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

CALIFORNIA ENERGY COMMISSION

Title of Proposed Initiative (Short and concise): **A Data and Analytics Platform to Guide the Design and Operation of Sustainable Urban Systems**

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:

Describe the issues and barriers that are impeding full market adoption of the proposed clean energy technology or strategy (such as cost, integration, or lack of information).

Collecting and managing data at the urban scale is costly and a major issue for urban systems research. As data come from various sources at various scales, structured vs. unstructured, homogeneous vs. heterogeneous, integration of them is challenging. There is a huge gap in developing and integrating analytics using the data to visualize key information to support decision making, policy, and regulations. This impedes the accommodation of design and operation for sustainable urban systems informed by data and analytics. Financing for city energy efficiency programs is a challenge, including the lack of an open and free data and analytics platform for city researchers and decision makers.

Initiative Description and Purpose:

How will this technology or strategy help address the issue/issues? Describe knowledge to be advanced to overcome critical barriers. Include the recommended funding level (minimum and maximum) for each project under this initiative.

The urban data includes the representation of sets of urban objects, environment, activities by transport and human, and its relationship between each other. A systematic urban data modeling built upon the CityGML will yield a systematic establishment to frame the sustainable urban development considering all the parameters needed for analytics including urban energy modeling, planning and climate studies to support California's data collection rule making and long term energy goals. Energy models in the urban scale are the cornerstones to manage the combined impact of interventions at different scales (building-community-city-region-grid). Appropriate model fidelity and approach are supported by ranging from high fidelity building energy models to reduced-order normative models and statistical models. The aggregation of models of individual building and multi-scale energy supply

systems, the hybrid energy modeling approach will yield the energy management for a sustainable built environment and reduction of CO_2 production over time. The initiative focuses on the data and analytics on a 3D GIS integrated, open and free platform.

Recommended funding level is $500k minimum and $4 million maximum for each project.

Stakeholders:

Identify the stakeholders who support the initiative.

Cities, CPUC, IOUs, ISO, ARB, city and state agencies

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)?
    - CityGML is industry standard data model for urban systems
    - Smart grid and energy system integration funded by USDOE
    - Demand response funded by CEC PIER
    - California Center of Sustainable Communities funded CEC PIER
    - Available energy and demand analysis tools such as EnergyPlus, DER-CAM, Commercial Building Energy Saver (being developed), and Home Energy Saver.
- 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.
    - Demonstration of low energy/carbon cities around the world especially in the developing countries.
    - A few case studies of retrofit of communities to be ZNE
- 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.).
    - Smart cities research programs
    - City energy programs and climate action plans
    - Big data initiatives, DOE
    - Smart Grid Integration, DOE
    - Prop 39, AB 32, AB 758, California
    - Community energy efficiency programs, HUD, DOD, Architecture 2030

Justification:

Describe how this technology or strategy will provide California IOU electric ratepayer benefits and provide any estimates of quantified annual savings/benefits in California, including:

- Name of sector and estimated size and energy use.
  - Cities. More than 50% of population lives in cities now (70% in 2030) and consumes more than 70% of total primary energy use.
- Quantifiable performance improvements for the proposed technology/strategy.
  - 30-50% of energy use can be reduced with better design, operation, and retrofit of urban systems.
- Maximum market potential, if successful.
  - Maximum of one-third reduction of energy use for cities.
- Number of direct jobs created in California.
  - Significant number of new jobs can be created.
- Why this research is appropriate for public funding.
  - This directly benefits cities, citizens, and state programs

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

The initiative will tackle barriers in urban challenges ranging from building scale to urban scale environmental impact assessment. The initiative will present opportunities for urban data analytics that can support sustainable urban systems. The initiative will reduce energy use and carbon emission in cities, can create new jobs, and stimulate economic development. An estimated of 30% of energy savings can be achieved in cities.

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.

The initiative aims to address main challenges in sustainable urban systems, which will benefit cities, citizen, and economics of California.

740.1. The commission shall consider the following guidelines in evaluating the research, development, and demonstration programs proposed by electrical and gas corporations:

(a) Projects should offer a reasonable probability of providing benefits to ratepayers.

(b) Expenditures on projects which have a low probability for success should be minimized.

(c) Projects should be consistent with the corporation's resource plan.

(d) Projects should not unnecessarily duplicate research currently, previously, or imminently undertaken by other electrical or gas corporations or research organizations.

(e) Each project should also support one or more of the following objectives:

(1) Environmental improvement.

(2) Public and employee safety.

(3) Conservation by efficient resource use or by reducing or shifting system load.

(4) Development of new resources and processes, particularly renewable resources and processes which further supply technologies.

(5) Improve operating efficiency and reliability or otherwise reduce operating costs.

8360. It is the policy of the state to modernize the state's

electrical transmission and distribution system to maintain safe, reliable, efficient, and secure electrical service, with infrastructure that can meet future growth in demand and achieve all of the following, which together characterize a smart grid:

(a) Increased use of cost-effective digital information and control technology to improve reliability, security, and efficiency of the electric grid.

(b) Dynamic optimization of grid operations and resources, including appropriate consideration for asset management and utilization of related grid operations and resources, with cost-effective full cyber security.

(c) Deployment and integration of cost-effective distributed resources and generation, including renewable resources.

(d) Development and incorporation of cost-effective demand response, demand-side resources, and energy-efficient resources.

(e) Deployment of cost-effective smart technologies, including real time, automated, interactive technologies that optimize the physical operation of appliances and consumer devices for metering, communications concerning grid operations and status, and distribution automation.

(f) Integration of cost-effective smart appliances and consumer devices.

(g) Deployment and integration of cost-effective advanced electricity storage and peak-shaving technologies, including plug-in electric and hybrid electric vehicles, and thermal-storage air-conditioning.

(h) Provide consumers with timely information and control options.

(i) Develop standards for communication and interoperability of appliances and equipment connected to the electric grid, including the infrastructure serving the grid.

(j) Identification and lowering of unreasonable or unnecessary barriers to adoption of smart grid technologies, practices, and services.