

# Energy transition

*But safely*

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# Agenda

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- Lithium-containing energy carriers
  - The challenges
- PGS 37-1 and 37-2 (Dutch guidelines)
  - PGS Guidelines new style
  - PGS 37-1 and 37-2
- Extinguishing systems
- Design must be different
  - Future developments
- Summary

# Lithium-Containing Energy Carriers



# The Challenges

## With electrification of our environment

- Energy transition brings:
  - An increasing number of electrical appliances and means of transport
  - Greater demand for energy carriers with increasing capacities
  - Gives completely different logistics (residual) flows
  - Asks for information to users, both private and certainly also business
  - Asks for active risk management

# The challenges

## Are new risks recognized?

- Risks:
  - Not just batteries;
    - Small barrels of chemicals with their own fire triangle
  - More and more permanently incorporated into consumer products;
  - Users are insufficiently aware of careful use;
    - Falling, bumping, charging, temperature influences
  - Energy storage systems (BESS) are getting bigger and bigger;
  - Increasingly large volumes in logistics processes due to wide applications;
  - Requires more and more attention in the waste/recycling process



**PGS 37- 1 and 2**

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# PGS-guidelines

## New style (2015)

- PGS New Style means that measures have been developed with a risk approach:
  - Legal frameworks;
  - Risk approach with the scenarios;
  - Goals;
  - Measures to meet the goals.
- PGS guideline provides:
  - Environmental Safety or Firefighting Environmental Safety;
  - Occupational safety;
  - Firefighting and Disaster Relief.
- Status PGS guidelines:
  - Min. I&W en BZK - Decree on Activities in the Living Environment (BAL)- directly effective rules;
  - Min. I&W - Decree on Quality of the Living Environment(BBT) - environmentally harmful activity when determining the Best Available Technology;
  - Min. SZW – Policies to Comply with Occupational Safety – state science and professional services;
  - Security Regions - Advising on fire safety in environmental permits and preparing fire and disaster control.



# PGS 37-1

## Lithium-containing energy carriers: Energy Storage Systems - BESS

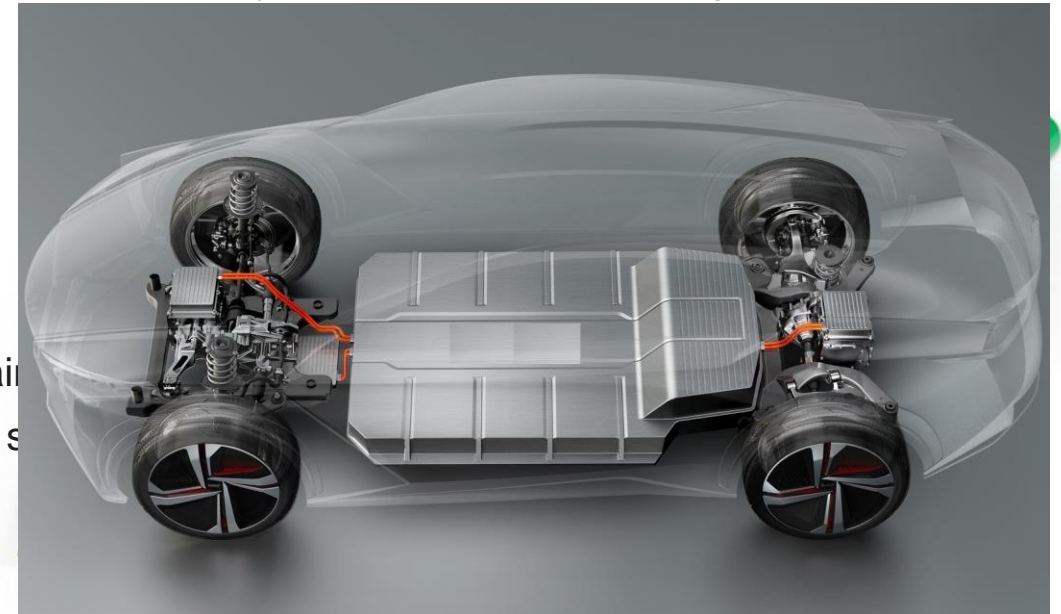
- Application:
  - BESS' consisting of lithium-containing rechargeable energy carriers that are electrically connected (in groups) with a total installed capacity in a room of more than 20 kWh, incl. peripheral equipment and BMS;
  - Both new, used and discarded BESS (waste stage) until the BESS is decommissioned;
  - Stationary, but also movable (rental);
  - Located indoors, outside (for example in a container), on a roof or on the outside wall.
- Does not apply to:
  - Systems used by private individuals, unless energy storage capacity > 20 kWh
  - The use of flow batteries;
  - Using solid state batteries;
  - The use of capacitors;
  - Electric motor vehicles as part of BESS (integrated in a smart grid).



# PGS 37-2

## Lithium-containing energy carriers: Storage

- Analyzed the risks associated with the storage of lithium-containing energy carriers
- Application:
  - On storage of lithium-containing energy carriers (cells, batteries or accumulators) referred to in table A chapter 3.1 ADR.
  - From storage to showroom;
  - Knows lower limits, but also refers to customization;
- Does not apply to:
  - Work stock;
  - Storage of vehicles, tools and two-wheelers in which lithium-containing energy carriers are installed;
  - Charging (large amounts of) energy carriers of electric bicycles or scooters.



# Extinguishing Systems

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# Extinguishing systems

## Recognize Thermal runaway

- Thermal-runaway arises in closed energy carrier
  - Visual 1st effects are extremely toxic and harmful
  - Very fast temperature rise
  - Escalation has violent effects with jet flames and flying exploding/burning cells
  - <https://www.youtube.com/watch?v=DACcpjbTGds&t=130s>



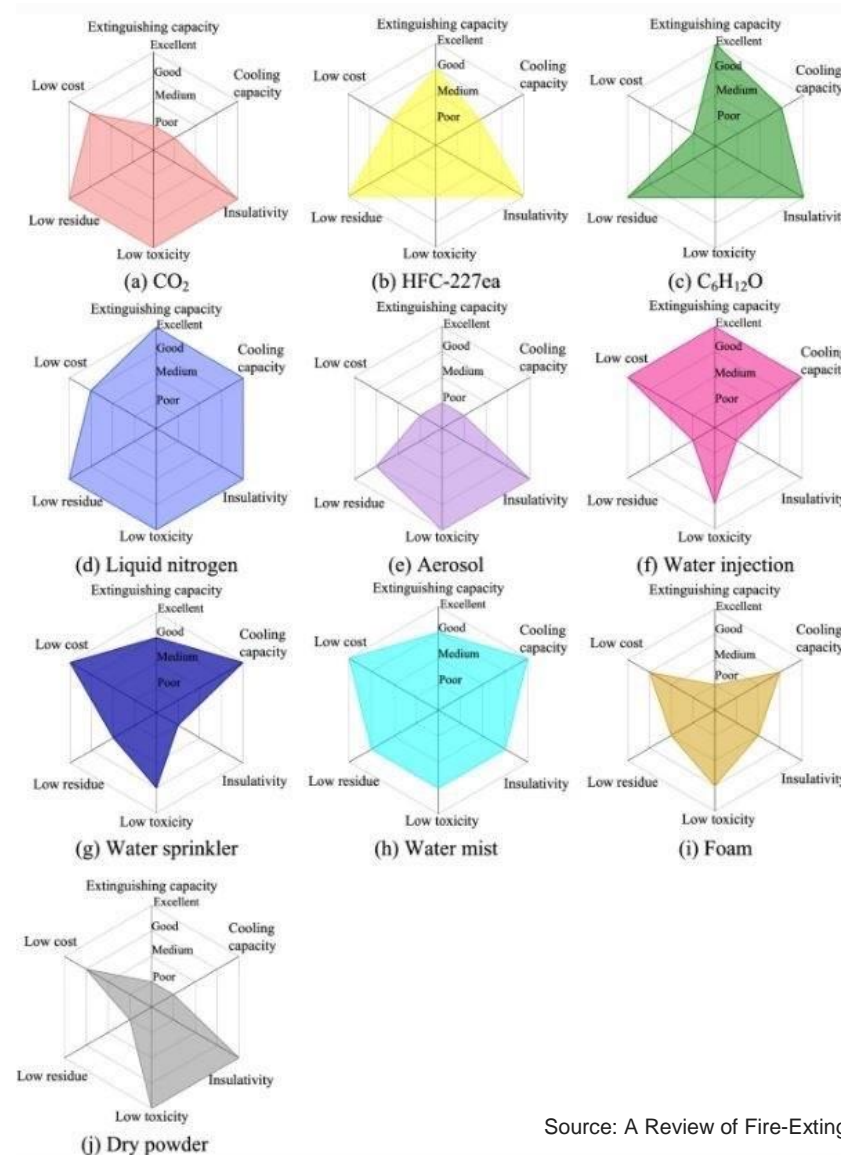
# Extinguishing systems

## Recognize Thermal runaway

- Application extinguishing systems
  - PGS 37-1 (at least not included)
    - FM DS 5-28 DC Battery Systems (April 2021)
    - FM DS 5-33 Electrical Energy Storage Systems (July 2020)
    - NFPA 855 Standard for the Installation of Stationary Energy Storage Systems (2020)
  - PGS 37-2 included - A certified fire extinguishing system is present within the storage facility in accordance with the CCV certification scheme Installing VBB installations when more than 2,000 kg of energy carriers are stored.
    - FM DS 8-1 Commodity Classification (April 2021)
    - FM DS 8-9 Storage of Class 1, 2, 3, 4 and Plastic Commodities (January 2022)
    - NFPA 1 Fire code (2018)
    - VdS 3856en Sprinkler Protection Of Lithium Batteries (2019-06)
    - VdS CEA-4001-TB-003-Li-Ion Batteries
  - New developments
    - Marioff High pressure water mist protection systems (BESS)
    - Liquid nitrogen systems (Siemens)

# Extinguishing systems

## Recognize Thermal runaway



Source: A Review of Fire-Extinguishing Agents and Fire Suppression Strategies for Lithium-Ion Batteries Fire 2022

# Design must be different

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# Future developments

## Design must be different

- New risks require real risk approach
  - Approx. 85% of all buildings are/will not be designed for (subsequent) users;
- Sustainability presents challenges
  - Can a sustainable building burn down completely?
  - Can you build continuity-oriented sustainable?
- Legislation lags behind facts;
- Social developments mean that continuity must be taken seriously;
  - Covid
  - Availability logistics
- Insurability of buildings is becoming a serious issue;
  - Insured values is growing
- Social impact/disruption
  - Growing sizes logistic locations in inhabited areas



# Summary

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# Summary

- Lithium-containing energy carriers are used more and more, but compositions are constantly changing and give a lot of challenges due to risk on thermal runaways
- Dutch guidelines PGS 37-1 en 2 (sub legislation) to structure the use and storage of lithium energy carriers are written and shared with the European Committee and will be the guideline for other countries
- Extinguishing systems are more and more tested to control fires with lithium energy carriers
- Design must be different and based on risk approach

