Architects (Provide experienced leadership and technical direction, Own the entire software development lifecycle - problem definition, design, development)
- DevOps (Infrastructure as Code, CI&CD, Monitoring and Tracking Performance of the whole Infrastructure)

## As a Human Resources Business Partner

- Strategic Leader
- International Mindset
- Qualified Talent Scouting
- Transparent, Trustworthy and Direct Communication

# Thank you

[www.circunomics.com](http://www.circunomics.com)

Phone +49 (0)160 9289233

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# Skills and Competencies for Battery Recycling and Battery Handling

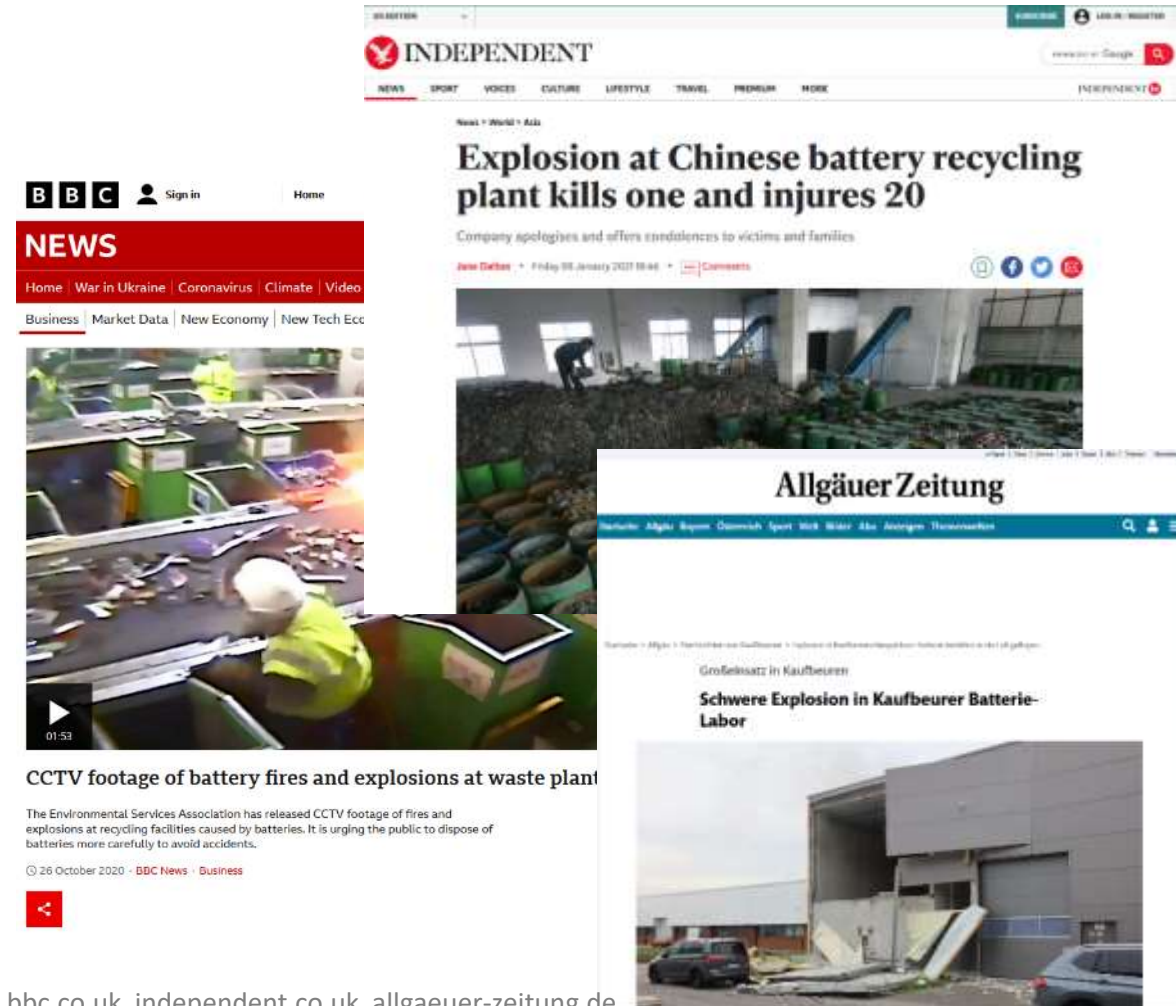
27.1.2023

Johannes Rößner



# Importance of safety in battery handling

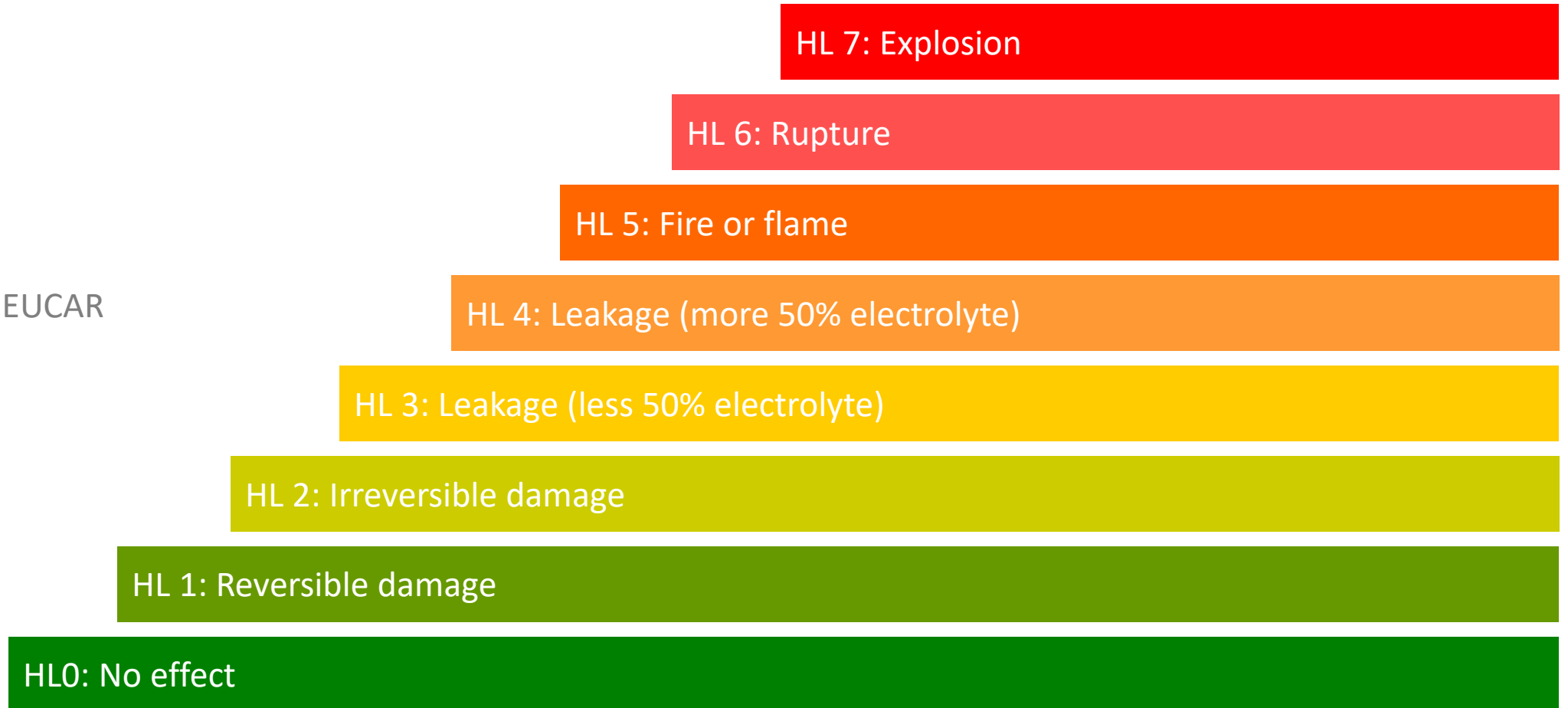
- Safe battery handling is a key point for successful operation
- Risks exist towards:
  - People
  - Machines
  - Environment
- Risk of event until batteries are drained of energy



Source: [bbc.co.uk](https://www.bbc.co.uk), [independent.co.uk](https://www.independent.co.uk), [allgaeuer-zeitung.de](https://www.allgaeuer-zeitung.de)

# What can happen: Hazard levels

According to EUCAR



# What can lead to such a reaction

- False treatment: outside of the operation conditions
  - Too hot
  - Too cold
  - Too high voltage
  - Too low voltage
  - Too high charge current
  - Too high discharge current
  - Too humid&dirty environment

# Battery Safety

## The recycling view

- Behavior of old batteries is not fully clear
- Batteries that go to recycling:
  - Towards end of life = poor SOH
  - Damaged
  - Sometimes undefined state / no means to analyze the status
- Typical handling can trigger event:  
Vibration & shock // Drop // Short circuit // Leakage
- High Voltage carries risk of electrocution in case of wrong handling
- As long as cell/pack contains energy, there is a risk
- Only after complete discharge can the battery be expected to be safe

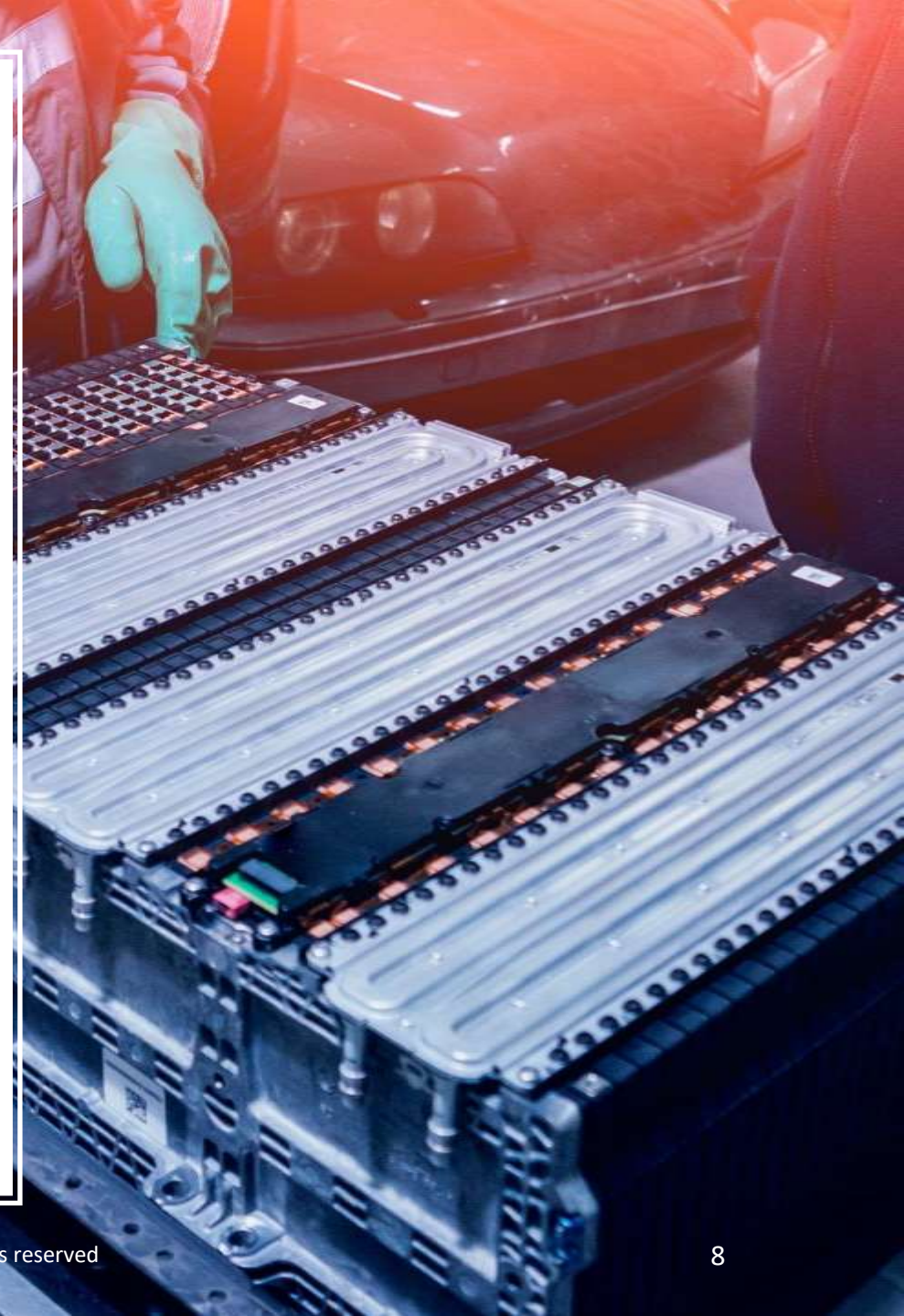




# Skills & Competency

## HV training and the actual doing

- Training for dealing with high voltage is baseline for meeting working safety regulations
- HV trainings are focused on government mandated requirements, based on electrical installations
- Work with batteries is only partly considered
- Specific challenges of recycling work is not considered



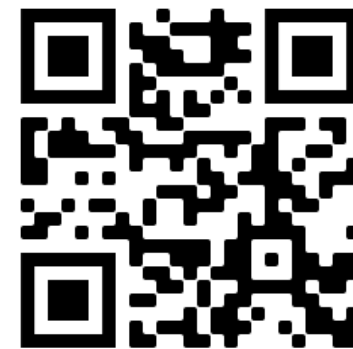
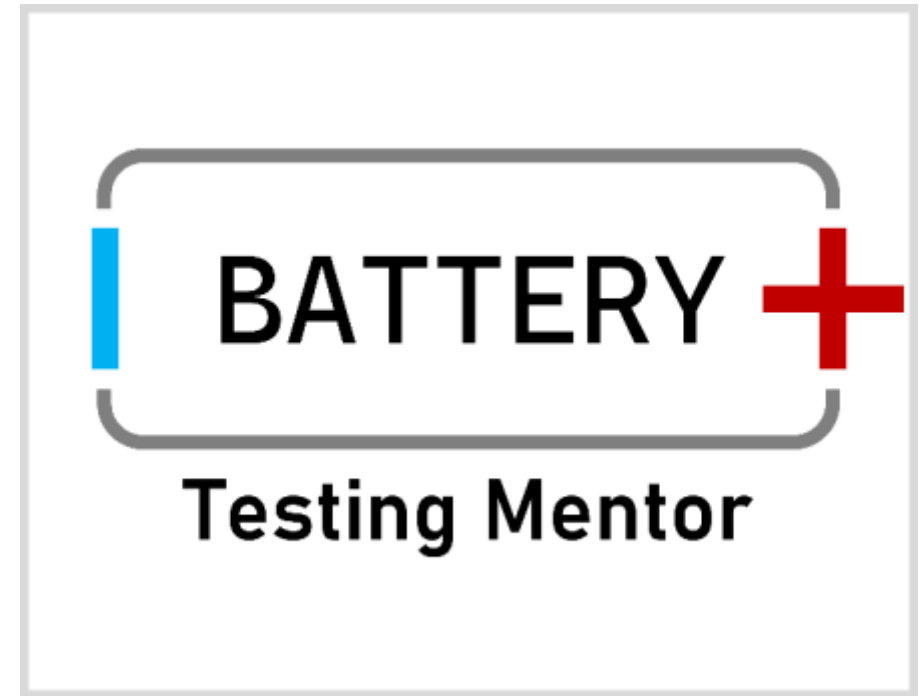
# Example: Training on battery disassembly

- Recycling company receives old battery packs
- Challenge: disassembly of live battery packs to enable discharging of modules
- 2 day training developed:
  - Sensibilization of dangers arising from batteries
  - Practical training of battery pack disassembly
  - Interactive group-work on batteries

# A new battery podcast

- A podcast focusing on advice for battery test labs, but also for companies handling batteries
- Subscribe to emails with the key takeaways for handling batteries
- Actionable, short and to the point!

[www.bt-advisor.com/btm](http://www.bt-advisor.com/btm)





# Get in contact!



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