Acknowledgement

Dr. Imre Gyuk, DOE – Office of Electricity
Energy Storage Program
What is Safety?

**safety | \ˈsāf-tē \**

*plural safeties*

- the condition of being safe from undergoing or causing hurt, injury, or loss.
- to protect against failure, breakage, or accident.

*Merriam Webster, 2022*

- The term Safety is not consistent across industries or technologies.
- With ESS does it mean zero fires?
- Is there an acceptable level of failure?
- Are Safety & Reliability mutually beneficial?
Safety & Reliability is a Systems Approach

- Chemistry
- Cell QC
- Integration
- BMS
- Communications
- HVAC
- Fire Protection
- Explosion Control
- Workmanship
# ESS Incidents (C&I)

## BESS Failure Event Database

<table>
<thead>
<tr>
<th>Location</th>
<th>Energy (MW)</th>
<th>Power (MW)</th>
<th>Module Type</th>
<th>Application</th>
<th>Install</th>
<th>Event Date</th>
<th>System Age (yr)</th>
<th>State During Accident</th>
<th>Source</th>
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<tbody>
<tr>
<td>US, CA, Moss Landing</td>
<td>730</td>
<td>182.5</td>
<td>Tesla</td>
<td>Energy Shifting, Ancillary Services</td>
<td>Subst</td>
<td>20 September 2022</td>
<td>0.5</td>
<td>Operational</td>
<td>KSBW News.9</td>
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<td>South Korea, Incheon</td>
<td>103</td>
<td></td>
<td></td>
<td>Energy Shifting</td>
<td>Factory</td>
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<td>Telstar Report.9</td>
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<td>10</td>
<td>LG Chem [NMC]</td>
<td>Solar Integration / Backup</td>
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<td>3 August 2022</td>
<td>4</td>
<td>Operational</td>
<td>KROC.9</td>
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<td>30</td>
<td>LG Energy</td>
<td>Solar Integration</td>
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<td>5 April 2022</td>
<td>0.2</td>
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<td>1</td>
<td>Solar Integration</td>
<td>Power Plant</td>
<td>10 March 2022</td>
<td>2</td>
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<td>Economic Daily.9</td>
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<td>Solar Integration</td>
<td>Rural</td>
<td>17 January 2022</td>
<td>3</td>
<td>Operation. Fully charged</td>
<td>E2News.9</td>
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<td>SK Innovation</td>
<td>Peak Load Reduction</td>
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</table>

Showing 1 to 10 of 50 entries
Trends & Barriers

- Trend – Rapid deployment IFM & BTM
- Trend – Increased availability of listed ESS
- Trend – Improved propagation resistance designs

- Barrier - Increasing fires from e-mobility devices
- Barrier - Fire suppression challenges and water use
- Barrier – Growing moratoriums to ESS projects
OE Funded Safety Efforts

- Project support for RESDP installations
- Emergency response training support for utilities, fire departments, and sister labs (NREL, ANL)
- EU Emergency Responders Support (UK, Netherlands, Sweden, Germany, Norway)
- Australian ESS Research Project support (SARET)
- NFPA Energy Storage Research Consortium member
- Active participation in key ESS Codes & Standards (NFPA, IFC, UL)
Reliability Efforts

• Completion and publication of IEEE 1547.9 ES Interconnection Guide

• MESA Testing & Certification WG (PNNL led) for the MESA DER Standard

• IEEE P2686 BMS Standard & IEEE P2688 EMS Standard (SNL led)
NFPA 855 Explosion Control

Three options for meeting requirement in room, building, cabinets, or walk-in enclosures:

1. NFPA 68 – Deflagration Venting.
   - Blow-out panels to protect structure from explosion based on max gas production in cell tests.

   - Exhaust system designed to keep below 25% of LEL in area.

3. Performance Based – Where Large Scale Fire Test has shown that no pressure waves will occur and no projectiles can be ejected.
IntelliVent™ testing at Snohomish PUD
Remaining Gaps

- Fire suppression agents/methods
- Deflagration prevention methods
- Further research in thermal runaway propagation prevention
- Emergency energy discharging

New ESS in transport w/LFP cells  
Source: Jimu News
Thank You

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