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Irrigation Permanent Load Shift

Additional submitted attachment is included below.

CALIFORNIA ENERGY COMMISSION

ELECTRIC PROGRAM INVESTMENT CHARGE 2021-2025 (EPIC 4)
RESEARCH CONCEPT PROPOSAL FORM

The CEC is currently soliciting research concept ideas and other stakeholder input for the EPIC 4 Investment Plan. For those who would like to submit an idea for consideration, we ask that you complete this form and submit it to the CEC by 5:00 p.m. on **July 2, 2021**.

To submit the form, please visit the e-commenting link, https://efiling.energy.ca.gov/Ecomment/Ecomment.aspx?docketnumber=20-EPIC-01, enter your contact information, and then use the "choose file" button at the bottom of the page to upload and submit the completed form. Thank you for your input.

1. Please provide the name, email, and phone number of the best person to contact should the CEC have additional questions regarding the research concept:

   David Meyers
   415.722.2261
   dmeyers@polarisenergyservices.com

2. Please provide the name of the contact person's organization or affiliation:

   Polaris Energy Services

3. Please provide a brief description of the proposed concept you would like the CEC to consider as part of the EPIC 4 Investment Plan. What is the purpose of the concept, and what would it seek to do?

   Permanent Load Shift of Irrigation Pumping Load. The purpose is to characterize and quantify the potential to permanently shift pumping load from constrained hours (ramp, high-carbon, expensive) to those when renewable energy is plentiful. Specifically, the concept seeks to address load that cannot be shifted with the addition of automation and optimization of operations but requires capital infrastructure. The concept would, additionally, implement and test one or more of the solutions identified by the researchers and agricultural energy users. It should fully fund these demonstration projects, such as reservoir storage, canal storage and hydraulic system capacity upgrades to provide references and proof points for energy users who will need to co-invest in an incentive program to emerge from the research.

4. In accordance with Senate Bill 96, please describe how the proposed concept will **"lead to technological advancement and breakthroughs to overcome barriers that prevent the achievement of the state's statutory energy goals."** For example, what technical and/or market barriers or customer pain points would the proposed concept address that would lead to increased adoption of clean energy technologies? Where possible, please provide specific cost and performance targets that need to be met for increased industry and consumer acceptance. For scientific analysis and tools, what data and information gaps would the proposed concept help fill, what specific stakeholders will use the results, and for what purpose(s)?

   It is generally understood that shifting irrigation pumping load from peak hours can be achieved by pumping from wells to storage facilities (reservoirs, canals, etc.) during off-peak hours and delivering to crops using smaller, lower-capacity pumps AND/OR by increasing the hydraulic capacity of irrigation systems to deliver the water required by crops during off-peak hours. There is, however, no standardized methodology for measuring permanent load shift opportunity, nor are there well-understood and quantified solutions, nor is there a system of incentives to induce energy users to upgrade their systems.

   A clear parallel of what is missing and what the concept would seek to develop is the program for replacing constant-speed motors with variable speed drives (VSD). In that case, there are standardized pump tests to measure baseline efficiency, an understanding of the efficiency gains provided by VSD, and an incentive structure that motivates energy users to upgrade their equipment while providing commensurate system benefits to the grid.

   Developing these tools and quantifying the costs and benefits of irrigation system upgrades for Permanent Load Shift using a variety of technologies would enable utilities to implement programs—at the direction of the CPUC—to permanently shift as much of the 2 GW of irrigation pumping load as possible that cannot be achieved operationally and is accessible at a reasonable cost.

   The incentive structure emerging from the research would need to account for alternatives to load shift, such as battery energy storage, as a ceiling for incentives.

5. Please describe the anticipated outcomes if this research concept is successful, either fully or partially. For example, to what extent would the research reduce technology costs and/or increase performance to improve the overall value proposition of the technology? What is the potential of the technology at scale?

   If the concept is successful, pumping water from wells for irrigation in California during peak demand hours should virtually disappear and the 'duck curve ramp' problem is reduced by 1-2 GW, in tandem with operational load shift. Component technology costs—pumps, hydraulic systems, water storage—will not be reduced individually but

the ability to efficiently define costs and benefits for Permanent Load Shift projects will enable utilities to offer and customers to take advantage of these opportunities.

6. Describe what quantitative or qualitative metrics or indicators would be used to evaluate the impacts of the proposed research concept.
    1. Quantification of Permanent Load Shift benefits to account for seasonal and annual variability, the useful life of equipment and infrastructure and the commensurate grid benefits are developed.
    2. The number of megawatts and MWh shifted during and following the project.
    3. The decarbonization impact of shifted load.
    4. The locational benefits of shifted load.
    5. Customer co-investment in PLS projects vs. incentives as a share of total project cost.

7. Please provide references to any information provided in the form that support the research concept's merits. This can include references to cost targets, technical potential, market barriers, etc.

    The final report for EPC-16-045 provides extensive analysis of the costs and benefits of shifting irrigation pumping loads. Those metrics apply to this concept with two caveats/additions:
    1. That report contemplated operational load shift while this concept complements the operational opportunity with capital upgrades to address that load which cannot be addressed operationally. The overall cost of shifting irrigation pumping load from peak hours will be the weighted average of the two efforts.
    2. That report discussed improvements to DR programs and pricing mechanisms for operational shift. In the case of Permanent Load Shift, no market or program exists and the goal of this concept is to spur one's creation.