Standards for safe stationary batteries

EASE Energy Storage Global Conference 2024

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Introduction

About the presenter

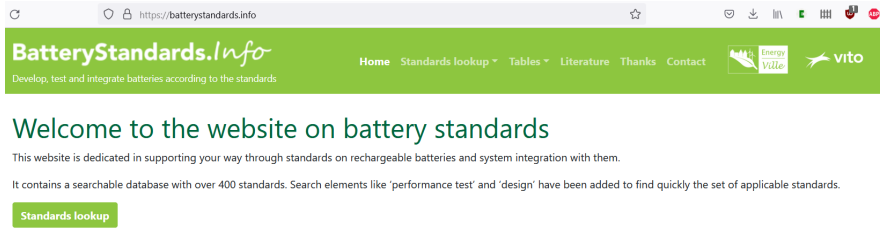
- Grietus Mulder is researcher Electrical energy storage
  - Batteries: testing, modelling & system integration
  - Standardisation
    - Chairman Belgian mirror committee for battery standardization (BEC-CEB TC21)
    - IEC & CENELEC committees (TC21, SC21A, TC21x)
    - Ecodesign Batteries study
      - https://ecodesignbatteries.eu/documents.html
- Teacher at SyntraPXL
  - Courses for professionals (evening courses)
    - Battery technology
    - Hydrogen technology
  - EIT InnoEnergy
    - European Battery Alliance

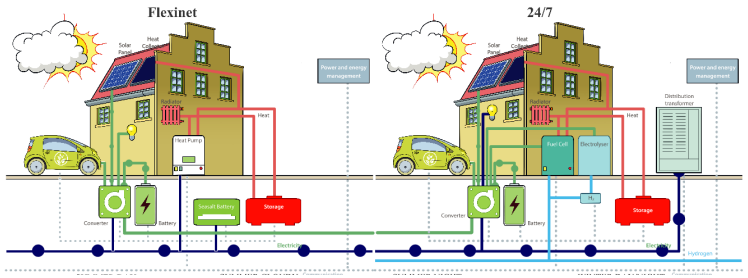
Introduction

About the presenter

- Interesting topics
  - Ecodesign EV charging supply equipment
    - BESS is used for charge parks
    - https://ecodesign-ev-charger.eu/
  - Website on battery standards with tables and reports
    - https://batterystandards.info/
  - Public report on repurposing batteries
    - https://zenodo.org/records/6674934
  - Battery-physics based energy management (Flexinet)
    - https://github.com/Battery-Intelligence-Lab/SLIDE
  - Microgrids and Energy Management System development in Morocco (VITO-MASEN)
    - https://www.fdfa.be/en/memorandum-shapes-cooperation-between-flanders-and-morocco

Government of Flanders





Rules and standards for stationary battery systems (and more)

Short overview

- European regulation
  - An obligation, valid throughout the European Union
    - European Battery Regulation 2023/1542
- European directives
  - A directive sets a goal that all EU countries must achieve and defines the essential (abstract) requirements
    - Machinery Directive & Low Voltage Directive.
- National legislation
- Regional legislation
- *Insurance companies*
- *Fire brigade*

- Standards
  - Support for e.g. legislation (esp. harmonised standards) and safe product development
    - World: ISO, IEC; Europe: CEN, CENELEC; Belgium: NBN, BEC
    - IEEE, UL

European Battery Regulation 2023/1542

Overview

- Regulation: directly applicable
  - Member states do not have to copy it first into national legislation
    - Previously it was a directive
      - Battery Directive 2006/66/EC
    - Applicable from 18 February 2024
    - https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32023R1542

28.7.2023 EN Official Journal of the European Union L 191/1

I

(Legislative acts)

REGULATIONS

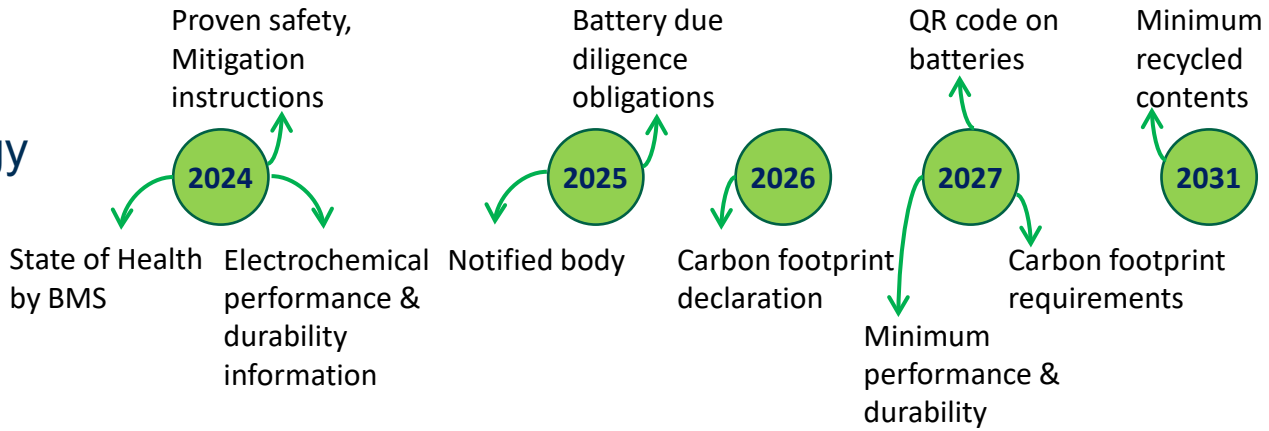
REGULATION (EU) 2023/1542 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

of 12 July 2023

concerning batteries and waste batteries, amending Directive 2008/98/EC and Regulation (EU) 2019/1020 and repealing Directive 2006/66/EC

(Text with EEA relevance)

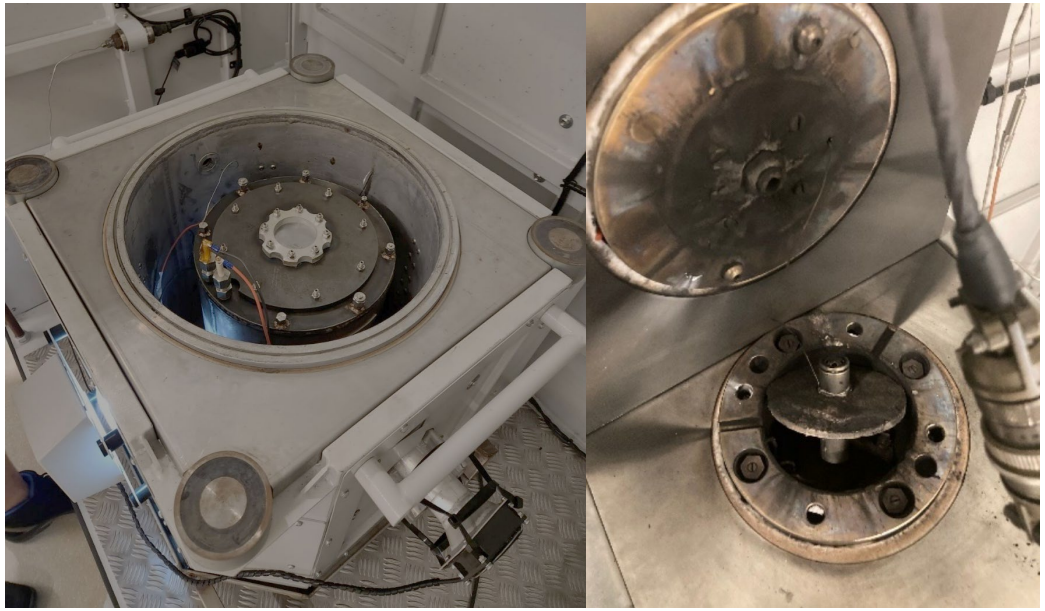
- Subjects put in force gradually
  - Some of them about industrial batteries and BESS shown in figure
- Supported by
  - Delegated acts
    - Like Carbon Footprint evaluation methodology
  - Standardisation development M/579
    - CEN & CENELEC



European Battery Regulation 2023/1542

Safety of stationary battery energy systems

- Annex V
  1. Thermal shock and cycling
  2. External short circuit protection
  3. Overcharge protection
  4. Over-discharge protection
  5. Over-temperature protection
  6. Thermal propagation protection
  7. Mechanical damage by external forces
  8. Internal short circuit
  9. Thermal abuse test: exposure to e.g. 85°C
  10. Fire test: risk of explosion by exposing battery to fire
  11. Emission of gases: risk of toxic gases
      (for all previous tests)



VITO

Existing safety standards for stationary battery systems (BESS)

Selection

- IEC TC21 & SC21A — Secondary Batteries
  - EN-IEC 62619 — Requirements and tests for the safe operation of industrial lithium batteries, including stationary applications
    Note: different from requirements for EV batteries
  - EN-IEC 63056 — Safety requirements for lithium cells and batteries for use in ESS
  - EN-IEC 62485-5 — Part 5: Safe operation of stationary lithium ion batteries
- IEC TC120 — Grid integrated EES systems
  - EN-IEC 62933-5-1 — Part 5-1 Safety considerations for grid-integrated EES systems - General specification
  - EN-IEC 62933-5-2 — Part 5-2 Safety requirements for grid-integrated EES systems – Electrochemical-based systems
  - IEC 62933-5-3 — Part 5-3 Safety requirements when performing unplanned modification of electrochemical based EES systems
  - IEC 62933-5-4 — Part 5-4 Safety test methods and procedures for grid integrated EES systems – Lithium ion battery-based
- IEC TC64 — Electrical installations
  - IEC 60364-5-57 — Part 5: Selection and erection of electrical equipment - Clause 57: Erection of stationary secondary batteries

Existing safety standards for stationary battery systems (BESS)

National standards and some other prescriptions

- Some national standards (non-exhaustive)
  - DE: VDE-AR-E 2510-50 — Application rule: Stationary energy storage systems with lithium batteries – Safety
  - DE: VDE-AR-E 2510-2 — Stationary storage systems coupled to low voltage grid
  - NL: NEN 4288 — Bedrijfsvoering batterij-energieopslagsystemen -aanvulling NEN 3140
  - ES: UNE 0075 — Requirements for the re-use of mobility batteries in stationary use
- By associations
  - PGS 37-1 — Lithiumhoudende energiedragers: energieopslagsystemen (EOS); Richtlijn voor de veilige opslag van elektriciteit in energieopslagsystemen
  - BVES — BVES-Brandschutzleitfaden
  - vds-3103 — VdS Merkblatt Schadenverhütung Lithium Batterien
  - OIB-Richtlinie 2 — Brandschutz
  - Vfds MB 10 17 Lithium Batterien Ref10 2020 09 Merkblatt Empfehlung Feuerwehreinsatz Lithiumgefahr

Standardisation mandate M/579

Involved committees and subjects

- CEN TC301 Road vehicles,
  - esp. WG18 Electric vehicle batteries

- CENELEC TC21X Batteries,
  - WG5 Light means of transport
  - WG6 Stationary batteries (was: industrial batteries)
  - WG7 EV batteries
  - WG8 Portable batteries

Table 1: List of new harmonised standards to be drafted as referred to in Article 1 and deadlines for their adoption

	Reference information	Deadline for the adoption
1.	Harmonised standard(s) on performance and durability aspects of portable rechargeable and non-rechargeable batteries	07 June 2026
2.	Harmonised standard(s) on performance and durability aspects of rechargeable industrial batteries and electric vehicle batteries	07 June 2026
3.	Harmonised standard(s) on capacity or average duration of portable rechargeable and non-rechargeable batteries, LMT batteries and SLI batteries	07 June 2027
4.	Harmonised standard(s) on parameters for determining the state of health and expected lifetime of stationary battery energy storage systems	07 June 2027
5.	Harmonised standard(s) on performance and durability aspects of LMT batteries and on parameters for determining the state of health and expected lifetime of LMT batteries	07 June 2027
6.	Harmonised standard(s) on safety aspects of stationary battery energy storage systems	07 June 2026

Table 2: List of new European standards to be drafted as referred to in Article 1 and deadlines for their adoption

	Reference information	Deadline for the adoption
1.	European standard(s) on the remanufacturing and repurposing of certain categories of batteries	07 June 2027

Standardisation mandate M/579

CENELEC TC 21X WG6 Stationary batteries

Action Item	Title
AI_3	Performance and durability for stationary storage applications
AI_10	Diagnostics and determination of the State of Health (SoH) for batteries with a management system.
AI_11	Diagnostics and determination of the State of Health (SoH) for batteries without a management system.
AI_12	Diagnostics and determination of the State of Health (SoH) for batteries with a management system – Part 3: advanced design
AI_13	Safety of Li-ion batteries from electrically propelled road vehicles for use in stationary applications
AI_16	Safety requirements for secondary lithium cells and batteries, for use in industrial applications
AI_17	Safety requirements for secondary batteries and battery installations Part 1: General safety information
AI_18	Safety requirements for secondary batteries and battery installations Part 2: Stationary batteries
AI_19	Safety requirements for secondary batteries and battery installations Part 5: Safe operation of stationary lithium ion batteries
AI_20	Stationary lead-acid batteries Part 11: Vented types - General requirements and methods of tests
AI_21	Stationary lead-acid batteries Part 21: Valve regulated types - Methods of tests
AI_22	Stationary lead-acid batteries Part 22: Valve regulated types - Requirements
AI_23	Stationary energy storage systems with lithium batteries in residential and small commercial applications - Safety requirements
AI_24	Insulation coordination, wiring, component dimensioning

Action items may change due to advancing insights

Harmonised standard on safety aspects BESS

CENELEC TC21X WG6 Stationary batteries: standards for action items

- AI 13 Safety of Li-ion batteries from electrically propelled road vehicles for use in stationary applications
  - Based on: DIN VDE V 0510-100 Safety of lithium-ion batteries from electrically propelled road vehicles for use in stationary applications
- AI 16 Safety requirements for secondary lithium cells and batteries, for use in industrial applications
  - Based on: EN-IEC 62619 Requirements and tests for the safe operation of industrial lithium batteries, including stationary applications
- AI 23 Stationary energy storage systems with lithium batteries in residential and small commercial applications - Safety requirements
  - Based on: VDE-AR-E 2510-50 Safety requirements for stationary battery energy storage systems (BESS) with lithium batteries

Harmonised standard on safety aspects BESS

CENELEC TC21X WG6 Stationary batteries: AI13

- Based on German VDE development
  - DIN VDE V 0510-100 Safety of lithium-ion batteries from electrically propelled road vehicles for use in stationary applications

  - Only the transfer of completely *unchanged* batteries
  - All the necessary steps to transfer a qualified, complete product into the "world" of stationary storage use

  - Homologised batteries in road vehicle application have to comply with legal requirements in stationary use.
  - Conformity of rules for both applications are compared and where necessary additional steps are defined.

  - The document does *not* cover higher level battery energy storage systems.
  - Document is covering industrial applications which only can be accessed and operated by professionals

Harmonised standard on safety aspects BESS

CENELEC TC21X WG6 Stationary batteries: AI13

- Based on German VDE development
  - E DIN VDE V 0510-100 Safety of lithium-ion batteries from electrically propelled road vehicles for use in stationary applications

Content

E DIN VDE V 0510-100

Harmonised standard on safety aspects BESS

Participation

- Please become member of your national mirror committee on battery standardization
  - France AFNOR UF35
  - Germany DKE AK 371
  - Belgium BEC-CEB TC21
  - Netherlands NEN Nec 21-35
  - Spain UNE CTN 203/SC 21
  - …

- These organisations can send you to the CENELEC and/or CEN committees for mandate M/579

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ENERGY IN TRANSITION