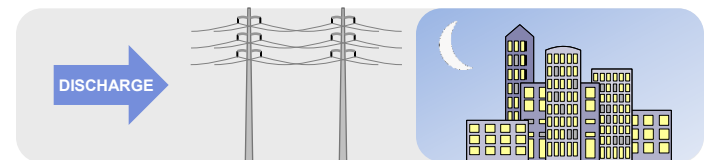


*RANCHO VIEJO PROJECT
Santa Fe County, NM*

Review of BESS Component



Joseph H Rowley

July 19, 2025

Joseph H Rowley – Credentials and Experience

- ▶ P.E. Mechanical Engineering, BS Chemical Engineering
- ▶ Various Management Positions with the IID Power Department
 - ❑ El Centro Unit 2 – 115 MW gas-fired combined cycle – in service 1993 – First CEC permitted utility power plant
 - ❑ System Operating Center – responsible for power grid operation and control
 - ❑ California ISO – contributing member of the team that created the CAISO's operating protocols
- ▶ Director – Project Development, Sempra Energy Resources
 - ❑ Elk Hills Power – 570 MW gas-fired combined cycle – in service 2003
 - ❑ Mesquite Power – 1,250 MW gas-fired combined cycle – in service 2003
 - ❑ Palomar Energy – 550 MW gas-fired combined cycle – in service 2006
- ▶ VP – Asset Management, Sempra Generation
 - ❑ Power Plant Operations – launched the organization, managed its initial 5 years
- ▶ VP – Project Development, Sempra USGP (U.S. Gas & Power)
 - ❑ Copper Mountain Solar – 458 MW solar PV – first 150 MW in service 2012
 - ❑ Mesquite Solar – 700 MW solar PV – first 165 MW in service 2012
 - ❑ ESJ Wind – 600 MW – first 156 MW in service 2014
 - ❑ Auwahi Wind – 21 MW + 5 MWh BESS – in service 2012
- ▶ Retired from Sempra in 2014 (began consulting work, including BESS development)



The BESS Industry Is in Its Early, Formative Years

- ▶ The BESS industry did not exist prior to 2011
 - ❑ BESS facilities did not exist in significant quantity prior to 2018
 - ❑ Consequently, the industry has little actual operating experience
- ▶ Codes and Standards are developed and revised in response to:
 - ❑ Actual operating experience and mishaps
 - ❑ Changing technology
- ▶ BESS codes and standards are behind and playing catch up
 - ❑ Due to lack of operating experience
 - ❑ Due to evolving BESS technology
 - ❑ e.g., NFPA 855, UL 9540 and UL 9540A
- ▶ Agencies that review BESS project siting should exercise caution
 - ❑ The performance and impacts of BESS facilities are not confidently predictable
 - ❑ In particular, battery fires due to thermal runaway is a major, unresolved issue



Large Scale BESS Pose Industrial Risk

- ▶ BESS do not store electricity
 - ❑ Rather, BESS convert electricity to chemical energy, and store chemical energy
 - ❑ Later, the chemical energy is reconverted back to electricity
- ▶ In terms of risk, BESS are akin to other forms of chemical energy storage
 - ❑ e.g., liquid fuel storage
 - ❑ However, a risk factor unique to lithium-ion BESS is thermal runaway
- ▶ Thermal runaway is an out-of-control chemical chain reaction
 - ❑ A reaction between battery chemicals releases heat
 - ❑ Heat accelerates the reaction, and the process feeds on itself
- ▶ Thermal runaway converts battery materials to a toxic airborne plume
 - ❑ Hydrogen fluoride, carbon monoxide, hydrogen cyanide, hydrogen chloride, fluorinated particulates, and heavy metals
- ▶ Proposed facilities posing such risk ordinarily conduct an OCA
 - ❑ Offsite Consequences Analysis based on plume dispersion modeling



Thermal Runaway Is an Inherent, Unresolved Risk

- ▶ Thermal runaway cannot be stopped by fire suppression
 - ❑ Water or foam blanketing are ineffective – cutting off oxygen does not work
 - ❑ Chemical agents such as Novec 1230 are ineffective (see 3M data sheet)
- ▶ Physical segregation of batteries is the only reliable measure
 - ❑ e.g., spacing between containers of 10 feet (see AIG bulletin)
 - ❑ This limits the quantity of battery material involved, so the fire burns itself out
 - ❑ Fire departments should plan on a single container burning for 24 hours or longer
 - ❑ To prevent propagation, the usual tactic is to spray water on adjacent containers
- ▶ BESS failure rates are proportional to facility size (expressed in MWh)
 - ❑ e.g., doubling the size doubles the number of points of potential failure
 - ❑ This is because BESS are modular at every level (battery cells, racks, containers)
- ▶ The worldwide annual failure rate is about 0.15 fires per 1,000 MWh
 - ❑ Per the Electric Power Research Institute (EPRI) failure rate graph



Rancho Viejo – Specific Issues

- A. The proposed Rancho Viejo site is not in an industrial setting
 - No municipal firefighting infrastructure is present
 - The nearest developed property is residential
 - The site is bounded by grasslands
 - A grassland fire may disrupt BESS cooling systems, triggering thermal runaway
 - Conversely, a BESS fire may spread to grasslands
- B. An OCA has not been prepared to assess offsite impacts
 - Because container pairs are planned only 3.5 ft apart, an OCA should assume that 2 containers are completely consumed by fire
- C. The proposed FK-5-1-12 suppressant is identical to Novec 1230
 - Per 3M, this suppressant “will not stop thermal runaway once initiated”
- D. The proposed 30,000 gallon fire water tank is inadequate
 - A 48-hour event involving a pair of containers would require about 900,000 gallons
 - Alternatively, a municipal water source would require 400 gpm at adequate pressure



Rancho Viejo – Specific Issues (continued)

- E. No retention basin to sequester firefighting water is proposed
- Firefighting water may contain dissolved and entrained toxins
 - A basin of about 900,000 gallons (plus freeboard) would be required
 - An “Environmentally Sensitive Area” is located immediately downhill of the BESS
- F. The proposed NCA lithium-ion technology is relatively unproven in large scale BESS application
- NCA batteries have a relatively low threshold for thermal runaway (about 150°C)
 - NCA batteries have a very high energy density (stability decreases with density)
- G. There is a major discrepancy in the proposed BESS size:
- 192 MWh as stated explicitly, or
 - 307 MWh, equaling 38 containers of 8.1 MWh each
 - The latter is a 60% increase in the expected failure rate, based on EPRI data
 - 138% over 30 years vs. 86% over 30 years
 - Failure rate may be higher due to the proposed NCA batteries
 - Failure rate may be higher due to the young age (2 yrs) of batteries in the EPRI database





Escondido Substation BESS Fire – September 5, 2024



Escondido Substation BESS Fire – Particulate Plume



Escondido Substation BESS Fire – Propagation Suppression



Escondido Substation BESS Fire – Media Coverage



Escondido Substation BESS Fire – Involved Container



Escondido Substation BESS Fire – Thermal Image



Fire at Neermoor, Germany Battery Storage Site