

## DOCKETED

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## **Requesting funding for applications that enable the use of solar in charging electric vehicles**

This feedback is with regards to the proposed funding areas in "Development of the California Energy Commission Electric Program Investment Charge 2018 - 2020 Triennial Investment Plan". We would like to request the inclusion of a topic that is currently not in the plan but is a technology area that could be very impactful for the program.

We would like to see the inclusion of funding for technological innovation that drives the use of solar for charging electric vehicles. Specifically, we are developing a EV charging system that is attached to the vehicle and can generate over 25 miles of charge per day using solar. Many car manufacturers are also working to incorporate solar in the EV as show below:

- Toyota is rolling out a 2017 "Prius Prime" with a solar roof option in Japan.

Link: <http://www.digitaltrends.com/cars/toyota-prius-prime-solar-roof/>

- Tesla has announced partnership with panasonic to include solar roof option in tesla model 3.

Link: <https://electrek.co/2017/02/28/tesla-model-3-solar-roof-panasonic/>

- Elon Musk has tweeted that they are also working on a solar charging system attached to Tesla model 3 that is an expandable option generating much more energy density

Link: <https://twitter.com/elonmusk/status/794580586379624448>

Clearly, car manufacturers are seeing value in the inclusion of solar on Electric Vehicle to provide additional charge to the car and increased driving range.

Such a technology can not only benefit the EV manufacturers but it can also help CEC attain many of its key goals: The adoption of zero emission vehicles, the increased use of renewable and DERs and the stabilization of the grid as detailed below:

(1) Greater Adoption of EV: Range anxiety has been a key concern for EV owners and is an issue that has impacted the adoption of EVs. The limited range of the EVs in the market today coupled with the lack of EV charging infrastructure has kept many people away from purchasing an EV. Enabling solar based charging solutions can increase the range of an EV (25 additional miles per day using our technology) and provide charging even when there is not a charge stations available mitigating range anxiety for a EV owner. This technology can help CEC attain the goal of 1.5 million ZEVs by 2025.

(2) New Applications/Markets for Solar: As indicated in your solicitation "Continued growth of renewables will become difficult as resource locations become fewer, costs to integrate become higher, and the market for rooftop PV begins to saturate". This technology creates a new application for Solar that is aligned with CEC's mission to drive continued growth of solar via new markets. Each charger in this technology has ~2 kW of solar, very close to what is deployed in many residential solar application. Hence as markets for rooftop PV begin to saturate, the proposed technology can open new applications and markets for solar. Highlighted below are notes from the CEC presentation:

Renewable generation capacity tripled between 2001 and 2016

â€¢ Onshore utility-scale wind, utility-scale solar PV and rooftop solar PV has led this increase

â€¢ Continued growth of renewables will become difficult as resource locations become fewer, costs to integrate become higher, and the market for rooftop PV begins to saturate

â€¢ This theme focuses on technology advancements needed to open new market opportunities for renewables:

â€“ Increase the economic potential of renewables within in California

â€“ Enable renewables to compete in grid service markets

â€“ Develop technologies whose unique attributes can create new uses and markets for renewables

(3) Accelerate Widespread Adoption of DERs: This solar based EV charging system (which incorporates ~2kW of solar and the EV battery storage) can act as a DER. Such an application allows the dual use of the battery since the energy generated from solar can be (a) stored in the battery and used for driving the EV or (b) it can be potentially be used to modulate the supply demand balance on the grid when it is connected to the grid. In addition, since the cost of the battery is already priced into the price of the EV, this DER is much more cost competitive compared to traditional DERs. If this technology is enabled, it will directly address the theme 2 in the proposed triennial plan: "Accelerate Widespread Consumer Adoption of Distributed Energy Resources".

(4) Smart Grid Technology: A lot of resources is being invested to enable smart grid. This is an alternative innovative technological approach to achieve the same end goal of a stable grid. One of the key issues with the addition of renewables on the grid has been the intermittency of the grid and issues with the duck curve. CEC is attempting to address this by multiple ways in the triennial plan. Enabling such solar based EV technologies will reduce the surplus solar generation during the day since these systems will be charged off grid as the car is sitting in the parking lot. Such systems will also reduce the large loads increasingly seen on the grid in the evenings as EV's are plugged into the grid at home just when solar generation falls off. Such a system acts to cushion the effect of increasing solar and EV usage has on the grid.

In summary, we believe enabling innovation in the use of Solar for EV applications can meaningfully impact multiple CEC goals all in one shot. We sincerely urge the CEC to include this topic in the triennial investment plan.