STATE OF CALIFORNIA
EPIC TRIENNIAL INVESTMENT PLAN 2015-17
Proposed Energy Research Initiative
Questionnaire

CALIFORNIA ENERGY COMMISSION

(This is a Request for Information only - Complete Pages 1 and 2 for each initiative)

Title of Proposed Initiative (Short and concise): Smart Grid Modeling

Investment Areas (Check one or more) – *For definitions, see First Triennial Investment Plan, page 12*:

☒ Applied Research and Development
☒ Technology Demonstration and Deployment
☐ Market Facilitation

Electricity System Value Chain (**Check only one**): *See CPUC Decision 12-05-037, Ordering Paragraph 12.a. http://docs.cpuc.ca.gov/PublishedDocs/WORD_PDF/FINAL_DECISION/167664.PDF.*

☒ Grid operations/market design
☐ Generation
☐ Transmission
☒ Distribution
☒ Demand-side management

Issues and Barriers:

Growing technology choices on the demand-side and distribution systems, new communication platforms, new distributed energy resources and advanced and new ways to control these assets, changing environmental conditions all impact the planning and operation of distribution systems. Before making significant investments in technologies, there is a need to test their capabilities in a holistic manner. In the next five to ten years, we are planning to add 1.5 million zero-emission cars, 1.3 GW of batteries, significant demand response and PV generation. However, we do not have a holistic approach and a way to analyze and evaluate various technology options.

Initiative Description and Purpose:

The purpose of the initiative is to develop a co-simulation environment to support technology deployments for the distribution system. This system will combine existing modeling tools and existing validated models IOUs currently have with communication system modeling and load modeling tools to evaluate the appropriateness of various technologies, control algorithms and level of data exchange to reduce big data burdens on the operation of distribution systems. As the tool develops, it can be integrated with climate models and market modeling tools as well.

Stakeholders:

IOUs, PUC, technology developers and vendors

Background and the State-of-the-Art:

- What research development and demonstration has been done or is currently being done to advance this technology or strategy (cite past research as applicable)?

    - Research is underway by many academics and national laboratories to develop co-simulation capabilities for smart grid. Most of these co-simulation environments have different approaches that provide limitations in their application. Also, most do not use well calibrated and validated models. This increases the development time and effort as well as uncertainty around validity of the results.

- Describe any public and/or private successes and failures the technology or strategy has encountered in its path through the energy innovation pipeline: lab-scale testing, pilot-scale testing, pre-commercial demonstration, commercial scale deployment, market research, workforce development.
    - The efforts in this area are mostly academic at this time. The approach has to lend itself to being used by utilities. This tool can be used in several different ways: 1) to develop and analyze various technology deployment scenarios (e.g. Peak problem at SONGS – should we deploy more solar or more DR?); 2) Large-scale impact of technologies (e.g. - should we invest in large-scale Wi-Fi for low income housing areas to assist them to adopt some low cost technologies?); and 3) What/if scenario analysis (e.g. - if we could communicate with all the inverters, how could differently could we operate the system?)
- Identify other related programs and initiatives that deal with the proposed technology or strategy, such as state and federal programs or funding initiatives (DOE, ARPA-E, etc.).
    - National Laboratories are investing their own funding to investigate this area. Each approach is slightly different. A scoping and an evaluation piece may be a good start.
        - LBNL - VirGIL
        - PNNL - Fenix

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Justification:

There are a variety of goals stated and mandated by various entities. These are mostly on the deployment of technologies. Without having a holistic approach to how these technologies impact the electricity grid and how they impact each other's operations, it is difficult to expect full system-wide benefits from these technologies. There are also cases where significant investments are made only to find out the technology delivers a portion of its promised benefits.
This research will impact all sectors. While it will not improve any given technology, it will improve its deployment and provide quantified metrics for its justification for large-scale adoption. If this tool is developed and applied in CA, there will be many other applications around the country and internationally. Because this is basic research that can have significant impact on decision making and improving societal benefits of technologies, which will be deployed in the future, this project is appropriate for public funding.

Ratepayer Benefits (Check one or more)**:**

☒ Promote greater reliability

☒ Potential energy and cost savings

☐ Increased safety

☒ Societal benefits

☐ Environmental benefits – specify

☐ GHG emissions mitigation/adaptation in the electricity sector at the lowest possible cost

☐ Low emission vehicles/transportation

☐ Waste reduction

☐ Economic development

Describe specific benefits (qualitative and quantitative) of the proposed initiative

This initiative suggests that technology deployments for smart grid applications require an analysis platform to consider the impact of technologies holistically, to evaluate various technologies for their appropriateness to solve a certain problem and scenarios for their deployment. Co-simulation of cyber-physical systems is suggested as an analysis platform. The benefits of such a platform are:

- Investing in impactful technologies
- Reducing wasted funds that are invested in technologies that provide limited benefits.
- Reduce unintended consequences that occur with some technology developments because of a lack of holistic approach and short and long-term evaluation capability.
- Selecting low-cost solutions with highest impact

Public Utilities Code Sections 740.1 and 8360:

Please describe how this technology or strategy addresses the principles articulated in California Public Utilities Code Sections 740.1 and 8360. The California Public Utilities Code is available online at www.leginfo.ca.gov/cgi-bin/calawquery?codesection=puc.

This initiative directly supports the items a through g and i in California Public Utilities Code Sections 740.1 and 8360.