

# New Mexicans for Responsible Renewable Energy

What is UL9540A

What is it's significance in this project

Other causes of failures, fires and threats

Is thermal runaway a question of old age

Property values

Better alternative

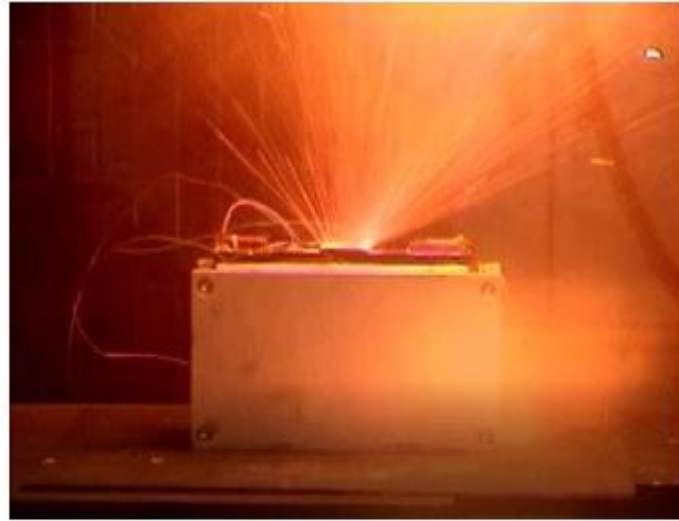
## UL 9540A test has 4 levels

- Cell: can a cell be forced into thermal runaway
- Module: will the heat/fire infect another cell or expand outside the module
- Unit: will the heat/fire infect another unit
- Installation: include the use of fire mitigation equipment

Requirement	Result <b>Cell Test</b>	Verdict
a) Thermal runaway cannot be induced in the cell and	Thermal runaway was achieved in all five cells	F
b) The cell vent does not present a flammable hazard	Cell vent found to be flammable	F



Cell 1 - Immediately before thermal runaway\*  
(00:43:54)



Cell 1 - Thermal runaway (00:43:55)



Cell 1 - After the end of test

Requirement	Result <b>Module Test</b>	Verdict
a) Thermal runaway is contained	A single cell infected the majority of the cells	F
b) The cell vent is not flammable	Cell vent found to be flammable	F

Other Observations During Module Test
<p>Flying debris</p> <p>Explosive discharge of gas</p> <p>Sparks or electric arcs</p>



(c) Thermal Runaway (Initiating Cell)  
00:46:14



(d) First Flame  
00:46:15



(e) Continuation of Initiating Cell Thermal Runaway  
00:46:18



(f) Continued Flaming (post initiating cell thermal runaway)  
00:46:41



(g) First propagation after Initiating Cell (Cell 35)  
00:58:04



(h) Second propagation After Initiating Cell (Cell 31)  
1:13:49



Requirement	Result <b>Unit</b> Test	Verdict	Other Observations During Unit Test
a) Flaming outside the BESS is not observed	Flaming outside the BESS was observed	F	Flaming outside of unit Explosive discharge of gas Gas analysis: 3340.26 L of total hydrocarbons 343.97 L of carbon monoxide
b) Surface temperatures on walls do not exceed 97°C	Maximum surface temperature was 169°C	F	
c) Heat flux on the center did not exceed 1.3kW/m <sup>2</sup>	Heat flux measured 6.74kWm <sup>2</sup>	F	Post Test Observations Thermal runaway behaviour during disposal

Necessity for an Installation level test
<p><b>[ X ]</b> The performance criteria of the unit level test as indicated in Table 9.1 of UL 9540A 4th edition has not been met, therefore an installation level testing in accordance with UL 9540A will need to be conducted on the representative the installation with this unit installed.</p> <p><b>[ ]</b> The performance criteria of the unit level tests as indicated in Table 9.1 of UL 9540A 4th edition has been met, therefore an installation level testing in accordance with UL 9540A need not be conducted.</p>



Figure 1 – Picture of the units in the container



Figure 2 – Picture of the container



(c) Initiating Unit Thermal Runaway  
[00:42:25]



(d) Ignition  
[00:42:30]

## Installation level test

- UL: “container becomes the test room, to understand the hazards associated with container BESS design, without resulting in the testing hazards associated with trying to run the test on a completely populated container BESS”
- The installation testing was done indoors
  - If outdoors:
    - Wind speed  $\leq$  12 mph
    - Control of vegetation and combustibles in the test area

### Installation Test Results

No spreading of thermal runaway  
No flaming or flying debris outside the enclosure  
Maximum enclosure wall surface temperature was 670°C



# Maximum enclosure wall surface temperature was 670°C

In BESS unit with combustible materials wall surfaces need to be  $\leq 97^{\circ}\text{C} + \text{ambient} = 120^{\circ}\text{C}$   
(dangers of inducing TR or burns)

AES: “containers are rated non-combustible”

The container door material was metal, therefore, it is non-combustible.	N/A
--------------------------------------------------------------------------	-----

“Surface temperatures are not applicable  
if wall assemblies, cables, wiring and other combustible materials are not present  
  
If they are not present, the report shall note that the installation shall contain no  
combustible materials”

# We have to depend on fire suppression and explosion protection

- The system including the direct injection system and the container were not certified
- There was an error in recording located inside of container, some snapshots of video were not available: recorded last snap shot was at 00:55:00 test ended at 02:19:57
- The hydrogen measurement system malfunctioned during the test
- Testing to determine fire characterization was done at battery system level rather than a complete BESS
- UL did not select the samples, determine whether the samples were representative of production samples, witness the production of the test samples, was not provided with information relative to the identification of the component materials used in the samples
- The test results relate only to the samples tested

# Problems with fire suppression system per Atar fire review

- Provide documentation this system complies with requirements for a fire suppression system
- It cannot be determined if the system is for suppression or for thermal runaway propagation prevention. If this is not a fire suppression system, specifically invoke approval for omission of a fire suppression system
- If the NOVEC 1230 system is a thermal runaway propagation prevention system provide a separate report interpreting the test results, defining the applicable codes and standards and validating the use and limitations
- The direct Injection System is credited as a preventative barrier. Determine if this is a mitigate or preventative barrier. Revise or confirm as appropriate
- HMA: “other key preventative barriers that may be present or in varying strength depending upon the final installation include system shut down capability, facility design and siting, emergency planning and fire service response”. Comments Atar: The HMA must reflect this specific installation and dictate all required parameters. Revise and clarify

## Problems with fire suppression system per Atar fire review

- The direct injection system activates on smoke, it will do nothing to increase the amount of time for event detection. Please update
- HMA: “the strength of the gas detection system and direct injection is conditional based on the quality of the emergency response plan”. Atar: Clarify or remove
- Confirm if container based NOVEC is provided or if it is direct injection thermal runaway propagation system. The ERP and HMA contain conflicting information
- Additional information is required about the NOVEC system. Clearly define the suppression system and associated hazards in the ERP
- Confirm AES capabilities for air monitoring during a large-scale incident to inform need for public protective measures
- The HMA should discuss the NOVEC system, because this system is not an NFPA 2001 system per the NFPA 855, it cannot be called a fire suppression system

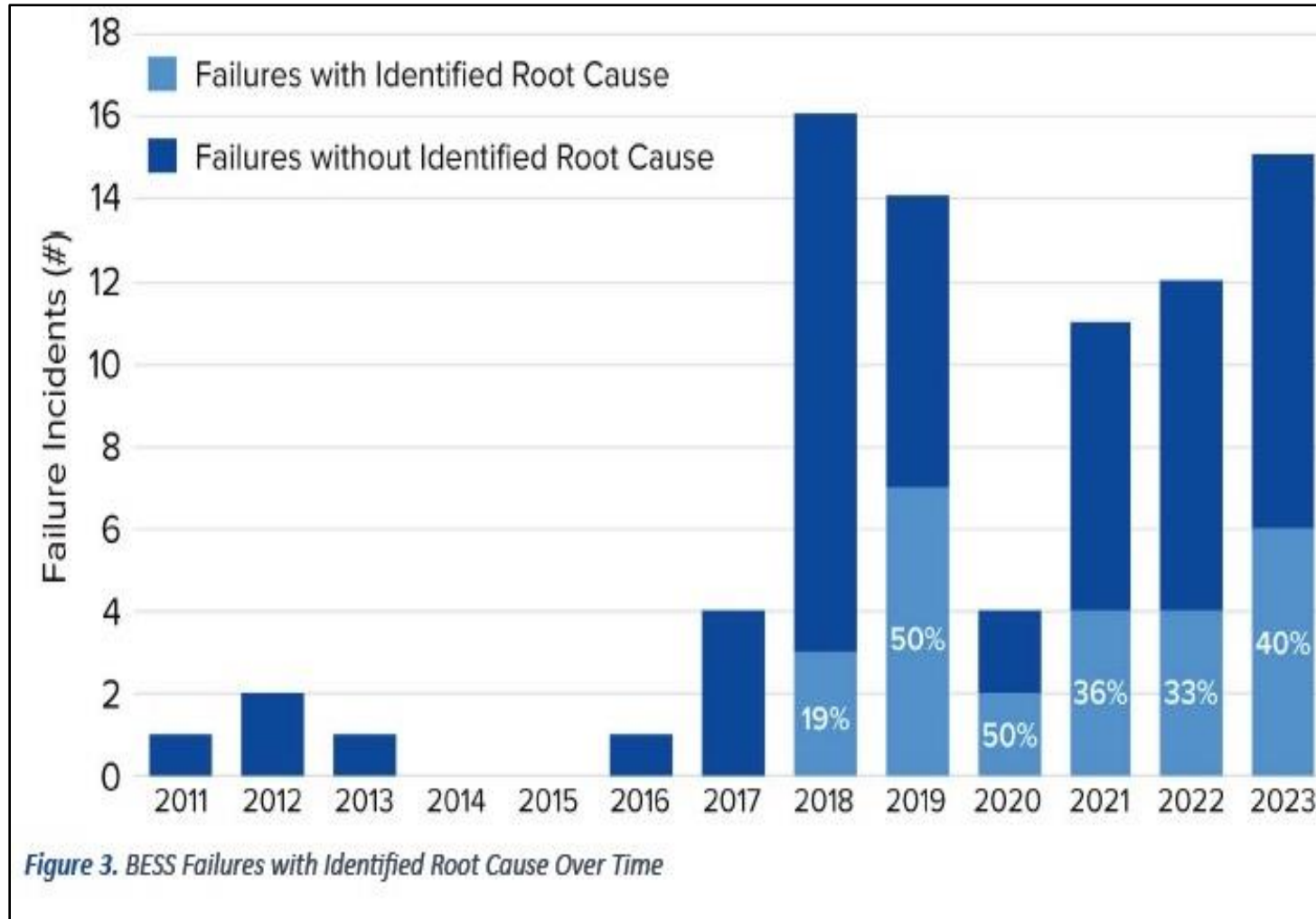
Despite these results, the installation demonstrated compliance with the standards because:

- Fires, flaming combustion, flying debris, explosive discharge of gas and sparks and electric arcs will not prevent occupants from evacuating to a safe location
- A ventilation system will release explosive gasses so that structural and mechanical damage is minimized



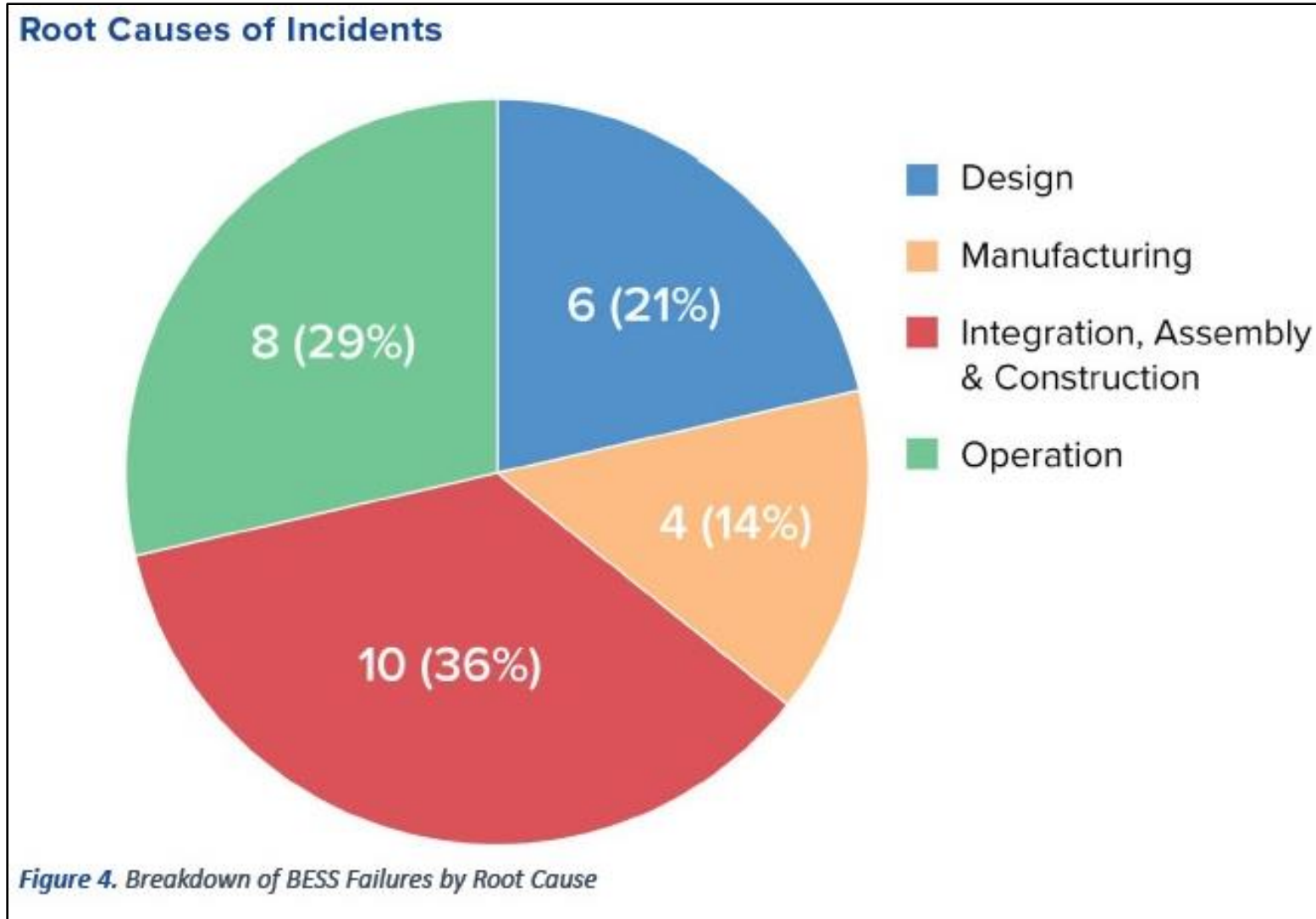
## Major analysis assumptions and limitations

- Major BESS failures not yet known by industry may exist



- Failures in more than one enclosures are not considered

- Hazards during construction, shipping and storage are not evaluated



- Protection systems inside the BESS enclosure and site wide must be installed per regulatory requirements. This has not been verified

## Other causes of fires and failures

Cell failure test method performed for the module level (summary of method and test clause):

- ☒ External heating using thin film with 4°C to 7°C thermal ramp.
- ☐ Nail Penetration ☐ Overcharge
- ☐ External short circuit ( $X \Omega$  external resistance)
- ☐ Others

- Balance of system fire, initiated in wire insulation, electrical components, or plastic inside the system
- High temperatures inside during normal operation, loose connections, blunt force to the battery system, water damage, external fire, dust-dirt-particulate accumulation, human error, HVAC failure, sensor failure, BMS failure, site control failures, shutdown failure

### More than a quarter of energy storage systems have fire detection and suppression defects: report

Defects such as faulty smoke and temperature sensors may be more common than some expect, according to clean energy advisory firm Clean Energy Associates.

Published Feb. 13, 2024 • Updated Feb. 23, 2024

- Hazardous voltage conditions, and ground- and isolation faults

### The 20 most destructive California wildfires

At least eight of California's most destructive wildfires had either electrical or power line causes. Those fires are shown in **bold**.

YEAR	NAME	STRUCTURES DESTROYED	YEAR	NAME	STRUCTURES DESTROYED
<b>2018</b>	<b>Camp</b>	<b>18,804</b>	2018	Carr	1,614
<b>2017</b>	<b>Tubbs</b>	<b>5,636</b>	2020	Glass	1,520
2025	Palisades (under investigation)	5,316	2020	LNU Lightning Complex	1,491
2025	Eaton (under investigation)	>5,000	2020	CZU Lightning Complex	1,490
1991	Tunnel	2,900	<b>2017</b>	<b>Nuns</b>	<b>1,355</b>
2003	Cedar	2,820	<b>2021</b>	<b>Dixie</b>	<b>1,311</b>
2020	North Complex	2,352	<b>2017</b>	<b>Thomas</b>	<b>1,063</b>
<b>2015</b>	<b>Valley</b>	<b>1,955</b>	2021	Caldor	1,003
<b>2007</b>	<b>Witch</b>	<b>1,650</b>	2003	Old	1,003
<b>2018</b>	<b>Woolsey</b>	<b>1,643</b>	1999	Jones	954

Source: CalFire · By The New York Times

Batteries are often the victims of BESS safety incidents

“As a test method, UL 9540A testing does not provide a certification or pass/fail results,” said Maurice Johnson, business development engineer with UL’s Energy Systems and e-Mobility group. “The best way for manufacturers to share that their energy storage battery products have been tested for thermal runaway is to list them in the UL 9540A test database.”

Several reports were withheld from the public:

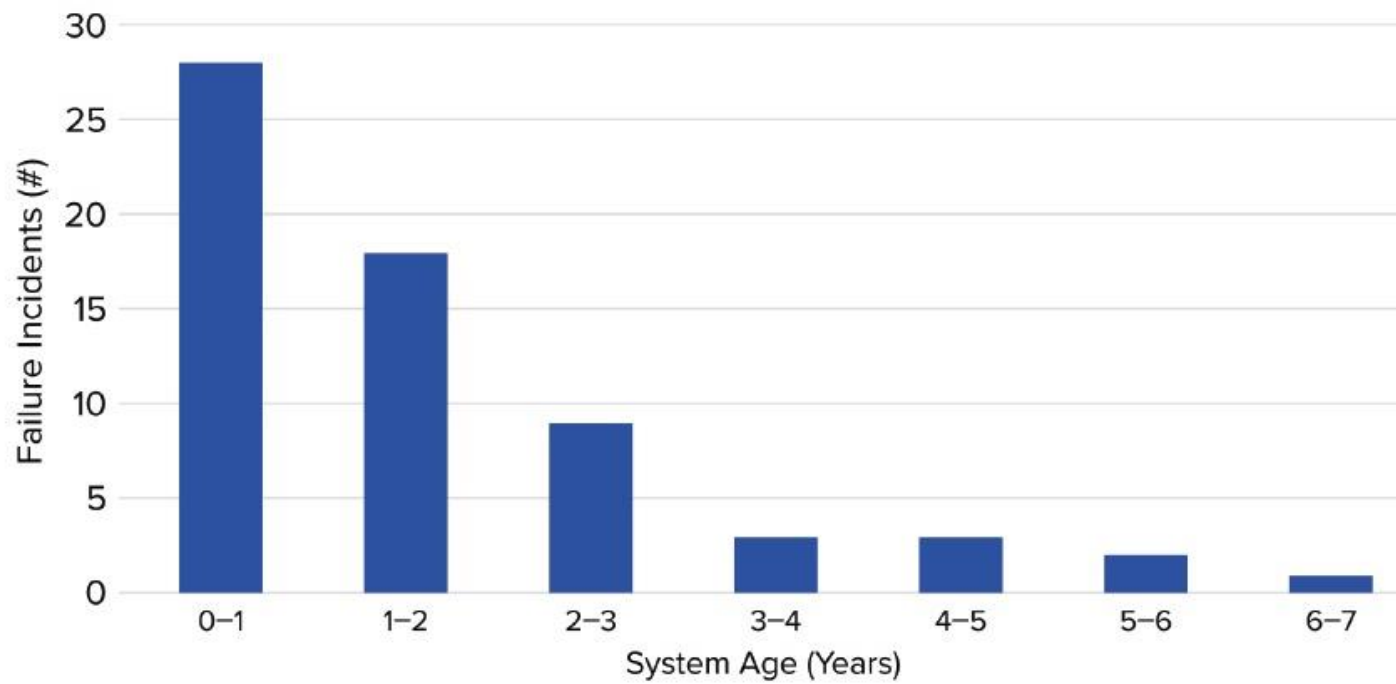
- A draft copy from the UL9540 listing report
- Deflagration Test Report (Per the Atar report: during that test an internal divider wall collapsed)
- Preliminary Dispersion and Deflagration Modeling Progress Report
- Vigilex NFPA A68 DesignCalcs

The draft preliminary HMA report was redacted at crucial point and only became available through court procedures.



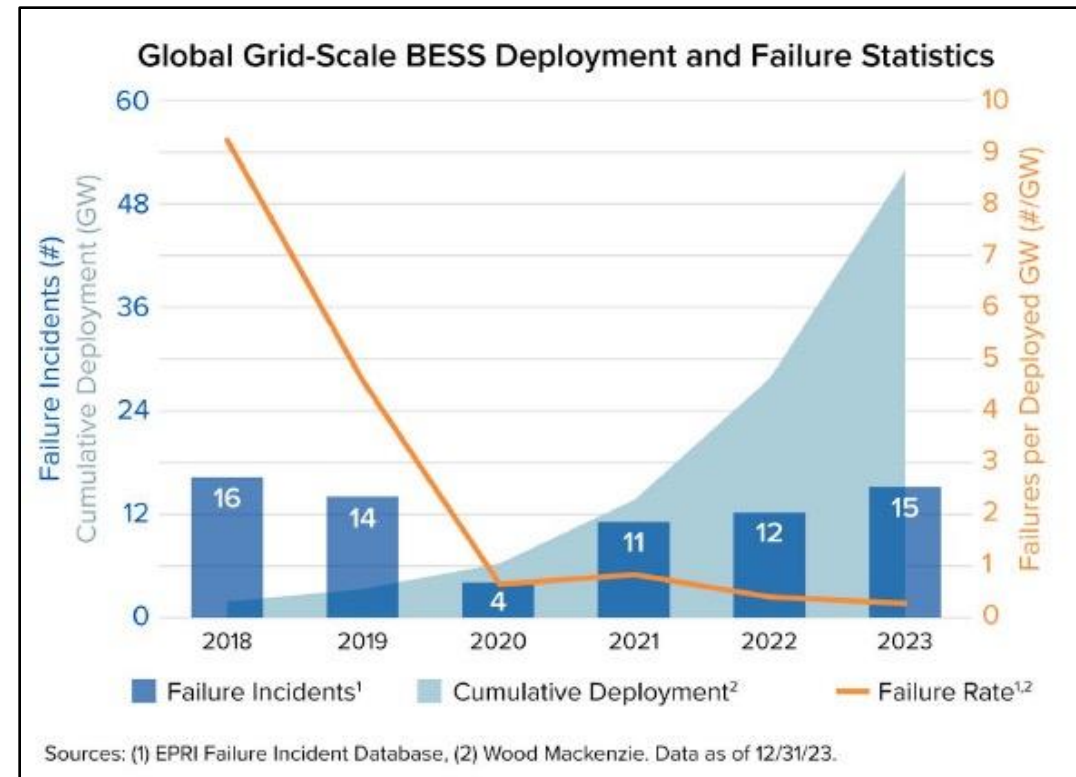
## McMicken Report

Today's standards are reluctant to prescribe that a battery module shall not cascade from cell to cell  
Standards are intentionally technology-agnostic and should not impose restriction on an industry that could increase cost



**Figure 5.** BESS Age at Failure, where known

Electric Power Research Institute EPRI



	Stationary BESS failure incidents	Other lithium ion storage failure incidents
2020	4	-
2021	11	5
2022	12	7
2023	15	5
2024	6	15
2025	1	-

EPRI data

Location	Age at incident
Moss Landing	0.5
Moss Landing	0.8
Moss Landing	1
Moss Landing	4
Escondido	7.6
San Diego	3.7
Idaho Melba	Pre-commission
Valley Center	0.2 and 1.6
NY, Warwick	0.1 and 0.1
NY, East Hampton	4.8
Rio Dell	4
AZ Chandler	3
AZ Surprise	2.1

[https://storagewiki.epri.com/index.php/BESS\\_Failure\\_Incident\\_Database](https://storagewiki.epri.com/index.php/BESS_Failure_Incident_Database)

## 200.000 Panels

- Fires start at cables and connectors going into the panels, and the external electrical cabinets and inverters
- Electrical shorts, flying sparks, heat buildup inside. “Avian incident” in California 2019 fire
- Risks are underestimated and underreported
- 430 cases 50% was in the panels themselves
- 25% were serious fires, difficult to extinguish and spread beyond the area
- Continue generate DC current, which is more unpredictable and difficult to protect than AC power (fire fighter safety)
- Environmental pollution due to the toxic smoke and toxic materials in the panels, could leak and contaminate the groundwater, serious impact on biodiversity



*Solar farm fire in California destroys 1,127 acres*



The United States doesn't centrally track solar panel fires – with the National Fire Data Center classifying them in the “other” category.



*Aerial footage of the blaze at Finley Solar Farm*

## Property values

### Hearing Officer

The Applicant provided market studies to support its position that the siting of the Project would not negatively affect home values. The comparable properties were located in the vicinity of much smaller solar generation and battery storage facilities, 10 to 20 megawatts. Of the three properties near such facilities of approximately 100 megawatts, one was sited in an industrial area and the other was neighboring an asphalt facility

### Kirkland 2023

The criteria that typically correlates with downward adjustments on property values such as noise, odor, and traffic all indicate that a solar farm is a compatible use for rural and suburban residential transition areas and that it would function in a harmonious manner with this area.

## 5 – Diablo Energy Storage System

This 200 MW battery storage system is located on a parcel with significant adjacency to industrial uses and residential uses. For these reasons it would be difficult to measure impacts due to the other adjoining industrial uses that might also have an impact. Given that most of the adjoining uses are industrial, I have not dug further on this one.

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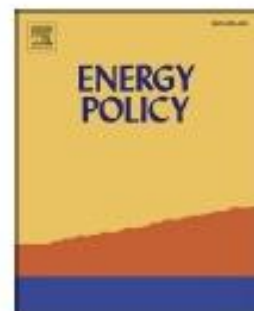


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# Shedding light on large-scale solar impacts: An analysis of property values and proximity to photovoltaics across six U.S. states

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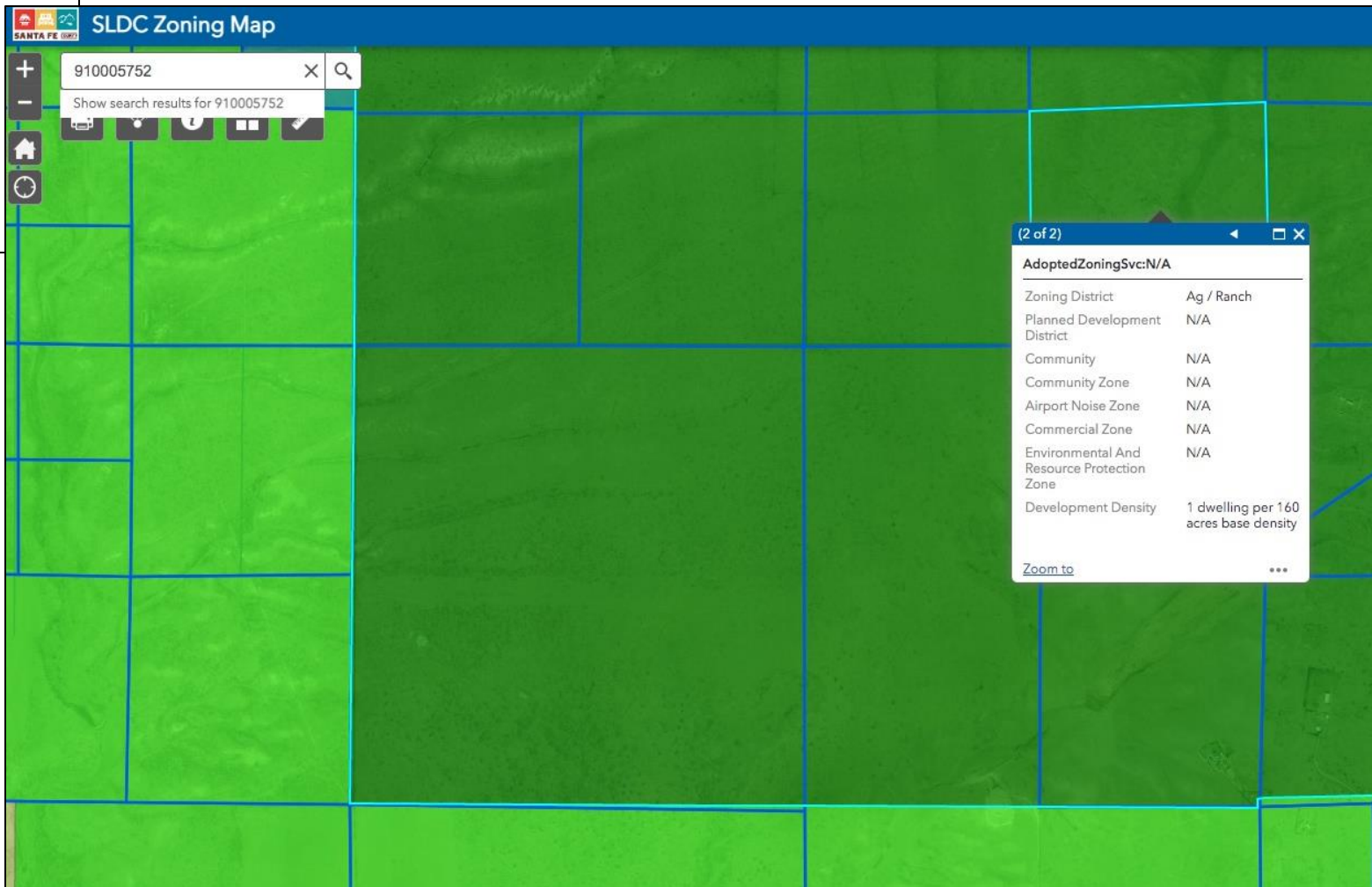


- Lawrence Berkeley National Laboratory looked at residential home prices in six states that together account for over 50% of the installed capacity of large-scale in the United States
- The study is the largest so far looking at how solar installations affect property values
- The researchers found the area where a solar installation is built has an enormous impact on whether it affects nearby home prices
- Homes in rural and agricultural areas saw declines in home prices, especially where solar farms were replacing agricultural land uses, as opposed to urban or suburban installations which saw no change in home prices
- The projects also tended to be medium-sized, most fewer than 35 acres. Large solar installations tend not to be built near areas where there are nearby homes that sold
- For homes within 0.5 miles of a large-scale solar project compared to 2-4 miles away they found a reduction in home sale prices in MN (4%) in NC (5.8%) and NJ (5.6%)
- Large-scale solar project developed on previously agricultural land, near homes in rural areas and extremely large solar project were found to be linked to adverse home sale price impacts within 0.5 mile

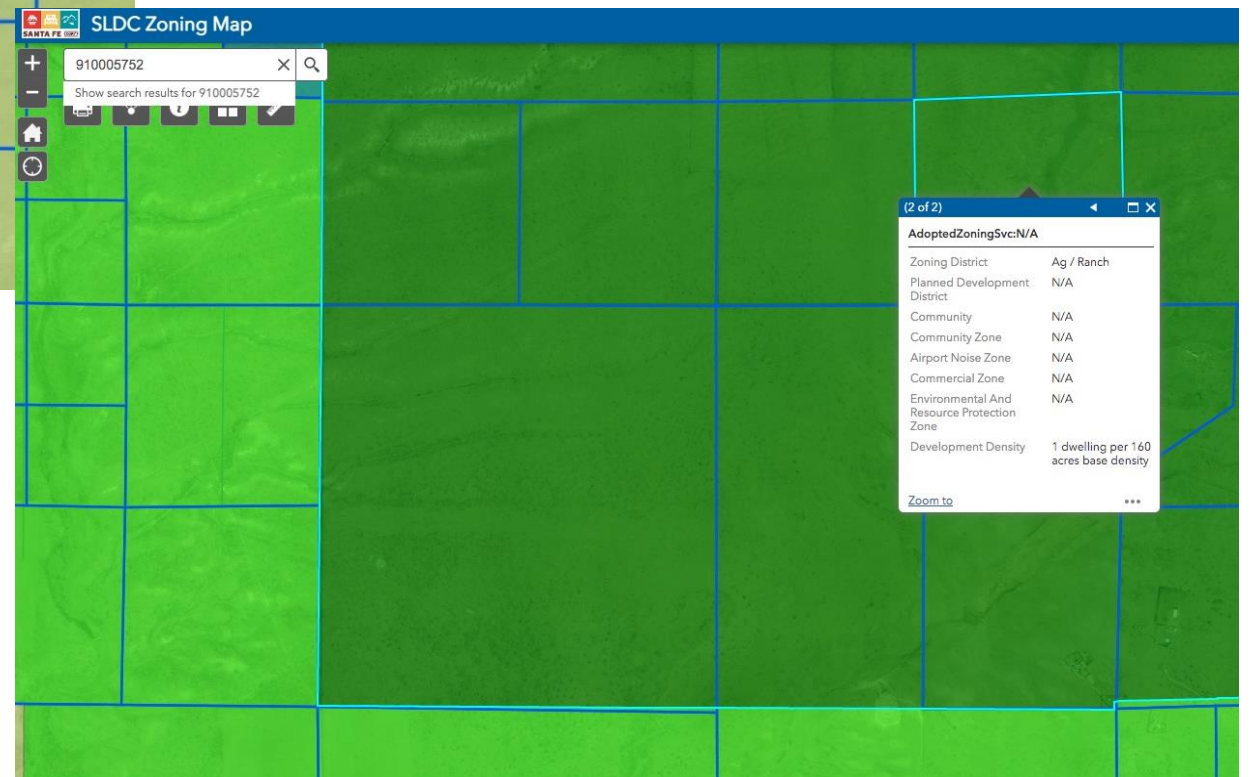
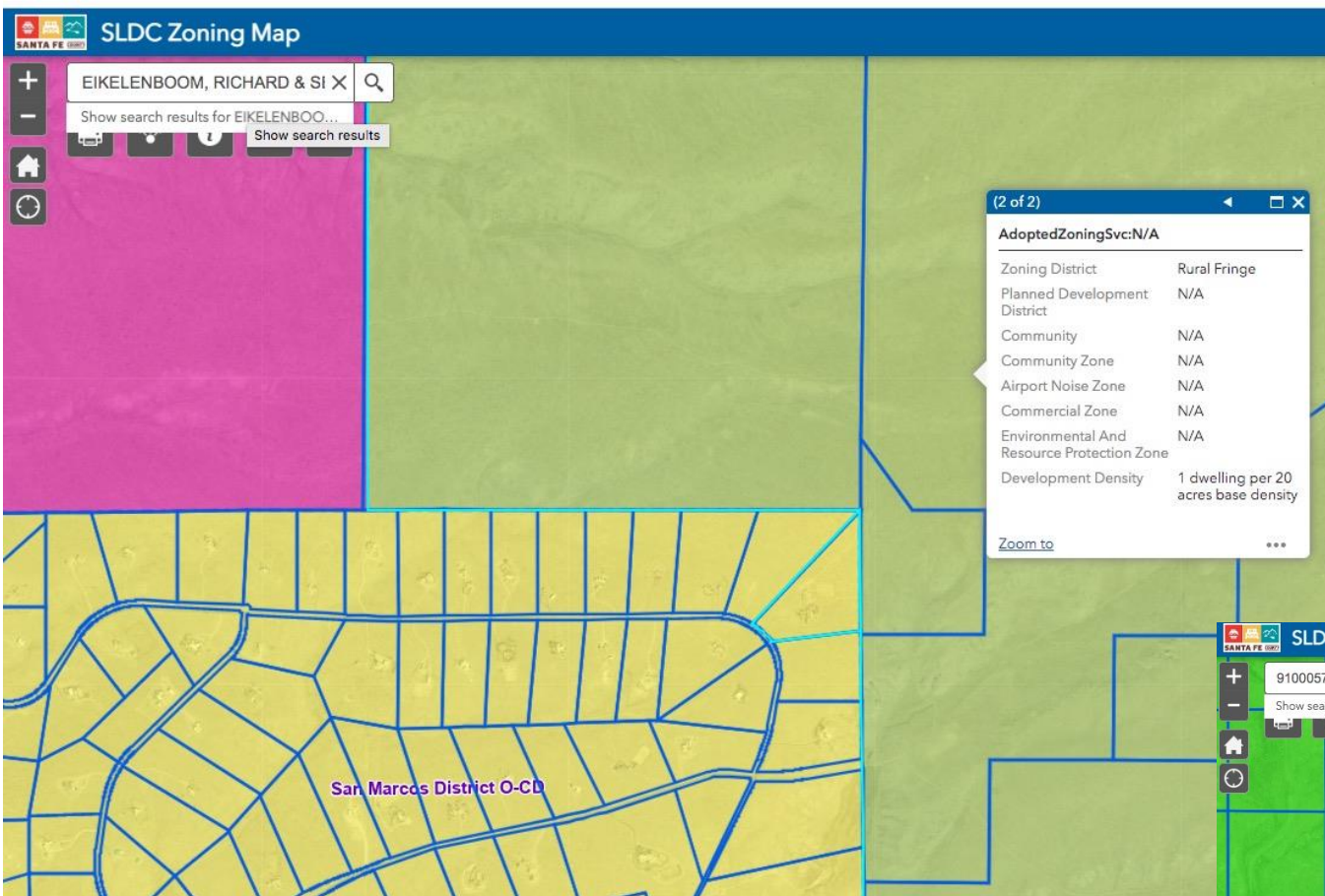


3 times as large  
Gen-tie line 0.1 mile  
No update to connect to the  
grid  
Zoning allowed

AES 2.3 mile  
Upgrade transmission station







## Conclusions

- Promises of safety through testing and standards are empty
- The systems components performed badly
- The back up systems are not certified, documentation is incomplete and showed malfunction
- Other threats are not addressed
- The 200.000 panels are not considered
- The property values will decline
- There is a better alternative

# Quotes

NM State Representative Matthew McQueen

“We have asked for a bill to be drafted that would direct the Public Regulation Commission to prepare rules dealing with appropriate siting of battery installation, solar installation and transmission lines”

San Diego County Commissioner: “I would not want them on my block”. “Don’t put them anywhere where people live”

Professor of chemical engineering at Texas University: “Some improvements, such as fire prevention measures, can be made to reduce fire risk with lithium batteries, but the only way to really address the problem is safer technology”

Professor Ezekoye of mechanical engineering at Texas University : A battery protection system in fine, but if you have significant enough failure event, it will be incapable of dealing with these severe environmental issues”



*"It keeps me focussed."*