

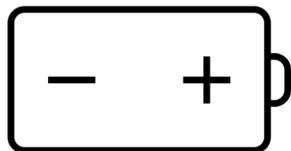


**STELLA**  
ENERGY SOLUTIONS

**Simply Better**

Clean, Resilient Solutions that Power the Energy Transition

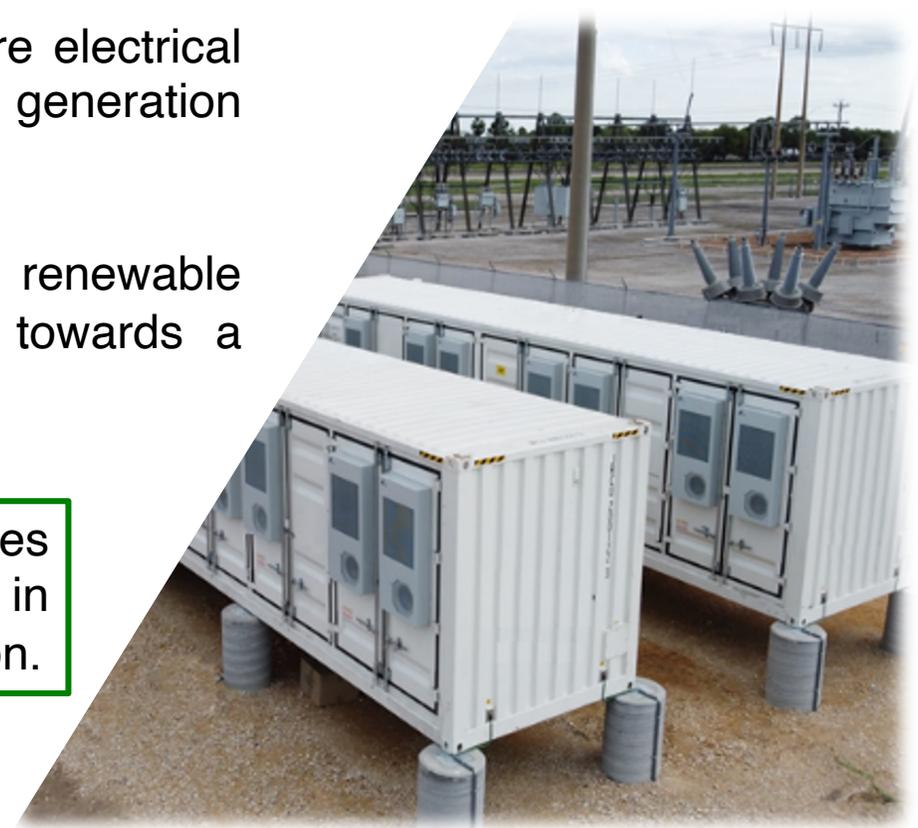
# Introduction



Battery Energy Storage Systems (“BESS”) have emerged as a groundbreaking solution in modern energy management.

- ★ These systems harness cutting-edge battery technologies to store electrical energy efficiently, enabling us to bridge the gap between energy generation and consumption.
- ★ BESS plays a pivotal role in stabilizing power grids, integrating renewable energy sources, and optimizing energy usage, propelling us towards a greener and more sustainable future.

In this short introduction, we will explore the fundamental principles and significance of Battery Energy Storage Systems in revolutionizing the way we approach energy storage and distribution.



# Introduction



Stella elevates America's electric infrastructure. Stella is a leading utility-scale clean energy platform that builds the energy storage and solar infrastructure that is modernizing electric power generation.

## Company Overview

- **Description:** Stella Energy Solutions ("Stella") is an American veteran-owned developer, builder, and owner of utility scale energy storage and solar projects across the United States.
- **Founded:** Q4 2021, based in The Woodlands, Texas

## Track Record

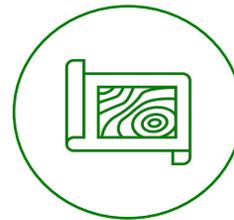
Stella's team is lead by experienced energy storage project experts:

<b>2,694</b> Energy Storage Designed (MWh)	<b>1,254</b> Commissioned Experience (MW)
<b>100+</b> Years of Team Experience	<b>23</b> U.S. States Experience

## Differentiation Built on a History of Energy Storage Leadership

- **Integration Expertise**
- **Commercial Flexibility**
- **Deep Industry Relationships**

## Strategies: (1) Develop/Own/Operate, and (2) Build-Transfer



### Develop

- Site Control
- Permitting
- Interconnection



### Build

- Engineer & Procure Major Equipment
- Construct & install
- Commission site



### Operate

- Asset management
- Maintenance
- Grid Reliability

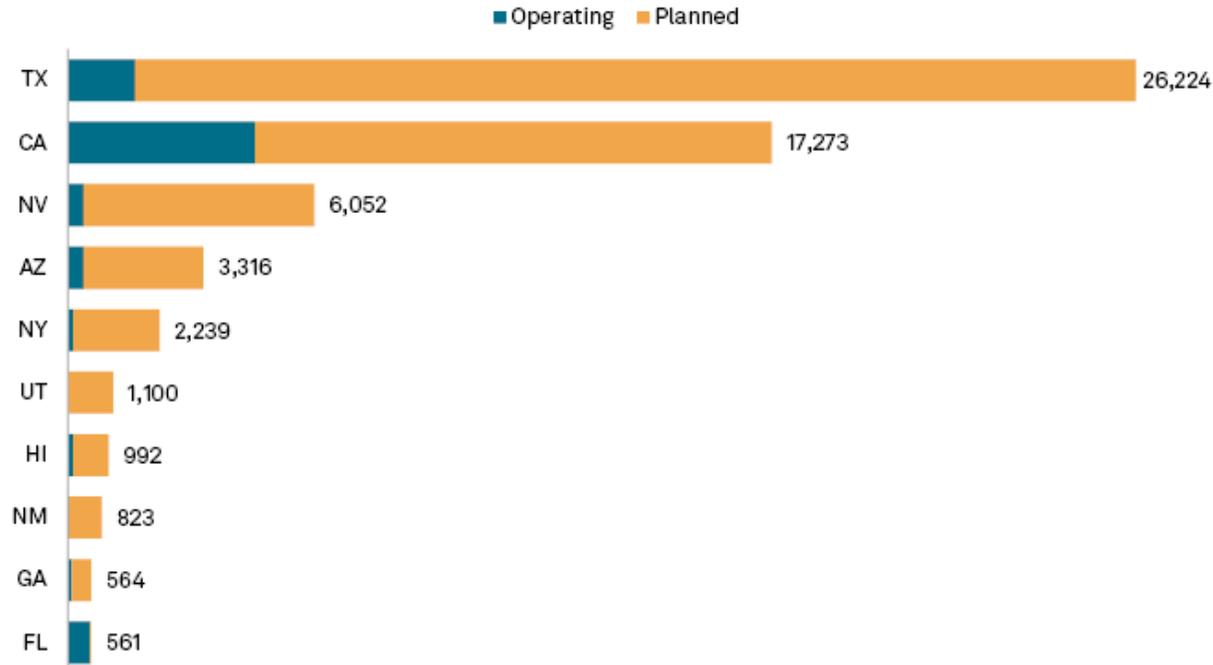
Stella's executes the following strategies:

- **Build-Transfer** agreements, where Stella builds an energy storage site or solar site on behalf of a utility.
- **Asset Ownership** of Stella fully developing a project through the project lifecycle and generating revenue at the site through a PPA, tolling agreement, or via merchant operation over a 10 to 25-year period.

# Battery Energy Storage in the United States

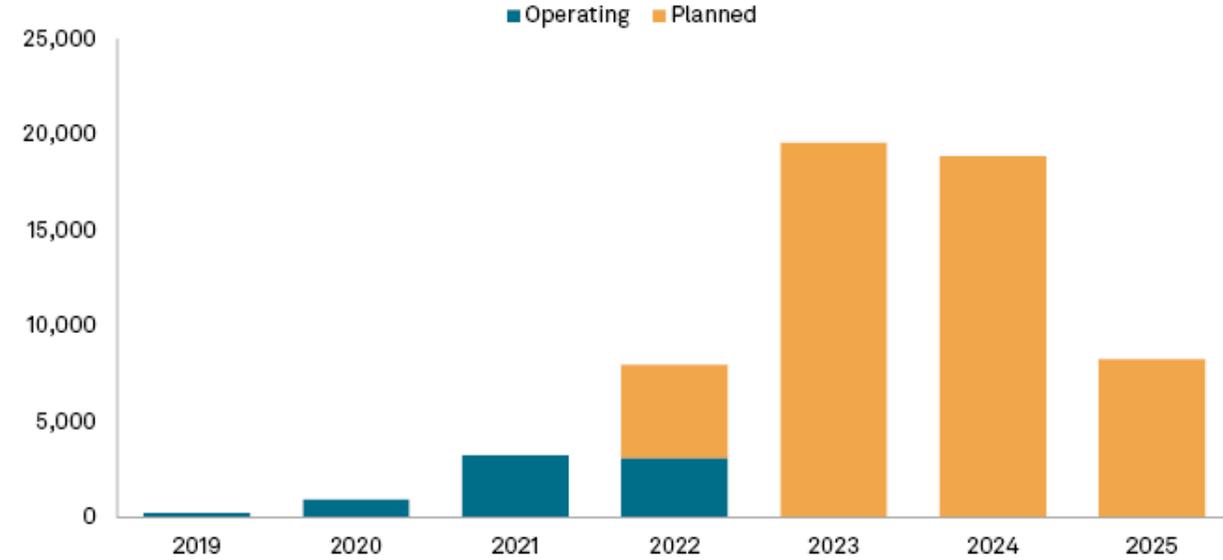


States with largest utility-scale energy storage resources (MW)



Data compiled Nov. 7, 2022.  
 Analysis includes stand-alone and colocated storage resources.  
 Excludes projects classified as pumped storage and those with no available in-service year.  
 Source: S&P Global Market Intelligence.  
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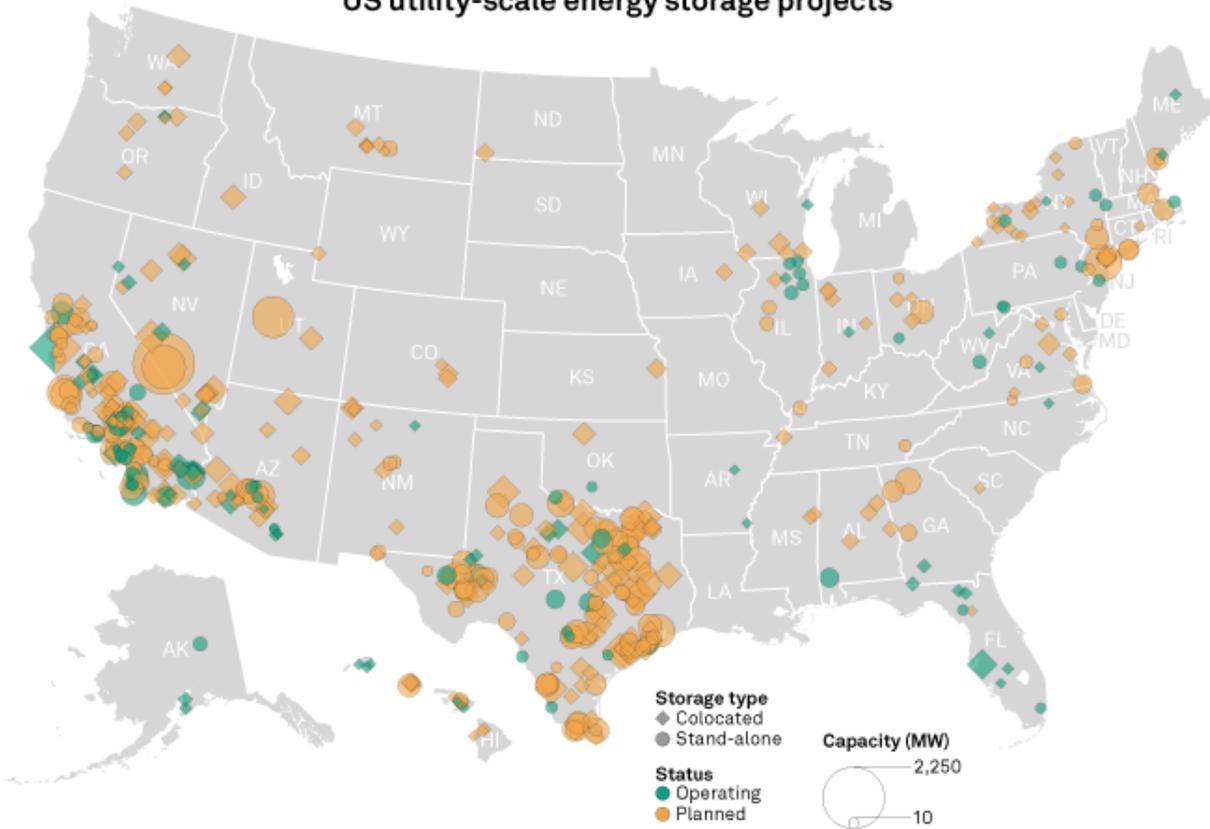
US utility-scale energy storage projects by status, year in service (MW)



Data compiled Nov. 7, 2022.  
 Analysis includes stand-alone and colocated storage resources. Projects classified as pumped storage are excluded.  
 Source: S&P Global Market Intelligence.  
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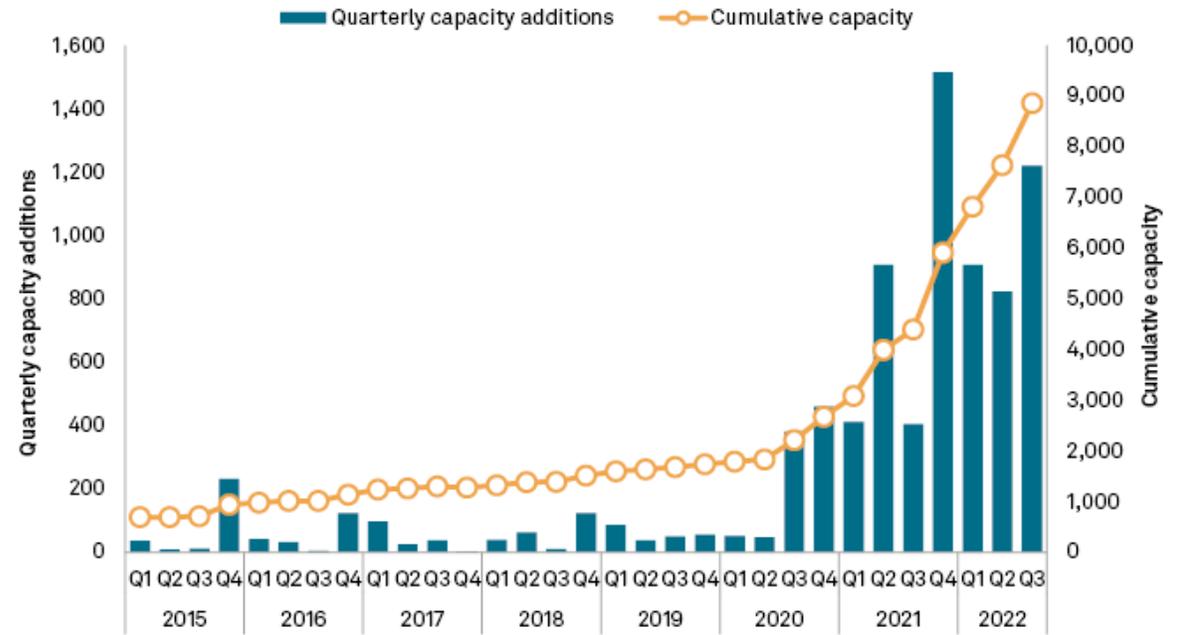
# Battery Energy Storage in the United States

US utility-scale energy storage projects



Data compiled Nov. 7, 2022.  
 Excludes projects classified as pumped storage, projects with less than 10 MW in capacity, and projects with no available in-service year.  
 Excludes projects with no available geographic coordinates.  
 Map credit: Ciaralou Agpalo Palicpic.  
 Source: S&P Global Market Intelligence.  
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US utility-scale energy storage resources by quarter in service (MW)



Data compiled Nov. 7, 2022.  
 Analysis includes stand-alone and colocated storage resources. Projects classified as pumped storage are excluded.  
 Source: S&P Global Market Intelligence.  
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# Hidden Lakes

## Site Details



Site is currently vacant  
– Parcel ID 232050



No direct proximity to  
business or residential



Short interconnection  
span to Texas New  
Mexico Power Hidden  
Lakes Substation



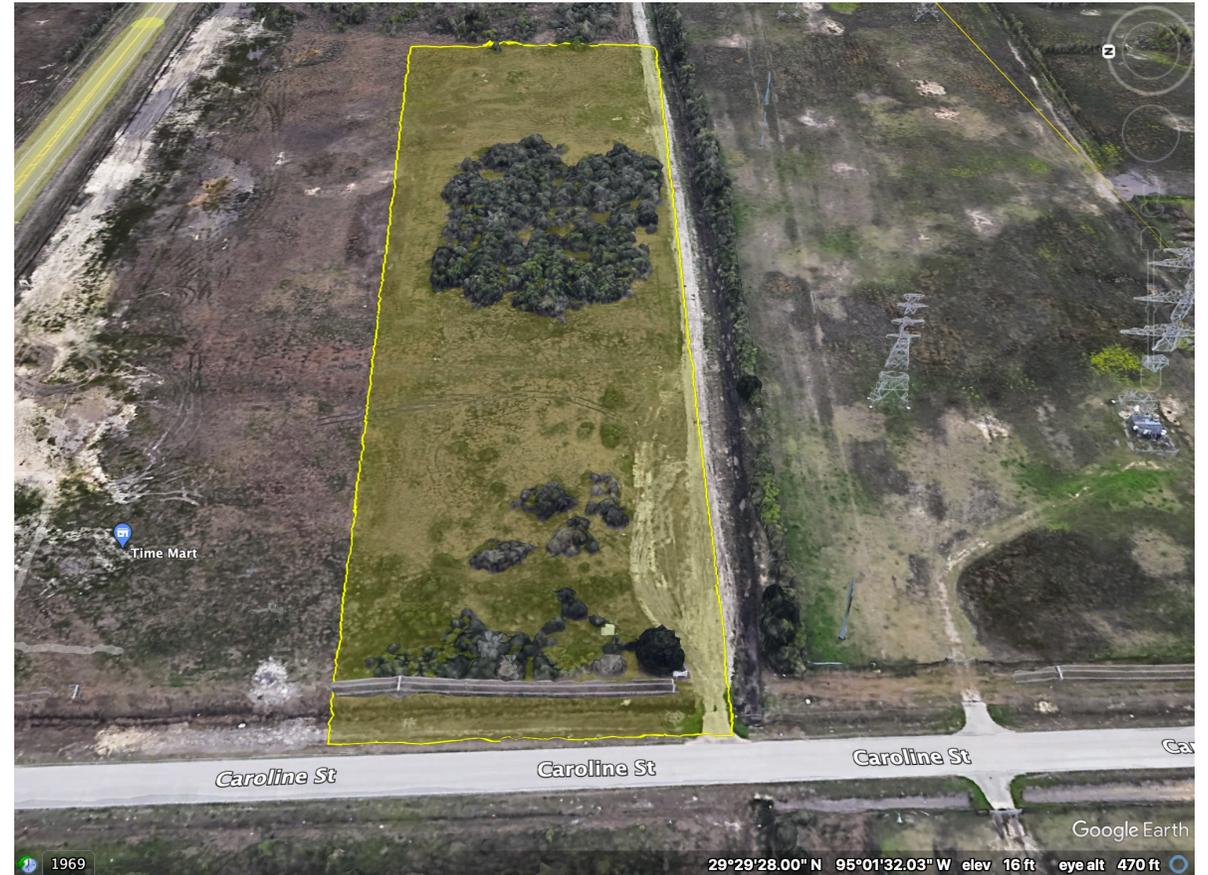
< 5 acres is more than  
enough land to  
accommodate the site  
layout and any  
additional landscaping  
and drainage  
requirements



# Hidden Lakes

## Site Details

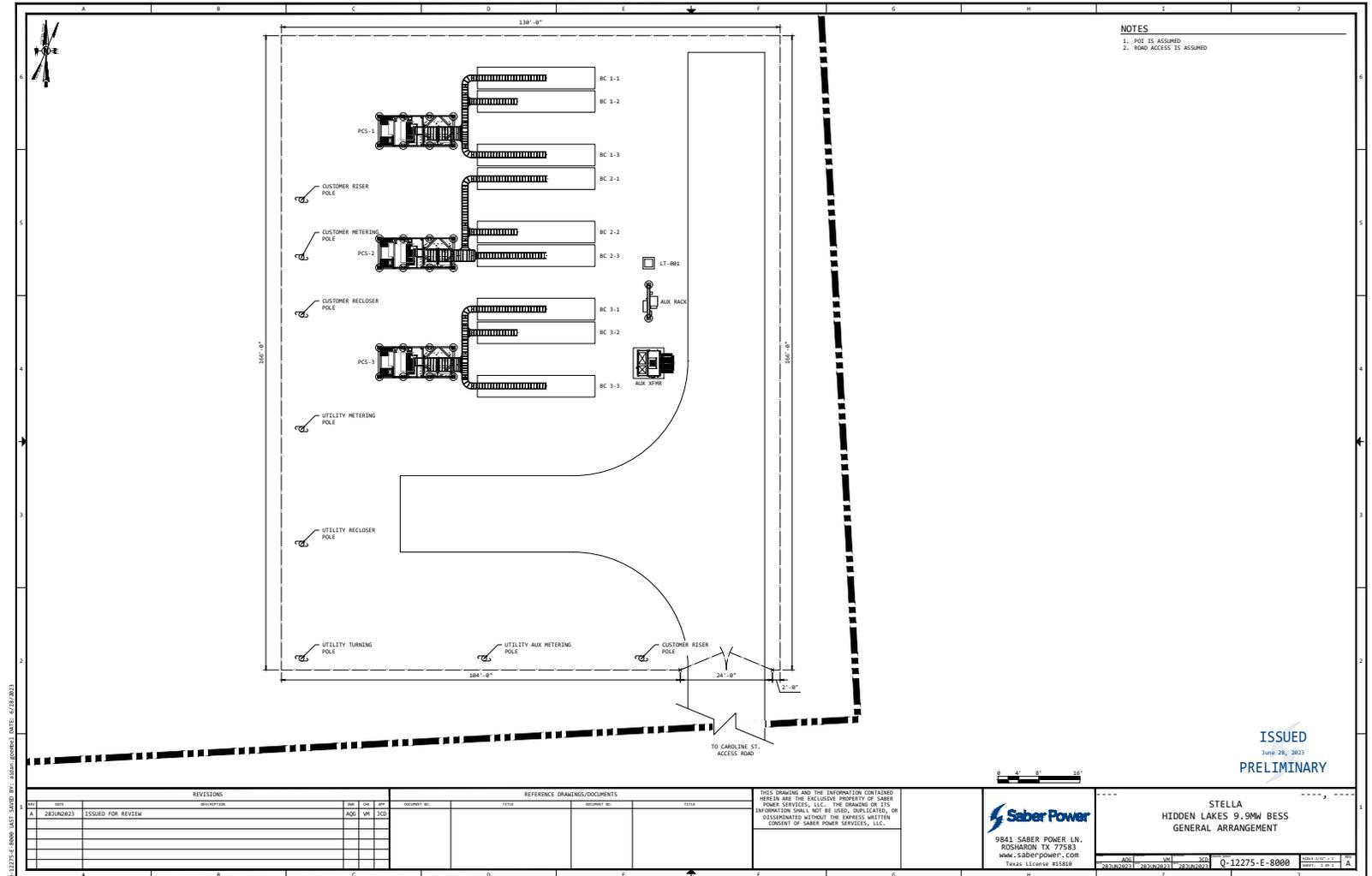
- The Project Site was pushed back to accommodate commercial frontage use
- Overhead line route will follow TNMP existing utility easement



# Hidden Lakes

## Site Details

- Layout contemplates minimal site disturbance
- Main Components are:
  - Battery Containers
  - Inverters
  - MV Transformers
- Aux Power Transformer
- Communications Equipment



# Hidden Lakes

Existing Site from FM 646

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# Hidden Lakes

Existing Site from Caroline St.

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# Hidden Lakes

Existing Site with Retail / Commercial Development along 646

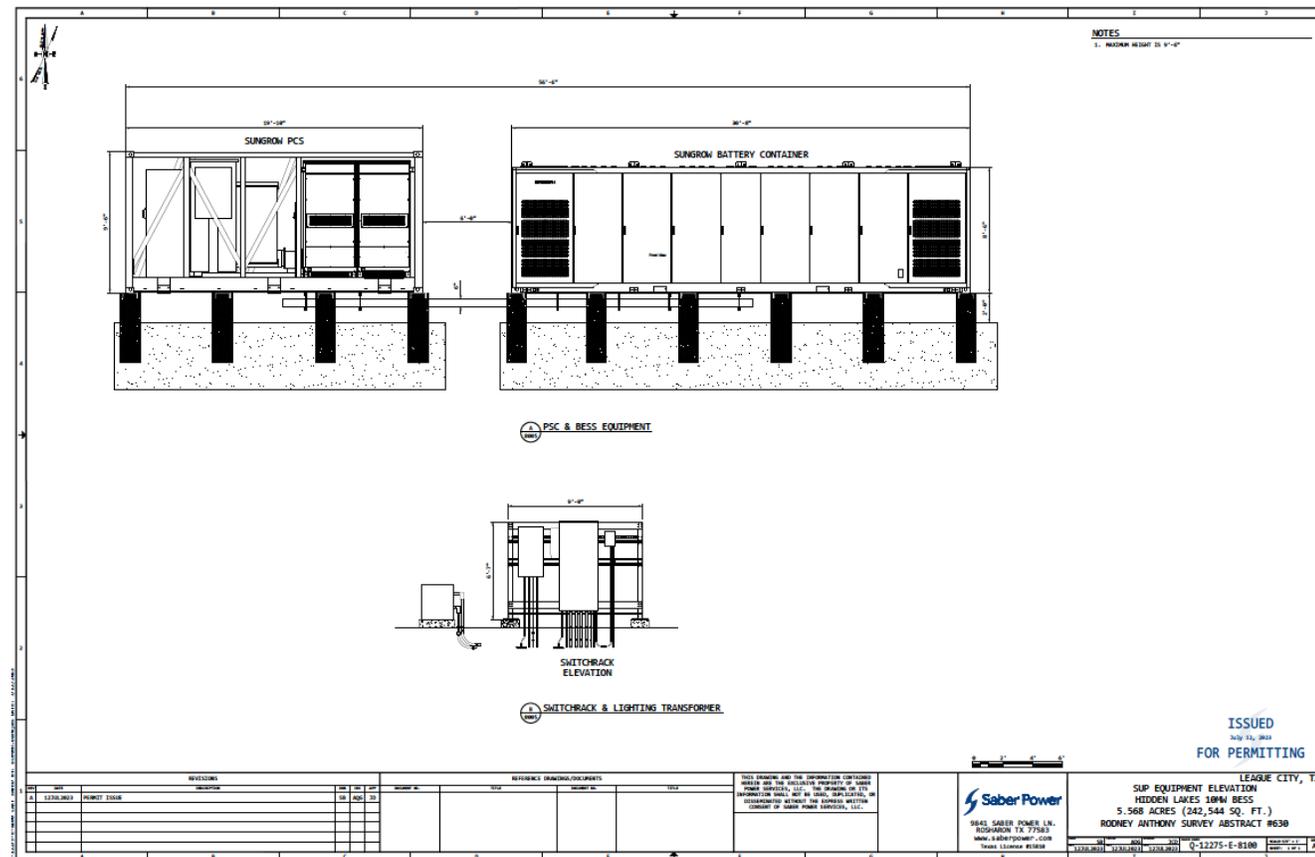


# Hidden Lakes

## Equipment Design - Inverters

### SC4000UD-MV-US

Power Conversion System  
Optimized for ST2236 / 2752UX-US



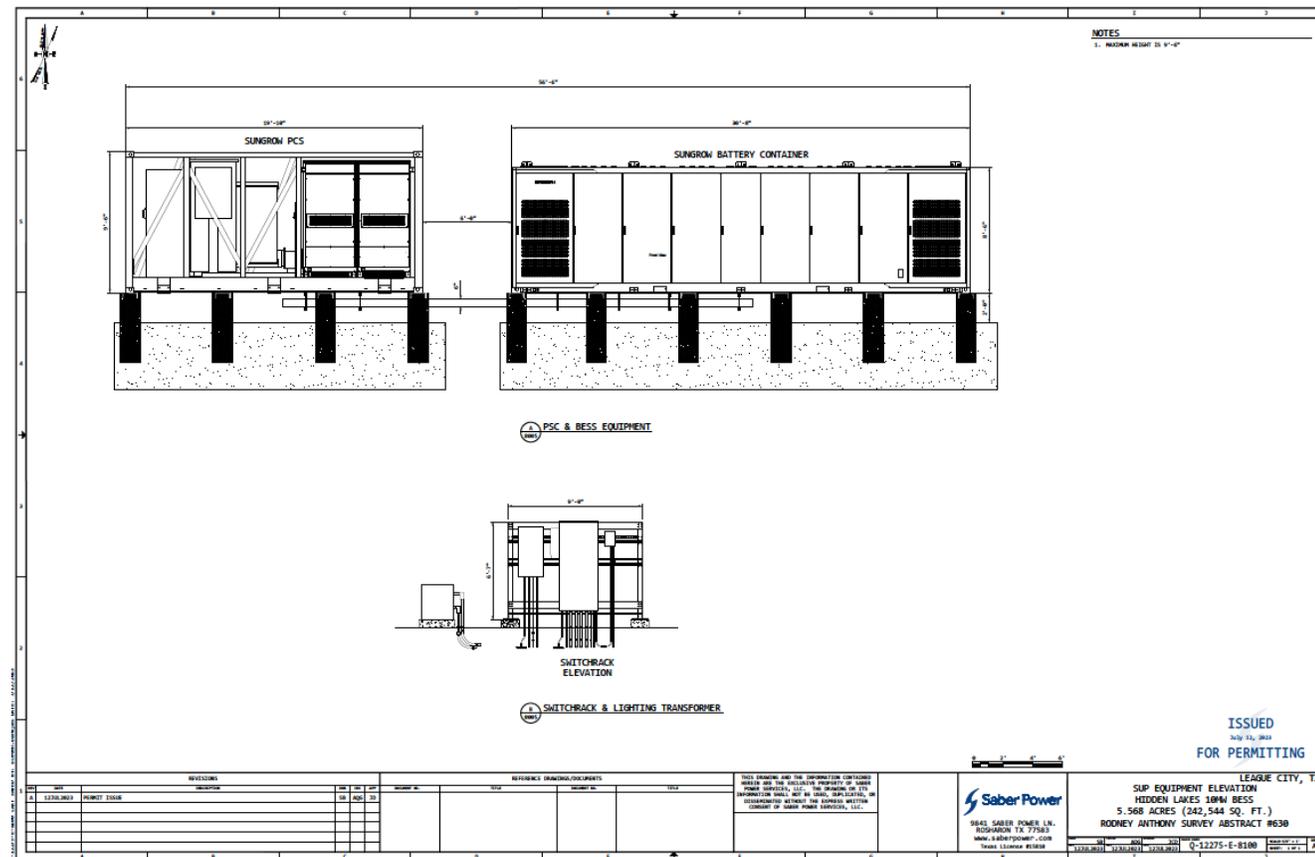
# Hidden Lakes

## Equipment Design – Battery Containers

### ST2752UX-US

Liquid Cooling Energy Storage System  
2 - 8 hour application

Preliminary



# Hidden Lakes

## Gas Composition During Testing – UL9540A Testing & 3<sup>rd</sup> Party Verification

UL 9540A Report  
Cell Level

Report Issued : 2021.09.14  
Report Revised :

 <b>CELL TEST REPORT</b> <b>UL 9540A</b> <b>Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems (AACD)</b>	
Project Number.....	4789886110
Date of issue.....	2021.09.14
Total number of pages.....	35
UL Report Office .....	UL(Changzhou) Quality Technical Service Co., LTD
Applicant's name.....	Batterotech Corporation Limited
Address .....	9855 Puwei Rd(N), Fengxiang, Shanghai, 201417, CN
Test specification:	4 <sup>th</sup> Edition, Section 7, November 12, 2019
Standard.....	UL 9540A, Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems
Test procedure .....	7.1 – 7.8
Non-standard test method .....	N/A
Copyright © 2021 UL LLC All Rights Reserved.	
<b>General disclaimer:</b>	
The test results presented in this report relate only to the sample tested in the test configuration noted on the list of the attachments.	
UL LLC did not select the sample(s), determine whether the sample(s) was representative of production samples, witness the production of the test sample(s), nor were we provided with information relative to the formulation or identification of component materials used in the test sample(s).	
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Table Re-normalized Gas Quantification, excluding N<sub>2</sub> and O<sub>2</sub>, and unknown compounds.

Item	Measure	Chemical formula	Conc.(%)
1	Carbon Monoxide	CO	12.642
2	Carbon Dioxide	CO <sub>2</sub>	26.413
3	Hydrogen	H <sub>2</sub>	46.491
4	Methane	CH <sub>4</sub>	7.016
5	Ethylene	C <sub>2</sub> H <sub>4</sub>	3.111
6	Acetylene	C <sub>2</sub> H <sub>2</sub>	0.158
7	Ethane	C <sub>2</sub> H <sub>6</sub>	1.174
8	Propane	CH <sub>3</sub> CH <sub>2</sub> CH <sub>3</sub>	0.154
9	Propylene	C <sub>3</sub> H <sub>6</sub>	0.422
10	Propadiene (Allene)	C <sub>3</sub> H <sub>4</sub>	0.000
11	Isobutane	CH <sub>3</sub> CH(CH <sub>3</sub> )CH <sub>3</sub>	0.007
12	Butane	C <sub>4</sub> H <sub>10</sub>	0.082
13	Isobutylene	C <sub>4</sub> H <sub>8</sub>	0.308
14	1-Butene	C <sub>4</sub> H <sub>8</sub>	0.099
15	trans-2-Butene	C <sub>4</sub> H <sub>8</sub>	0.050
16	cis-2-Butene	C <sub>4</sub> H <sub>8</sub>	0.111
17	Pentane	C <sub>5</sub> H <sub>12</sub>	0.120
18	trans-2-Pentene	C <sub>5</sub> H <sub>10</sub>	0.041
19	cis-2-Pentene	C <sub>5</sub> H <sub>10</sub>	0.027
20	1,4-Pentadiene	C <sub>5</sub> H <sub>8</sub>	0.012
21	Hexane	C <sub>6</sub> H <sub>14</sub>	0.016
22	1-Hexene	C <sub>6</sub> H <sub>12</sub>	0.066
23	Benzene	C <sub>6</sub> H <sub>6</sub>	0.058
24	1-Heptene	C <sub>7</sub> H <sub>14</sub>	0.016
25	Toluene	C <sub>7</sub> H <sub>8</sub>	0.008
26	Styrene	C <sub>8</sub> H <sub>8</sub>	0.000
27	Dimethyl Carbonate	C <sub>3</sub> H <sub>6</sub> O <sub>3</sub>	1.209
28	Ethyl Methyl Carbonate	C <sub>4</sub> H <sub>8</sub> O <sub>3</sub>	0.188
29	Diethyl Carbonate	C <sub>5</sub> H <sub>10</sub> O <sub>3</sub>	0.000
<b>Total</b>		<b>Measurement result</b>	<b>100.000</b>

BESS Projects **DO NOT** release any gas, fumes, vapors or any chemicals during normal operation

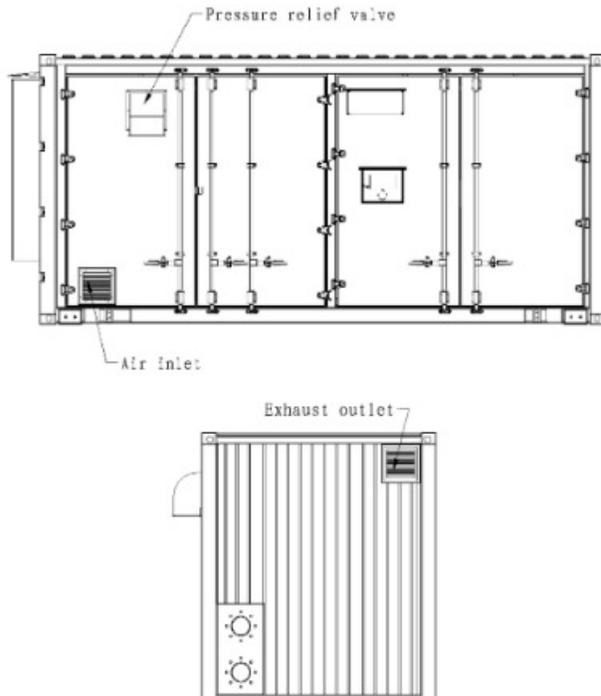
If gas is released during an incident, it is held in the container under 10% LEL.

Venting only occurs to prevent build up on gasses within the container above acceptable levels. **This is avoided by using preventative shut down methods and early detection**

# Battery Energy Storage System Safety

- 24/7 energy and thermal monitoring (EMMU)
- Smoke detection for each battery cabinet
- Ability to remotely shut down batteries
- Pressure relief system
- Fire rating for containers
- FM-200 / Stat-X Dry Powder Suppression system
- First Responder Coordination

The following figure shows the installation positions of the pressure relief valve:



## 8. BESS communication topology

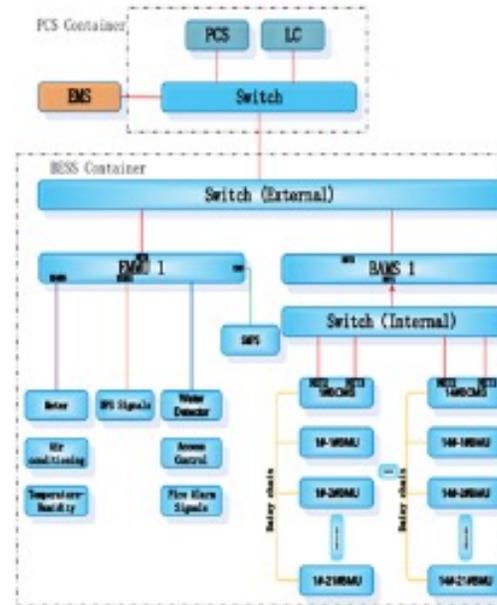


Fig.8.1BESSCommunication Topology

## 4.4 EMMU



### Functions

- ↪ Communication : communicate with BEMS and ESS Controller.
- ↪ Data collection : collect devices states of HVAC, module fans, energy meter, door access, humidity, fire suppression and so on.
- ↪ Data sorting : sort humidity and temperature values in the container
- ↪ Fans control : control BMU to start/stop fans,
- ↪ Alarm protection: temperature anomaly alarm,
- ↪ HVAC management: manage HVAC to control the container temperature
- ↪ Events logging: record faults, alarms, operation events
- ↪ Data storage : store all data from terminal acquisition

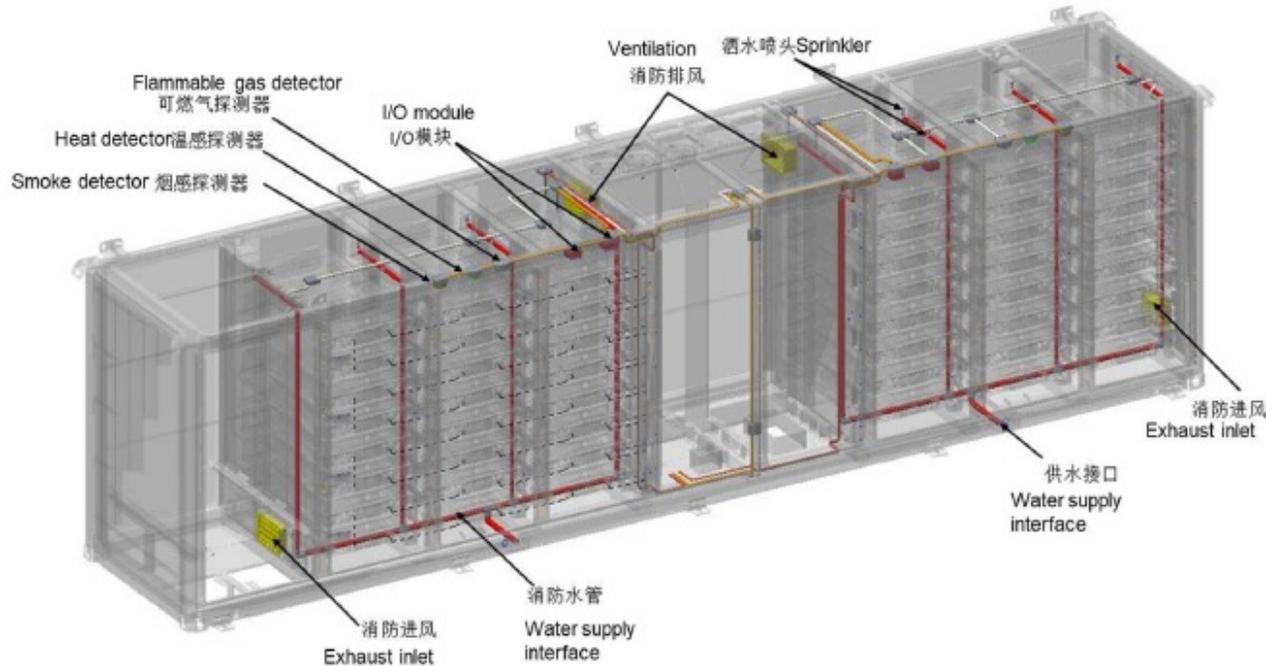
The specifications of EMMU are as follows:

Type	Items	Specifications
Operation Environment	Operation Temperature	-20~65℃
	Atmospheric Pressure	70kPa~106kPa
	Relative Humidity	5%~95% RH
	Voltage Range	18~80V

# Hidden Lakes

## BESS Venting System – 3<sup>rd</sup> Party Analysis

### Fire Protection System Diagram



Venting system is designed to prevent flammable gas from building up inside of the battery container

UL9540A test reports did not indicate that there is module to module propagation, This means that no more than on module will be engaged after thermal runaway.

Individual cells are monitored for temperature increases and can be isolated to avoid increasing the temperature.

Gas / Heat / Smoke Detection is installed in each container.

The ventilation system design is confirmed to comply to Chapter 8 in NFPA69—2019: Deflagration Prevention by Combustible Concentration Reduction

# Hidden Lakes

## BESS Emergency Response



### IAFC BULLETIN

August 1, 2022

#### Recommended Fire Department Response to Energy Storage Systems (ESS) Part 1

Events involving ESS Systems with Lithium-ion batteries can be extremely dangerous. All fire crews must follow department policy, and train all staff on response to incidents involving ESS. Compromised lithium-ion batteries can produce significant amounts of flammable gases with potential risk of deflagration and fire.

1. If a commercial or utility install, follow pre-plan and **do not** enter structure.
2. Residential setting response, control power to the unit, ventilate the area, and protect exposures.
3. In all cases contact manufacturer technical support as soon as possible.

This guide serves as a resource for emergency responders with regards to safety surrounding lithium ion Energy Storage Systems (ESS). Each manufacturer has specific response guidelines that should be made available to first responders prior to activation.

ESS systems come in many shapes and sizes. They may be affiliated with renewable systems (wind, photovoltaic systems, etc) or used as standby power. ESS Systems can be installed in single family homes too large commercial and utility applications.

#### Pre-Incident

Modify or establish your department policy or standard response guideline to ESS incidents. Include guidelines for mitigation of the event which may include a defensive operations such as non-intervention and manage fire propagation or protect exposures.

Review installation procedures for systems with the various code officials including Building, Fire, and Electrical

ESS systems must be installed per the adopted fire and building codes in the region.

For the 2015 editions of the International Fire Code and NFPA 1 Fire Code and earlier editions the necessary safety requirements are not present (Consider language in 2021 Fire Codes or NFPA 855).

Ensure pre-incident plans are covering location, type, disconnect, and other contact information

Pre-incident plans should provide rapid response resources for company officers specific to your area and region including OEM emergency contact information

Train on department policy and perform practical scenarios which support the response plan

#### INCIDENT ACTIONS

The fire crew should allow the battery to burn itself out, during which it is recommended to apply water spray to neighboring battery enclosures and exposures to further mitigate the spread of the hazards rather than directly onto the burning unit.

Applying water directly to the affected enclosure will not stop the thermal runaway event, as the fire will be located behind several layers of steel material, and direct application of water has shown to only delay the eventual combustion of the entire unit.

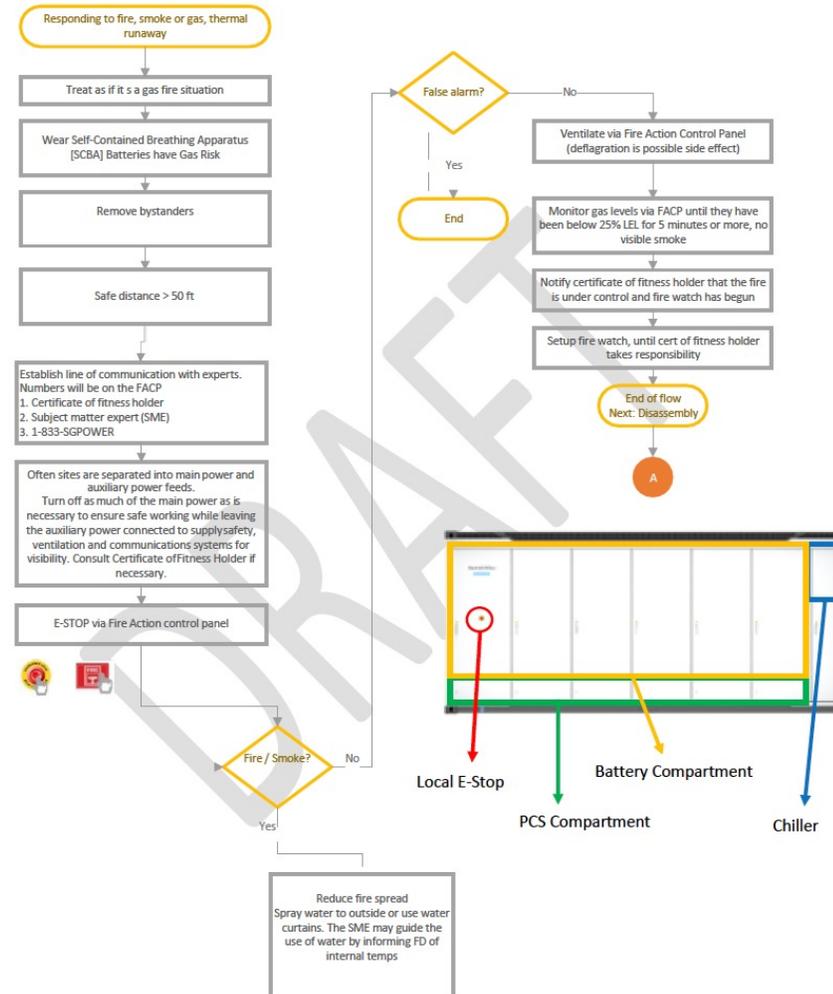
- Firefighters must wear full personal protective equipment, including SCBA with face-piece.
- If identified in pre-incident plan, shut off the unit/system by operating any visible disconnects or E-stops (**turning off the disconnect does not remove the energy from the battery**). To isolate any PV system and ESS in an emergency, multiple disconnects may need to be shut off. This could include circuit breakers, knife-blade disconnects, or other switches.
- Lithium ion batteries that are in thermal runaway or off gassing will create hazardous atmospheres. Firefighters must stay out of the vapor cloud and not rely on gas monitors (without consideration of cross contamination of the gas sensors)
- Due to construction of the unit, thermal imaging cameras may not give true thermal conditions.

Events can occur from damage, exterior fire, or a malfunction. Smoke or suspicious odor from an ESS system can be an indication of a hazardous condition. When batteries or cells enter thermal runaway, there is typically a period of smoke (may be under pressure). The smoke is most likely flammable and may ignite at any time.

#### Responding to a venting ESS product

- **Evacuate the area**. Never open any doors or remove panels to ESS units.
- Contact vendor-specific technical support for assistance including BMS data.
- Residential units that are located inside a dwelling unit or garage, the space should be properly ventilated with charged hand-lines in place.
- Maintain a safe distance from the ESS and monitor. A remote FDC may be present on larger commercial or utility ESS to support a sprinkler system inside the enclosure.
- Each manufacturer will have a recommended time for a battery pack to cool down. This can be near a full work cycle of 12 hours or more.
- **Defensive Firefighting**. Water spray is the preferred agent for response to lithium-ion battery fires (*Lithium-ion is not water reactive*).
  - If a fire has not developed and only smoke is visible, take a defensive stance toward the system and be prepared to apply water spray.
  - If a fire develops, take a defensive stance toward the burning unit and apply water spray to neighboring battery enclosures and exposures.
- Maintaining a safe distance from the unit involved (large commercial systems, at least 300').
- Response crews should allow the **battery to burn out**. Water should be applied to adjacent battery enclosures and exposures (building).

#### Fire, Gas release & Smoke incident flow chart



In case of any venting, concentrations did not reach hazardous concentrations during testing, due to natural ventilation.

The compositions closely resemble any structural fire. These projects have reduced risk through documented / continual testing, safety protocols, monitoring and coordination with local first responders.

**Close coordination with EMS / First Responders has put Texas at the front of safety and reliability related to energy storage. Other states are contacting our Fire Marshals / Fire Chiefs to get their recommendations. League City's team closely reviewed this project prior to submission.**

# Hidden Lakes

## BESS Container Wind Load Testing

At 49.9m/s (equal to a level 15 hurricane) the maximum stress on the container is 279.35MPa, which is less than the yield strength of SPAH steel, 355Mpa.

