Exhibit 2

Mrs. Marilyn Hebert,
Hearing Officer Santa Fe Country
Per email:
lynhebert@q.com

Regarding:
Application of Rancho Viejo Solar, LLC and
Clean Energy Development, LLL
for a Conditional Use Permit for a Utility-scale Solar Energy System.

Request to be accepted as Intervenor.

To the Hearing Officer,

1. New Mexicans for Responsible Renewable Energy (NMRRE) is a Registered Organization (RO), formally recognized by the Growth Management Department of Santa Fe County (Exhibit 1). Currently, I am the President of this RO.

   The purpose of the NMRRE is to advocate for and assist residents in defending the rural character of this region and the safety of its residents as described in the Santa Fe County SGMP and the SLDC. We do this by keeping residents informed of all aspects of commercial and large-scale solar renewable energy projects as indicated in the "Use Matrix" in Appendix B from the SLDC: "Gas or electric power generation facility", and "Commercial solar energy production facility" (Appendix B-Use matrix, 150A Attachment 3:11, publication Dec 2022). These facilities potentially pose risks of fire, environmental degradation and the quality of life of the community. We advocate for and promote clear communication between the residents and county officials and staff and work toward a fair resolution. (The Matrix is attached as Exhibit 2).

2. Rule V.B.6. of the Rules of Conduct, Resolution NO 2009-2, regarding Administrative Adjudicatory Proceedings states:

> **6. Presentation of Other Parties.** A person who claims an interest in the outcome of an administrative adjudicatory process shall be permitted to make a presentation in support of or in opposition to the application, and may call witnesses in support of the person's position. Any such person must identify themselves as a party to the proceedings, and state with specificity their interest in the outcome. The person and any witness called to support that

Rules of Order (Exhibit 3)

   Chapter 4 of the Sustainable Land Development Code, Procedures and Permits, under 4.7.2.1 states:

4.7.2.1. Conduct of Hearing. Any person or persons may appear at a quasi-judicial public hearing and submit evidence, either on their own behalf or as a representative. Each person who appears at a public hearing shall take a proper oath and state, for the record, his/her name, address, and, if appearing on behalf of an association, the name and mailing address of the association. The hearing shall be conducted in accordance with the procedures set forth in the Board's Rules of Order. At any point, members of the Board, the Planning Commission or the Hearing Officer conducting the hearing may ask questions of the owner/applicant, staff, or public, or of any witness, or require cross-examination by persons with standing in the proceeding to be conducted through questions submitted to the chair of the Board, Planning Commission or to the Hearing Officer, who will in turn direct questions to the witness. The order of proceedings shall be as follows:

SLDC (Exhibit 4)

3. On August 30, 2024, Rancho Viejo Limited Partnership, Rancho Viejo Solar LLC, and AES Clean Energy Development, LLC, applied for a Conditional Use Permit to build the Rancho Viejo Solar Project (RVSP). The Project would include a 680-acre solar facility, a 1-acre collector substation, a 3-acre battery energy storage system (BESS), a 2.3-mile generation tie-in line (gen-tie), a 2.1-mile access road, a 26.3-feet diameter by 7.2-feet above ground water storage tank, and a 1,400-square-feet by approximately 18 feet above ground Operations Building, on private land in Santa Fe County.

   Per AES' own definition, this project can be considered a "utility-scale solar energy system". (Exhibit 5 and https://www.aes.com/new-mexico). Utility-scale solar facilities and commercial solar facilities are typically distinguished by their scale, purpose, and impact. Utility-scale facilities are larger, designed to provide power directly to the grid, and may require more extensive infrastructure, while commercial facilities are often smaller, tied to on-site energy needs, and may have a less significant impact on the surrounding area.

4. The San Marcos zoning map depicts the area where the RVSP is planned, as "Rural Fringe". (Exhibit 6). Section 9.14.3 of the SLDC defines "Rural Fringe":

3. SMCD Rural Fringe (SMCD RUR-F); Purpose. The purpose of this district is to designate areas suitable for a combination of estate-type residential development, agricultural uses and other compatible uses. This zone also serves to protect agricultural and environmental areas that are inappropriate for more intense development due to their sensitivity. The SMCD RUR-F zone accommodates primarily large lot residential, retreats, ecotourism, equestrian uses and renewable resource-based activities, seeking a balance between conservation, environmental protection and reasonable opportunity for development.

Definition of Rural Fringe (Exhibit 6)

Figure 1 and 2 show the location and zoning of our property and the one of the Applicants.
https://sfcomaps.santafecountynm.gov/mapsvc/apps/webappviewer/index.html?id=dea8fcef5092468883caf0d691852bcd

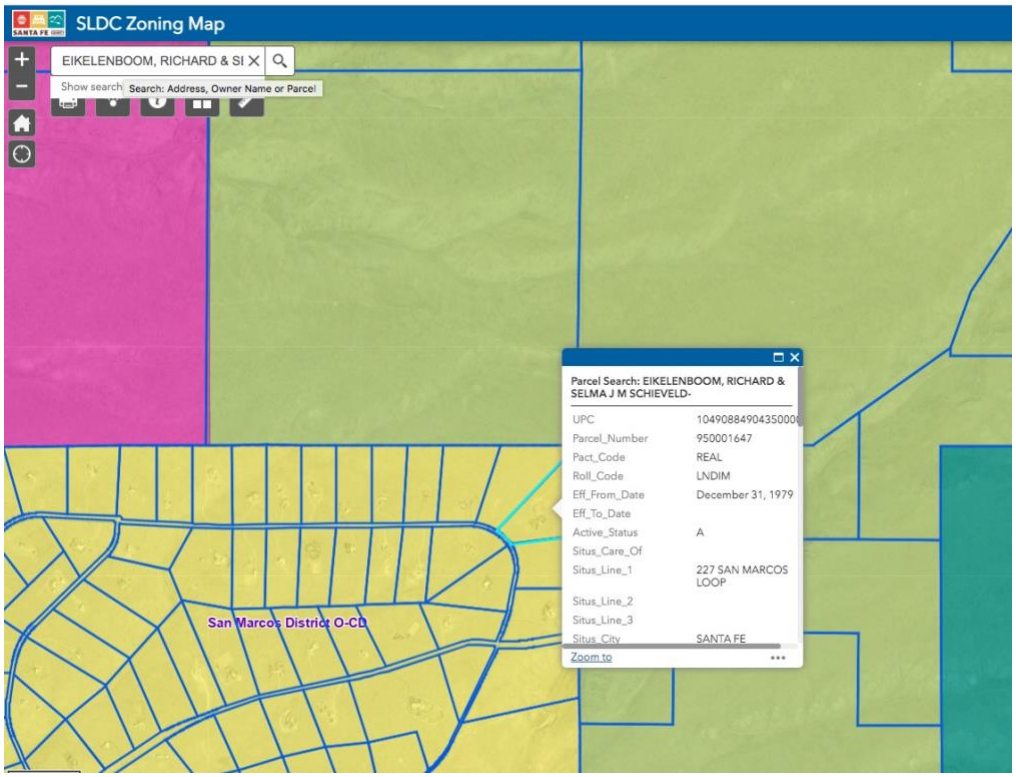


Figure 1: Location and Zoning of our property

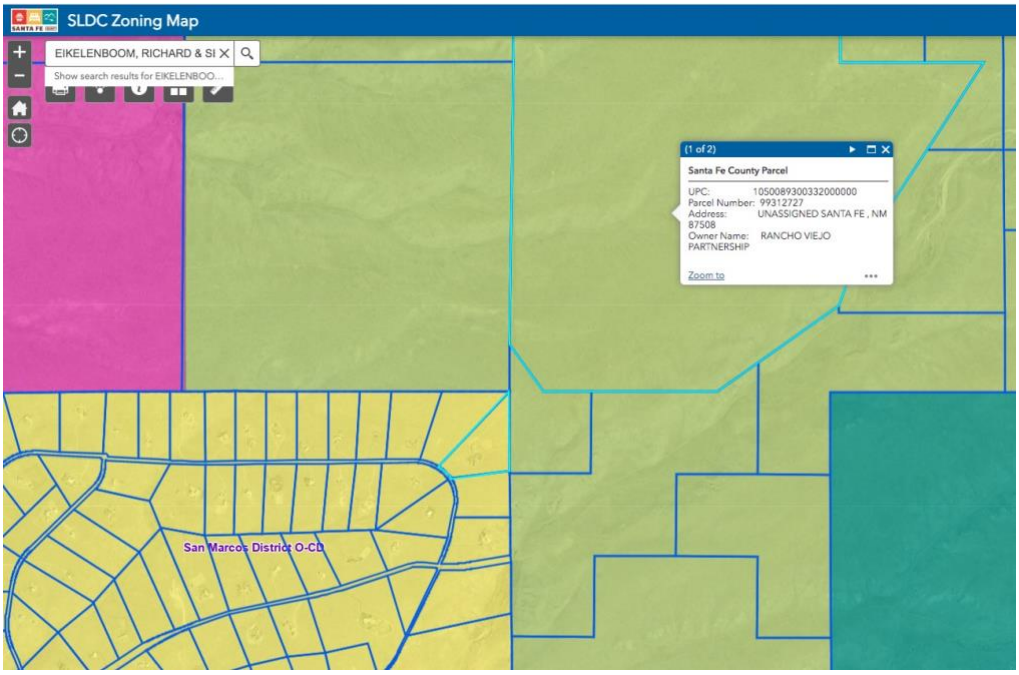


Figure 2: Location and Zoning of the RVSP

Figures 1 and 2 show the close proximity of the RVSP to Rancho San Marcos. In the Development Density (see Figure 3) 1 dwelling per 20 acres is allowed.

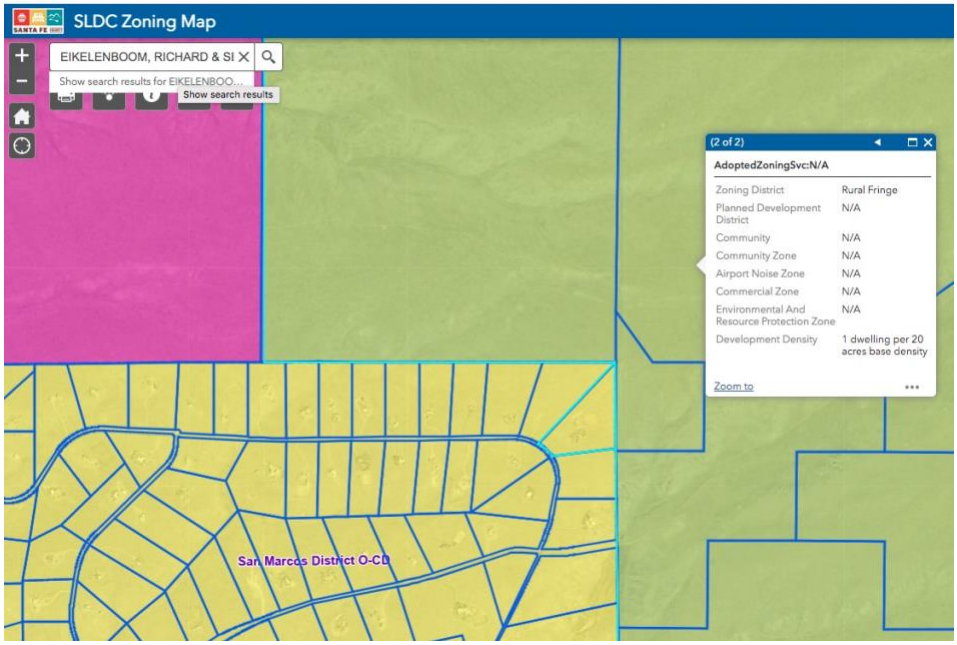


Figure 3: Location, Zoning and Development Density of the planned location for the RVSP

5. On July 19, 2024, Linea Energy informed Santa Fe County of their intention to locate two solar projects of Route 41, near Stanley. (Exhibit 7). One project would include a 960-acre solar facility and battery energy storage system (BESS). The other is located on an adjacent 1936 acres, also including a BESS.

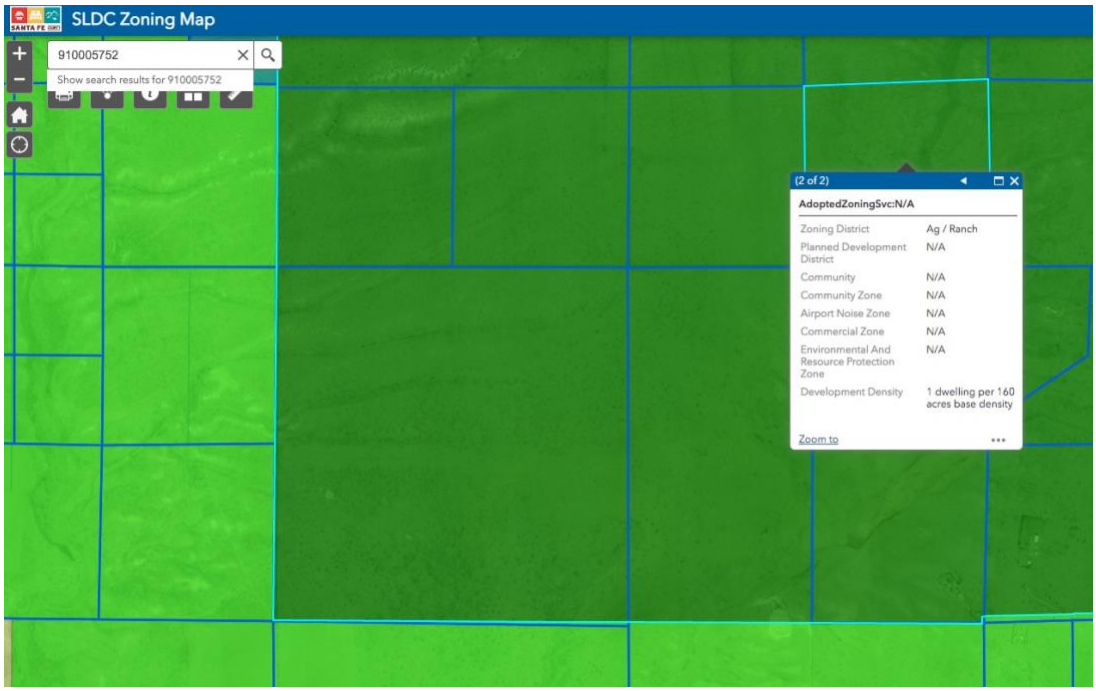


Figure 4: Location, Zoning and Development Density of the planned location for the Linea projects

Figure 4 shows the Location, Zoning and Development Density of the planned location for the Linea projects. In the Development Density (see Figure 4), 1 dwelling per 160 acres is allowed. The zoning for the proposed Linea projects is Agriculture/Ranch and Rural.

On August 19, 2024, the County Technical Advisory Committee replies in a letter, stating “that a commercial solar energy production facility is a Conditional Use within the Ag/Ranch and Rural zoning district”. (Exhibit 8).

6. The SLDC differentiate between “Gas or electric power generation facility” and “Commercial solar energy production facility”. The first, “Gas or electric power generation facility” is prohibited, “X”, in a Rural Fringe zone, see Figure 5.

SUSTAINABLE LAND DEVELOPMENT CODE

Use	Function	Structure	Activity	Agriculture/ Ranching	Rural	Rural Fringe	Rural Residential	Residential Fringe	Residential Estate	Residential Community	Traditional Community	Commercial Neighborhood	Mixed Use	Commercial General	Industrial General	Industrial Light	Public Institutional	Planned Development	Special Conditions
Gas or electric power generation facility		6400		C	C	X	X	X	X	X	X	X	X	X	C	C	C	P	

Figure 5: Adapted from Exhibit 2

See Table 8-4 from the SLDC, indicating the meaning of the labels in the Matrix.

Table 8-4: Use Matrix Labels

P	Permitted Use: The letter “P” indicates that the listed use is permitted by right within the zoning district. Permitted uses are subject to all other applicable standards of the SLDC.
A	Accessory Use: The letter “A” indicates that the listed use is permitted only where it is accessory to a use that is permitted or conditionally approved for that district. Accessory uses shall be clearly incidental and subordinate to the principal use and located on the same tract or lot as the principal use.
C	Conditional Use: The letter “C” indicates that the listed use is permitted within the zoning district only after review and approval of a Conditional Use Permit in accordance with Chapter 4.
DCI	Development Of Countywide Impact: The letters “DCI” indicate that the listed use is permitted within the zoning district only after review and approval as a Development Of Countywide Impact.
X	Prohibited Use: The letter “X” indicates that the use is not permitted within the district.

The second, ““Commercial solar energy production facility”, is a Conditional use in a Rural Fringe zone.

SUSTAINABLE LAND DEVELOPMENT CODE

Use	Function	Structure	Activity	Agriculture/ Ranching	Rural	Rural Fringe	Rural Residential	Residential Fringe	Residential Estate	Residential Community	Traditional Community	Commercial Neighborhood	Mixed Use	Commercial General	Industrial General	Industrial Light	Public Institutional	Planned Development	Special Conditions
Commercial solar energy production facility				C	C	C	X	X	X	X	C	C	C	C	P	P	X	P	

Figure 6: Adapted from Exhibit 2

In the list of definitions of the SLDC, a Commercial Solar Energy Production Facility is defined as “a renewable energy production facility that uses sunlight to generate energy for sale or profit”. There is no definition for an electric power generation facility in the SLDC.

7. Section 2.2.3.4. from the Sustainability Growth Management Plan (SGMP) describes the Existing Public and Institutional Land Use and Zoning (Exhibit 9):

The County’s existing zoning allows public, institutional, and utilities in a broad range of zoning districts, mainly designated as “community service facilities”, so the adequacy of the supply of land for such uses is not a concern. The main challenges with the location of these uses are:

- Encouraging the location of schools, community centers, government offices, places of worship, and other institutional uses within communities, to serve as a focal point for the community and afford easy access to residents, and encourage development of joint agreements to provide access to school land and recreational facilities after hours; and

- Ensuring that potential land use compatibility and environmental conflicts are taken into consideration in the location of utility uses, such as landfills, solid waste transfer stations, wastewater treatment plants, power lines and substations, and solar- or wind-power generation sites.

Section 2.2.3.4. from the SGMP

Section 14.1.2.2 from the SGMP states that “the SGMP should be established as the framework for all land use codes and regulations within the County” (Exhibit 10). The SGMP designates “solar- or wind-power generation sites” as utilities, see the last paragraph of section 2.2.3.4.

Based on the SLDC matrix, the Rancho Viejo utility-scale solar energy system is prohibited in a Rural Fringe zone, being the electric power generation facility it is. PNM is a utility company; the RVSP should be re-directed to an area that allows for such facilities, like the Agriculture/Ranch and Rural zone Linea Energy is applying for.

The SLDC zoning codes and land use regulations are designed to protect the community by controlling what types of activities and developments can occur in different zones and to ensure that the community is protected from unintended consequences. By allowing a utility-scale facility in an area where only commercial solar is permitted, the County would be undermining the purpose and intent of those regulations. It would set a dangerous precedent, given the rise of renewable energy projects.

The misclassification of a utility-scale solar facility as a commercial solar project could be a strong basis for an appeal or legal action, especially since the zoning regulations distinguish between the two and prohibit utility-scale projects in a Rural Fringe area.

The difference between three types of renewable solar energy is further substantiated in section 7.2.2.2 “Solar” from the SGMP, where the rise of large-scale solar electric generating facilities is anticipated. (Exhibit 11). The SGMP differentiate between residential and commercial, while noting the potential for utility scale solar projects:

> The scale for the integration of solar technology varies from residential to commercial. Many County residents in remote areas are already using solar energy for electricity, space and water heating. The potential for large-scale solar electric generating facilities exists within Santa Fe County. Impacts on the view sheds, historic and archaeological resources and the creation of a grid network to distribute the power would have to be considered in future development proposals in order to preserve the integrity of the landscape.

Section 7.2.2.2. from the SGMP

8. The purpose of the SMCD Rural Fringe zoning, as mentioned previously, is to protect agricultural and environmental areas that are inappropriate for more intense development due to their sensitivity. It seeks a balance between conservation, environmental protection and reasonable opportunity for development. Hence residential or commercial solar would be permitted, utility-scale does not qualify for a CUP.

   Figures 7 and 8 were taken from the RVSP Visual Impact Assessment. https://www.santafecountynm.gov/uploads/documents/SRA08_VisualImpact.pdf

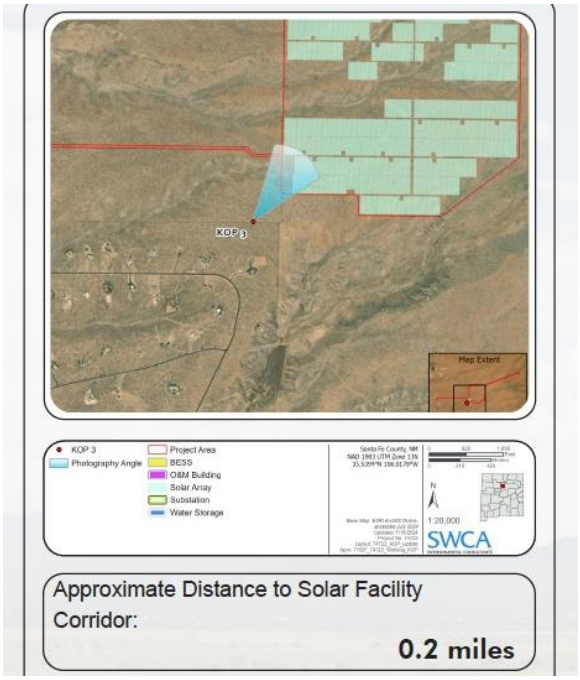


Figure 7: View from our house

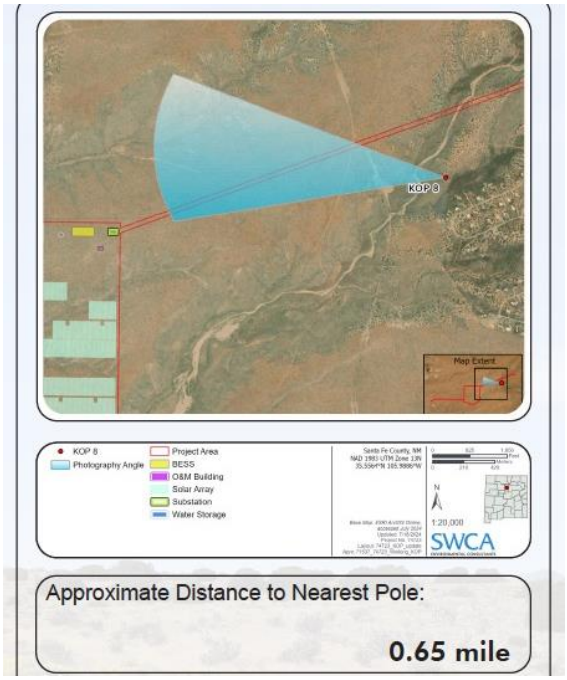


Figure 8: View from Encantado

Figure 7 is a visual assessment analisys, projected from our house, “Kop 3”, our house is the closest to the project. Figure 8, “Kop 8”, is from Encantado, on the other side of the project. The comment in the report regarding these two locations is as follows:

KOP 3 (Southern Boundary East) is within the foreground of the analysis area and would have an unobstructed view of the solar PV array and distant views of the transmission line as it continues into the distance. The current landscape character is described as a flat high desert plain with isolated short stature vegetation. The vegetation community consists of low indistinct grasses and stippled arrangement of cactus. The mountains to the east of Santa Fe can be clearly seen in the distance. The level of change to the visual character of the area and impacts to viewers looking northeast from the KOP towards the solar PV array would be moderate due to the introduction of new structural elements and the general proximity of the KOP to project components.

Comment in the report regarding Kop 3 (our house)

KOP 8 (Encantado Community Perimeter Trail) is within the foreground of the analysis area and would have a skylined view of the proposed transmission line. The current landscape character is described as a low prairie grass, stippled arrangement of cactus and short globular desert shrubs. The landforms of the area are rolling hills with angular mountains within the distance. The level of change to the visual character of the area and impacts to viewers under Option 1 (H-frame) would be high due to skylining of the transmission line, viewer distance in relation to the transmission line along with minimal vegetation, or intervening topography.

Comment in the report regarding Kop 8 (Encantado)

"Table 2. Criteria for Assessing Magnitude of impact on Visual Resources" is part of the Rancho Viejo Solar Project Visual Impact Assessment. It describes the magnitude of impact on the character and scenic quality of the environment when looking in the direction as depicted in Figures 7 and 8.

Table 2. Criteria for Assessing Magnitude of Impact on Visual Resources

Magnitude of Impacts	Sensitive Viewing Platforms and Key Observation Points	Landscape Character and Scenic Quality
None	• Project components would repeat elements/patterns common in the landscape. • Project components would not be visually evident.	• The landscape would appear to be intact and would not attract attention. • Project components would repeat form, line, color, texture, or scale common in the landscape and would not be visually evident (no contrast).
Low	• Project components would introduce elements/patterns common in the landscape that would be visually subordinate. • Project components would create weak contrast, compared with other features in the landscape.	• The landscape would be noticeably altered and begin to attract attention. • Project components would introduce form, line, color, texture, or scale common in the landscape and would be visually subordinate (weak contrast).
Moderate	• Project components would introduce elements/patterns not common in the landscape. • Project components would be visually prominent in the landscape and would create moderate contrast, compared with other features in the landscape.	• The landscape would appear to be substantially altered. • Project components would introduce form, line, color, texture, or scale not common in the landscape and would be visually prominent in the landscape (moderate contrast). • Project components would attract attention. • Project components would begin to dominate the visual setting.
High	• Project components would introduce elements/patterns that would be visually dominant and create strong contrast, compared with other features in the landscape.	• The landscape would appear to be severely altered. • Project components would introduce form, line, color, texture, or scale not common in the landscape and would be visually dominant in the landscape (strong contrast). • Project components would demand attention. • Project components would dominate the visual setting.

Rancho Viejo Solar Project Visual Impact Assessment

The descriptions mention that the landscape would appear to be substantially altered, the project would introduce components not common in the landscape, it would begin to dominate the visual setting, which is designated as “Moderate”, or that the landscape would appear to be severely altered, the project would introduce components not common in the landscape, it would dominate the visual setting, designated as “High”.

The magnitude of alteration of the landscape as it is described by the RVSP Visual Impact Assessment, is not consistent with “to preserve the integrity of the landscape”, as mentioned in the SLDC with regards to large-scale solar electric generating facilities”, see under point 7.

No impact assessments were provided for higher altitude, e.g. coming from I-25 or NM14 into the city. A dark area of approximately 680 acres (approximately 500 US football fields) most likely will interfere with the designation of the Turquoise Trail being a “Scenic Byway”.

9. The U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) has determined that lithium-ion batteries are not considered to be “articles” and are subject to the OSHA Chemical Hazard Communication Standard (HCS). (Exhibit 12). Manufacturers and importers are required to evaluate the hazards of the chemicals they produce or import, and prepare labels and safety data sheets to convey the hazard information to their downstream customers; an exemption is made for lithium-ion batteries used for personal, family, or household purposes.

   The exemption does not apply to any large commercial type that are not available for purchase or use by the general public. Lithium-ion batteries are not considered to be “articles”, because although they are sealed, they have the potential to leak, spill or brake during normal conditions of use and in foreseeable emergencies causing exposure to chemical. (Exhibit 13).

   Although OSHA has not conducted a hazard classification on Li-ion batteries, the agency has reviewed publically-available information from U.S. government agencies and industry consensus standards such as the U.S. Consumer Product Safety Commission (CPSC), USDOT/Pipeline and Hazardous Material Safety Administration (USDOT/PHMSA), and the National Fire Protection Association (NFPA). The information shows that while lithium cell or battery technology is complex, potential cell or battery failure during use and handling can present a fire (physical) hazard, which has caused or could cause workers to be exposed to burns. Additionally, the information shows that toxic air contaminants (e.g., lithium, cobalt) can be released due to chemical leakage or venting when the battery is damaged or catches fire, potentially exposing workers to a health hazard. (Exhibit 12).

   Lithium-ion batteries are also subject to the Emergency Planning and Community Right-to-Know act. (Exhibits 13 and 14).

In a 2019 fire in an AES' Battery Energy Storage System (BESS) in Surprise, Arizona, 8 firefighters were injured, 4 seriously. The independent investigative report that followed, the McMicken Technical Report, noted short comings in the standards, e.g. NFPA 855 and UL 9540 / UL 9540A and UL 1973, (Exhibit 15):

6.1 Current and future standards and codes should directly address cascading thermal runaway

Today's codes and standards (specifically NFPA 855) do discuss the hazard of cascading thermal runaway, but without prescription. They are reluctant to prescribe that a battery module *shall not* cascade from cell to cell. One reason for this is that consensus-built codes and standards are intentionally technology-agnostic and should not impose restrictions or solutions on an industry that are perceived to increase cost or be commercially inviable.

UL 9540A does not prescribe that the cell cascading rate be measured directly, nor does it define pass/fail criteria. At present, there is no "pass" criteria for UL 9540A.

The UL 9540A test method is only meant to provide information but does not guide interpretation of the data or deliver a certification. In theory, the unit level test could result in full consumption of a rack and this result would be reported without a judgement on whether this was poor performance.

The deficiency in the "pass" criteria for UL 1973 is that the module could still fail catastrophically in thermal runaway even if it did not project flame. Internal heat could consume every battery inside; but, if it did not eject flame, it would pass. It could reach temperatures above 600°C and cause its aluminum frame to sag and yield, potentially contacting neighboring modules and cells. It could radiate enough heat energy to successfully induce thermal runaway in modules directly above or below it. It could create a plume of flammable gases without igniting them. It could do these things and still be considered to "pass" UL 1973 as long as no explosion or external flame was observed. Heat transfer from module to module is what occurred in the McMicken BESS. Hence, UL 1973 pass/fail criteria need to be revised to acknowledge unmitigated cell-to-cell cascading and the resulting heat production and flammable gases.

Although since then some upgrades have been made to some standards, they still are kept limited for the sake of the industry. I received this answer from UL LLC to my inquiry about the chances of malfunction if a system is tested per the standards UL 9540 and UL 9540 A, (Exhibit 16):

"This is a test methodology that evaluates a product to determine whether it meets or performs as intended against specific requirements outlined in regulatory requirements/codes. We would not claim that evaluation to 9540a prevents any kind of future malfunction or issue, but it goes a long way to help identify and address known sources of flaws and risks".

UL 9540A does not have a traditional "pass/fail" criterion but instead is a test method used to evaluate the fire hazards associated with thermal runaway in battery energy storage systems (ESS).

The testing occurs at multiple levels—cell, module, unit, and installation—and is designed to gather data on whether thermal runaway can occur and how it propagates if it does. Each test provides information to guide safe installation practices, particularly in terms of fire safety, but the process is focused on determining the fire and explosion hazards rather than issuing a binary pass/fail result.

Abiding by the industrial standards is obligatory, but no guarantee to safety. Another argument put forward by the industry is that battery management systems will prevent an uncontrolled thermal runaway. However, a large study by an advisory firm quality audit, revealed that more than a quarter of energy storage systems have fire detection and suppression defects (Exhibit 17).

Despite the industry's efforts to downplay the risks, BESS pose a real fire hazard. The Electric Power Research Institute (EPRI) performed a root cause analysis from BESS failures between 2011 and 2023, see Figure 9. (Exhibit 18). In the majority of cases no cause of the failure could be detected. Which means these failures cannot be anticipated or be prepared for. This is a significant risk for first responders and the general public close to such facilities.

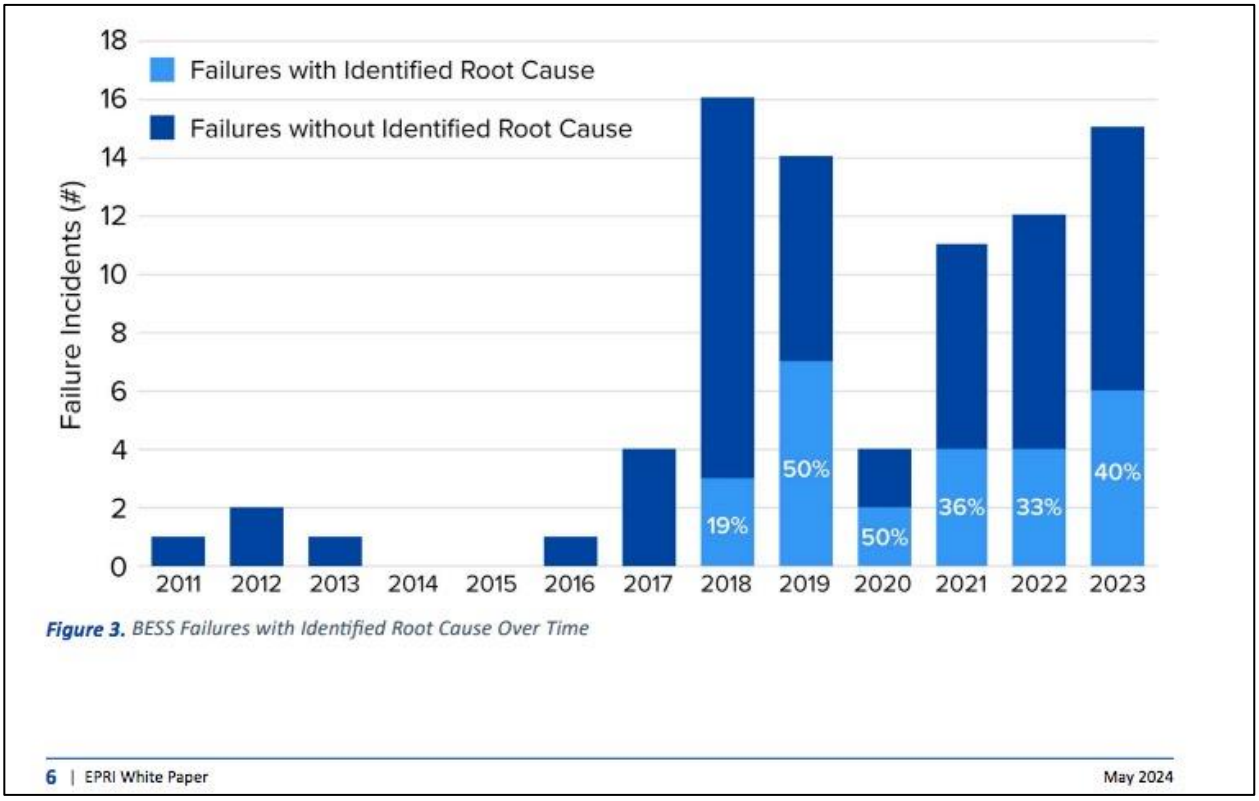


Figure 9: Root cause analysis

In an recent EPRI publication it was mentioned that “Although prior EPRI research suggests that failure rate per megawatt-hour installed is decreasing, there will be failure”. (Exhibit 19). The amount of energy may have increased, but the number of failures has not decreased, and is increasing since 2020, see Figure 9. That means that more energy is generated by the photovoltaic systems (the solar panels), but the number of failures for the BESS is increasing as well.

In addition to the fire risk posed by the BESS, the estimated 200.000 solar panels are a fire risk as well. A report by FireTrace International mentioned that the solar industry is potentially underestimating the risk of fire at solar farms. (Exhibit 20). Research indicated that fires at solar farms are under reported. The US Department of Solar Energy Technology Office cited a European study conducted by testing and certification company TÜV, which found that in approximately half of the 430 cases of fire or heat damage the photovoltaic system itself was considered the cause or probable cause. A study by BRE National Solar Centre found that more than a quarter of fire involving solar systems were caused by the photovoltaics and that those fires were all “serious fires”, meaning fires that were “difficult to extinguish and spread beyond the area of origin”. (Exhibit 20).

A fire at a solar farm can result in pollution as well as posing a serious threat to human life and health. (Exhibit 21). In addition to the obvious fire risk, the damage can include pollution of the water supply. Many residents in vicinity of the RVSP depend on wells and pollution of our aquafer would be disastrous. Air pollution due to toxic smoke from burning panels also poses serious health risks.

10. Section 4.9.6.5. from the SLDC provides the criteria for approval of a CUP. Seven points are mentioned that should unequivocally lead to rejection of such a permit:

4.9.6.5. Approval Criteria. CUPs may only be approved if it is determined that the use for which the permit is requested will not:

1. be detrimental to the health, safety and general welfare of the area;

2. tend to create congestion in roads;

3. create a potential hazard for fire, panic, or other danger;

4. tend to overcrowd land and cause undue concentration of population;

5. interfere with adequate provisions for schools, parks, water, sewerage, transportation or other public requirements, conveniences or improvements;

6. interfere with adequate light and air; and

7. be inconsistent with the purposes of the property's zoning classification or in any other way inconsistent with the spirit and intent of the SLDC or SGMP.

Approval Criteria

Regarding point 1: that area is designated Rural Fringe. Residents moved into that area with the expectation of the relative peace of large lot residencies, retreats, ecotourism and equestrian use. With trust in the County to seek a balance between conservation, environmental protection and reasonable opportunity for development, see Exhibit 6. With trust that the County would preserve the integrity of the landscape. Many of us are now confronted with County Officials who are considering to disregard those standards for the sake of a utility-scale electric generating facility that is not even allowed there in the first place. The general welfare of the area is clearly in jeopardy.

Regarding point 3: create a potential hazard for fire, panic and other danger. Under point 9 I extensively provide evidence of the inherent fire danger of BESS and photovoltaic panels. Despite all the precautions the industry is putting in place, the technology is not safe. The facilities are increasing in size and numbers, but failures keep occurring, most of the time by unknown causes. Expecting residents to live close by facilities that are not under the control of the companies that build and profit of them is not an acceptable situation.

Regarding points 5 and 6: if a fire occurs millions of gallons of water might be needed to cool the containers. That water might become contaminated with toxic material. It can take days for such a fire to burn itself out and long after that the containers still need to be cooled to prevent spontaneous reigniting. When contaminated water leaks into the soil, it might very well contaminate the aquafer, destroying the wells of the residents that depend on them.

Regarding point 7: be inconsistent with the purpose of the property's zoning classification or in any other way inconsistent with the spirit and intent of the SLDC or SGMP. The RSVP is inconsistent with the zoning classification to such a degree that it is questionable how the Applicants were even allowed to file for a CUP in the first place. Trying to pass of a utility-scale solar facility as a commercial solar project would violate the letter of the Codes, creates a hazardous precedent and sets the stage for an appeal and legal action.

11. My husband and I are residents of Rancho San Marcos and I am President of the Registered Organization "New Mexicans for Responsible Renewable Energy" (NMRRE). Several of our members including, my husband and I, live close to the perimeter of this project (0,2 miles), other live somewhat further out, but we all fear for the possible consequences associated with a project of this scale and magnitude in between 3 residential areas. From the magnitude of this project it is clear that it will significantly negatively impact our life. We all have an interest in the outcome of this process. If permitted, the RVSP will put our lives at risk, reduce our joy in living in this area because of a continuous fear of fire, destroyed view of the surroundings and 24/7 noise from this facility. The flora and fauna will be reduced because of about 500 US football fields of black covering.

12. I have been a medical doctor for 30 years, I received a PhD from the University of Denver, Department of Mathematics and Biological Sciences, worked as a forensic medical examiner for 24 years, and I am still licensed to work as an MD in the EU. I testified as an expert in the Netherlands, Australia, Costa Rica and the US approximately 60 times, and I am familiar with judicial procedures. I will represent the NMRRE and myself, present testimony and evidence and I will cross-examine witnesses.

13. My communications with the County started on February 20, 2023, when I wrote a formal request to refuse a permit for the RVSP.

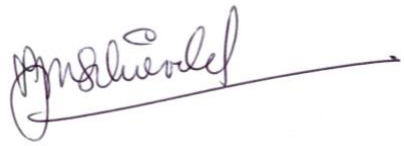
14. I request that I will be served with all notices, pleadings, discovery requests and responses and any prepared testimony filed in this case.

15. I have sent a copy of this request to be accepted as Intervenor to representatives of the Applicants and Santa Fe County.

16. Per the Rules of Order, this should qualify for me to be accepted as an Intervenor during these proceedings. I understood from the County Officials that The Clean Energy Coalition of Santa Fe County acquired RO-status and will be given standing. I would respectfully request the same standing for the NMRRE and myself.

Santa Fe, October 18, 2024

Respectfully submitted

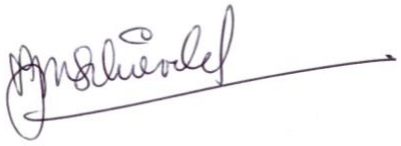


Dr. Selma Schieveld MD PhD
227 San Marcos Loop
Santa Fe, NM 87508
303-548-5225
selma@ifscolorado.com

Self Affirmation

I, Selma Schieveld, upon penalty or perjury under the laws of the State of New Mexico, affirm and state the forgoing request for leave to intervene is true and correct based on my personal knowledge and belief.

October 18, 2024



Dr. Selma Schieveld MD PhD

Certificate of Service

I hereby certify that I have served a copy of the forgoing request to intervene to the following persons by email on October 18, 2024:

Mrs. Marilyn Hebert, Hearing Officer	lynhebert@q.com
Joshua Mayer, authorized representative Rancho Viejo Solar LLC, AES Clean Energy Development LLC	Joshua.Mayer@aes.com
Warren Thompson, Rancho Viejo LP	warrenthompson@mac.com
Brian Egolf, Esquire Luke Pierpont	Brian@EgolfLaw.com Luke@EgolLaw.com
County attorney Jeffrey Young	jyoung@santafecountynm.gov
Case manager Dominic Sisneros	djsisneros@santafecountynm.gov

Exhibit 1

SANTA FE COUNTY

Growth Management Department

FORMALLY RECOGNIZES

New Mexicans for Responsible Renewable Energy as a Registered Organization in Santa Fe County

This organization has submitted an application that is consistent with the Sustainable Land Development Code (SLDC) requirements to be recognized as a Registered Organization.

Recognized this 25th day of September 2024

Jordan A. Yutzy
Land Use Administrator

SANTA FE COUNTY

GB Clavio
Planning Manager

Exhibit 2

Use	Function	Structure	Activity	Agriculture/ Ranching	Rural	Rural Fringe	Rural Residential	Residential Fringe	Residential Estate	Residential Community	Traditional Community	Commercial Neighborhoo	Mixed Use	Commercial General	Industrial General	Industrial Light	Public Institutional	Planned Development	Special Conditions
Septic tank service, repair, and installation business	4346			X	X	X	X	X	X	X	C	C	C	P	P	P	X	P	
Household hazardous waste collection facility				C	C	C	X	X	X	X	C	X	C	C	P	C	X	P	
Hazardous waste storage facility		6340		C	C	X	X	X	X	X	X	X	X	X	C	X	X	P	
Hazardous waste treatment and disposal facility				C	C	X	X	X	X	X	X	X	X	X	C	X	X	P	
Sewage treatment plant and disposal facilities		6350		C	C	C	C	C	C	C	C	X	C	C	C	C	C	P	
Gas or electric power generation facility		6400		C	C	X	X	X	X	X	X	X	X	X	C	C	C	P	
New wireless communication facility/Modification of existing wireless communication facility with substantial changes		6500		C	C	C	C	X	X	X	X	X	C	C	C	C	C	C	
Modification of existing wireless communication facility with no substantial changes/Collocation		6500		P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	
Roof-mounted/ surface-mounted/ stealth		6500		P	P	P	P	C	C	C	C	P	P	P	P	P	P	P	
Amateur radio antenna		6510		P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	
Weather stations		6520		P	P	P	C	X	X	X	C	A	P	P	P	P	P	P	
Environmental monitoring station (air, soil, etc.)		6600		P	P	P	P	P	P	P	P	A	P	P	P	P	P	P	
Commercial solar energy production facility				C	C	C	X	X	X	X	C	C	C	C	P	P	X	P	
Geothermal production facility		6450		C	C	C	X	X	X	X	X	X	C	C	P	P	C	P	
Large-scale wind facility				C	C	C	C	X	X	X	X	X	C	C	P	C	X	C	Sec. 10.16

made to the Board shall be under oath and on the record. The applicant or witness may be questioned by members of the Board .

5. Cross Examination (if requested). A party to an administrative adjudicatory proceeding shall be afforded the opportunity to cross examine the applicant or any witness presented by the applicant. The party seeking the cross examination must notify the Chair that cross examination is desired before the witness is excused or such cross examination shall be waived.

6. Presentation of Other Parties. A person who claims an interest in the outcome of an administrative adjudicatory process shall be permitted to make a presentation in support of or in opposition to the application, and may call witnesses in support of the person's position. Any such person must identify themselves as a party to the proceedings, and state with specificity their interest in the outcome. The person and any witness called to support that person's position shall be sworn prior to addressing the Board, and all statements made to the Board shall be under oath and on the record. The party or witness may be questioned by members of the Board on the application.

7. Cross Examination (if requested). The applicant shall be afforded the opportunity to cross examine the interested party so presenting or any witness presented by the party. The party seeking the cross examination must notify the Chair that cross examination is desired before the witness is excused or such cross examination shall be waived.

8. Public Input. Members of the public shall be allowed to testify in favor of and in opposition to an administrative adjudicatory item. Members of the public shall be sworn and all such testimony shall be under oath and on the record. The Chair may impose reasonable restrictions to limit testimony so as to eliminate extraneous, redundant, irrelevant, or harassing testimony. The Chair may set time restrictions on testimony as necessary.

C. Adoption of Ordinances and Other Matters Requiring Public Hearings.

1. Tabling, Postponing or Withdrawing Ordinances and Other Public Hearing Matters. The Board of County Commissioners may hear any matter on the agenda, or table, postpone or permit withdrawal of the item. Once an item has been tabled, postponed or withdrawn three times, the relevant application, if any, shall be deemed withdrawn and a new application and appropriate notice shall be required before the item may be placed on the agenda.

2. Staff Presentation. Staff shall present a detailed report and shall respond to questions from Board or committee members. Staff shall provide sworn testimony as necessary. During the staff presentation, only Board or committee members shall be permitted to question staff on the item.

4.6.11.3. request consideration of a larger land area than indicated in the original application;

4.6.11.4. request a greater variance than that requested in the application;

4.6.11.5. request any diminution in buffer or transition area dimensions, reduction in required yards, setbacks or landscaping, increase of maximum allowed height, or any change in the design characteristics or materials used in construction of the structures; or

4.6.11.6. reduce or eliminate conditions attached to a legislative or quasi-judicial development order unless a new application is filed.

4.7. HEARING STANDARDS.

4.7.1. Legislative Hearings.

4.7.1.1. Conduct of Hearing. Testimony may be presented by the owner/applicant, any member of the public, and by the County or other affected governmental entities. Testimony need not be submitted under oath or affirmation. The Hearing Officer, Planning Commission or Board may establish a time limit for testimony and may limit testimony where it is repetitive.

4.7.1.2. Special Rules: Contested Zoning Matters. If the owners of twenty percent or more of the area of the land or representing more than twenty percent (20%) of the lots included in an area proposed to be changed by a zoning regulation, or within one hundred feet, excluding public right-of-way, of the area proposed to be changed by a zoning regulation, protest in writing the proposed change in the zoning regulation, the proposed change in zoning shall not become effective unless the change is approved by a two thirds vote of the Board. NMSA 1978, §3-21-6(C).

4.7.1.3. Planning Commission Recommendation. The Planning Commission shall make a written recommendation to the Board on any application requiring final approval of the Board that an application be approved, approved with conditions, or denied. If an application requiring final approval of the Board has been duly submitted to the Planning Commission, and the Planning Commission has failed to convene a quorum or to make a recommendation approving, approving with conditions or denying such development approval at two (2) meetings on the application, the application shall move to the Board without a recommendation unless the Applicant waives this requirement and agrees in writing to any additional Planning Commission meetings.

4.7.1.4. Minutes. Written verbatim minutes shall be prepared and retained with the evidence submitted at the final hearing. Verbatim or summary minutes shall be prepared and retained with the evidence submitted at a preliminary hearing.

4.7.1.5. Board Action. The Board shall hold a public hearing to consider a legislative application. The Board shall duly consider the recommendation of the Planning Commission.

4.7.2. Quasi-Judicial Public Hearings.

4.7.2.1. Conduct of Hearing. Any person or persons may appear at a quasi-judicial public hearing and submit evidence, either on their own behalf or as a representative. Each person who appears at a public hearing shall take a proper oath and state, for the record, his/her name, address, and, if appearing on behalf of an association, the name and

mailing address of the association. The hearing shall be conducted in accordance with the procedures set forth in the Board's Rules of Order. At any point, members of the Board, the Planning Commission or the Hearing Officer conducting the hearing may ask questions of the owner/applicant, staff, or public, or of any witness, or require cross-examination by persons with standing in the proceeding to be conducted through questions submitted to the chair of the Board, Planning Commission or to the Hearing Officer, who will in turn direct questions to the witness. The order of proceedings shall be as follows:

1. The Administrator, or other County staff member designated by the Administrator, shall present a description of the proposed development, the relevant sections of the SGMP, area, district or community plans, the SLDC, and state and federal law that apply to the application, and describe the legal or factual issues to be determined. The Administrator or County consultant or staff member shall have the opportunity to present a recommendation and respond to questions from the Board, Planning Commission or Hearing Officer concerning any statements or evidence, after the owner/applicant has had the opportunity to reply;

2. The owner/applicant may offer the testimony of experts, consultants or lay witnesses and documentary evidence that the owner/applicant deems appropriate, subject to cross examination by adverse parties with standing within reasonable time limits established by the Board, Planning Commission or Hearing Officer;

3. Testimony, including expert, consultant or lay witnesses, and relevant documentary evidence for or against the application, from the public, governmental agencies or entities and interested parties with standing, shall be received, subject to reasonable time limits established by the Board, Planning Commission or Hearing Officer, subject to cross examination by the owner/applicant, any adverse interested party with standing, or by the County;

4. The owner/applicant may reply to any testimony or evidence presented, subject to cross examination;

5. The Board, Planning Commission or Hearing Officer may pose questions to the owner/applicant, the County, any consultant or lay witness at any time during the hearing concerning any statements, evidence, or applicability of policies and regulations from the SGMP, the SLDC, other County ordinances and regulations, any applicable area, or community plan, or other governmental law or recommendations; and

6. The Board, Planning Commission or Hearing Officer conducting the hearing shall close the public portion of the hearing and conduct deliberations. The Board or Planning Commission may elect to deliberate in a closed meeting pursuant to the Open Meetings Act, NMSA 1978, §§10-15-1 et seq.

4.7.2.2. When Conducted. For an application for approval of a preliminary plat, the first public hearing shall take place within thirty (30) days from the receipt of all requested public agency opinions where all such opinions are favorable, or within thirty (30) days from the date that all public agencies complete their review of additional information submitted by the subdivider pursuant to NMSA 1978, § 47-6-11. If a requested opinion is not received within either thirty-day period, the public hearing shall be conducted notwithstanding.

Exhibit 5

consulting for the future solar industry workforce. These efforts aim to stimulate participation in New Mexico's clean energy future.

Individuals selected for the AES scholarship will enroll in SEI's North America Board of Certified Energy Practitioners (NABCEP) PV Associates training program, which includes online solar system design and installation classes, along with NABCEP PV Associate testing. By empowering soon-to-be solar energy experts with the necessary training, the AES scholarship program will strengthen the growing New Mexico solar workforce.

New mexico residents can apply here

Download scholarship & program fact sheet

Partnering with Santa Fe Youthworks

AES is building relationships and programs in New Mexico as we continue to expand our utility-scale and community solar development in the state. Our partnership with Santa Fe YouthWorks is a workforce development program co-created with the organization.

Santa Fe YouthWorks is a Santa Fe-based non-profit organization that has engaged thousands of young people representing diverse cultural and ethnic backgrounds from across Northern New Mexico, offering them undivided attention to help them navigate the world around them. YouthWorks combines non-traditional education attainment with employability skills training, mentoring and leadership development.

AES donated funds to support a customized, computer-based solar installation training program for YouthWorks. Our donation will help ten students to attend two courses that prepare the students for the PV Associates exam. In a cohort setting in YouthWork's computer lab, students will follow the coursework for a PV101 and a PV203 training course which introduces students to the fundamentals and ap-

Exhibit 6

(a) This does not prohibit private wells.

b. Dimensional Standards. As regulated in Chapter 8 of this Code except as prescribed in Dimensional Standards Table 9-14-2.

Table 9-14-2: Dimensional Standards SMCD RUR (Rural).

Zoning District	SMCD RUR
Density (# of acres per dwelling unit)	40
Lot width (minimum, feet)	150
Lot width (maximum, feet)	n/a
Height (maximum, feet) – hay or animal barn, silo	50
Height (maximum, feet) – all other structures	24
Lot Coverage (maximum)	20%
Setbacks from front, rear and side property lines	100 feet
* In cases where setback requirements prohibit development of a parcel, the Administrator may approve setback requirements in accordance with Section 7.3 of this SLDC.	

3. SMCD Rural Fringe (SMCD RUR-F); Purpose. The purpose of this district is to designate areas suitable for a combination of estate-type residential development, agricultural uses and other compatible uses. This zone also serves to protect agricultural and environmental areas that are inappropriate for more intense development due to their sensitivity. The SMCD RUR-F zone accommodates primarily large lot residential, retreats, ecotourism, equestrian uses and renewable resource-based activities, seeking a balance between conservation, environmental protection and reasonable opportunity for development.

a. Use Regulations. Uses shall be permitted, conditional and prohibited as identified in Chapter 8 and Appendix B of this Code, with exceptions identified on the SMCD Use Table.

i. Commercial greenhouses:

(a) There shall be a minimum 500 foot setback from property lines for commercial greenhouses.

b. Dimensional Standards. As regulated in Chapter 8 of this Code, except as prescribed in Dimensional Standards Table 9-14-3.

Exhibit 7

info@lineaenergy.com
www.lineaenergy.com

LINEA ENERGY
RENEWABLES REENVISIONED

230 California Street, Suite 303
San Francisco CA 94111

July 19, 2024

Jordan Yutzy
Building and Development Manager
Santa Fe County
100 Catron St.
Santa Fe, NM 87501

RE: Pentstemon Solar and Globemallow Solar – TAC Meeting Request Letter of Intent

To Whom It May Concern:

Pentstemon and Globemallow are two planned, collocated solar projects with energy storage located off Route 41 near Stanley, NM. Based on our review of the Santa Fe Sustainable Development Code (the "Code"), the projects are considered commercial solar energy production facilities and other electrical generation facilities. They are located in the Agricultural/Ranching District and thus will require a Conditional Use Permit pursuant to Section 4.9.6 of the Code. We are submitting this letter of intent as a request to be placed on the agenda for TAC to commence the application process for the CUP. Please see below and attached for further details on the projects

Project Description	Pentstemon is a 199 MWac planned solar facility with 100 MW of planned energy storage, to be located on approximately 1,936 acres. Globemallow is a 150 MWac planned solar facility with 75 MW of planned energy storage, to be located on approximately 960 acres. The projects are located on contiguous land and will each interconnect to the Diamond Trail-Clines Corner 345kV transmission line that crosses the project land. The projects' improvements will include the installation of solar racking, modules, appurtenant electrical equipment, energy storage units, and a substation. The projects will also require ancillary improvements, including the improvement of an existing access road and the construction of an operations and maintenance building.
Project Location (Pentstemon)	35.202755, -105.93105935

Project Location (Globemallow)	35.191961, -105.929503
Pentstemon Parcel #'s	910005752, 910005753, 910005736, 910005737, 910005738, 910005739, 910005740, 910005741, 910005742, 910005743, 910005745, 910005746, 910005747, 910005748, 910005749, 910005750, 910005751, 910010647, 910014134, 910014135
Globemallow Parcel #s	99309472, 94448768
Project Site Maps	Attached
Property Address	16-26 Via Compostela, Stanley, NM 87056
Proposed Entrance Points	Linea Energy proposes that the access road for the projects to be on Via Compostela Road. There is an existing road that will need minor upgrades to be suitable for traffic during construction. This road is on the Pentstemon property and will be extended to reach Globemallow.
Completed Due Diligence	Critical Issues Analysis, Hydrology Study, Wetland Delineation, Phase 1 Environmental Site Assessment, Fatal Flaw Analysis, and a Biological Resources Report
In-Progress Due Diligence	ALTA and TOPO Survey, and Cultural Resources Survey and Correspondence with SHPO
Project Contacts	**Andrew Davidson** Associate, West Development Email: Andrew.davidson@lineaenergy.com Cell: (760) 579-8719 **Heather Kane** Director, M&A & Development Operations Email: heather.kane@lineaenergy.com **Jonathan Vasdekas** Executive Vice President, Development Email: Jonathan.Vasdekas@lineaenergy.com
Notarized Letters of Consent for land use approvals from the landowner	A notarized letter of consent has been received from one landowner to proceed with land use approvals. The second letter of consent is in progress.

We look forward to discussing the projects further.

Sincerely,

Andrew Davidson

Attachments

- Pentstemon Conceptual Site Plan Version A
- Pentstemon Conceptual Site Plan Version B
- Globemallow Conceptual Site Plan
- Globemallow and Pentstemon combined conceptual site plan

Exhibit 8

S A N T A F E C O U N T Y
T E C H N I C A L A D V I S O R Y C O M M I T T E E

August 19, 2024

This letter concerns the Linea project, not Rancho Viejo Solar project (Selma Eikelenboom-Schieveld)

BY ELECTRONIC MAIL

Re: Rancho Viejo Solar LLC/Community Energy Solar, LLC Conditional Use Permit (CUP)

Thank you for presenting the above-mentioned project at the pre-application Technical Advisory Committee (TAC) meeting on August 1, 2024. Below is a summary of relevant issues and follow-up actions in regard to your presentation.

Summary:

Pentstemon and Globemallow Conditional Use Permit (CUP). Pentstemon and Globemallow Solar, Applicant, Andrew Davidson, Agent, request approval of a Conditional Use Permit (CUP) to allow a 100 Mega Watt solar facility on 1,936 + acres and a 75 Mega Watt solar facility on 960 acres +. The sites are zoned as Ag/ Ranch (A/R) and Rural (RUR). Appendix B, Use Matrix illustrates that a commercial solar energy production facility is a Conditional Use within the Ag/ Ranch and Rural zoning districts. The site will take access via Hwy. 14, SDA-3 (Commission District 3). Parcel ID # 910005752, 910005753, 910005736, 910005737, 910005738, 910005739, 910005740, 910005741, 910005742, 910005743, 910005745, 910005746, 910005747, 910005748, 910005749, 910005750, 910005751, 910010647, 910014134, 910014135, 99309472, 94448768

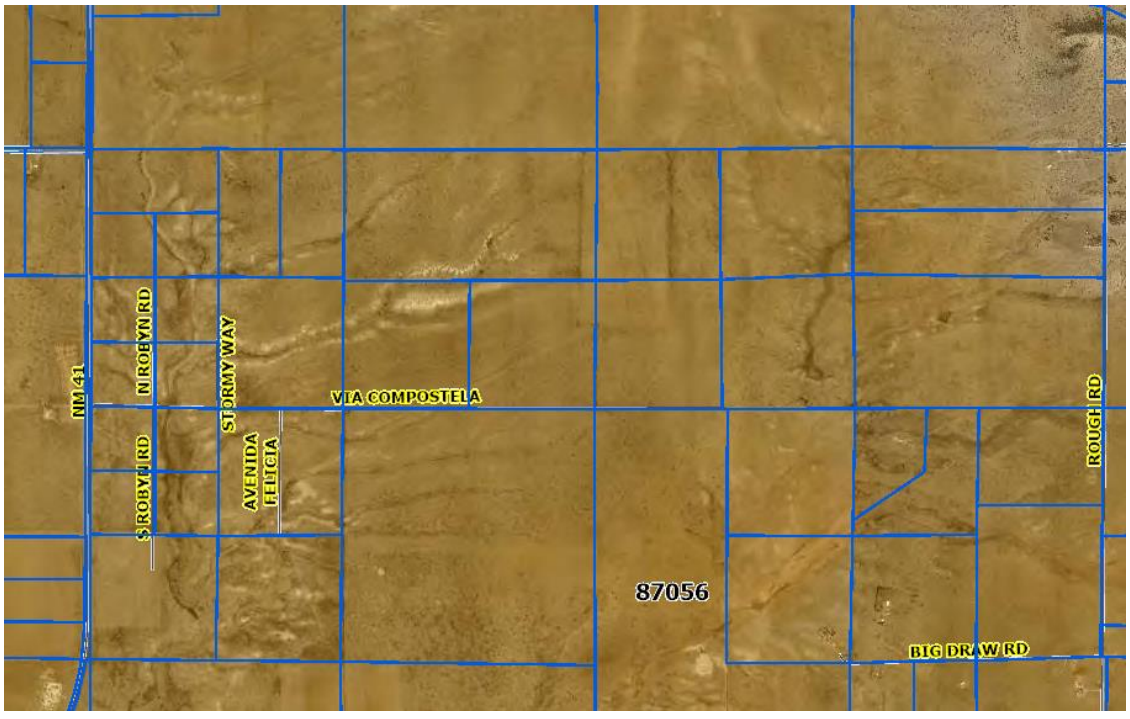


Exhibit 9

demand for supporting industrial uses. Since the existing industrial development of 4.1 acres per 1,000 residents is relatively low in terms of providing adequate employment opportunities for new residents, the average of 12.5 acres per 1,000 residents is used in this analysis. The current Countywide industrial zoning could accommodate a population of 213,047, whereas the projected 2030 population for the entire County is 200,876. Therefore, the supply and future demand for industrial land appears to be only slightly less than adequate. The current industrial zoning in unincorporated the County can accommodate a population of 79,116, at rate of 12.5 acres per 1,000 residents, whereas the projected 2030 population for the unincorporated County is 99,738. An additional 257.8 acres industrially-zoned land would therefore be needed in the unincorporated County, based on the ratio of 12.5 acres/1,000 residents.

Figure 2-5: Industrial Zoned Land (Countywide)

Jurisdiction	Industrial Zoned Acres Available (6/16/09)
Unincorporated Santa Fe County	989.0
City of Santa Fe*	1,674.1
City of Española**	0.0
Town of Edgewood**	0.0
Pueblos	0.0
TOTAL	2,663.1 acres

*Including proposed City of Santa Fe annexation area.**Portion in Santa Fe County only.

2.2.3.4 EXISTING PUBLIC AND INSTITUTIONAL LAND USE AND ZONING

There are approximately 4,948.3 acres of land in the unincorporated County that are developed for public, institutional, and utilities uses. Land uses in this category consist mainly of federal, state, and county offices, community centers, schools, and places of worship. The largest developed sites in this category include:

The State prison (650.6 acres) and the National Guard Amory (349.5 acres) located on State Road 14, south of the Interstate 25 interchange. The Glorieta Conference Center operated by a religious organization and located on 2,172.6 acres along Interstate 25, east of Glorieta Pass. The landfill managed by the Solid Waste Management Authority (SWAMA), located on about 160 acres, to the west of the Tres Arroyos planning area and adjacent to the Caja del Rio unit of Santa Fe National Forest. Other major public/institutional land uses in the unincorporated County include: the Santa Fe Opera, which occupies about 122 acres to the west of Tesuque; the Santa Fe Community College campus, which occupies about 160 acres in the southern suburbs of the City of Santa Fe; and the Institute of American Indian Arts, which occupies about 135 acres near the Santa Fe Community College.

The County's existing zoning allows public, institutional, and utilities in a broad range of zoning districts, mainly designated as "community service facilities", so the adequacy of the supply of land for such uses is not a concern. The main challenges with the location of these uses are:

- Encouraging the location of schools, community centers, government offices, places of worship, and other institutional uses within communities, to serve as a focal point for the community and afford easy access to residents, and encourage development of joint agreements to provide access to school land and recreational facilities after hours; and

- Ensuring that potential land use compatibility and environmental conflicts are taken into consideration in the location of utility uses, such as landfills, solid waste transfer stations, wastewater treatment plants, power lines and substations, and solar- or wind-power generation sites.

Exhibit 10

CHAPTER 14: GOVERNANCE ELEMENT

Good governance is effective and practical, provides a basis to achieve clear and consistent policies and strategies, and should focus on achieving the goals of the SGMP and the County's long-term vision. The role and expectations for governance arising from past and current planning processes that produced good results should continue and new processes should be developed so that the process is more effective and transparent. Establishing greater efficiency and effectiveness in the planning process is an on-going effort that the SGMP seeks to improve upon. Good governance also lays the foundation for building more effective regional partnerships in the County and is one of the key ingredients for sustainable living and development of our communities.

14.1.1 KEY ISSUES

1. **Public has requested more involvement and transparency in County decision making and solving community problems.**
2. **Need to honor the community efforts through recognition and incorporation of existing Community Plans and Ordinances and support continued community planning efforts.**
3. **Problems with variances and loopholes in the existing Code has undercut comprehensive growth management and promoted uncertainty and mistrust among residents and developers.**
4. **Provide better coordination with municipalities, counties, tribal governments, acequias and land grant communities.**
5. **Inadequate and uncoordinated provision and funding of public facilities and services.**
6. **Lack of a consistent, clear and efficient development review process.**
7. **Inadequate code enforcement staff to effectively enforce County codes and regulations.**

14.1.2 KEYS TO SUSTAINABILITY

1. **Recognize and evolve the community participation process to meet County and community needs.**
2. **The SGMP should be established as the framework for all land use codes and regulations within the County.**
3. **Create a consistent and predictable development review process.**
4. **Provide additional coordination on regional issues including environmental and watershed protection, maintenance of roads, economic development and service provision.**
5. **Coordinate with tribal governments to address and solve issues of mutual concern.**
6. **Recognize and establish better working relationships with other governmental and quasi-governmental agencies.**
7. **Ensure that ethical and financially responsible governance occurs.**
8. **Enforce County codes and regulations.**
9. **Adopt a sustainable land development code.**
10. **Establish a funding mechanism for implementation of the SGMP through a Capital Improvements Plan.**
11. **Develop a strategic plan to implement the directives of the SGMP.**

and inspections. If it fails, a full interconnection study may be necessary to determine impacts to the distribution system and modifications to be made for the interconnection to be compatible and the associated costs to be paid for by the Interconnection Customer.

7.2.1.4 NATURAL GAS

Natural Gas service is available from New Mexico Gas Company via pipelines coming from the San Juan wells. Areas outside of the pipeline have to rely on propane gas. Wood for space heating and cooking is also popular in the traditional/historic communities adjacent to the foothills and forested areas.

7.2.2 RENEWABLE ENERGY RESOURCES

Existing Resources. There are already resources, training and examples available in Santa Fe County to support renewable energy. There are a dozen solar energy equipment companies located in Santa Fe offering solar design, solar equipment, system services and repair. Educational institutions are developing training programs in alternative energy and green jobs. Santa Fe Community College is building a Trades and Advanced Technology Center that will be home to the Sustainable Technologies Center, a cutting-edge educational and training facility for alternative energy and green jobs integrating 21st century trades with advanced technologies and green curricula to promote a sustainable economy. There is a Sustainable Degree Program and biomass plant at SFCC, and a SFPS geothermal system for the Amy Biehl Elementary School in Rancho Viejo. These efforts provide a starting point for more intensive investment in green technologies and energy.

7.2.2.1 BIODIESEL AND ETHANOL

Energy security, ever rising oil prices, and the climate crisis are three facets of the same energy challenge. While various alternative energy sources are under development globally, multiple challenges impede the near-term viability of most of those options. Biofuels are a preferred alternative because they rely on the use of a proven technology, with minimal adverse environmental impacts where full consideration is taken with sustainable crop production practices and reuse and recycle of previously used resources and available production and distribution infrastructure that is easily modified. One of the benefits of biofuel is that the distribution infrastructure for petroleum products can be used or is easily modified to support biofuel distribution.

7.2.2.2 SOLAR

New Mexico gets approximately 6 full sun hours per day, on average, almost everywhere in the state. This coupled with gentle sloped terrain of Santa Fe County coupled with the annual mean total sunshine hours of 3,400 creates an ideal setting for solar energy applications. Space heating, water heating, photovoltaic cells, cooking and food production via solar greenhouse are just a few of the possible applications that already exist.

The scale for the integration of solar technology varies from residential to commercial. Many County residents in remote areas are already using solar energy for electricity, space and water heating. The potential for large-scale solar electric generating facilities exists within Santa Fe County. Impacts on the view sheds, historic and archaeological resources and the creation of a grid network to distribute the power would have to be considered in future development proposals in order to preserve the integrity of the landscape.

New Mexico's Solar Rights and Solar Recordation Acts (both contained in NMSA § 47-3) allow property owners to create solar easements for the purpose of protecting and maintaining proper access to sunlight. The Solar Rights Act established the right to use solar energy as a property right and prevents neighboring property owners from constructing new buildings or planting new trees which would block their access to the sun.

In May 2007, SB 1031 strengthened solar access rights in New Mexico by limiting the ability of a county or municipality to restrict the placement of solar collectors unless the location is within a historic district. SB 1031 also voided all covenants and restrictions (from July 1, 1978 forward) that effectively prohibit the installation of solar collectors.

Exhibit 12

U.S. DEPARTMENT OF LABOR

Occupational Safety and Health Administration

- **Standard Number:** 1910.1200 , 1910.1200(b)(1) , 1910.1200(b)(5)(v) , 1910.1200(b)(6)(v) , 1910.1200(c) , 1910.1200(d)(1)

OSHA requirements are set by statute, standards and regulations. Our interpretation letters explain these requirements and how they apply to particular circumstances, but they cannot create additional employer obligations. This letter constitutes OSHA's interpretation of the requirements discussed. Note that our enforcement guidance may be affected by changes to OSHA rules. Also, from time to time we update our guidance in response to new information. To keep apprised of such developments, you can consult OSHA's website at https://www.osha.gov.

June 23, 2021

Mr. Hans Craen
Secretary General
European Portable Battery Association
Avenue de Tervueren 188 A, Postbox 4,
B-1150 Brussels,
Belgium

Dear Secretary General Craen:

Thank you for the letter to the U.S. Department of Labor, Occupational Safety and Health Administration's (OSHA) Directorate of Enforcement Programs, from you and other international battery producers, associations, and special interest groups that raised concerns on OSHA's application of its Hazard Communication standard (HCS), 29 CFR § 1910.1200, to "lithium-ion" batteries. This letter constitutes OSHA's interpretation only of the requirements herein, and may not be applicable to any questions not delineated within your original correspondence. Please excuse the delay in our response.

Background: The European Portable Battery Association and representatives of several other international battery producers and special interest groups (*i.e.*, the Latin American Battery Association, the Battery Association of Japan, EUROBAT, Electro-Federation Canada, and RECHARGE) have been made aware that OSHA does not consider lithium-ion batteries to be "articles" under its HCS.[1] You expressed concern that this will have a significant impact on the industry since it would require compliance with the HCS by supplying safety data sheets (SDSs), labelling products, and training employees. You and the other representatives urged OSHA to carry out a complete risk assessment and take into account the three pillars of sustainable development (social, economic, and environment), and give consideration to practical opportunities available for the management of identified risks.

Your collective concerns have been paraphrased below, followed by our responses. Our responses refer to lithium-ion (Li-ion) batteries and battery packs and Li-metal cells.

Question 1: Will OSHA conduct a risk assessment on Li-ion batteries to determine their applicability to the HCS?

Response: The HCS places the primary responsibility for chemical hazard classification on the manufacturer or importer of the material or substance. *See* 29 CFR §§ 1910.1200(b)(1), (d)(1). The original manufacturer is in the best position to develop and disseminate this information, not only because it ordinarily has the greater scientific expertise with respect to the chemicals it produces or uses in its product, but also because it often is the only one who knows the identity of the chemicals. *See* 48 Federal Register 53322. Similarly, importers are in the best position to either develop the chemical hazard information or obtain it from the foreign manufacturer or supplier.

When conducting the hazard classification, the manufacturer or importer must bear in mind that the HCS classification is based on the intrinsic *hazards* posed by a chemical/product, not the *risk*. Risk refers to the probability that an adverse effect will occur with specific exposure conditions. The hazard classification must take into consideration the hazards of the product in its shipped form as well as under the product's normal conditions of use (*e.g.*, downstream use, processing, hazardous by-products) and foreseeable emergencies. See 29 CFR § 1910.1200(d). For example, publically-available evidence exists that in certain workplace operations, such as repair or recycling operations, where workers routinely handle or are exposed to scrapped, damaged, or defective/rejected Li-ion batteries and battery packs and Li-metal cells (*e.g.*, laptop batteries), these type of products have resulted in worker exposures to fire (physical) and/or chemical (health) hazards. While a "risk assessment" may consider a lithium cell or battery's makeup (its chemistry, form factors, etc.), as well as how the chemical is contained or handled, under the HCS, manufacturers or importers are responsible for determining if their chemical or product presents a physical hazard and/or health hazard to workers.

When the Li-ion battery or cell does not meet the HCS exemptions as an "article," a lithium-ion cell/battery manufacturer or importer is required to develop an SDS and HCS-compliant label for their product(s), and employers are required to provide training to exposed workers on the hazards of the chemical / product. Some Li-ion batteries, battery packs, and cells (*e.g.*, button and laptop batteries) may be exempt from the HCS label requirements if they meet the definition of a consumer product.[2] The manufacturer or importer is also required to provide the SDS to downstream employers if it is known workers may be exposed to a Li-ion battery's physical or health hazard. Please note that these batteries are regulated under U.S. Department of Transportation's (USDOT) Hazardous Materials Regulations, 49 CFR Parts 171-180.

Question 2: What scientific justification did OSHA use in its decision that a Li-ion battery cannot be considered an article under HCS?

Response: The HCS definition of an "article" has been in effect for nearly thirty years. Although OSHA has not conducted a hazard classification on Li-ion batteries, the agency has reviewed publically-available information from U.S. government agencies and industry consensus standards such as the U.S. Consumer Product Safety Commission (CPSC), USDOT/Pipeline and Hazardous Material Safety Administration (USDOT/PHMSA), and the National Fire Protection Association (NFPA).[3] The information shows that while lithium cell or battery technology is complex, potential cell or battery failure during use and handling can present a fire (physical) hazard, which has caused or could cause workers to be exposed to burns. Additionally, the information shows that toxic air contaminants (e.g., lithium, cobalt) can be released due to chemical leakage or venting when the battery is damaged or catches fire, potentially exposing workers to a health hazard.

OSHA appreciates the concerns of the battery producer representatives and their associated industry. Thank you for your interest in occupational safety and health. I hope you find this information helpful. OSHA's requirements are set by statute, standards, and regulations. Letters of interpretation do not create new or additional requirements but rather explain these requirements and how they apply to particular circumstances. This letter constitutes OSHA's interpretation of the requirements discussed. From time to time, letters are affected when the agency updates a standard, a legal decision impacts a standard, or changes in technology affect the interpretation. To ensure that you are using the correct information and guidance, please consult OSHA's website at www.osha.gov. If you have further questions, please feel free to contact OSHA's Office of Health Enforcement at 1-202-693-2190.

Sincerely,

Patrick J. Kapust, Acting Director
Directorate of Enforcement Programs

[1] “Articles” are excluded from coverage under the HCS. See 29 CFR § 1910.1200(b)(6)(v). Articles are defined as “a manufactured item other than a fluid or particle: (i) which is formed to a specific shape or design during manufacture; (ii) which has end use function(s) dependent in whole or in part upon its shape or design during end use; and (iii) which under normal conditions of use does not release more than very small quantities, e.g., minute or trace amounts of a hazardous chemical (as determined under paragraph (d) of this section), and does not pose a physical hazard or health risk to employees.” 29 CFR § 1910.1200(c).

[2] The HCS exempts any consumer product or hazardous substance as those terms are defined in the Consumer Product Safety Act (15 U.S.C. 2051 et seq.) and Federal Hazardous Substances Act (15 U.S.C. 1261 et seq.) respectively, when subject to a consumer product safety standard or labeling requirement of those Acts, or regulations issued under those Acts by the Consumer Product Safety Commission. See 29 CFR § 1910.1200(b)(5)(v).

[3] For example, see CPSC report, Updated Status Report on High Energy Density Batteries Project, March 31, 2020.

U.S. DEPARTMENT OF LABOR

Occupational Safety and Health Administration
200 Constitution Ave NW
Washington, DC 20210
1-800-321-OSHA
1-800-321-6742
www.osha.gov

Exhibit 13

Emergency Planning and Community Right-to-Know Act (EPCRA)

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Lithium - Ion Batteries and EPCRA 311-312 Reporting Requirements

When are lithium - ion batteries subject to the EPCRA Sections 311 and 312 Hazardous Chemical Inventory Reporting requirements?

The reporting requirements of EPCRA sections 311 and 312, *Hazardous Chemical Inventory Reporting*, [40 CFR part 370 <https://www.ecfr.gov/current/title-40/chapter-i/subchapter-j/part-370> apply to owners and operators of facilities that are required to prepare or have a Safety Data Sheet (SDS) [formerly known as Material Safety Data Sheet (MSDS)] for any hazardous chemical as defined under the Occupational Safety and Health Administration's (OSHA) Hazardous Communication Standards (HCS) [29 CFR 1910.1200(c) <https://www.osha.gov/laws-

regs/regulations/standardnumber/1910/1910.1200>], except those hazardous chemicals that are exempt from reporting under the OSHA HCS [29 CFR 1910.1200(b)(6) <https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.1200>] or the EPCRA section 311(e).

Exemptions that may apply to lithium-ion batteries include the Consumer Product Exemption [40 CFR 370.13(c)(1) <https://www.ecfr.gov/current/title-40/chapter-i/subchapter-j/part-370/subpart-b/section-370.13>] and the Resource Conservation and Recovery Act (RCRA) exemption [29 CFR 1910.1200(b)(6)(i) <https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.1200>]. These exemptions are explained further below.

For more information on the EPCRA Hazardous Chemical Inventory Reporting requirements please visit: https://www.epa.gov/epcra/epcra-sections-311-312 <https://epa.gov/epcra/epcra-sections-311-312>

What does it mean for lithium-ion batteries to be exempt from EPCRA Sections 311 and 312 Hazardous Chemical Inventory Reporting requirements?

The Hazard Communication Standard [29 CFR 1910.1200(b)(6) <https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.1200>] and EPCRA section 311(e) [40 CFR 370.13(c) <https://www.ecfr.gov/current/title-40/chapter-i/subchapter-j/part-370/subpart-b/section-370.13>] both provide exemptions from the definition of a *hazardous chemical*. If lithium-ion batteries are exempt from the definition of a *hazardous chemical*, they do not need to be reported as a *hazardous chemical* under EPCRA sections 311 or 312.

Please note that even though lithium-ion batteries may be exempt from the definition of a *hazardous chemical*, they may still be reportable under EPCRA as other classes of chemicals:

- If lithium-ion batteries are comprised of chemicals on the CERCLA list of *hazardous substances* [40 CFR 302.4 <https://www.ecfr.gov/current/title-40/section-302.4>], reporting of releases may be required under CERCLA 103 and EPCRA 304 <https://epa.gov/epcra/emergency-release-notifications>.
- If lithium-ion batteries are comprised of *toxic chemicals* under EPCRA 313 (Toxics Release Inventory) [40 CFR 372.65 <https://www.ecfr.gov/current/title-40/chapter-i/subchapter-j/part-372/subpart-d/section-372.65>], reporting may be required to the Toxics Release Inventory (EPCRA Section 313 <https://epa.gov/toxics-release-inventory-tri-program>).

What is the Consumer Product Exemption and how does it apply to lithium-ion batteries?

Some lithium-ion batteries may be exempt from EPCRA sections 311 and 312 Hazardous Chemical Inventory Reporting requirements under EPCRA section 311(e)(3) [40 CFR 370.13(c)(1) <https://www.ecfr.gov/current/title-40/chapter-i/subchapter-j/part-370/subpart-b/section-370.13>], which is

often referred to as the Consumer Product Exemption. The Consumer Product Exemption applies to any lithium-ion battery to the extent it is used for personal, family, or household purposes, or is present in the same form and concentration as a product packaged for distribution and use for the general public. This exemption applies to household or consumer lithium-ion batteries, either in use by the general public or industrial use when in the same form and concentration as the product intended for use by the public.

The exemption applies to such lithium-ion batteries when purchased in larger quantities by industrial facilities if packaged in substantially the same form as the consumer product and present in the same concentration. The exemption does not apply to lithium-ion batteries present in different concentrations from the consumer products even if the batteries are only used in small quantities. This exemption does not apply to any large commercial type batteries that are not available for purchase or use by the general public. [October 15, 1987, 52 FR 38348 <https://epa.gov/sites/default/files/2013-09/documents/52fr38364.pdf>).

Are End-of-Life lithium-ion batteries (for waste or recycle) exempt from the EPCRA Sections 311 and 312 Inventory Reporting requirements?

End-of-Life lithium-ion batteries may be exempt from EPCRA sections 311 and 312 Hazardous Chemical Inventory Reporting requirements if the batteries meet the definition of a Resource Conservation and Recovery Act (RCRA) hazardous waste [42 U.S.C. 6903(5) <https://www.govinfo.gov/content/pkg/uscode-2011-title42/html/uscode-2011-title42-chap82.htm>] and are subject to RCRA regulations. RCRA regulates hazardous waste and also universal wastes. Universal wastes are certain hazardous wastes, including batteries, that are subject to certain specific universal waste regulations at 40 CFR part 273 <https://www.ecfr.gov/current/title-40/chapter-i/subchapter-i/part-273>. This EPCRA exemption is due to an OSHA HCS exemption [29 CFR 1910.1200(b)(6)(i) <https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.1200>], which exempts RCRA hazardous wastes. Thus, RCRA hazardous wastes and universal wastes, because they are subject to RCRA regulations, are eligible for this exemption from EPCRA 311 and 312 *hazardous chemical* reporting.

End-of-Life batteries that may not be exempt from EPCRA hazardous chemical reporting requirements include Lithium-ion batteries that are handled under the *transfer based exclusion* [40 CFR 261.4(a)(24) <https://www.ecfr.gov/current/title-40/chapter-i/subchapter-i/part-261#261.4>] and any materials that are exempted or excluded from being hazardous waste by a *general recycling exclusion*. The term “End-of-Life” does not include the *reuse case*, where a battery might have been used once and then gets refurbished or used in another application. *Reuse case* batteries are not solid waste and therefore do not meet the RCRA exemption [RCRA Online Document #14668 <https://rcrapublic.epa.gov/files/14668.pdf> and 71 FR 42929–30; July 28, 2006].

To determine if your operations and materials fall under a general recycling exclusion, please see Regulatory Exclusions and Alternative Standards for the Recycling of Materials, Solid Wastes and Hazardous Waste – Recycled Materials that are not Subject to RCRA Hazardous Waste Regulation <https://epa.gov/hw/regulatory-exclusions-and-alternative-standards-recycling-materials-solid-wastes-and-hazardous#notsubject>.

For more information:

- https://www.epa.gov/hw/regulatory-exclusions-and-alternative-standards-recycling-materials-solid-wastes-and-hazardous <https://epa.gov/hw/regulatory-exclusions-and-alternative-standards-recycling-materials-solid-wastes-and-hazardous>.
- RCRA Regulations for Electronic Materials That Are Resued or Resold <https://rcrapublic.epa.gov/files/14668.pdf> [EPA530-R-03-002d]
- Hazardous waste guidance documents (RCRAOnline) – Topic Batteries <https://rcrapublic.epa.gov/rcraonline/topics.xhtml>
- Contact Us About RCRA Laws and Regulations <https://epa.gov/rcra/forms/contact-us-about-resource-conservation-and-recovery-act-rcra-laws-and-regulations>
- OSHA Letter May 20, 2019 for 1910.1200(b)(6)(i) <https://www.osha.gov/laws-regs/standardinterpretations/2019-05-20>

Are recycled batteries exempt from the EPCRA Sections 311 and 312 Hazardous Chemical Inventory Reporting requirements under the RCRA hazardous waste exemption?

No. Once materials and batteries have completed the recycling or reclamation processes, the new materials and products are no longer covered under the RCRA regulations, and are therefore not eligible for the EPCRA hazardous waste exemption..

Are lithium-ion batteries considered to be "articles" under the OSHA HCS and for EPCRA Sections 311 and 312 Inventory Reporting Requirements?

No. OSHA has determined that lithium-ion batteries are not considered to be "articles" and are subject to the OSHA HCS regulations. Lithium-ion batteries are not considered to be articles because although they are sealed, they have the potential to leak, spill, or break during normal conditions of use and in foreseeable emergencies causing exposure to chemicals.

Source: https://www.osha.gov/laws-regs/standardinterpretations/2021-06-23 <https://www.osha.gov/laws-regs/standardinterpretations/2021-06-23>

Can states require that lithium-ion batteries be reported as Hazardous Chemicals, if reporting isn't a federal requirement?

Yes. States, tribes, and territories can have more stringent applicability and reporting requirements for lithium-ion batteries.

"States were always given the flexibility to implement the EPCRA program as necessary to meet the goals of EPCRA, which is to prepare for and respond to releases of EHSs and to provide the public with information on potential chemical risks in their communities. This flexibility includes adding more chemicals, setting lower reporting thresholds and creating a reporting form or format that includes more information than is required by the Federal reporting requirements." (75 FR 39854 <https://www.govinfo.gov/content/pkg/fr-2010-07-13/pdf/2010-17031.pdf>; July 13, 2010).

Facilities should contact their state for the specific requirements for that state.

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Hazardous Chemical Inventory Reporting <https://epa.gov/epcra/hazardous-chemical-inventory-reporting>

EPCRA Trade Secrets <https://epa.gov/epcra/epcra-trade-secret-forms-and-instructions>

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LAST UPDATED ON SEPTEMBER 7, 2023

Exhibit 14

Emergency Planning and Community Right-to-Know Act (EPCRA)

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Hazardous Chemical Inventory Reporting

Emergency Planning and Community Right-to-Know Act Sections 311-312

For any hazardous chemical used or stored in the workplace, facilities must maintain a safety data sheet (SDS) (formerly known as material safety data sheet, MSDS). Facilities must submit the safety data sheet (SDS) or a list of hazardous chemicals to their State or Tribal Emergency Response Commission (SERC or TERC), Local or Tribal Emergency Planning Committee (LEPC or TEPC), and local fire department.

Facilities must also submit an annual inventory of these chemicals by March 1 of each year to their State or Tribal Emergency Response Commission (SERC or TERC), Local or Tribal Emergency Planning Committee (LEPC or TEPC), and local fire department. The information submitted by facilities must be made available to the public.

- What facilities are covered?
- What is a hazardous chemical?
- What are facilities required to do?
- How do I submit a Tier I or Tier II Inventory Report?
- Where can I find more information on these requirements?

What facilities are covered?

Any facility that is required to maintain SDSs under the Occupational Safety and Health Administration (OSHA) regulations for hazardous chemicals stored or used in the workplace.

Facilities with chemicals in quantities that equal or exceed the following thresholds must report:

- For Extremely Hazardous Substances (EHSs) (40 CFR part 355 Appendix A <https://www.ecfr.gov/current/title-40/chapter-i/subchapter-j/part-355#appendix-a-to-part-355> and Appendix B <https://www.ecfr.gov/current/title-40/chapter-i/subchapter-j/part-355#appendix-b-to-part-355>), either 500 pounds or the Threshold Planning Quantity (TPQ), whichever is lower.
- For gasoline (all grades combined) at a retail gas station, the threshold level is 75,000 gallons (or approximately 283,900 liters), if the tank(s) was stored entirely underground and was in compliance at all times during the preceding calendar year with all applicable Underground Storage Tank (UST) requirements at 40 CFR part 280 or requirements of the State UST program approved by the Agency under 40 CFR part 281.
- For diesel fuel (all grades combined) at a retail gas station, the threshold level is 100,000 gallons (or approximately 378,500 liters), if the tank(s) was stored entirely underground and the tank(s) was in compliance at all times during the preceding calendar year with all applicable UST requirements at 40 CFR part 280 or requirements of the State UST program approved by the Agency under 40 CFR part 281.
- For all other hazardous chemicals: 10,000 pounds.

What is a hazardous chemical?

Hazardous chemicals are substances for which a facility must maintain a SDS under the OSHA (Occuptational Safety and Health Administration) Hazard Communication Standard <https://www.osha.gov/dsg/hazcom/standards.html>, which lists the criteria used to identify a hazardous chemical. SDSs are detailed information sheets that provide data on health hazards and physical hazards of chemicals along with associated protective measures. Over 500,000 products have SDSs which are normally obtained from the chemical manufacturer.

What are facilities required to do?

- Under Section 311 of the Emergency Planning and Community Right-to-Know Act (EPCRA), facilities must submit the SDSs of hazardous chemicals present on-site at or above the reporting threshold to their State or Tribal Emergency Response Commission (SERC or TERC), Local or Tribal Emergency Planning Committee (LEPC or TEPC), and local fire department. Facilities may choose to submit a list of the hazardous chemicals grouped into hazard categories instead. This is a one-time submittal. New facilities have three months after becoming subject to the OSHA regulations to submit their SDSs or the list of the hazardous chemicals to their State or Tribal Emergency Response Commission (SERC or TERC), Local or Tribal Emergency Planning Committee (LEPC or TEPC), and the fire department.

- Facilities that need to submit SDSs or the list of hazardous chemicals under Section 311, also need to submit an annual inventory report for the same chemicals (EPCRA (Emergency Planning and Community Right-to-Know Act) Section 312). This inventory report must be submitted to the State or Tribal Emergency Response Commission (SERC or TERC), Local or Tribal Emergency Planning Committee (LEPC or TEPC), and the local fire department by March 1 of each year.

Please check with your state, tribe, or territory <https://epa.gov/epcra/state-tier-ii-reporting-requirements-and-procedures> for any additional reporting requirements.

How do I submit a Tier I or Tier II Inventory Report?

Facilities covered by these requirements must submit an emergency and hazardous chemical inventory form to their State or Tribal Emergency Response Commission (SERC or TERC), Local or Tribal Emergency Planning Committee (LEPC or TEPC), and the local fire department annually. Facilities provide either a Tier I or Tier II form. Most States require the Tier II form. Tier II forms require basic facility identification information, employee contact information for both emergencies and non-emergencies, information about chemicals stored or used at the facility, and additional data elements which would be useful to local planners and responders.

The following is a list of some of the information required on the inventory form:

- The chemical name or the common name as indicated on the SDS
- An estimate of the maximum amount of the chemical present at any time during the preceding calendar year and the average daily amount
- A brief description of the manner of storage of the chemical
- The location of the chemical at the facility

- An indication of whether the owner of the facility elects to withhold location information from disclosure to the public

Tier I Forms and Instructions <https://epa.gov/epcra/tier-i-forms-and-instructions>

Tier II Forms and Instructions <https://epa.gov/epcra/tier-ii-forms-and-instructions>

Tier II Reporting Requirements by State <https://epa.gov/epcra/state-tier-ii-reporting-requirements-and-procedures> and Tier2 Submit Software <https://epa.gov/epcra/tier2-submit-software>

Where can I find more information on these requirements?

For more information, see 40 CFR part 370 <https://www.ecfr.gov/current/title-40/chapter-i/subchapter-j/part-370> and EPCRA Amendments <https://epa.gov/epcra/emergency-planning-and-community-right-know-act-non-section-313-regulations-and-amendments> and EPCRA Guidance Documents and Fact Sheets <https://epa.gov/epcra/epcra-guidance-documents-and-fact-sheets>.

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Hazardous Chemical Inventory Reporting

State Reporting Requirements <https://epa.gov/epcra/state-tier-ii-reporting-requirements-and-procedures>

Tier II Forms <https://epa.gov/epcra/tier-ii-forms-and-instructions>

Tier2 Submit Software <https://epa.gov/epcra/tier2-submit-software>

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LAST UPDATED ON APRIL 4, 2023

6 RECOMMENDATIONS

This event clearly demonstrates the hazards associated with cascading thermal runaway in Li-ion battery energy storage facilities. As the industry moves forward from this incident, and looks to prevent similar incidents from occurring, it should consider implementing the following recommendations:

- Address vulnerabilities to thermal runaway cascading, ventilation, and suppression in existing and operational systems.
- Update standards and codes to directly address cascading thermal runaway in future energy storage systems. Merely acknowledging cascading thermal runaway in the annex or appendix of the standard is insufficient to warn the industry of the hazard and falls short of requiring prevention.
- Implement ventilation and extinguishing or cooling systems to manage thermal runaway in future energy storage facilities.
- Implement battery and battery storage system designs that aim to slow or halt cascading or propagation of battery cells and modules during thermal runaway.
- Implement education, training, and emergency response procedures that account for the risks and hazards of cascading thermal runaway—including flammable gases—and how to enter systems after a failure.

6.1 Current and future standards and codes should directly address cascading thermal runaway

Today's codes and standards (specifically NFPA 855) do discuss the hazard of cascading thermal runaway, but without prescription. They are reluctant to prescribe that a battery module *shall not* cascade from cell to cell. One reason for this is that consensus-built codes and standards are intentionally technology-agnostic and should not impose restrictions or solutions on an industry that are perceived to increase cost or be commercially inviable.

But there are solutions available that are both cost effective and commercially viable. The slow standards development cycle is outpaced by the rapid evolution of technology. Today's energy storage codes and standards must acknowledge this conflict, and attempt to reconcile it in their present drafts and revisions. As discussed in subsequent sub-sections, there are ways to limit or prevent cells from cascading in thermal runaway that are currently commercially viable options. Moreover, the standards and codes should be updated with recent developments in testing, research, and commercially available solutions involving cascading thermal runaway.

6.1.1 Shortcomings that should be addressed in UL 9540 / UL 9540A and UL 1973

UL 1973 preceded the UL 9540A test method and was the only standard that addressed module-level battery fire risk, but it did not directly address the heat and gas load of cell-to-cell cascading thermal runaway. The deficiency in the "pass" criteria for UL 1973 is that the module could still fail catastrophically in thermal runaway even if it did not project flame. Internal heat could consume every battery inside; but, if it did not eject flame, it would pass. It could reach temperatures above 600°C and cause its aluminum frame to sag and yield, potentially contacting neighboring modules and cells. It could radiate enough heat energy

to successfully induce thermal runaway in modules directly above or below it. It could create a plume of flammable gases without igniting them. It could do these things and still be considered to "pass" UL 1973 as long as no explosion or external flame was observed. Heat transfer from module to module is what occurred in the McMicken BESS. Hence, UL 1973 pass/fail criteria need to be revised to acknowledge unmitigated cell-to-cell cascading and the resulting heat production and flammable gases.

In 2016, UL formed a task group to partially address these deficiencies in UL 1973, aligning the initiation criteria to a single cell, similar to IEC 62619 but not addressing the deficiency of the pass/fail criteria. As of the 2016 edition, UL 1973 fails to provide a means to arrive at a judgement of whether cell-to-cell cascading is an undesirable outcome, nor does it arrive at a judgement of what exterior temperatures are acceptable. [54, 55] IEC 62619 is a similar test that went a step further to prescribe that only a single cell be used for initiation and the DUT enclosure shall not rupture.

UL 9540A is a test method. In the last 2-3 years, the emergence of UL 9540A as an energy storage system thermal runaway test still has not directly addressed cell-to-cell cascading and its role in the creation of a potentially explosive atmosphere. [34]

UL 9540A does not prescribe that the cell cascading rate be measured directly, nor does it define pass/fail criteria. At present, there is no "pass" criteria for UL 9540A.

Measurement of a cell-to-cell cascading rate would be accomplished by instrumenting the module with a thermocouple array with sufficient quantity and density of locations to measure thermal runaway initiations as a function of time. As each cell ignites, it will present in the data as a sudden temperature spike. Post test, the time-series temperature data could be aligned with the locational map of the thermocouples such that a cascading rate and direction can be determined.

But UL 9540A does not require this. Instead, the test is designed to deliberately ignite modules and racks without defining how many cells are involved in the initiation. This is the first shortcoming of the test, because it can artificially "load" the initiating event and therefore affect the outcome. By failing to define how many cells are involved in initiation, the initial heat load can be variable by integer multiples, i.e., 2 cells, 3 cells, 4 cells, etc. Because the size and chemistry of battery cells varies widely across manufacturers, UL 9540A provides no means to benchmark results of the testing because the initiation criteria are uncontrolled. Therefore, the method does not quantify the natural cascading rate from a single cell, which should be a metric used to rank and grade the safety performance of modules.

Even after UL 9540 and UL 9540A were released, there was confusion in the market as to whether UL 9540A testing resulted in a certification or whether it was required. Many manufacturers did not understand whether the result of the testing was a pass/fail evaluation. Ultimately, requirement of such testing is AHJ dependent. UL 9540 and 9540A are now referenced in NFPA 855, so if an AHJ is knowledgeable of this code and enforces it, they will implicitly require UL 9540/9540A. [35] NFPA 855's treatment of thermal runaway is explained below.

The UL 9540A test method, as it is written today, allows that thermal runaway will proceed to an entire rack and offers testing of suppression systems as an option. The method addresses the symptoms—not the cause—of the problem and does not provide evaluation procedures or criteria to determine what results are acceptable.

The UL 9540A test method is only meant to provide information but does not guide interpretation of the data or deliver a certification. In theory, the unit level test could result in full consumption of a rack and this

result would be reported without a judgement on whether this was poor performance. In fact, a manufacturer could point to the lack of rack-to-rack propagation and present it as a good result.

The test method has not yet defined pass/fail criteria because the expectation is that the industry will use the data to objectively calculate such criteria that are specific to the installation site. However, procedures on how to compute the explosion risk, ventilation requirement, and cascading thermal runaway risk are not defined.

Presentation of this data to an AHJ doesn't immediately translate to a succinct understanding of the potential risks and what should be done to mitigate them. The AHJ may receive this data without interpretation and be uninformed on whether the result was a good or bad outcome. Since most AHJs are not battery experts, and perhaps not well trained in explosion modeling, they may not know enough to determine that an entire rack failure, or even multiple cells or modules, is a dangerous outcome.

6.1.2 Shortcomings that should be addressed in NFPA 855

Neither UL 9540 nor NFPA 855 acknowledge that cascading thermal runaway should be first addressed at the cell level. If the risk of cascading was reduced, then the requirement for large scale testing is significantly reduced and the heat mitigation, extinguishing, and ventilation requirements may also lessen. Data demonstrates that flammable gases evolve from Li-ion cells undergoing thermal runaway and the chances of reaching the LFL are reduced if the number of cells undergoing thermal runaway is limited. NFPA only addresses cascading thermal runaway in the Annex of the 855 standard but does not prescribe codes or rules to address or prevent it. A single cell undergoing thermal runaway may not produce a flammable environment in a room, but unmitigated cascading will.

Even in today's form, neither NFPA 855 nor UL 9540 prescribe that cell-to-cell cascading is not permitted, and neither standard acknowledges that testing should quantify the cascading rate.

Another human factors issue with NFPA 855 is that it does not distinguish between the roles of the parties (as shown in Figure 29) involved in the procurement and development of a battery energy storage system, and instead generally states that the owner or their authorized representatives shall provide training and response.

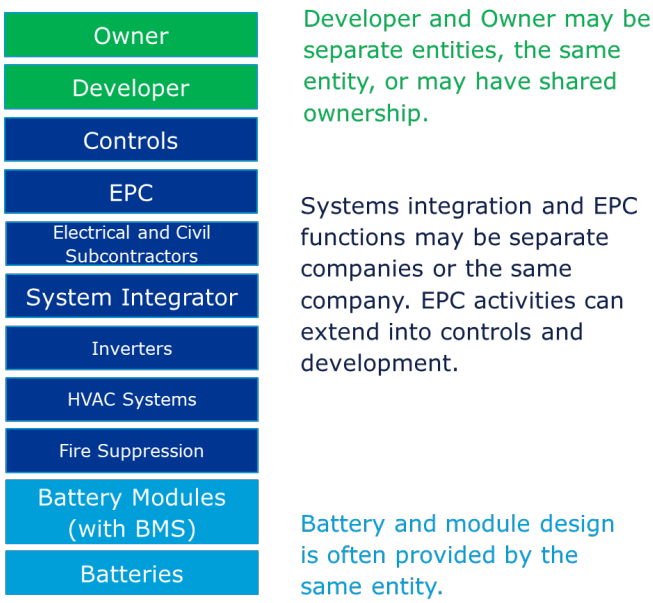


Figure 29 Division of roles and responsibilities in a typical commercial energy storage project, 2014-present

However, the insistence on the owner to provide training is not always appropriate with today's practice in the energy storage industry, where owners of energy storage systems are more frequently private equity firms, investment funds, and independent power producers (IPPs) who might not be engaged directly in operations—and are less frequently utilities, although that is changing. Today, it is the practice in the industry that the EPC contractor—in this case AES and its subcontractors—take the lead in advising, training, and recommending practices for design and safety, as well as assume maintenance and response operations.

While it is certainly the responsibility of an owner of any piece of equipment to understand the risks associated with its use, it is the inherent responsibility of the manufacturers, designers, system integrators, operators, and service providers of such systems to educate customers on the risks involved and provide the training necessary. It is also the responsibility of the AHJ to know which codes to review and prescribe. This includes interpretation of the UL 9540A test data. Today, if an EPC contractor or system integrator does not have data on cascading thermal runaway, both the owner and the AHJ should request such data. This is the exercise of trying to uncover the "unknown-unknowns" as described in the Johari Window in Figure 28.

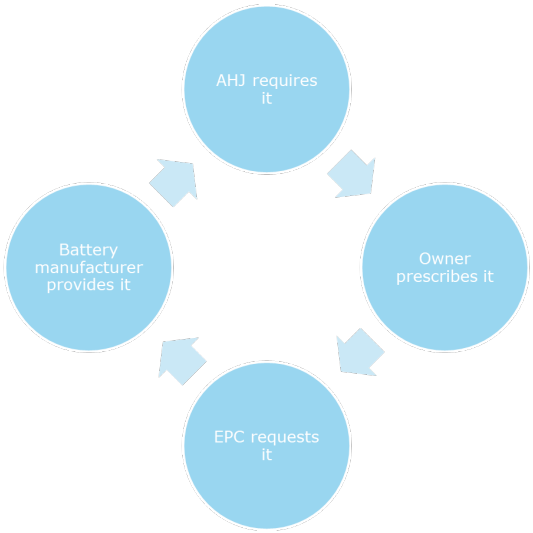


Figure 30 Multiple parties involved in safety and design data information exchange

The key issue here is that the entire supply chain needs to know what to ask for—otherwise it may not be disclosed. If the battery manufacturer is not a direct participant in providing thermal runaway safety data for their product, the entire supply chain may not receive the necessary data. If the AHJ does not require it, the manufacturer may not voluntarily disclose it. If the owner does not prescribe it, then the supplier may not provide it, and the AHJ may not know to ask for it either. The cycle shown in Figure 30 demonstrates this classic chicken-egg problem—where the whole cycle is broken if any single party does not initiate, respond to, or request the appropriate information.

The fundamental issue of cascading thermal runaway was not addressed by the NFPA 855 drafts. Although, cascading thermal runaway is mentioned 37 times in at least one NFPA 855 draft, no requirements were written to address it. Today, in section C.7.2 (annex) of the 2020 release of NFPA 855, it states [35]: "Passive fire control features should be designed to limit the cascading effects of fire spread. This might include cell to cell (built into the module), module to module (built into the rack/or pack), rack to rack (built into the ESS room or container), or even protection from system to system propagation."

However, this is in the annex, and is therefore not prescriptive. It does not acknowledge or inform a reader (such as a code official) about the significant heat hazard and flammable gases that will be produced if cascading is allowed to proceed unmitigated.

In Section 4.1.4.2, NFPA 855 states that a hazard mitigation analysis shall be submitted to the AHJ and shall evaluate the consequences of failure of a thermal runaway condition in a single module, array, or unit.

In table 9.2 of NFPA 855, it acknowledges that thermal runaway protection is necessary for Li-ion battery systems, but it assigns this role to the BMS. Thermal runaway, once started, is an electrochemical reaction that can't be stopped electrically. There is no BMS—which is just a circuit board with control logic connected to sensors and contactors —that can stop thermal runaway in all circumstances.

Indeed, the collective awareness of thermal runaway preceded the commission dates of the McMicken BESS and Festival Ranch BESS. The fundamental concepts of cascading and an understanding that off-gassing could be flammable was publicly known, but not widely known to everyone. Perhaps the collective energy storage community had not yet made the logical calculation concerning how much gas volume and how fast gases could be generated if the thermal runaway propagated through all the battery cells within a module or rack.

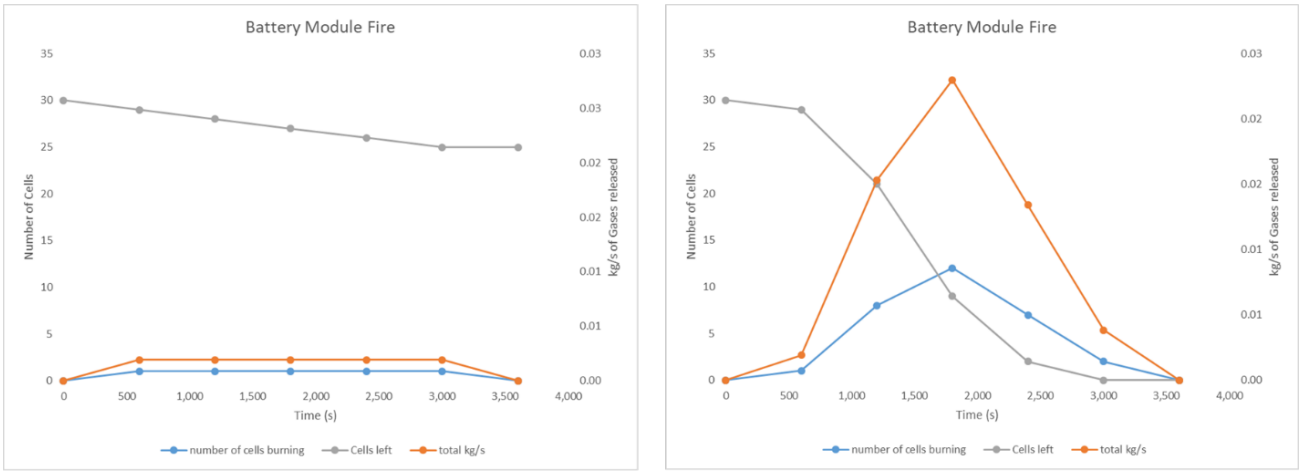
Unfortunately, the McMicken BESS explosion demonstrates the consequences of this oversight. The extent of cascading and its rate are not addressed in past and present standards as measurement criteria, but they should be. Information was available to assess this hazard prior to the construction of this project and during its first year of commercial operations, but it was not emphasized enough among the suppliers of these systems or commonly referenced standards.

It is perhaps time for the industry to collectively acknowledge that cascading thermal runaway should be stopped or mitigated at the smallest unit possible. The next iteration of standards should finally acknowledge this in codified form. Until then, it is up to the supply chain to voluntarily develop, seek, design, and deploy solutions, while being at risk of deficiency of information.

The best way to overcome this deficiency in information exchange is to address it directly in the most commonly used codes and standards, i.e., NFPA 855, the upcoming IFC revision, UL 9540 and 9540A, and UL 1973.

6.2 Ventilation and cooling

In 2015-2017, DNV GL published results related to the management of flammable gases from Li-ion battery thermal runaway for stationary storage systems and their contribution to an explosion risk. [16] As shown in Figure 31, DNV GL models demonstrate the gas release rate of Li-ion cells as they burn; as one would expect, the gas release is larger when multiple cells are cascading versus when no more than one cell is burning at a time.



No more than one cell burning at a time

Lower gas release

Multiple cells cascading

Large gas release

Figure 31 Gas quantities are limited when fewer cells are burning

Additionally, Figure 32 exhibits the intense heat produced during thermal runaway, and demonstrates the temperature differences between large and small battery modules. For comparison, the McMicken BESS modules were 6.7 kWh, so they would be more in line with the left graph depicting the temperature for the large module.

Exhibit 16

From: Grams, Lisa <Lisa.Grams@ul.com>

Sent: Sunday, September 18, 2022 11:45
To: Selma Eikelenboom <s.eikelenboom@ifscolorado.com>
Subject: FW: Re: UL9540A

Hi Selma – I received your inquiry this morning and had a chance to review. Can you provide a bit of background on your organization and why you seek information on 9540a? This is a test methodology that evaluates a product to determine whether it meets or performs as intended against specific requirements outlined in regulatory requirements/codes. We would not claim that evaluation to 9540a prevents any kind of future malfunction or issue, but it goes a long way to help identify and address known sources of flaws and risks.

https://www.ul.com/services/ul-9540a-test-method

If you have further questions, please feel free to reach out.

Thanks,

Lisa Grams
Director of Product Management
Energy & Industrial Automation

UL LLC
333 Pfingsten Road
Northbrook, IL 60062
T: +1.262.227.9911
E: lisa.grams@ul.com
W: ul.com

Exhibit 17

UTILITY DIVE

DIVE BRIEF

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

By Emma Penrod

Battery energy storage projects face more defects and other problems than the power sector may expect, leading to potential performance and safety risks, according to Clean Energy Associates, a clean energy advisory firm.
PhonlamaiPhoto via Getty Images

Dive Brief:

- Battery energy storage systems may contain more defects and deviate from industry best practices more often than expected, according to six years of factory quality audits by industry advisory firm Clean Energy Associates.
- More than a quarter of inspected energy storage systems, totaling more than 30 GWh, had issues related to fire detection and suppression, such as faulty smoke and temperature sensors, according to the report.
- While the industry has generally focused on cell integrity, system level issues accounted for nearly half of the defects identified by Clean Energy Associates.

Dive Insight:

A significant percentage of the world's energy storage systems could contain defects that pose a risk of thermal runaway and fire, according to data released last week by Clean Energy Associates.

The advisory firm has compiled factory quality audit data on 64% of tier one lithium-ion battery energy storage system manufacturers over the past six years, identifying more than 1,300 manufacturing defects in the process. They found that 26% of energy storage systems contained fire suppression system defects, while 18% had defects in thermal management systems. Tier one systems are considered suitable for use in EVs manufactured outside of China, according to Benchmark Mineral Intelligence.

Faulty actuators that did not respond to the command to release a fire extinguishing agent were a relatively common finding in the Clean Energy Associates audits. The auditors also commonly encountered incorrect wiring in smoke sensors and temperature sensors, and often found fire alarm abort buttons unresponsive. Failure to deactivate a false alarm could lead to unnecessary releases of fire extinguishing agent or unwanted sprinkler system activation, which could cause serious damage to energy storage equipment, according to Clean Energy Associates.

More than half of the issues identified by Clean Energy Associates were system-level defects related to improper system integration procedures, according to the report. These defects include issues such as improper wiring and coolant leaks due to defective valves and loose pipe connections.

However, defects in the battery cells themselves accounted for just under a third of the issues identified by Clean Energy Associates. Cell-level defects typically pose greater risk to energy storage system performance and safety than system-level issues, according

to Clean Energy Associates. Common problems include lack of calibration and welding defects, as well as electrolyte leakage, according to the report.

A final 23% of issues identified were related to battery module assembly, according to the report. Most module-level defects could be attributed to manual production lines, according to Clean Energy Associates.

The American Clean Power Association said the report should not be taken to suggest that these defects are prevalent in large numbers in installed energy storage systems already connected to the grid. Existing industry practices mean installers screen for and correct the deficiencies observed by Clean Energy Associates prior to system installation, according to Noah Roberts, senior director of energy storage for the association.

“Under current industry standard practices, and the nationally recommended safety standard, NFPA 855, all of the faults identified in this report would be corrected during the project installation and commissioning process,” Roberts said in a statement. “As we have seen over the past few years, the leadership of the energy storage industry and its prioritization of safety and reliability has made fire incidents in the field increasingly rare.”

Editor’s Note: This story has been updated with comments from the American Clean Power Association.

Exhibit 18

2024 White Paper

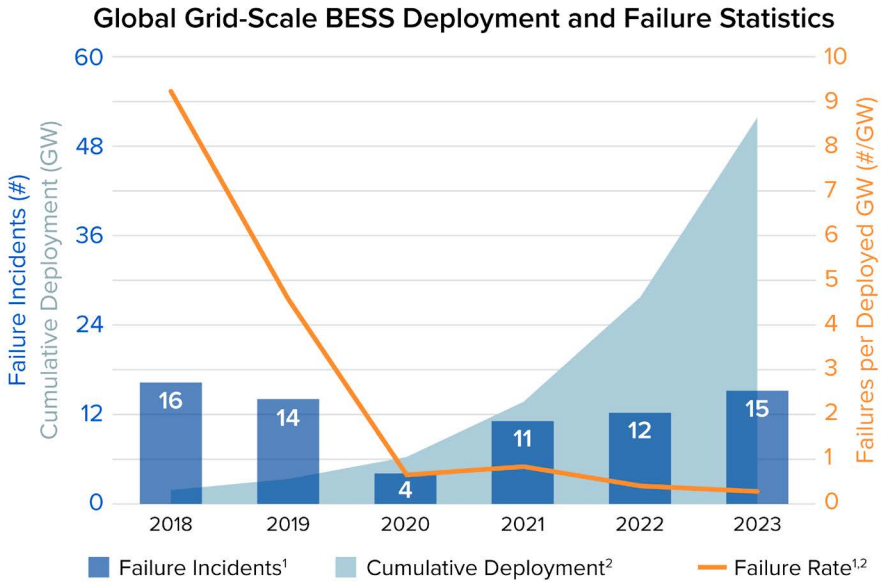
Insights from EPRI's Battery Energy Storage Systems (BESS) Failure Incident Database

Analysis of Failure Root Cause

TABLE OF CONTENTS

INTRODUCTION

The global installed capacity of utility-scale battery energy storage systems (BESS) has dramatically increased over the last five years. While recent fires afflicting some of these BESS have garnered significant media attention, the overall rate of incidents has sharply decreased,[1] as lessons learned from early failure incidents have been incorporated into new designs and best practices. Between 2018 and 2023, the global grid-scale BESS failure rate has dropped 97%. The battery industry continues to engage in R&D activities to improve prevention and mitigation measures, including development of a better understanding of the diverse causes of BESS failures.



Sources: (1) EPRI Failure Incident Database, (2) Wood Mackenzie. Data as of 12/31/23.

Figure 1. *Global Grid-Scale BESS Deployment and Failure Statistics*

Several entities compile information on battery fires that have occurred in various products (e.g., mobile, stationary, consumer product) categorized by differing battery technologies (e.g., lead acid, lithium ion). EPRI has produced the most comprehensive compilation of stationary BESS incidents, called the EPRI BESS Incident Database,[2] based on publicly accessible underlying data. Other notable databases include UL's Lithium-Ion Battery Incident Reporting[3] and EV FireSafe.[4]

1 *Technology Innovation Spotlight: Lithium Ion Battery Fires in the News.* EPRI, Palo Alto, CA: 2023. 3002028411.

2 BESS Failure Incident Database. This was formerly known as the BESS Failure Event Database. It has been renamed to the BESS Failure Incident Database to align with language used by the emergency response community. An 'incident' according to the Federal Emergency Management Agency (FEMA) is an occurrence, natural or man-made, that requires an emergency response to protect life or property, while an 'event' is a planned, non-emergency activity. The use of incident is prevalent, for example, in referring to the Incident Command, or Incident Command System used by public and private agencies to coordinate incident management operations, https://www.fema.gov/pdf/emergency/nrf/nrf-glossary.pdf.

3 Lithium-ion Battery Incident Reporting. UL Solutions. https://www.ul.com/insights/lithium-ion-battery-incident-reporting.

4 EV FireSafe Database. https://www.evfiresafe.com/.

The UL Lithium-Ion Battery Incident Reporting encompasses incidents caused by utility-scale, C&I, and residential BESS, as well as EVs, e-mobility, and consumer products. This database focuses exclusively on lithium ion technologies. EV FireSafe tracks EV and electric micro-mobility fires involving (though not necessarily *caused* by) the traction battery, and categorizes incidents by cause. Both the UL Lithium-Ion Battery Incident Reporting and EV FireSafe provide statistics and figures, but do not disclose details of individual failures or sources.

There is currently no public resource that categorizes BESS incidents by cause of failure. This information would provide industry-level insights on common and uncommon failure modes, and would help to prioritize needed mitigation technology R&D. This knowledge is particularly important because individual incident details and root cause information are not always easily accessible, but are crucial to improve safety and understand risk. Failure classification can help determine the role of different components of a BESS, from controls to battery cell/module, in contributing to an incident and in preventing future incidents. No current federal, state, or local jurisdiction requires incident reporting. Even in cases where detailed root cause investigations are conducted, legal barriers often prevent the results from being shared publicly. New York state encouraged Original Equipment Manufacturers (OEMs) to disclose root cause analyses (RCAs) after failure incidents, but stopped short of including a requirement for disclosure in their pending update[5] to the fire code.

This report is intended to address the failure mode analysis gap by developing a classification system that is practical for both technical and non-technical stakeholders. Once categorized in a standardized manner, the aggregated failure data was analyzed to better understand trends in how, why, and how infrequently BESS fail, and to provide recommendations for future safety improvements.

5 New York State Inter-Agency Fire Safety Working Group: Fire Code Recommendations. NYSERDA. Feb 6, 2024. https://www.nyserda.ny.gov/-/media/Project/Nyserda/Files/Programs/Energy-Storage/Draft-New-York-State-Inter-Agency-Fire-Safety-Working-Group-Fire-Code-Recommendations.docx.

METHODOLOGY

This report relies on data from EPRI's BESS Failure Incident Database along with findings from incident reports and root case analyses and expert interviews conducted by the authors to build robust descriptions of each event. Each incident from the database is categorized through a biaxial framework to allow for analysis of two distinct failure facets. BESS failures were classified by a) the root cause of failure (design; manufacturing; integration, assembly & construction; or operation); and b) by the element of the BESS that experienced the failure (cell/module, controls, or balance of system). The study examines the proportion of failures sharing a root cause or responsible element, the relationship between root cause and the element experiencing failure, and the trends in failure type and rate over time. Results from this analysis will inform the industry's efforts to optimize safety research and product development.

The BESS Failure Incident Database

EPRI's BESS Failure Incident Database is the main source of data for this report. The database was initiated in 2021 following the series of lithium ion BESS fires in South Korea and the Surprise, AZ, incident in the US. The database gathers information on stationary BESS failure events for commercial and industrial (C&I) and utility-scale BESS. This database defines utility-scale BESS as a system that is interconnected to the grid, with no capacity limitations, while C&I systems could include behind-the-meter installations. Residential energy storage system failures are not tracked by this database and were not considered in this report.

It contains incidents as far back as 2011 and continues to be updated with new incidents as they occur. The focus of the database is on occurrences that had a wider public health and safety risk or impact, rather than on operational failures where no additional risk to personnel or equipment was present or likely. EPRI defines *failure incident* as an occurrence which resulted in increased safety risk, *caused by* a BESS system or component failure rather than an exogenous cause of failure (e.g., wildfire impacting the BESS).

The database captures incidents occurring globally and cites information from publicly available sources, including media reports, published root cause analyses (RCA), and corporate press releases. Source documents are identified by active searching of global English-language media, and passive collection of reports through keyword flagging on internet websites and RSS feeds. Crowdsourced information that can be verified through publicly available documentation is also incorporated. EPRI has used academic publications, and collaborated with other organizations tracking failures, to ensure all publicly known stationary BESS events are captured. However, many incidents are not reported in news media, especially before 2018-19 when there was a renewed industry focus on safety. There is no guarantee that the database captures every relevant BESS failure incident, nor that all project data related to an incident is captured. Despite these caveats, this remains the most comprehensive stationary BESS failure database available.

Data Collection

At the time of writing, the database contained 81 incidents. Of these, 26 incidents had sufficient information to assign a root cause and to identify the element that experienced failure. Certain incidents had published root cause analysis reports that explicitly noted the cause of failure. The remaining incidents were classified based on engineering judgement by subject matter experts at EPRI, TWAICE, and Pacific Northwest National Laboratory (PNNL). The authors reviewed publicly available technical details and interviewed other industry experts involved in failure incident analysis. No proprietary information was discussed in these interviews nor used in the classification of the incidents.

Transparency on the cause of BESS failures continues to be limited. Battery OEMs and BESS integrators are often reluctant to disclose the cause of failure, and many investigation reports are not released to the public. In several instances, legal complications prevent site owners or manufacturers from divulging information about the nature of the failure. Aggregation and anonymization by a third-party can encourage disclosure of such information to support safety research advancement.

Classification of Failure Incidents

Incidents can result from a variety of causes, such as water intrusion, retrofitting errors, operating conditions, coolant leaks, temperature stress, quality control, component manufacturing defects and other factors. For meaningful analysis, these causes were grouped into classifications. Each failure incident with sufficient information was classified by root cause and by failed element. Definitions for each classification are provided below:

Root Cause:

- **Design**
  A failure due to planned architecture, layout, or functioning of the individual components or the energy storage system as a whole. Design failures include those due to a fundamental product flaw or lack of safeguards against reasonably foreseen misuse.
- **Manufacturing**
  A failure due to a defect in an element of an energy storage system introduced in the manufacturing process, including but not limited to, the introduction of foreign material into cells, forming to incorrect physical tolerances, or missing or misassembled parts.
- **Integration, Assembly & Construction**
  A failure due to poor integration, component incompatibility, incorrect installation of elements of an energy storage system or due to inadequate commissioning procedures.
- **Operation**
  A failure due to the charge, discharge, and rest behavior of the energy storage system exceeding the design tolerances of an element of an energy storage system or the system as a whole. Operational failures include, but are not limited to, incorrect sensing of voltage, current, temperature, and other set point values, or operation above designed temperature, C-rate, state of charge, or voltage limits of the energy storage system.

Failed Element:

- **Cell/Module**
  A failure originating in the lithium ion cell or battery module, the basic functional unit of the energy storage system. It consists of an assembly of electrodes, electrolyte, casing, terminal, and usually separators.[6]

6 IEC Glossary. https://www.electropedia.org/iev/iev.nsf/display?openform&ievref=482-01-01.

Cell failures usually begin with short circuits within the cell leading to eventual thermal runaway. They can originate from poor cell design, manufacturing defects, incorrect installation, or cell abuse.

- **Controls**
  A failure in the sensing, logic circuits, and communication systems. Control systems coordinate the operation of the ESS, including the battery management system (BMS), energy management system (EMS), plant controllers, and any subsystems. Controls failures include those due to control system incompatibility, incorrect installation of the control system, defects leading to errors in sensors or controls, or inappropriate operation limits.
- **Balance of System (BOS)**
  A failure in any of the elements of a BESS excluding the cells, modules, and controls. BOS typically comprises of, but is not limited to: busbars, cabling, enclosures, power conversion systems, transformers, fire suppression systems, HVAC, or liquid cooling systems.

An incident may have multiple failure elements or root causes; such incidents are assigned multiple classifications. The following example illustrates this classification methodology. The Elkhorn battery facility located at Moss Landing, CA, experienced a fire on September 20, 2022. The investigation report[7] was shared publicly by Tesla (the BESS manufacturer and integrator) and Pacific Gas & Electric (site owner). The investigation found that rainwater intrusion through the container caused electrical arcing within the system, leading to thermal runaway within one BESS unit on site. A water ingress point in the enclosure had been created when an umbrella valve had been dislodged during the improper installation of a vent shield. As a confounding factor, insulation loss alarms were not properly escalated to the operator. Two days after the initial insulation alarms were recorded, smoke and fire were reported to the fire department. Appropriate reporting of the insulation loss alarms could have prevented escalation of the initial failure into a fire that consumed the whole BESS unit. Therefore, the root cause was classified as both an integration, assembly & construction failure in the BOS and a design failure of the control system.

RESULTS

Results Overview

The following section contains insights from the 26 incidents that were classified. The distributions along the biaxial classification system are examined in detail. As described above, investigations into battery failures are often inconclusive, and there is a lack of transparency that further limits the sharing of lessons learned. The industry experts who provided additional information beyond public reports are based in the United States, so information on incidents in other parts of the world is more limited in this report.

7 Report: *Elkhorn Battery Energy Storage System Fire of September 20, 2022 - PGE Currents*. https://www.pgecurrents.com/articles/3833-report-elkhorn-battery-energy-storage-system-fire-september-20-2022.

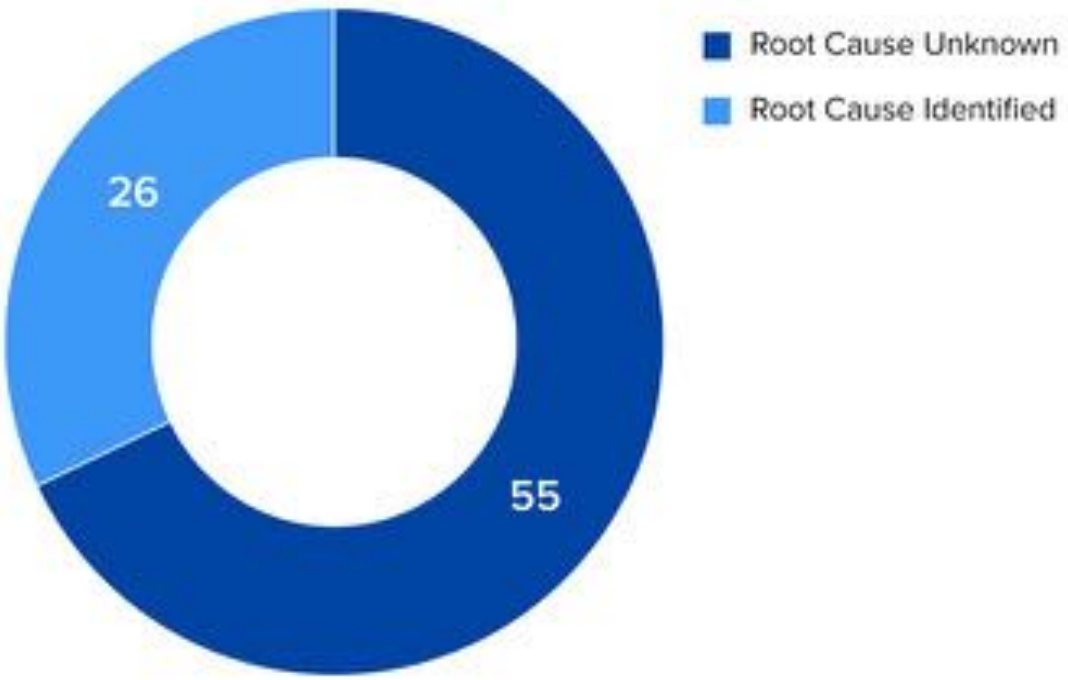


Figure 2. *Fraction of BESS Failures with Identified Cause*

Of the 9 incidents recorded in the BESS Failure Incident Database between 2011 and 2017, none were able to be classified, while 36% of incidents between 2018 and the present had root causes identified. The availability of root cause information starting in 2018 is an indication of both energy storage industry maturity as well as collective action and scrutiny on lithium ion BESS safety.

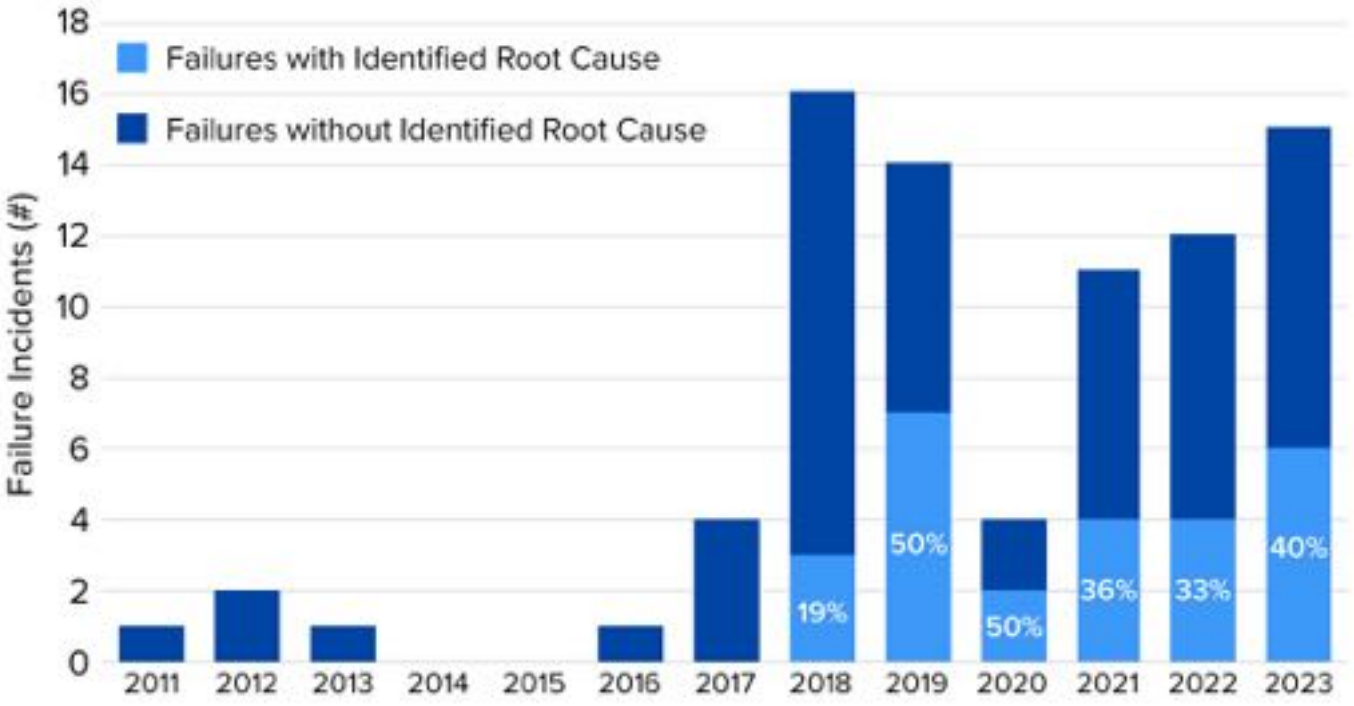


Figure 3. *BESS Failures with Identified Root Cause Over Time*

Between 2017 and 2018, the lithium ion BESS deployments increased by ~1 GW, more than doubling total global deployment, and signaling the advent of the commercial BESS industry.[8] The period between 2017-2019 also experienced a spike in BESS failure incidents. Of the 30 incidents in the database between 2018 and 2019, 27 occurred in South Korea. The Korean government had provided strong economic incentives for BESS, especially paired with solar PV generation. The number of installed BESS in South Korea rose from 30 in 2013 to 947 in 2018. The rapid deployment was not accompanied by robust safety standards and regulations, which contributed to the failures.[9] After the first spate of fires, the South Korean government investigated the incidents, and provided summarized findings for the failures in aggregate. Subsequent academic papers provided more detailed root cause analyses for individual incidents.[10]

In the United States, a fire and explosion at a BESS facility in Surprise, AZ in 2019 injured four firefighters. Following the incident, multiple root cause investigation reports were released publicly, and safety became a priority issue for the energy storage industry in the US. In the subsequent years, root cause investigations have occasionally been made public to support industry learnings. However, the number of unclassified incidents in the preceding figures are a clear indication of the continued challenges around failure data access and transparency.

Root Causes of Incidents

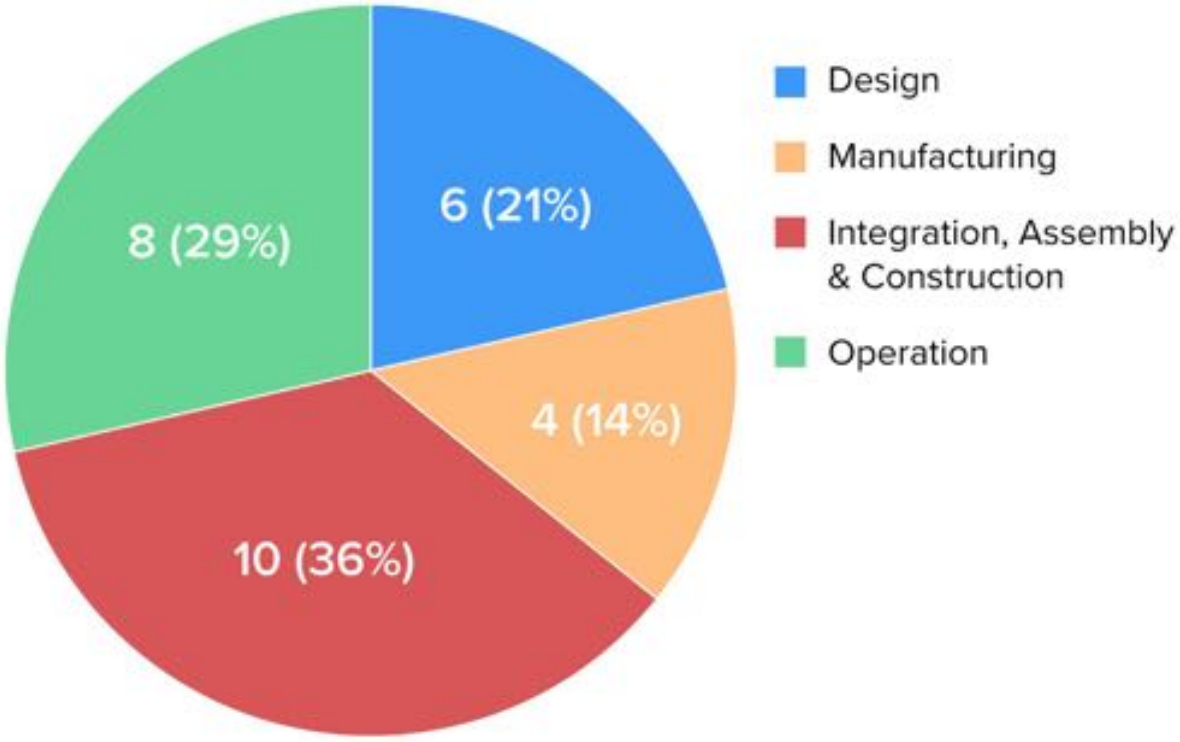


Figure 4. *Breakdown of BESS Failures by Root Cause*

8 WoodMackenzie Energy Storage Database. Accessed Apr 17, 2024.

9 Im, D-H and J-B Chung. Social construction of fire accidents in battery energy storage systems in Korea. *Journal of Energy Styorage,* Volume 71, 1 November 2023, 108192. https://doi.org/10.1016/j.est.2023.108192.

10 Na, Y-U and J-W Jeon. Unraveling the Characteristics of ESS Fires in South Korea: An In-Depth Analysis of ESS Fire Investigation Outcomes, *Fire,* 6(10), 389, 2023. https://doi.org/10.3390/fire6100389.

Figure 4 shows the root cause classification for the 26 incidents considered in the analysis. Note that two incidents were classified with dual root causes (Design as well as Integration, Assembly & Construction), and the discrepancy in total incidents is due to this double-counting. There is no clear phase across the product lifecycle that is particularly susceptible to failure, with all phases contributing to several failures. EPRI has also gathered information on failure incidents during manufacturing, transportation, and recycling of batteries, which can be found in the 'Other' table in the database.[11] These incidents were not considered for this analysis.

Integration, Assembly & Construction was the most common root cause of failure in this analysis. Figure 5 highlights the number of failures in the database that happen early in the project lifecycle. Referring back to Figure 1, deployment has increased significantly in recent years, and there are relatively few older BESS that are operational. This may be why there are not many recorded failure incidents of aged systems so far. It remains to be seen if this trend will be sustained as systems being installed today age over time. Regardless, the majority (72%) of failures where the system age is known happen during construction, commissioning, or within the first two years of operation. Integration, Assembly & Construction is a critical phase in BESS risk mitigation. This root cause is examined further in subsequent sections of this report.

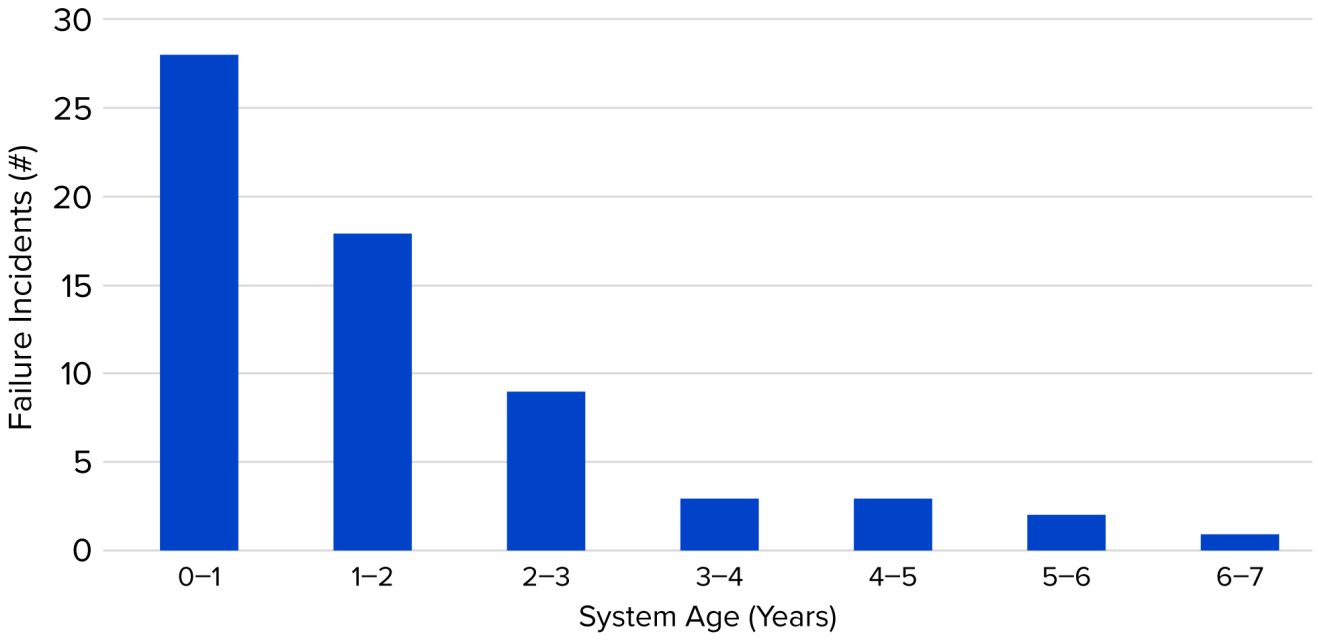


Figure 5. *BESS Age at Failure, where known*

11 BESS Failure Event Database.

Manufacturing as a root cause has the fewest failures attributed to it. This is most likely due to the difficulty in definitively identifying a manufacturing defect as a root cause with the loss of physical evidence after a fire or explosion. Earlier failures from 2018-2020 in particular may have involved cell or module manufacturing defects as a contributing factor. Several product recalls from major EV manufacturers during those years cited manufacturing issues by battery OEMs.[12,13] Some residential ESS products were also recalled during the same timeframe.[14] It is important to note that recalls do not definitively point to manufacturing issues, but indicate the probable failure cause. In recent years, more robust product standards such as Underwriters Laboratory (UL) 1973 (Standard for Batteries for Use in Light Electrical Rail Applications and Stationary Applications) and UL 1642 (Standard for Lithium Batteries) have improved the quality of manufactured batteries. Product certifications include quarterly and annual audits of factories to review quality control procedures, part inspection standards, and more. A recent report from Clean Energy Associates (CEA) summarizes findings from BESS factory quality audits. Of the identified issues in cell and module manufacturing, the majority were classified as minor issues, meaning they were not expected to impact safety in the short or long term.[15]

Failed Element

The distribution of failure sources across BESS elements (i.e. components) provides an insightful view of the vulnerabilities within the system.

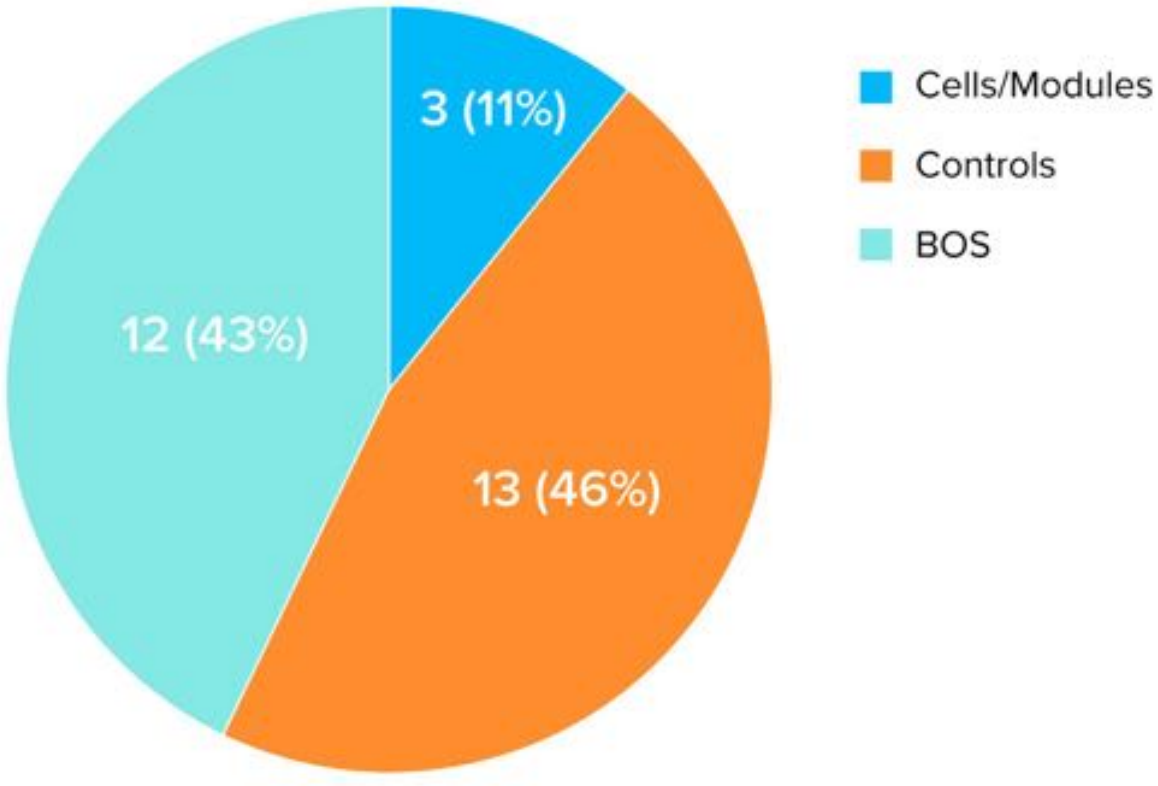


Figure 6. *Breakdown of BESS Failures by Failed Element*

12 Gitlin, J. Multiple recalls spark Fed investigation of LG's electric car batteries. *Ars Technica*, 2022. https://arstechnica.com/cars/2022/04/multiple-recalls-spark-fed-investigation-of-lgs-electric-car-batteries/.

13 De Chant, T. GM recalls every Chevy Bolt ever made, blames LG for faulty batteries. *Ars Technica*, 2021. https://arstechnica.com/cars/2021/08/gm-recalls-every-chevy-bolt-ever-made-blames-lg-for-faulty-batteries/.

14 United States Consumer Product Safety Commission. LG Energy Solution Michigan Recalls Home Energy Storage Batteries Due to Fire Hazard.

15 BESS Quality Report. February 2024. Clean Energy Associates Insights.

The BOS and controls account for the vast majority of failed components. The prevalence of BOS failures is corroborated by the recent CEA report cited above, which found that nearly 50% of quality assurance items were in the BOS. Only 3 incidents, or 11% of classified incidents, are attributed directly to the cells. However, it should be noted that many of the failures classified as controls were related to operational issues aimed at restricting cell state of charge (SOC), voltage and current, due to cell limitations. These were classified as controls failure rather than cell/module since the failures could have been prevented if more limited operational windows were maintained.

Biaxial Analysis

The following analysis looks at the combination of root cause and failed elements across the 26 incidents considered.

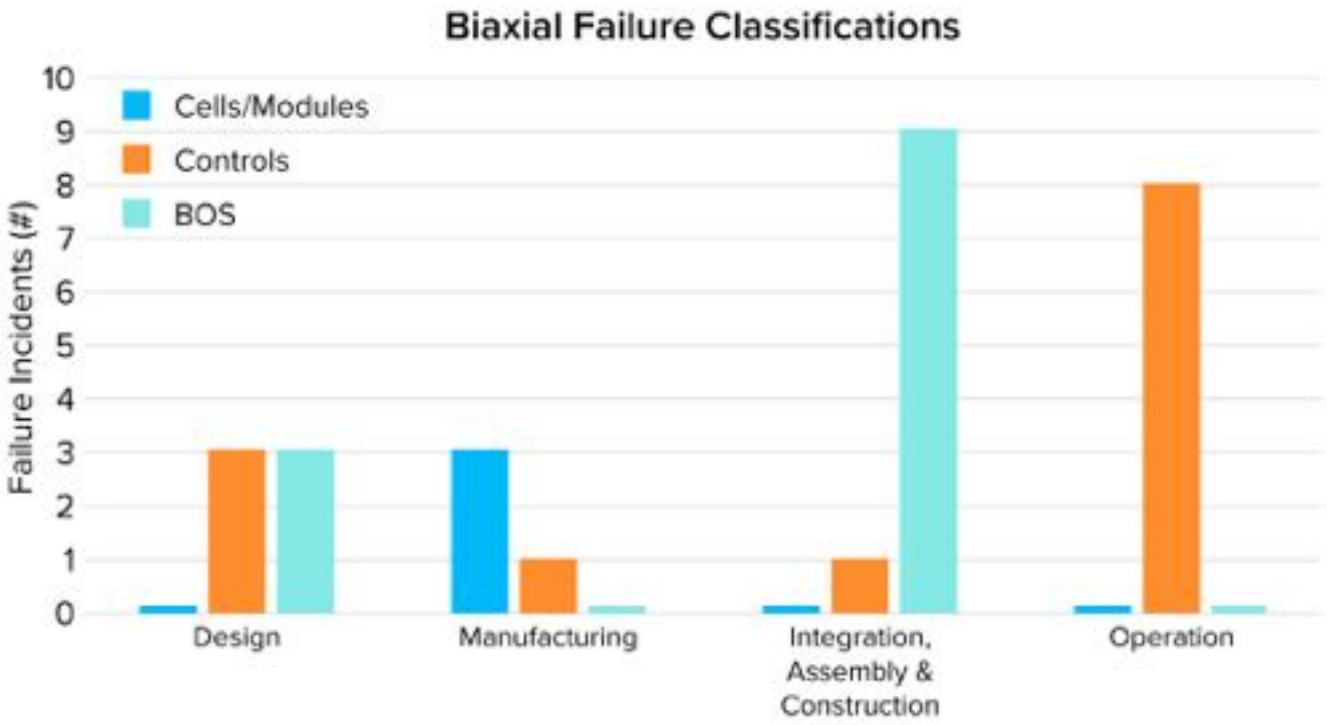


Figure 7. *Relationship between Root Cause and Failed Element*

1. ***Integration, Assembly & Construction and BOS***
   Integration is the most common root cause of BESS failures, and the vast majority of incidents with this classification involved BOS components. These components included DC and AC wiring, HVAC subsystems, and safety elements such as the fire suppression system. Lithium ion BESS contain components from multiple suppliers, which are not necessarily designed to work together. Integration is a critical part of the deployment and installation process to ensure all interfaces are compatible and functional. A 2021 incident in Australia at the Victoria Big Battery facility is an example of BOS failure due to assembly quality issues. During commissioning, a leak in the coolant system led to a fire that spread across two BESS units.[16]

2. ***Operation and Controls***
   Operation is the second most common root cause, and in all cases, the operation failure occurred in the controls system. Seven of these incidents occurred in 2018-2019 in South Korea, reflecting the early challenges in determining appropriate BESS operation limits for parameters such as voltage and SOC.

16 *Lessons Learned from Past Failures Around the World, Session 6: Responding to a Safety Event.* EPRI, Palo Alto, CA: 2023. https://www.sandia.gov/app/uploads/sites/163/2023/06/2023ESSRF_Session6.2_Srinivasan_Lakshmi.pdf.

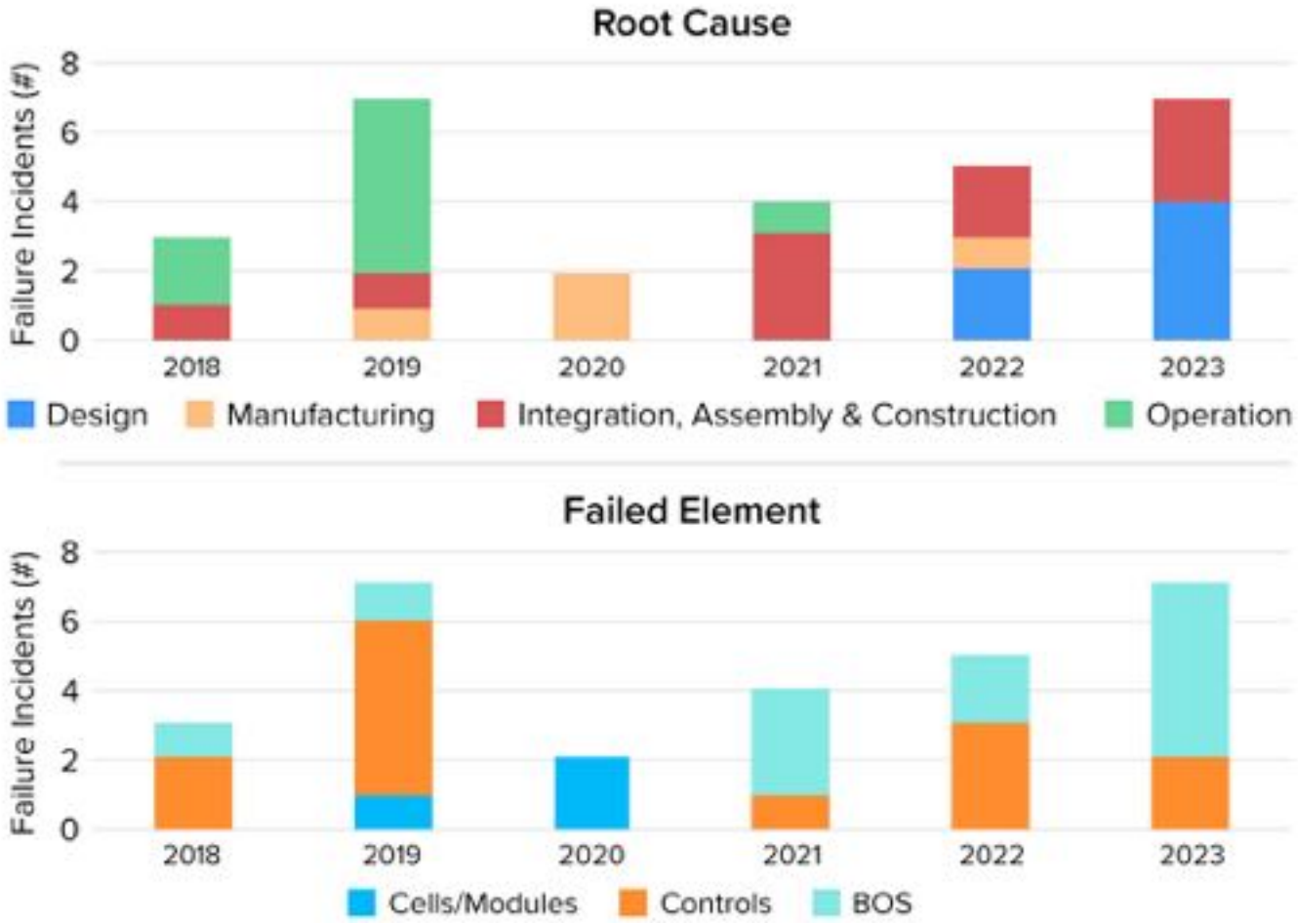


Figure 8. *Root Cause and Failed Element Trends Over Time*

Considering root cause trends over time, the bulk of operational failures occurred in 2018-2019 when a significant number of BESS installed in South Korea experienced fires. Many of these were classified as operational failures since the SOC just before incidents was higher than recommended limits. Investigation of the failures revealed that a significant fraction of those failures occurred when the SOC was above 90%.[17] It is possible that these failures could also be attributed to manufacturing or design issues with the cell, but there was not sufficient evidence to make that determination with confidence.

Integration-related failures have become more common. The vast majority of these failures are related to poor build quality in the BOS, whether it is AC or DC wiring, coolant systems, or safety systems such as water suppression piping. The CEA report corroborates these findings: 26% of inspected BESS units had defects in the fire suppression system, while 18% had thermal management system defects.[18] Both subsystems are critical for BESS safety. It is important to note that some of these failures occurred during the commissioning phase, when monitoring and communications were not online, thus allowing leaks or isolation failures to cascade into large-scale fires. Site-specific hazard assessments, monitoring, and procedures during commissioning are recommended to avoid failures. EPRI published an updated commissioning guide[19] in 2023 through the Energy Storage Integration Council (ESIC) that captures recommendations and lessons learned to improve safety.

While the core battery technology has been in commercial development since the 1990s, fully integrated BESS products arrived much later to market. BOS subsystems like cooling, and especially safety components are not yet

17 Na, Y-U and J-W Jeon. Unraveling the Characteristics of ESS Fires in South Korea: An In-Depth Analysis of ESS Fire Investigation Outcomes, *Fire,* 6(10), 389, 2023. https://doi.org/10.3390/fire6100389.

18 BESS Quality Report. February 2024. Clean Energy Associates Insights.

19 *ESIC Energy Storage Commissioning Guide*. EPRI, Palo Alto, CA: 2023. 3002013972.

mature. BESS products have rapidly evolved from walk-in containers assembled on-site to module, pre-integrated systems. There is a diversity of products, architectures, thermal management approaches etc., leading to integration challenges and the potential for incompatible interfaces or unexpected interactions between components.

As deployment increases, many more individuals and organizations are working on BESS for the first time. New products without long operational histories are entering the market. A lack of experience and training in integration and assembly could have contributed to the assembly and construction-related failures in the recent years. Designs may have flaws, or may not account for all operating and ambient conditions. For example, three of the four design-related failures in 2023 occurred due to same BOS design flaw in a BESS product. The enclosure design for systems in New York and Idaho allowed water intrusion into the battery compartment, leading to loss of isolation and thermal runaway. Global storage deployment is expected to grow exponentially, and many new entrants to the industry are expected. Sufficient training for manufacturers and integrators/developers and more extensive product quality control systems are needed to prevent integration, assembly, and construction failures going forward.

Mitigations and Recommendations

Reducing the risks associated with lithium ion BESS is a complex task. Safety must be embedded at every scale of a project, from material selection at the cell level to public health impacts at the community level. As illustrated by this analysis, safety must also to be considered at every phase of the project lifecycle, from design to operation to decommissioning. For an overview of related lithium ion BESS safety resources, including state-of-the-science documentation of safety technology and hazard assessments, visit EPRI's Storage Wiki Safety Page.[20]

The recommendations in this section focus on addressing the gaps identified in this report. These are not intended to be exhaustive. Preventative and mitigative measures against thermal runaway can take many forms, included components design/engineering, monitoring, procedural, and site-level analyses. A comprehensive view of risk mitigation options can be found in the ESIC Energy Storage Reference Hazard Mitigation Analysis.[21]

Table 1. *Mitigations and Recommendations for Each Root Cause*

ROOT CAUSE	FAILED ELEMENT	MITIGATIONS AND RECOMMENDATIONS
Design	Controls, BOS	• Compliance with relevant codes and standards (UL, NFPA). Latest revisions have incorporated lessons learned from past failures. • Site-specific hazard assessments to consider all risks and failures. • Robust sensing and monitoring to provide early alert for design failures.
Integration/Assembly/ Construction	BOS, Controls	• Workforce training and quality checks during energy storage commissioning and installation. • System-level failure analysis, especially for interfaces between components.
Manufacturing	Cell/Module, Controls	• Increased manufacturing quality controls. • Supplier quality verification. • Robust system specifications. • Factory acceptance testing.
Operation	Controls	• Battery monitoring and analytics to augment BMS operation, generating trends and predictive analyses to identify potential failures early.

20 Storage Safety. EPRI, Palo Alto, CA.
21 *ESIC Energy Storage Reference Fire Hazard Mitigation Analysis*. EPRI, Palo Alto, CA: 2021. 3002023089.

Looking Ahead

This analysis is the first look at BESS failure root causes in aggregate. For a significant fraction of the incidents, the root cause was unknown, highlighting challenges in transparency around BESS failures. Additionally, it is possible that there are BESS failures that have not been captured in the EPRI database. A comparison of deployments in energy capacity and reported failures in recent years by country points to a possible information gap. The number of failures is taken from the EPRI BESS Failure Incident Database, while installed capacity numbers are from Rho Motion Consulting.[22]

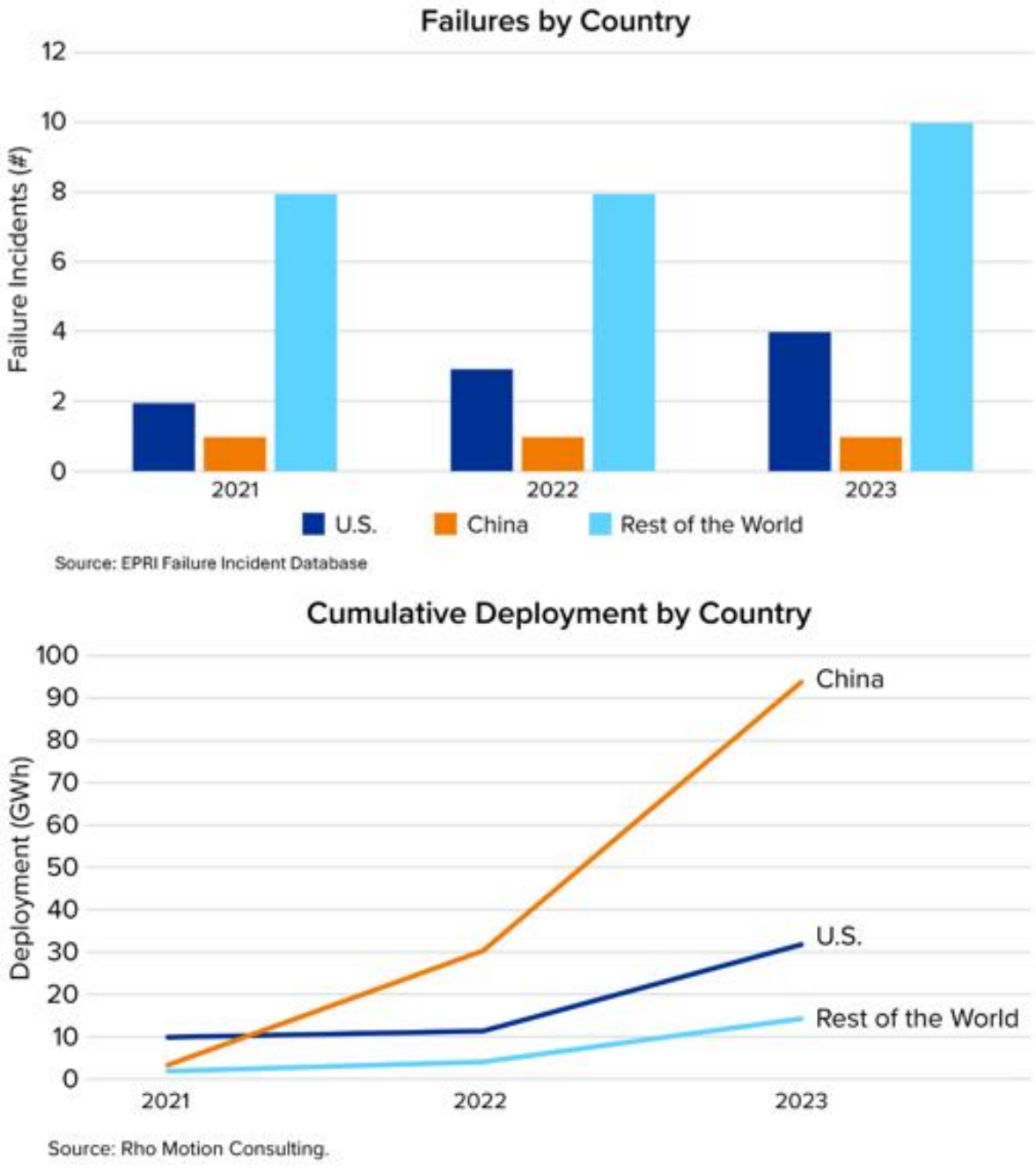


Figure 9. *Failures and Cumulative Deployment by Country*

22 Rho Motion Consulting. Battery Energy Stationary Storage Monthly Database.

EPRI and the other co-authors of this paper call for more transparency and data-sharing by the storage industry, especially of root cause investigations. With additional incident identification and classification, future work could build on this initial report to provide deeper insights on root causes and effectiveness of preventative measures.

EPRI continues to conduct research in BESS safety, and the current portfolio[23] includes projects on thermal runaway off-gas characterization, propagation mitigation technologies, characterizing risks of siting BESS near critical infrastructure, first responder training, and more. These activities are done in collaboration with a variety of industry stakeholders including electric power companies, OEMs, fire departments, and other research organizations. Ongoing regulatory development, voluntary industry efforts, and focused research initiatives will continue to support increased BESS safety.

CONCLUSION

Industry efforts to improve BESS safety during a period of rapid deployment expansion have led to a sharp decrease in the failure rate, but areas of needed improvement remain. This analysis demonstrated that all stages of the product lifecycle contribute significantly to BESS safety and must be rigorously engineered and diligently tested. Notably, the data challenges the widespread assumption that the lithium ion battery cell is the primary cause of failure. The BOS and controls were the leading causes of failure, with the cell having a relatively small number of failures attributed to it. Finally, this analysis is limited by the data that is publicly available. Of the known incidents, less than a third were assigned a cause of failure due to lack of sufficient information. Industry transparency on details of BESS failures will be essential to more comprehensive analysis, to ongoing safety research, and to future development that will ensure the continued safe operation of BESS facilities.

23 *Battery Energy Storage Fire Prevention and Mitigation Phase III*. EPRI, Palo Alto, CA: 2023. 3002028531.

Exhibit 19

Energy Delivery and Customer Solutions

Emergency Response Planning for Battery Energy Storage System (BESS): Review and Guidance

Details

Product ID	Date Published	Pages	Document Type
3002030488	Aug 29, 2024	19	Technical Update

Abstract

As the pace of battery energy storage system (BESS) installations quickens, it is important to ensure that facilities and first responders are prepared for emergency events resulting from system failure. Although prior EPRI research suggests that the failure rate per megawatt-hour installed is decreasing, there will be failures. Creating an emergency response plan (ERP) is the first step to ensure such events are mitigated with the safety of first responders, operators, and the public central to the response.

This paper reviews BESS ERPs from standards, industry groups, and electric utilities and tabulates the considerations therein. These features are quantitatively evaluated for their commonality to gauge the overlapping focus of existing ERPs. They are then qualitatively assessed to determine more thorough versions of each consideration. Some potential gaps in incident response and public communication are highlighted. Finally, an example of a quick-reference ERP with a sample color-coded site map is provided in the Appendix.

Program

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Keywords

Exhibit 20

How significant is solar fire risk?

There is a severe lack of data on the prevalence of solar farm fires.

Indeed, some studies have concluded that there is a high likelihood that instances of solar farm fires are under-reported.

A study by the UK's BRE National Solar Centre – which was entitled 'Fire and Solar PV Systems – Investigations and Evidence' and detailed an investigatigation into a total of 80 potential PV-related fire incidents – led to the finding that researchers "strongly suspect a degree of under-reporting, especially amongst solar farms and domestic thermal events that were resolved by a solar installer/ maintenance engineer."[2]

With regard to the data that is actually available, the US Department of Energy's Solar Energy Technologies Office has cited a study conducted by European testing and certification company TÜV Rheinland – entitled 'Assessing Fire Risks in Photovoltaic Systems and Developing Safety Concepts for Risk Minimization' – which found that, in approximately half of 430 cases of fire or heat damage in PV systems, the PV system itself was considered the "cause or probable cause."[3]

Meanwhile, the study carried out by the BRE National Solar Centre found that more than a quarter of fires involving solar systems were caused by the photovoltaics and those fires were all "serious fires", meaning fires that were "difficult to extinguish and spread beyond the area of origin."

2 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/786882/Fires_and_solar_PV_systems-Investigations_Evidence_Issue_2.9.pdf

3 https://www.energy.gov/sites/default/files/2018/10/f56/PV%20Fire%20Safety%20Fire%20Guideline_Translation_V04%2020180614_FINAL.pdf

Exhibit 21

How Solar Farm Fires Can Damage the Environment

October 11, 2022 | By Firetrace International

A fire at a solar farm can result in pollution as well as posing a serious threat to human life and health – consequently it's vital you protect your solar project from fire risk.

A fire at a solar farm can have devastating consequences for the surrounding environment. This is in addition to the obvious risks fires pose to human health. The damage can include air pollution, water pollution, fatalities, bronchitis, the exacerbation of asthma, and other lung diseases in the local population.

How Big Can Solar Fires Get?

Despite studies showing that the prevalence of solar farm fires may be underreported, there have been known instances of fire events in the solar sector that have caused significant damage to the surrounding environment.

Have you ever wondered what happens when a solar farm catches on fire? Well, earlier this year there was a solar farm fire in Australia that resulted in the loss of an area of grassland totaling five hectares, which is roughly equivalent to **12 NFL football fields**. In this instance, it took the local fire department an hour and a half to get fire under control. With the remoteness of many solar farm locations, it can be challenging for firefighters to get to the scene of a fire in a short timeframe.

What Damage Can Solar Farm Fires Do to the Surrounding Environment?

Here are three ways in which a solar farm fire could cause serious damage to the surrounding environment and the local population:

1. Polluted Water Supply

Stormwater runoff has been highlighted as one of the most noticeable impacts of forest fires. After vegetation has been destroyed by fire, the ground's soil becomes hydrophobic – meaning it is unable to absorb water. This means debris and sediment is transported into larger bodies of water, resulting in the pollution of local supplies. Filtering such water sources is often costly and time-consuming.

2. Poor Air Quality

For example, if a forest burns, then large amounts of smoke are released into the atmosphere. This smoke includes microscopic particles – often less than 2.5 micrometers in diameter, or around one-seventieth the size of a human hair. These particles are so small that our bodies find it difficult to filter them out of our airways. Consequently, they get **lodged deep in our lungs**.

3. Serious Damage to Human Health

The World Health Organization (WHO) has highlighted how forest fires can have a major impact on **mortality and morbidity** depending on the size, speed, and proximity of the fire. The WHO says young children, pregnant women, and older adults are the most susceptible to "health impacts" from smoke and ash. In addition, the WHO explains that smoke and ash from wildfires can greatly affect "those with pre-existing respiratory diseases or heart disease." Meanwhile, as well as fatalities, wildfires can cause burns, decreased lung function, pulmonary inflammation, bronchitis, exacerbation of asthma, and exacerbation of cardiovascular diseases, such as heart failure.

How You Can Reduce Solar Farm Fire Risk

Given that fires at solar farms pose significant danger to environmental and human health, solar farm operators must do all they can to protect their renewables from fire risk. There are a few ways to stay safe from fire in addition to integrating fire suppression systems and fire risk assessments.

- Make certain independent third parties regularly test solar systems
- Integrate additional safety components at your solar panel farm
- Establish standardized quality assurance measures

- Replace defective or prematurely aged components

With the challenges of the solar supply chain and current solar prices, it's important to take action and prevent the worst-case scenario from occurring.