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Renewell Energy Response to â€œEnergy Storage Innovations to Support Grid Reliability Conceptâ€

Additional submitted attachment is included below.

Response to EPIC Draft Solicitation Concept for Energy Storage Innovations to Support Grid Reliability

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Docket #: 23-ERDD-01

Who We Are:

Renewell Energy ("Renewell") has developed an innovative technology that converts idle or abandoned O&G assets into energy storage systems (ESS) that exploit the gravitational potential energy embodied in a vertical well. Gravity Well (GrW) installations range from 30–200 kWh depending on the depth and diameter of the wellbore and the mass of the weight being moved within the wellbore. Deploying Renewell's GrW systems in just one-third of currently inactive oil and gas wells in the U.S. would create ~132GWh of flexible energy storage with zero self-discharge. By coordinating multiple GrWs to act in series or parallel, Renewell's system can provide both short duration storage in today's markets and the long duration storage needed for renewables to exceed a 35% market share, all while delivering considerable electrical infrastructure cost savings. The research and learning opportunities available in a Group 2 project will enable Renewell to deliver both economically competitive and environmentally safe energy storage capacity to the growing ESS market while simultaneously eliminating 10.7 MMT CO2e/year over the system lifetime.

General Question Responses:

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?

Yes. The EPIC Energy Storage Innovations to Support Grid Reliability draft solicitation concept succeeds in its objective of enabling strategic and high-value implementation of new energy storage technologies. The funding levels, project timelines, and required storage amounts (100 kWs; Group 2) are all feasible with the scope of funding available for companies at the technology readiness levels (TRLs) listed for each group. We appreciate the inclusion of climate-related emission reduction as a scored benefit, as well as the emphasis on building an equitable future for disadvantaged and low-income communities.

2. In addition to the target performance metrics outlined in Section IV.A regarding LCOS, calendar life, and roundtrip efficiency, what other metrics should be reported?

When devising performance metrics on which to score success of validation, emphasis is often placed on metrics related to achieving desired storage amounts and efficiencies. For mechanical storage applications, however, these factors often aren't the primary technical barriers to large scale application. We have found technoeconomic metrics, specifically those quantifying what a change in a subsystem (wire rope, winch, suspended weight material, etc.) means for CAPEX, OPEX, and subsystem lifetime, are actually more beneficial in determining market feasibility of an energy storage technology. Testing to quantify and extend the lifetime of a subsystem in a real field environment, reduce the physical footprint

of a system, or validate a failsafe, is often just as, if not more, important to validate financial metrics and enable accelerated deployment and further private investment. Thus, as this funding is intended to help solve technical barriers, specific metrics for success should be discussed on a technology to technology basis.

Our Gravity Well system, for example, currently takes up 80 feet of space, which limits its available markets. We could build out a system that would lower that footprint to 10 ft, however, it would entail validating a different type of winch, and thus testing a new subsystem. We would also benefit from comparing the increased wire rope wear, and thus increased OPEX associated with this new subsystem, against the CAPEX savings of the design. In general, the soundness of the technology should be assessed before the award is granted and individualized data and metric requirements should then be devised for the technology's specific barriers.

3. CEC is considering releasing this funding opportunity as a two-phase solicitation that includes a Pre-Application Abstract phase and Full Application phase. Projects that are successful in the Abstract phase will have two months to prepare a Full Application. Is this approach preferable to applicants or should the CEC consider a one-phase solicitation without the Pre-Application Abstract phase?

A two-phase solicitation is beneficial in guiding small companies in allocating their time only toward the opportunities that best fit their technology. A full application can be time consuming, so having an initial abstract phase benefits both the applicants and reviewers.

A two-phase solicitation is not preferable only if it significantly extends the review and award timeline.

4. Are the draft funding levels and match requirements appropriate to achieve the desired outcomes of each Group?

The draft funding levels and match requirements are appropriate and well-aligned with their respective technology demonstration sizes.

Group 1 Question Responses:

We are in a stage more aligned with a Group 2 application, however, we have previously installed Group 1 level technology demonstrations and will provide our insights as applicable.

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

A three year project timeline is definitely feasible. The largest opportunities for timeline setbacks tend to be niche part lead times and permitting related to installations. In early 2023, for example, we had a

winch lead time exceed 9 months and several other smaller part lead times exceed 3 months. Even with similar lead times, 3 years is enough time to fully achieve the Group 1 project goals.

2. What level of analysis would an applicant be able to provide to demonstrate supply chain sustainability improvements of a proposed innovation? For example, could Energy Storage Innovations to Support Grid Reliability applications be expected to describe the source and lifecycle impacts of relevant materials, ethics or workforce implications, and/or manufacturing scale-up capabilities?

For mechanical systems, early stage companies are often reliant on third party vendors when building and sourcing parts. It would likely be possible to build out a brief assessment of a company's current supply chain sustainability, but that third party dependence might pose a barrier in predicting specific future sustainability improvements. Manufacturing scale-up can be modeled at this stage. Large scale ethics and workforce implications can be discussed in the macro sense, but specific metrics might be difficult to provide.

3. What data would be useful to gather and publish to validate technology improvements and accelerate commercialization?

The most beneficial data to any technology will differ, so data requirements should be developed on a technology-to-technology basis.

4. What emerging technologies can be demonstrated to further reduce energy storage safety risks?

No comment.

5. Are there additional energy storage applied R&D or innovation opportunities not captured by this Group 1 concept?

No comment.

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

Current market metrics (CAPEX, LCOS, etc.) for short duration and long duration systems do differ, so that should be taken into consideration when evaluating energy storage systems. For flexible systems that can fit within both the long and short duration markets, applicants should be able to choose whether they want to be considered short or long duration and should be scored on those criteria.

7. Should real-world field demonstrations be required or optional for Group 1 Projects?

Real world field demonstrations are valuable.

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?

A four year project timeline, including at least one year of operation, is definitely feasible. The largest opportunities for timeline setbacks tend to be niche part lead times and permitting related to installations. IEven with similar lead times or unexpected supply chain issues, 4 years is enough time to fully achieve the Group 2 project goals.

2. Are there any use cases missing from Table 1 that should be included?

Table 1 appears to be representative of most relevant use cases.

3. What are some examples of innovative use cases for commercial Li-ion batteries that are worth exploring in this solicitation?

No comment.

4. Is the minimum scale of demonstration (>100 kW capacity) reasonable?

Yes. 100 kW capacity is definitely achievable within the time and budget constraints outlined within the draft solicitation, especially considering that applicants can install multiple systems of smaller capacity to achieve the total capacity requirement,

5. Do the Group 2 requirements sufficiently encourage projects to be in and benefitting disadvantaged communities, low-income communities, or Native American tribes?

Yes. We commend the commitment to using these energy storage demonstrations as an opportunity to build an equitable future for disadvantaged and low-income communities. Some ways to quantify the impacts are to 1) look at the Justice40 maps of potential installation sites and 2) evaluate the ease of job transition and/or creation in installation areas, for a proposed technology. Some factors to consider might be utilizing translatable skills without need for further training and new jobs within driving distance of old fossil fuel roles.

6. To maximize the impact and benefits of Group 2 demonstrations, what partnerships are most critical?

For Renewell specifically, our most critical partnerships are with CALGEM and with county permitting offices around CA. These two bodies can rapidly increase or decrease the rate at which we can deploy our gravitational energy storage across CA.

7. What barriers and opportunities exist for partnerships with utilities or other stakeholders to demonstrate transmission or distribution-connected energy storage use cases?

One barrier to demonstration of new energy storage technologies, and thus opportunity for valuable partnership, lies within CA permitting. When attempting to install a new system without a UL listing, early stage companies often encounter a chicken and egg situation. Installation for demonstration requires a civil and electrical permit, where the electrical technology is typically approved due to its UL listing. A demonstrated installation, however, is often necessary in order to get a UL listing, and even if one could get a UL listing prior to first installation, when the design is still iterative, it often does not make sense financially for a small company to go through that listing process for each iterative design. This results in timeline delays and significant back and forth between the company and the permit office while individualized review and requirements are developed on the fly. Building out a “demonstration” category into California’s electrical and civil permitting framework with clear submission requirements would significantly streamline the permitting process and allow teams to achieve the same demonstration goals under shorter timelines.

8. What data would be useful to gather and publish for measurement and verification purposes and to inform bankability and replicability?

While useful data is technology-specific, physical metrics that can further inform system modeling, such as system wear vs. operation cycles, or efficiency vs. a wellbore’s dogleg severity, are of the most use to us. While we have means of digitally modeling our systems in detail, having specific inputs from field operation allows us to further refine these technical and financial models to a point where we can confidently replicate a digitally tested system and achieve its predicted lifetime and financial metrics in the field.

9. Is the 12-month minimum demonstration period requirement reasonable for Group 2 projects?

Yes.