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Additional submitted attachment is included below.

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Jamie Patterson
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Dear Mr. Patterson and CEC Staff,

Subject: Modeling Tools RFC, Docket No. 16-EPIC-01

We appreciate the opportunity to respond and provide input to the *Draft Solicitation on Modeling Tools to Evaluate Distributed Energy Resources (DERs) and Microgrids located behind the meter on California's Modern Distribution Systems*. This timely solicitation supports an exciting area that requires continued investment and growth to support the modernization of electric utilities. In regards to CEC staff's particular questions:

Question 1

Proposed funding amounts are in line with the work requested. In addition, CEC staff should consider what the long-term goals of this program might be (beyond this funding effort) to help drive the particular software deliverables that might emerge. For example, if the goal is to drive towards a thriving open-source community, more emphasis could be placed on developing modular software frameworks with well-defined interfaces that allow for future expansion into additional planning areas. If the goal is shorter term, then more emphasis should be placed on the specific use cases, which will tend to drive developers towards single application outcomes with greater use case progress but less flexibility. Each approach has it strengths and weaknesses, but we believe that the former will provide greater long-term benefits to the State of California and its utilities by laying the framework for a robust open-source development community in this space.

Question 2

Groups 2 and 4 refer to "desktop environments", but it is unclear what constitutes a desktop environment in this context. We would suggest that "web-based applications" also be considered as the software industry continues to adopt and grow this type of application at a rapid rate, and browser-based applications tend to reduce cross-platform issues. Considerations could be made to limit data and model transfer to alleviate concerns related to data privacy, such as requiring the ability to host a local instance of the software.

In Group 3, we would suggest expanding high-performance computing (HPC) beyond graphics processing units (GPUs) and allow for additional low cost solutions. Overall, the intent is good, but limits the potential solution space by disallowing solutions that use desktop HPC (e.g., 8-16 core workstations), cloud computing for massively parallel runs, or intelligent multi-threading, among a whole host of others. GPU solutions also tend to be very specialized (whereas CPU solutions can often be represented as libraries), potentially requiring significant restructuring of the software application to support the GPU solutions. While GPUs are definitely a viable option, we would suggest being open to other possibilities.

Question 3

There are certainly a large number of ongoing complementary efforts, most of which CEC staff are likely aware of. Of interest may be the DOE Grid Modernization Initiative and Laboratory Consortium, which just completed its first year: https://energy.gov/under-secretary-science-and-energy/2017-grid-modernization-initiative-peer-review . The "Design and Planning Tools" section potentially has complementary (not competing) efforts that might be investigated for future collaboration.

Question 4

In regards to forcing tools into the open source, we would suggest a more measured approach that allows for both open-source development, particularly of the underlying frameworks, while still allowing businesses to develop proprietary additions. This can take a number of forms, but the most important is making room for optional proprietary extensions, allowing companies to extend and develop the software beyond the current funding amounts with their own business justifications. Licensing rules can be made to require core improvements be made back to the

open source, while still allowing developers to keep certain elements proprietary (e.g., control algorithms). Note, this is similar to the Red Hat Enterprise Linux business model – Red Hat Enterprise contributes significantly to the open-source Linux kernel, but also sells a proprietary product with extensions, wrappers, and interfaces – but varieties of other open-source business models also exist. Those developing proprietary extensions would maintain their source code in private repositories, derived from forks or branches of the public repositories on GitHub. Proprietary extensions would also support standard interfaces to the extent possible, such as CIM, MultiSpeak, OpenFMB, FMI, etc. Both mechanisms would leverage public investments, by ensuring that proprietary extensions remain compatible with the public core software. We would suggest that CEC staff consider a wide variety of open-source solutions, rather than forcing all pieces of all software into the open source.

Question 5

This is a great question. Of immediate need is more advanced models, including those that deal with the behavior of humans as they interact with the energy system. For example, it is (relatively) easy to model a battery storage system and therefore an electric vehicle (EV) charging system. However, it becomes much more difficult to model how that EV moves throughout the system (or how groups of EVs move through the system) and charge at different locations (e.g., home versus work), especially when considering tariff changes that might be designed to encourage greater charging during high solar periods. How would customer A change their charging and consumption pattern versus customer B under two different tariff scenarios? Additionally, commercial and small industrial systems represent a large fraction of dynamic load capabilities, but are under-represented in the grid modeling tools; more advanced, grid-focused models are needed to better represent those capabilities, especially under evolving tariffs and dispatch signals.

Again, we thank Mr. Patterson and the CEC staff for allowing us to provide additional comments. If additional information is needed, please do not hesitate to contact us.

Sincerely,

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