DOCKETED

Docket Number:	23-ERDD-01
Project Title:	Electric Program Investment Charge (EPIC)
TN #:	254081
Document Title:	Antora Energy Comments Re Draft Solicitation Concept for Energy Storage Innovations to Support Grid Reliability, TN #253877
Description:	N/A
Filer:	System
Organization:	Antora Energy, Inc.
Submitter Role:	Applicant
Submission Date:	1/22/2024 4:45:37 PM
Docketed Date:	1/22/2024

Comment Received From: Antora Energy, Inc.
Submitted On: 1/22/2024
Docket Number: 23-ERDD-01

Antora Energy Comments Re Draft Solicitation Concept for Energy Storage Innovations to Support Grid Reliability, TN #253877

See attached file.

Additional submitted attachment is included below.

ANTORA
1244 Reamwood Ave
Sunnyvale, CA 94089
www.antoraenergy.com

January 22, 2023

California Energy Commission
Electric Program Investment Charge (EPIC) Program
Re: Draft Solicitation Concept for Energy Storage Innovations to Support Grid Reliability, TN #253877, Docket 23-ERDD-01

Comments from Antora Energy

Thank you for the opportunity to comment on Draft Solicitation Concept for EPIC's Energy Storage Innovations to Support Grid Reliability. Antora Energy commends the CEC's focus on accelerating the deployment of long-duration energy storage to support a zero-carbon grid, in addition to emphasizing the importance of non-lithium battery technologies that increase safety, minimize supply chain constraints, and lower the cost of energy storage.

About Antora Energy

Based in Sunnyvale, CA, Antora Energy manufactures thermal batteries that convert low-cost, intermittent renewable electricity into reliable, on-demand zero-emissions industrial heat and power. The company has received funding from the U.S. Department of Energy's Advanced Research Projects Agency-Energy and Industrial Efficiency and Decarbonization Office; the National Science Foundation; and the California Energy Commission. Antora is also backed by leading investors including Breakthrough Energy Ventures, Lowercarbon Capital, Shell Ventures, and BHP Ventures. At scale, Antora's products can eliminate gigatons of emissions while strengthening the U.S. manufacturing sector.

Question General-1 — Do the Project Groups described in Section IV.A address the primary objectives of the solicitation to enable more strategic and high-value implementation of energy storage to support grid reliability?

Roundtrip Efficiency & Stacked Benefits

Antora supports the goal of stacking energy storage system benefits to achieve a more reliable, zero-emissions grid. As noted in Section I, "Stacking multiple use cases within one energy storage system can increase the value proposition and revenue streams for these installations and benefit overall electric system reliability."

Section IV.A, however, imposes a requirement that inadvertently restricts the achievement of this goal. By limiting eligible projects to those with a "Roundtrip efficiency of >50% DC-DC," the draft solicitation limits the eligibility of low-cost, long-duration energy storage systems, especially those with dual outputs that can provide multiple benefits to ratepayers and multiple revenue streams for energy storage projects.

<u>50% Efficiency Threshold</u>

Many of the most promising long-duration energy storage technologies, such as thermal batteries and iron-air batteries, are characterized by ultra-low storage materials costs (thermal battery storage media, for instance, are often ~10x cheaper on a per-kWh basis than lithium-ion battery materials) as well as lower (<50%) round-trip efficiencies (RTEs). Despite these lower RTEs, these technologies' low costs enable them to compete with and even undercut lithium-ion batteries on LCOS.

The 50% DC-DC conversion efficiency requirement does not recognize that efficiency of a battery is implicitly included in its levelized cost of storage (LCOS). As calculated in the DOE Energy Storage Grand Challenge Cost and Performance Assessment, charging cost inputs are "inclusive of costs due to losses," ensuring that even systems with low round-trip efficiencies would still have to meet the same stringent LCOS requirements. *Crucially, systems with low round-trip efficiencies can have significantly lower LCOS than high-RTE systems when capital costs are low, as is the case in thermal battery systems.*

In the case of thermal batteries, for instance, storing electricity as heat can be orders-of-magnitude cheaper than storing it electrochemically, but converting that energy back into electricity incurs conversion losses typically in the range of 50-70%. *We urge the CEC to reconsider the 50% conversion efficiency threshold in order to recognize that lower-RTE systems can undercut high-RTE systems on LCOS, and thereby provide equal or larger benefits to ratepayers. If a conversion threshold is implemented, we recommend a 30% threshold.*

<u>Stacked Benefits</u>

Another key benefit of thermal batteries is their ability to output energy in the form of both heat and power. Their ability to output heat (in addition to power, as keeping with the requirements of the draft solicitation) provides critical decarbonization and ratepayer services, including (a) decarbonizing the 24/7 process heat loads of industrial facilities using only intermittent renewable or grid electricity, (b) serving as a fully flexible load that can rapidly flex up or down to help balance the grid, including using zero energy during times of peak demand, (c) reducing or eliminating local air pollution at industrial facilities by displacing onsite fossil fuel combustion, benefiting surrounding (and often disadvantaged) communities, and (d) deferring or eliminating the need for transmission investment by only using power when it's cheap and abundant.

Thermal batteries' ratepayer and decarbonization benefits are often most economically achieved in a behind-the-meter configuration. In such a configuration, thermal batteries can eliminate the peak-power loads of industrial facilities, reduce local air pollution, lower industrial energy energy costs, and provide significant additional grid benefits including many of those outlined in Section I: "behind-the-customer-meter load management, backup power, and demand response."

The benefits of dual-output energy storage systems strongly align with the goals of the EPIC program and California's GHG reduction targets and local air quality improvement goals. By providing two forms of energy output, certain thermal battery installations can also secure multiple revenue streams, increasing the competitiveness of this critical energy storage technology. In addition, dual output operation increases the efficiency of the system, as thermal outputs have high round-trip efficiencies, typically around 90%.

We urge the CEC to consider the full potential of energy storage system benefits by ensuring that any requirements (such as the draft "electricity in – electricity out" requirement for Group 2 projects) recognize that eligible systems may output other forms of useful energy in addition to electricity, and that the grid benefits provided by such configurations are fully considered. In addition, we support the CEC's recognition of the immense grid benefits of fully behind-the-meter systems.

TRL Requirements

In order to maximize the impact of this funding, we suggest expanding the range of technology readiness levels (TRLs) eligible for Group 1 and Group 2 projects as follows:

Group 1 TRLs

Technologies with a higher overall TRL may have subcomponents or subsystems that require additional development in order to improve overall product performance, enhance system safety, lower cost, and/or improve sustainability. R&D funding for low-TRL (TRL 3-4) subcomponents or subsystem technologies that would be part of a system with a higher TRL (up to TRL 7) should be eligible for Group 1, as the same project parameters would apply with a similar benefit to ratepayers and technology advancement.

Group 2 TRLs

1244 Reamwood Ave
Sunnyvale, CA 94089
www.antoraenergy.com

Demonstrating the stacked benefits of a Group 2 system requires not just product innovation, but also innovations in areas such as controls, integration, and demand response, as well as interaction with regulations and customer requirements. Even existing early-stage products will be challenged by addressing these stacked benefits in a real-world context, and slightly more mature technologies would strongly benefit from the activities funded by this program. We therefore suggest that the Group 2 eligibility be expanded to include projects at a TRL of 7.

Question Group 1-2 — What level of analysis would an applicant be able to provide to demonstrate supply chain sustainability improvements of a proposed innovation?

The type of analysis needed to demonstrate supply chain sustainability improvements varies widely depending on the materials and manufacturing processes used. We believe that this should be an open response for applicants to complete based on the specifics of their proposal, with an opportunity to provide the information and data to support their claims. Adding specific required analyses may risk over-generalizing across very different projects.

Question Group 1-4 — What emerging technologies can be demonstrated to further reduce energy storage safety risks?

Thermal batteries greatly reduce or eliminate the safety risks associated with energy storage systems. Since energy is stored as heat in a stable solid material, there is no risk of leakage or of materials entering the outside environment. Storage media consist of nontoxic, noncombustible, basic materials such as rocks, sand, bricks, and graphite, and insulation keeps the stored heat within the containerized system. *Critically, because the energy is stored as heat instead of electrochemical bonds, there is no risk of thermal runaway or combustion. This means that they pose less fire risk to the surrounding environment than electrochemical batteries.*

R&D activities into key components of thermal batteries will help accelerate the technology's commercialization, including for earlier-TRL applications and configurations. As such, Group 1 activities can help drive down costs and improve performance of these safe, reliable, and flexible systems.

Question Group 1-6 — Should there be separate qualifications or target metrics for short-duration and long-duration storage within Group 1?

As discussed in Question General-1, long-duration storage requires different considerations for round trip efficiency.

ANTORA
1244 Reamwood Ave
Sunnyvale, CA 94089
www.antoraenergy.com

Question Group 1-7 — Should real-world field demonstrations be required or optional for Group 1 projects?

Real-world field demonstrations should be optional for Group 1 projects, as R&D in large-scale energy storage systems requires significant resources that would limit the feasibility of field demonstrations given the budget and timeline laid out in this draft solicitation.

Question Group 2-1 —Is a four-year project timeline feasible for Group 2 projects to meet the objectives of the solicitation? Are there any potential barriers or challenges in implementing these types of projects over four years?

While the four-year project timeline is feasible for Group 2 projects to meet most of the objectives of the solicitation, interconnection remains a major barrier for implementing these types of projects over four years.

Thank you for your consideration,

Haley Gilbert

Haley Gilbert
Head of Business Operations
Antora Energy