



# LI-ION AKKUMULÁTOROK GYÁRTÁSA

## Li Ion akkumulátor gyártás Magyarországon:

- SAMSUNG, 10 Gwh és épül 30 Gwh kapacitás
- SK Battery, 45 Gwh és épül 50 Gwh kapacitás
- Yuasa
- CATL Debrecen
- És egyéb beszállítók



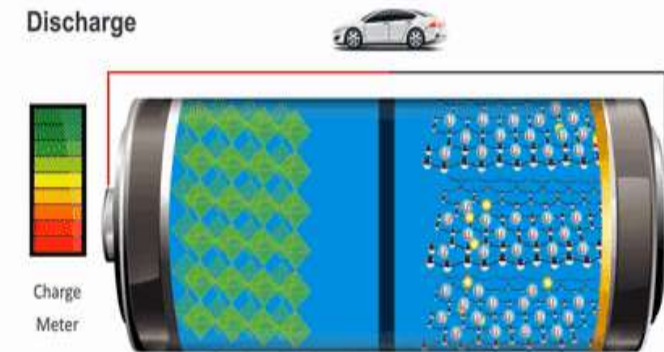
**Globális LIB gyártás 2021 -ben 296 GWH**

# LÍTIUM ION AKKUMULÁTOROKRÓL ÁLTALÁBAN

## Technológiához kapcsolódó tények:

- Sérülékeny nagy precizitást igénylő technológia
  - Túltöltés, mély kisülés
  - Cellák közötti rövidzárlat
- Érzékeny a hőmérsékletemelkedésre (folyamatos megfigyelést, hűtést igényel)
- Nehezen határozható meg a Li Ion cellák öregedése
- Új, még fejlődésben lévő technológia (kémiai összetevők változnak)

### How Lithium-ion Batteries Work



U.S. DEPARTMENT OF  
**ENERGY** | Office of ENERGY EFFICIENCY  
& RENEWABLE ENERGY

# LÍTIUM ION AKKUMULÁTOR MEGHIBÁSODÁSÁT OKOZÓ TÉNYEZŐK

- Túltöltés
- Használatból adódó sérülés
- Magas hőmérsékleti behatás
- Gyártási hiba
- Rövidzárlat a cellákat elválasztó közeg hibája miatt

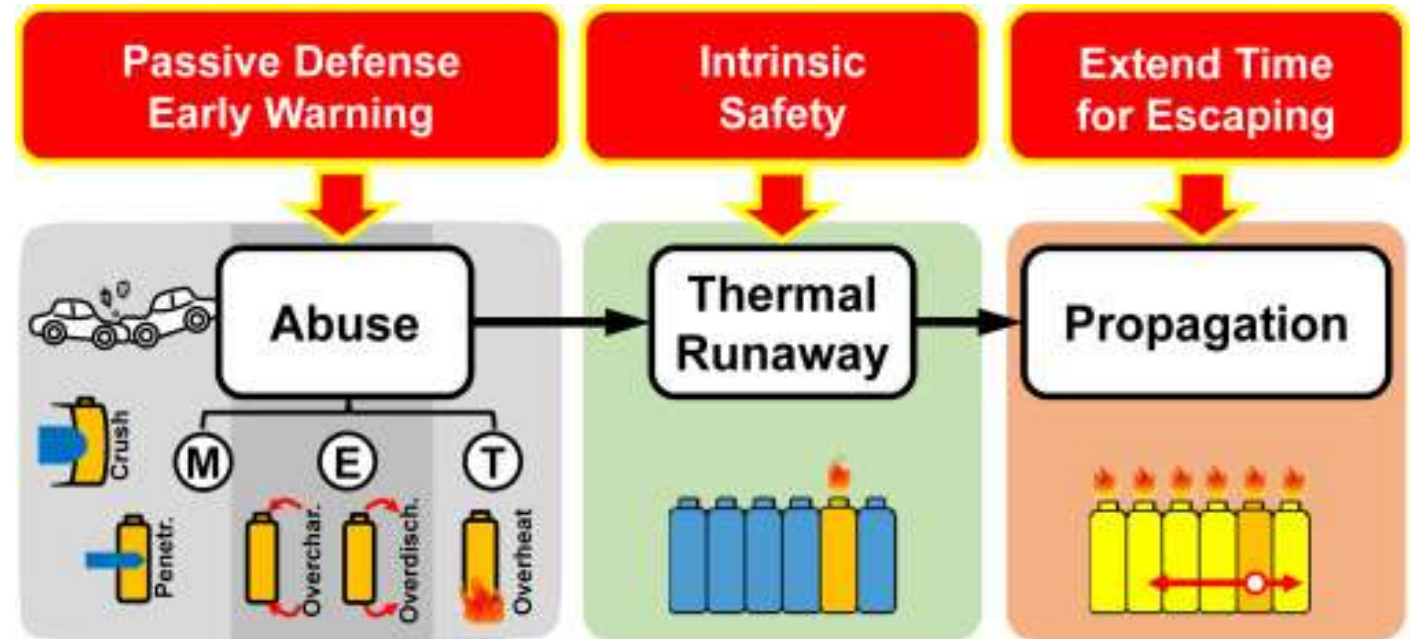


Image Source: <https://www.powerelectronicstips.com/thermal-propagation-triggering-and-mitigation-in-medium-and-large-format-battery-modules/>

# TŰZESETEK

## 2019

- Arizona - APS McMicken napelem park energia tároló egység robbanása



## 2017

- Dél-Korea - 23 különböző energia tároló egység és főleg gyártó egységben bekövetkezett tüzeset
- Samsung Galaxy Note 7 termék visszahívás



## 2020

- Anglia Merseyside – Orsted ipari létesítmény

## 2021

- Németország – stuttgarti autóbusz garázsban keletkezett tüzeset, 25 darab Mercedes-Benz eCitaro busz égett ki



Honeyw

It looked dramatic when the emergency services on Sunday night had to have a crane to lift the hybrid car with the burning battery up and down in the container so that it could be covered with water. Photo: Thomas Olsen

# UL 9540A TESZTEREDMÉNYEK (2021)

## Takeaway from UL Fire Test Report:

- UL very clearly states that traditional detectors are not capable of detecting gas/smoke before TR
- H2, CO, LEL and smoke only alarm only after TR occurs

### Fire Test 1: Page 51

Venting at 23 minutes & 43 sec.

TR at 26 minutes & 22 sec.

**Early Warning: 2 minutes & 39 sec.**

**UL Findings:** Smoke Observed at TR, 30 seconds later gas detectors reacted

### Fire Test 2: Page 88

Venting at 22 minutes & 30 sec.

TR at 28 minutes & 9 sec.

**Early Warning: 5 minutes & 39 sec.**

**UL Findings:**

- Smoke Observed at TR, within 30 seconds another cell went into TR
- CO & combustible sensors reacted 30 seconds after second TR
- (2) Smoke detectors reacted @ 53 & 55 seconds, respectively, after TR

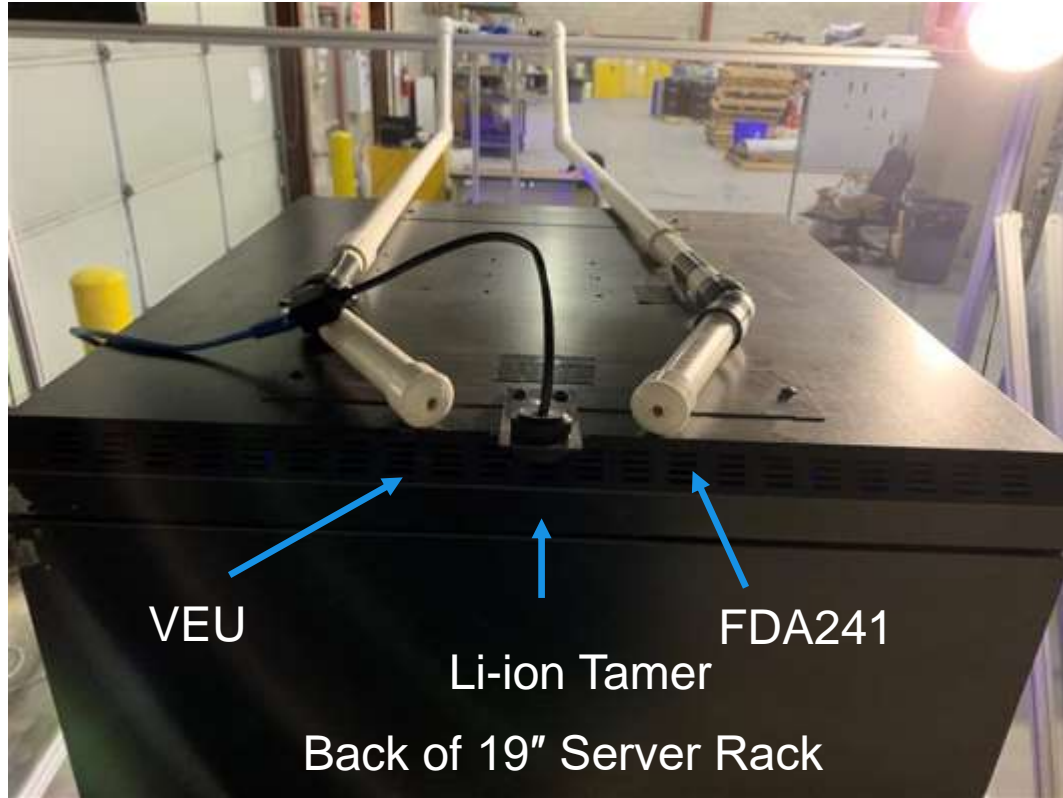
### Fire Test 3: Page 139

- Venting at 21 minutes & 37sec.
- TR at 29 minutes & 53sec.
- **Early Warning: 8 minutes & 16 seconds**
- **UL Findings:**
  - All gas detectors alarmed 30 seconds after TR
  - Smoke detectors alarms 60 seconds after TR
  - Propagation occurred after 8 min & 49 seconds



# LI-ION TAMER TEST EREDMÉNYEK

Setup A: Battery Abuse by Over-Heating in a Battery Rack



**Notes:**

- ASDs comprised 10m pipe with single hole sampling (no clean air dilution)
- XCL gas detectors installed in-line with VEU pipe
- Setup A: comprised front-to-back rack airflow, Setup B: sampling located downstream of abuse battery (i.e. vent size of the room)

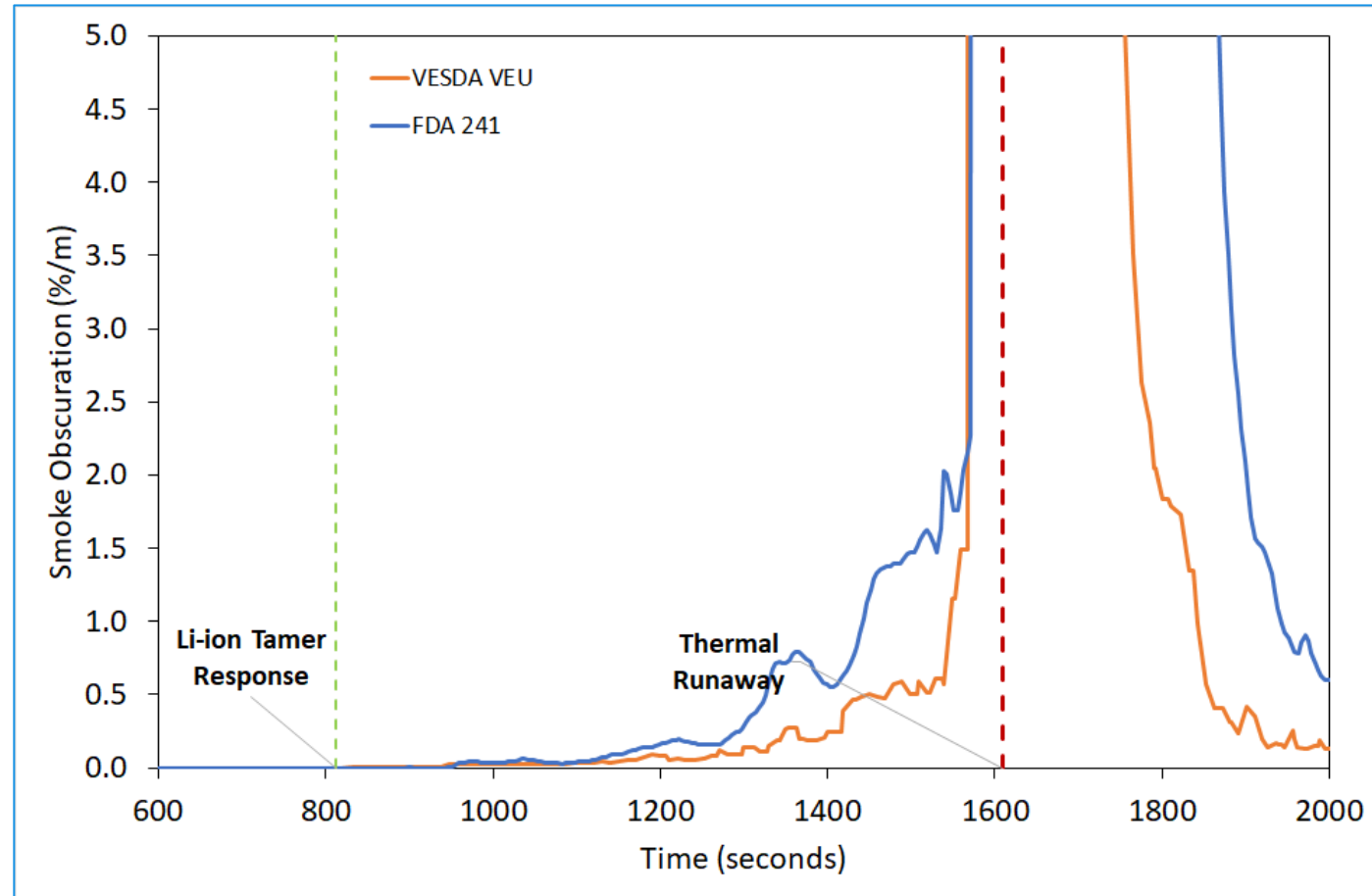
Setup B: Battery abuse by Over-Charging



# LI-ION TAMER ÉS ASPIRÁCIÓS ÉRZÉKELŐ ÖSSZEHAISONLÍTÁSA

## Teszt :

- Beltér
- Gáz érzékelés
- Füst érzékelés
- Túltöltés



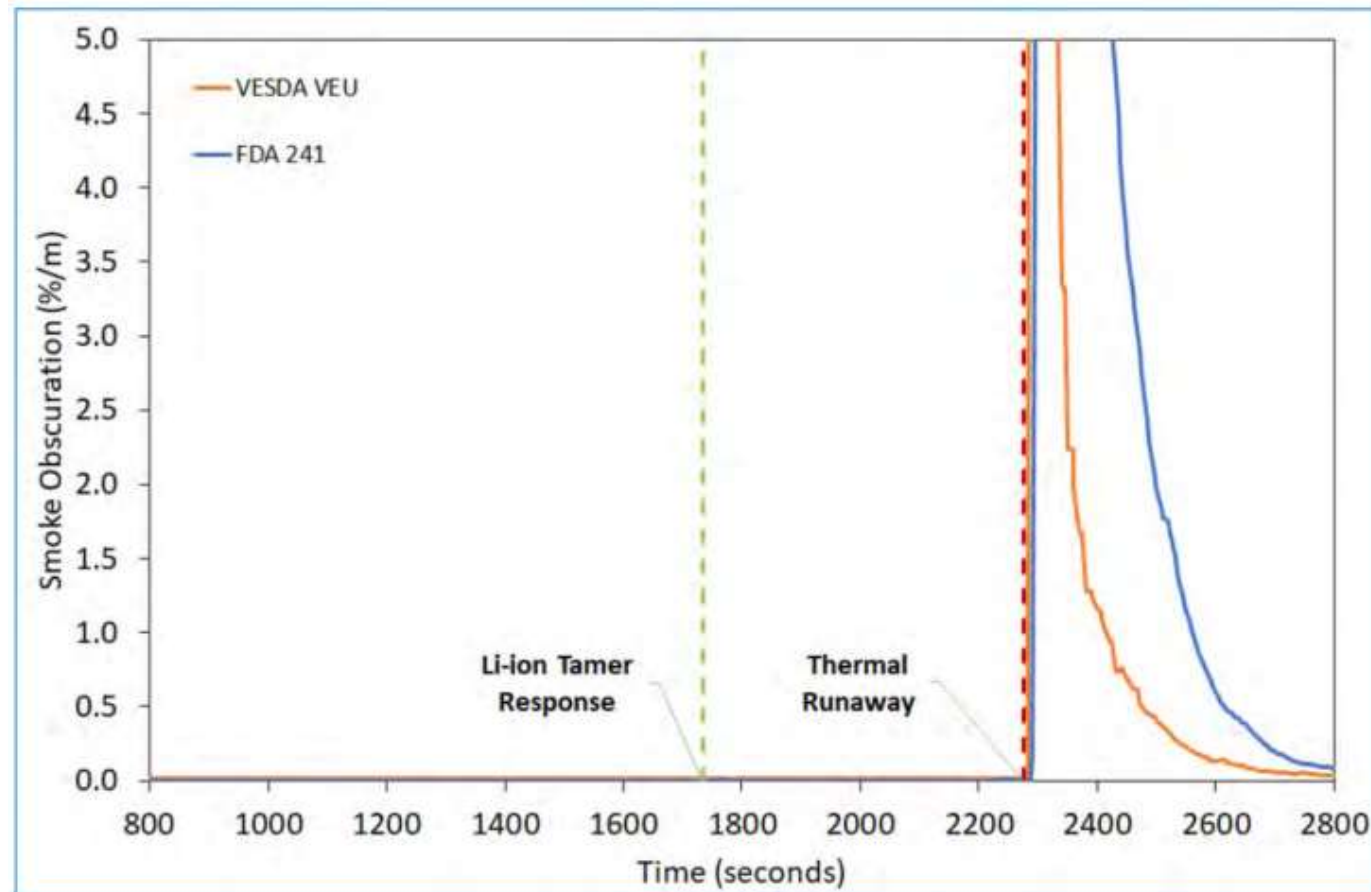
Both Li-ion Tamer and ASDs responded before Thermal Runaway with Li-ion Tamer providing earlier notification.



# LI-ION TAMER ÉS ASPIRÁCIÓS ÉRZÉKELŐ ÖSSZEHAISONLÍTÁSA

## Teszt :

- Beltér
- Gáz érzékelés
- Füst érzékelés
- Túlhevítés

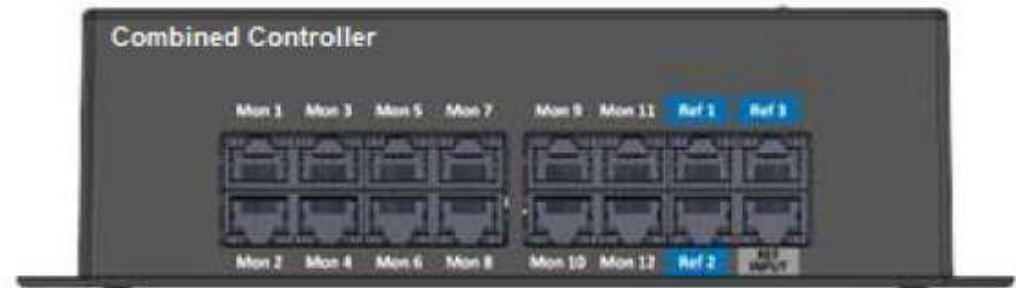


There were no responses from any of the ASD detectors during the off-gas event or prior to thermal runaway.

# KIÉRTÉKELŐEGYSÉG



12 érzékelő szenzor illesztéséhez alkalmas kiértékelőegység



# ÉRZÉKELŐK



Mintavételező szenzor  
LT-SEN-M



RJ45 Ethernet kábel  
LT-ACC-MCL-50



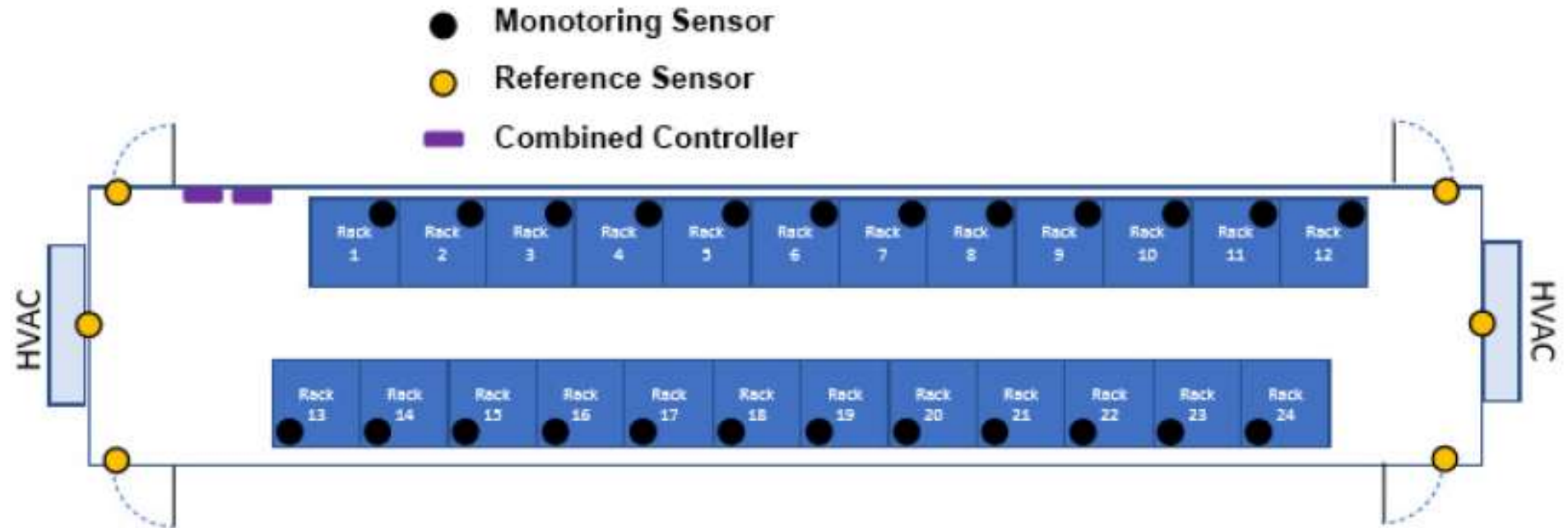
Referencia Szenzor  
LT-SEN-R



RJ45 Ethernet kábel  
LT-ACC-RCL-50



# LI-ION TAMER TELEPÍTÉSE EGY 40 LÁBAS KONTÉNERBE



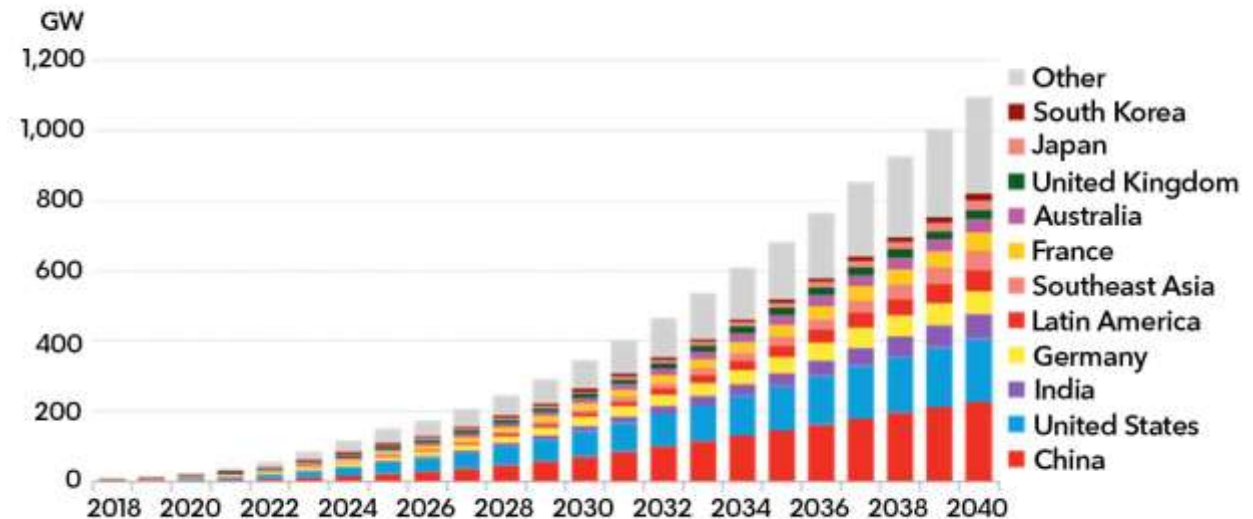
Note that there are a total of twenty-four (24) Monitoring Sensors and six (6) Reference Sensors that are aggregated by two (2) Combined Controllers.

# LI-ION TÁMER ALKALMAZÁSI TERÜLETE

- ✓ Li Ion akkumulátoros járművek töltő helysége és zárt parkolója
- ✓ Napelem, szélenergia parkok energia tároló egysége
- ✓ Li Ion akkumulátor gyárak



Global cumulative energy storage installations



Source: BloombergNEF

**Energia tárolási igények növekedése**

# FIA TERVEZÉSI ÚTMUTATÓ

Guidance  
Note



Fire Industry Association



Guidance on Li Ion Battery Fires

Elérhető a FIA weboldalán:

[https://www.fia.uk.com/news/guidance-on-li-ion-battery-fires.html?utm\\_source=Fire%20Industry%20Association&utm\\_medium=email&utm\\_campaign=12106310\\_Mid%20January%20Focus%202021](https://www.fia.uk.com/news/guidance-on-li-ion-battery-fires.html?utm_source=Fire%20Industry%20Association&utm_medium=email&utm_campaign=12106310_Mid%20January%20Focus%202021)

### 6.3 Gas detection

Off-gassing occurs early in cell/battery failure. Some battery cells provide vents specifically intended to release the over-pressure that may develop within individual cells as a result for abuse or failure, others (such as pouches) may expand to accommodate a degree of off gassing but at some point these may burst – perhaps along a seam or pre-designed weak point. Systems that can detect off-gases in low concentrations can provide an early warning of an impending thermal runaway – and trigger shut down systems to electrically isolate the individual, or bank of, or rack of battery cells – and thus avoid thermal runaway occurring in a single cell. Such systems generally rely on a degree of enclosure around the batteries, such as an ESS container or a room housing large banks of batteries. It is not uncommon for effective off gassing detection, specifically tailored to be sensitive to the concoction of gases (predominately H<sub>2</sub>, CO<sub>2</sub>, CO, Hydrocarbon gases and battery electrolyte solvents) being generated by off gassing, to detect it within 30 seconds of it's initial release from the cell.

Note, the presence and build-up of significant quantities of H<sub>2</sub> and Hydrocarbon gases may present an explosion hazard. While such matters are beyond the scope of this document, it is worth noting that ventilation is an important feature in the mitigation of potentially explosive risks. Such hazards are traditionally associated with the slow accumulation of the gases given off during normal operation (e.g. charging of lead-acid batteries) but they may also occur relatively quickly as a result of the gases emitted during failure or thermal runaway of lithium-ion batteries. Thus, off gassing detection can play an important part in the control of ventilation systems.

It is also worth noting that early detection of off gassing is most effective when the ventilation is limited/minimal or at least fully understood. However, it is often the case that air movement is used to keep batteries cool during normal charging operations. Hence, off gassing sensors need to be strategically positioned and sensitive enough to detect the first signs of off gases before they become too diluted. Reference sensors are often used as well as off-gas sensors and are installed to monitor the ambient air conditions. Moreover, off gassing detection can provide situational awareness of the conditions within a facility; for example, providing information on where the incidence started to assist personnel responding to an event as well as more general information on any hazardous or toxic risks which may indicate that entering the facility is not appropriate.

**Köszönöm szépen a megtisztelő figyelmüket!**



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**Jó egészséget kívánok!**