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## SolarCity Comments EPIC 2018-2020 Investment Plan Initiatives (5)

*Additional submitted attachment is included below.*

CALIFORNIA ENERGY COMMISSION
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The Energy Commission is currently soliciting ideas and stakeholder input for the 2018 – 2020 EPIC Triennial Investment Plan. For those that would like to submit an idea for consideration in the 2018-2020 EPIC Triennial Plan, we ask that you complete the form below. Submittals are due by **5:00 p.m. on February 10, 2017.**

**Part 1. Initiative Description and Purpose:**

1. Please provide a brief description of the proposed initiative:

Develop a study that identifies the absolute and relative costs and benefits of deploying electric resistance, heat pump, and natural gas water heaters under various consumption and water heater control profiles. Specifically, evaluate intelligently controlled or grid enabled electric resistance as well as heat pump water heaters to determine their performance using California's Time Dependent Valuation (TDV) metric, greenhouse gas emissions (GHG) and the total cost of ownership. Water heaters can be evaluated under numerous water heating and gross home consumption profiles and could also include comparing electric water heaters to natural gas water heaters as the baseline case.

2. What technical and/or market barriers would the proposed initiative help overcome? For scientific analysis and tools, what knowledge gaps would the proposed initiative help fill?

In order for California to meet its greenhouse gas (GHG) goal of reducing emissions 80% below 1990 levels by 2050, analysis by Energy + Environmental Economics (E3) shows that it will likely be necessary to switch building end uses – particularly water heating and space heating – from natural gas to electricity. One possible means to achieve both strategies simultaneously would be to deploy technologies that replace natural gas use with electricity and that can be operated in a flexible manner in order to absorb and integrate renewable resources. In considering which technologies to deploy there will likely be tradeoffs between cost, value, and GHG emissions abatement. For example, an electric resistance water heater that is paired with rooftop solar and intelligently controlled such that it operates primarily from solar might be less efficient than a heat pump water heater, but it could nevertheless offer greater GHG reduction at a lower cost. Thus, in formulating strategies to meet the state's long-term carbon reduction goals, it would be helpful for policymakers to have data on the relative cost and benefits of intelligently controlled electric resistance and heat pump water heaters compared to natural gas water heaters from the standpoint of carbon emissions, customer economics and grid benefits.

**Part 2. Benefits and Impacts**

3. If this initiative is successful, either fully or partially, what would be the expected impact? Who are the primary users and/or beneficiaries?

Help policymakers understand the impact of electrifying building end uses and potentially devise upfront incentives that may be necessary in order to drive customer adoption. Furthermore, help policymakers understand the differences between natural gas and electric water heating and how cost effectiveness standards can be taken into consideration when evaluation various technology options to meet the state's greenhouse gas (GHG) emissions reduction goals.

4. Describe what quantitative or qualitative metrics or indicators would be used to evaluate the impacts of the proposed initiative:

Evaluate CA residential load data and water heater consumption profiles and correlate the two.
Utilize potential different types of water heaters schedules that are intelligently controlled and test these on hardware.
Utilize a lab setting to install water heaters and test different scenarios.
Performance of various water heater technologies could be evaluated by analyzing cost of ownership given CA utility rate model, analyzing Title 24 time dependent valuation (TDV) value of each scenario using CEC 2016 methodology, and analyzing greenhouse gas (GHG) emission each scenario using publicly available models.

5. Please provide a list of peer-reviewed references that support the responses for questions 3 and 4. Proposed initiatives that include peer-reviewed references will be given stronger consideration.

Last year, Brattle Group released a report that revealed that advanced strategies of using electric water heating to provide ancillary services, store thermal energy on a daily basis, or adopt heat pumps can provide significant value to the electric power grid. Report available at http://www.brattle.com/news-and-knowledge/news/report-by-brattle-economists-finds-electric-water-heaters-can-provide-economic-and-environmental-benefits
In order for California to meet its greenhouse gas (GHG) goal of reducing emissions 80% below 1990 levels by 2050, analysis by Energy + Environmental Economics (E3) shows that it will likely be necessary to switch building end uses – particularly water heating and space heating – from natural gas to electricity. In addition, E3 recommends a strategy of deploying "flexible loads," in order to integrate intermittent zero-emission resources, like wind and solar power. California Pathways GHG Scenario Results, by Energy and Environmental Economics. April 6, 2015. https://ethree.com/documents/E3_PATHWAYS_GHG_Scenarios_Updated_April2015.pdf

6. (For technologies only) What competitive advantages does the proposed technology solution have over current benchmark technologies? If the technology is beyond the prototype stage, what strategies do you suggest to bring to scale?

As the Brattle Group study demonstrates, grid enabled electric water heating can provide net benefits. In particular, grid enabled electric water heating technologies are available today and have the potential to serve as an additional grid asset to provide grid services for customers.

**Part 3. Connection to Energy Commission's EPIC Framework**
Energy Commission staff have developed a draft strategic framework to guide the CEC's planning and implementation of EPIC across triennial investment cycles. One of the objectives of the draft strategic framework is to communicate a consistent set of priorities for organizing current and future EPIC investments.

7. Please indicate which of the following strategic framework themes you feel the proposed initiative best fits within:
    - Advance Technology Solutions for Deep Energy Savings in Building and Facilities
    - Accelerate Widespread Customer Adoption of Distributed Energy Resources
    - Increase System Flexibility from Low-Carbon Resources
    - Increase the Cost-Competiveness of Renewable Generation
    - Create a Statewide Ecosystem for Incubating New Energy Innovations
    - Maximize Synergies in the Water-Energy-Food Nexus
    - Develop Tools and Analysis to Inform Energy Policy and Planning Decisions
    - Catalyze Clean Energy Investments in California's Underrepresented and Disadvantaged Communities

If Other, Please Specify

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