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Comment Opposing Approval of Vaca Dixon opt-in Application

See attachment.

Additional submitted attachment is included below.

Comment in Opposition to Vaca-Dixon Project - Applicant's conclusory representations are not sufficient to create a complete application

I. The applicant has not completed its application because there is insufficient explanation concerning the hazards of LFP Batteries.

The applicant represents that lithium iron phosphate batteries (LFP) are safer than lithium nickel manganese cobalt batteries (NMC). This representation is questionable and the source of this research and any conflicts of interest need to be examined.

Significantly, research in the UK found that **LFP batteries are more toxic and more flammable** depending on the state of charge. Note that "Researchers in the United Kingdom have analyzed lithium-ion battery thermal runaway off-gas and have found that nickel manganese cobalt (NMC) batteries generate larger specific off-gas volumes, while lithium iron phosphate (LFP) batteries are a greater flammability hazard and show greater toxicity, depending on relative state of charge (SOC)." See "How Safe are Lithium Iron Phosphate Batteries", PV magazine, April 10, 2024.

Specifically, "The composition of off-gas on average is very similar between NMC and LFP cells, but LFP batteries have greater hydrogen content, while NMC batteries have greater carbon monoxide content.

To assess the fire hazard of each chemistry, the researchers calculated and compared the lower flammability limit (LFL) of the off-gasses. They have found that LFL for LFP and NMC are 6.2% and 7.9% (in an inert atmosphere) respectively. Given the LFL and the median off-gas volumes produced, LFP cells breach the LFL in a volume 18% smaller than NMC batteries." See "How Safe are Lithium Iron Phosphate Batteries", PV magazine.

II. The application is incomplete because there is a failure to address and/or discuss in any detail alternative energy storage alternatives pursuant to the City of Vacaville's Policies (draft ordinance will be voted on at the City Council Meeting in March).

The application states it considers the following alternative technologies: compressed air energy storage (CAES), flow battery energy storage systems, flywheel battery energy storage systems, and hydrogen storage. The applicant has not considered specifically the following types of alternative batteries: Zink-Air, Iron-Air, Vanadium Redox Flow, Iron Flow, Solid State Graphene, and Sodium Ion Alternative Energies.

While LFP is considered "safer" compared to other lithium ion batteries, it's not immune to the threat of thermal runaway. In fact, recent studies have shown that LFP is prone to more flammable gas buildup and could increase the risk of explosions. More info below:

The Unique Toxic Threat of LFP

• **Hydrogen and Deflagration Risk:** The specific chemical makeup of LFP batteries produces a **greater percentage of hydrogen-based gases** during thermal runaway compared to other chemistries. (Source https://www.sciencedirect.com/science/article/pii/S2352152X24008739#sec4)

• **A Real Explosion Risk:** This higher hydrogen content introduces a significant and unique danger: a **greater risk of deflagration incidents** (a rapid, high-pressure burning/explosion). This risk is often

downplayed by the industry but is a major safety concern for nearby residents, employees and workers on site of the Corby Project and first responders.

• **Immediate Impact[i]:** The reality is that the burning of **even one container of LFP batteries** will trigger an immediate and disruptive **evacuation and/or sheltering-in-place order** for the surrounding community. Even if a worse-case scenario never occurs, emergency response plans need to reflect an abundance of caution.

For residents and businesses within the evacuation or shelter in place zone, this can have significant negative impacts. It can cause stress and anxiety, hardships of being evacuated and gives potential for the loss of home equity and financial stability. Businesses operating in the evacuation or shelter in place zones could also be negatively impacted by inconvenience of temporarily closing, the loss of income or wages leading to financial hardship, and negative stigma of their business.

3. Safety is a non-negotiable, site-independent priority that always outweighs financial concerns. Projects utilizing any large-scale battery chemistry, whether LFP or NMC, **can be sited safely away from communities** and still successfully tap into the existing transmission infrastructure. Another developer of a similar project, NextEra- states in their Corby Project application, it could be sited as far as 6.5 miles away and still be fully functional.

Additionally, there are other non-flammable technologies commercially available that could be used for this project. In the alternative analysis in the application, the developer fails to mention several points about flow batteries that make this project site not only feasible but a superior option for this location:

The Case for Flow Batteries at Vaca Dixon and why it should be considered to qualify as a complete application

1. Superior Asset Longevity (35-Year Life)

The Project's own analysis anticipates a **35-year design life**. Lithium-ion (LFP) batteries physically degrade with every cycle and typically require "augmentation" (replacing or adding new batteries) every 7–10 years to maintain capacity.

• **VFB Advantage:** Flow batteries do not degrade. The vanadium electrolyte maintains 100% capacity for 30+ years. Choosing Lithium-ion commits the site to three separate rounds of battery replacement and hazardous waste disposal over the project's life, whereas a VFB is a "buy once" permanent infrastructure asset.

2. Eliminating Fire Risk in Vacaville

The Vaca Dixon site is located near existing infrastructure and transit corridors where fire safety is paramount. Lithium-ion systems carry the risk of **thermal runaway**—a chemical fire that is nearly impossible to extinguish and releases toxic gases.

• **VFB Advantage:** The electrolyte in a flow battery is primarily water; it is **physically impossible for it to catch fire or explode**. By using VFBs, the project eliminates the need for complex fire suppression systems and high-risk emergency response planning, making it a "good neighbor" to the Vacaville community.

3. Future-Proofing for Long-Duration Storage

California's grid is rapidly evolving. While 4-hour storage (standard for Lithium) is useful today, the California Energy Commission (CEC) and CAISO are increasingly prioritizing **Long-Duration Energy Storage (LDES)** of 8–12+ hours to manage overnight renewable gaps.

Flow Batteries

- **Functionality**: Uses liquid electrolytes to store energy, allowing for scalable storage capacity.

  Applications: Suitable for long-duration energy storage and grid applications

• **VFB Advantage:** To increase duration in a flow battery, you simply add more liquid to the tanks. In Lithium-ion, you must buy entirely new battery racks. VFBs allow the Vaca Dixon site to adapt to California's future grid needs without a total hardware overhaul, providing 10+ hours of resilience that Lithium-ion cannot economically match.

a. True Sustainability & Circular Economy make VFB a more financially viable option

At the end of a Lithium-ion battery's 12-year life, it becomes a recycling challenge with limited material recovery.

• **VFB Advantage:** The vanadium electrolyte is **indefinitely recyclable**. At the end of the project's 35-year life, the liquid can be pumped out and reused in a new battery or sold back into the metal market. VFBs turn a "decommissioning cost" into a **recoverable asset**. This aligns with California's strict environmental goals and reduces the project's total carbon footprint.

Because VFBs do not degrade, they provide 100% of their rated power on Year 30 just as they did on Day 1. Lithium-ion projects see a steady decline in usable energy, meaning their revenue-earning potential shrinks every year.

Due to the total absence of fire risk (non-flammable electrolyte), VFBs can significantly lower the project's annual insurance premiums and fire-safety compliance costs compared to Lithium-ion.

While the initial price tag of Lithium is lower, the Total Cost of Ownership for a Vanadium Flow Battery is nearly 50% lower over the project's lifespan. For a long-term utility asset, VFBs represent the superior financial and safety choice for the community.

b. Land Use Efficiency: Quality over Quantity

While Lithium-ion is more compact, the 10-acre site is sufficient for a meaningful VFB deployment.

• **VFB Advantage:** Modern VFB designs (like Invinity's Mistral) are increasingly modular and stackable. It is better to have a **stable, safe, 35-year asset** that fits comfortably on 10 acres than a high-density system that requires constant maintenance, carries fire risks, and needs to be completely replaced every decade.

The Case For Sodium-Ion Batteries at Vaca Dixon:

Sodium-Ion Batteries are another Viable Alternative Battery without the high risk

- **"Sodium-Ion Batteries:** Represent a promising alternative to lithium-ion technology, particularly for stationary storage applications. Sodium-ion batteries offer several advantages:
- Abundant raw materials (sodium vs. lithium)
- Potentially 20% lower costs than LFP
- Enhanced safety characteristics
- Better performance at extreme temperatures
- However, current limitations include lower energy density (120-160 Wh/kg vs. 170-190 Wh/kg for LFP) and shorter cycle life (2,000-4,000 cycles). At least six manufacturers are expected to launch commercial sodium-ion production in 2025." See https://solartechonline.com/blog/renewable-energy-storage-guide/

According to the October 15, 2025 SolarTech on-line blog, "Sodium-ion batteries are entering commercial production with 20% lower costs than LFP, flow batteries are demonstrating 10,000+ cycle capabilities for long-duration applications, and emerging technologies like iron-air batteries promise 100+ hours of storage at costs competitive with natural gas plants. This diversification addresses different duration needs and reduces dependence on critical minerals." https://solartechonline.com/blog/renewable-energy-storage-guide/

Summary for CEC Decision Makers – The Applicant should Consider Viable Alternatives in Detail to Meet the Requirement of Considering Viable Alternatives

The goal of the Vaca Dixon Power Center should not be to cram the most batteries into 10 acres, but to provide the safest, most reliable, and most sustainable energy for the next 35 years. All Commercially available options should be considered, and specifically, Vanadium Flow Batteries or Sodium-Ion Batteries offer Vacaville a fire-safe, non-degrading solution that eliminates the waste and replacement costs of Lithium-ion, while perfectly aligning with California's long-duration energy future.

III. This application is incomplete due to the misrepresentation that there will be no significant environmental impacts of this Project.

It appears that the application has an inadequate discussion of noise from BESS facilities and toxics from thermal runaway as an environmental impact on sensitive receptors. Specifically, the applicant asserts that the operational noise will be minimal and there will be no stationary source of toxics. Aside from construction noise, BESS facilities make a constant noise and tend to disturb neighbors. Energy storage News notes in its article, *BESS noise has 'exploded as a concern' recently.*

> "BESS units primarily emit noise from their cooling systems, but balance of system (BOS) components like inverters and transformers also produce noise emissions. Growing deployments mean projects are being built nearer to populations and in more population-dense regions, creating potential problems for local acceptance."

Furthermore, the lithium-ion battery proposed for the project is unstable, and toxic gasses are produced when thermal runaway occurs (see above). The proposed BESS is near to neighboring

rural properties, a hospital, and businesses and facts in the real world must be presented in the application so that the CEC can issue a determination based on the facts rather than conclusory statements.

IV. The application misrepresents the socio-economic impact of the proposed project.

The applicant represents at section 6.3.3, that the project would cause no socio-economic impacts on the community, and it would not displace existing residents. As the project creates an industrial area backing up to neighbor's backyards, and it will emit noise, have a visual impact, and create the risk of thermal runaway, toxic gas, and fire, rural residents used to a country life-style would leave and property values would decrease. The applicant has submitted insufficient proof of its representation that there would be no impact.

V. **Conclusion**

For the above reasons, we request that the application be rejected as incomplete.

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[i] Note – The applicant represents in the application that there would be no significant environmental impact due to a conflict with any land use plan, policy, or regulation. As this proposed project is on agricultural land and business zoned land, an industrial use that makes noise, has a significant risk of exploding and/or undergoing thermal runway, there will be a significant impact.