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): *Tapping the Residential Sector for DR and Energy Savings by Pre-cooling Buildings with Outside Air and Air Conditioner Operation.*

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).

As currently structured, IOU programs are not well suited to adopt technologies that can access the potential of residential demand reduction by means other than compromising comfort. A statewide programmatic approach is needed to inform the public of the opportunity, develop the incentive structure, deploy the technology, and expand it to other utilities and areas.

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.

Coupling ventilation and air conditioner pre-cooling provides substantial energy savings through improved cooling efficiency on most days, and effective demand response on peak demand days, and both approaches have been developed and are proven. The critical barrier is deployment. The funding level to implement this program in one community, for example Sacramento, would range from $1-2 million, including implementation and M&V.

Stakeholders:

Hardware and software providers, program managers, and M&V consultants, all who are within California.

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)?

  The Alternatives to Compressor Cooling project was initiated by CIEE and supported by the California Energy Commission PIER project between 1996 and 2004, resulting in the development of ventilation cooling technology. Subsequent research was completed under the DOE's Building

America program and was supported by PG&E. Prior to the real estate market crash, over 20,000 integrated ventilation cooling systems were installed in the Sacramento area. A DOE sponsored project to determine the value in this climate using a calibrated model is currently underway. A PG&E study completed by Matrix in Sacramento and Yolo Counties showed an average demand reduction of 48% using ventilation cooling only.

Preliminary EM&V studies of air conditioner pre-cooling in the Las Vegas area has shown an average demand reduction of about 3 kW per home and about 10% energy savings. Reductions in the Sacramento climate would be lower because of the lower cooling load, but would probably average about 2 kW.

- 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.

  Ventilation cooling suffered slow market adoption due to lack of interest by HVAC equipment manufacturers, and setbacks due to changes in motor technology that have recently been overcome. A CASE study was completed with the result that ventilation cooling is now incorporated in the 2013 Title 24 standards. Air conditioner pre-cooling was implemented relatively recently and has been shown to be successful in achieving demand reduction as well as energy savings due to the improved EER resulting from operation at lower outdoor temperatures. A pilot project by Nevada Power has installed systems in 14,000 homes.

- 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.).
  A research initiative on ventilation cooling was launched by CIEE in 1994, and the PIER program continued to support research until 2004. Through the Building America program, DOE supported research on ventilation cooling and is currently funding research on air conditioner pre-cooling. Monitoring was completed on three California homes, calibrated models were developed, and a technical report is in preparation.

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. *The entire residential sector (~13 million homes)*
- Quantifiable performance improvements for the proposed technology/strategy. *Approximately 2 kW demand reduction per household, plus energy savings of 10-20% (primarily for ventilation cooling in new homes).*
- Maximum market potential, if successful. *Ultimately at least half of the residential sector.*
- Number of direct jobs created in California. *Would require a ramp-up of program implementers plus some manufacturing and HVAC contract workers as the market expands. Difficult to quantify without detailed analysis but all in California.*
- Why this research is appropriate for public funding.

  HVAC manufacturers have shown little or no interest in ventilation cooling because it cannot be applied to a global market – that is it is only appropriate for hot-dry climates like California's central valley. In coastal and cooler inland climates it can displace air conditioning, which has a negative influence on air conditioner sales. Thus the needs of manufacturers do not align with the needs of homeowners who would benefit from the improved indoor air quality, energy savings, and convenience the technology offers, nor with the needs of utilities to reduce peak load.

Residential IOU DR programs in some cases are managed in isolation from energy efficiency and require multiple levels of organization to implement, making it difficult to organize and execute the deployment of the described technology. Public funding is needed to jump start a combined ventilation cooling and pre-cooling program to demonstrate the value to IOUs as well as public utilities and the residential market at large.

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

☐ Promote greater reliability
☒ Potential energy and cost savings
☒ Increased safety *through improved indoor air quality and comfort*
☒ Societal benefits
☒ Environmental benefits - specify *Reduced carbon emissions resulting from improved efficiency and reduced demand.*
☒ 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. *Minor impact on job creation.*

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.

Responding to each of the policy guideline sections:

Section 740.1

(a) Benefits to ratepayers for ventilation cooling have been demonstrated through research supported by PG&E, the Building America program, and the California Energy Commission PIER program, with energy savings exceeding 20% and demand reduction of over 40%. Benefits of pre-cooling in general are being demonstrated by Nevada Power currently, showing energy savings of 10-20%.
(b) There is substantial evidence to show that deployment projects would have a high probability of success. Over 20,000 ventilation cooling systems have been installed in the Sacramento area and 14,000 pre-cooling systems have been deployed in Nevada.
(c) A project developed around these demand reducing and energy saving approaches are consistent with the resource plan.
(d) The suggested project would not duplicate prior research and would focus on deployment of proven technologies.
(e) The project would (1) improve the environment by reducing on-peak electricity generated from low efficiency natural gas equipment thereby reducing carbon emissions; (2) would improve public safety by improving indoor air quality; (3) provide a more efficient use of resources and shift system load; (4) would be compatible with renewable resources; (5) improve operating efficiency of residential cooling equipment by reducing compressor operation and/or by operating cooling systems during cooler periods of the day thereby elevating the EER, and reduced compressor run time will extend equipment lifetime.

Section 8360

(a) By shifting load using digital technology that is local to the residence, grid reliability and efficiency can be improved.
(b) Not applicable to the suggested project.
(c) The technology is fully distributed and cost-effective
(d) The suggested project directly addresses cost-effective demand response and energy efficiency.
(e) The suggested project would deploy cost-effective smart technology that is fully automated and interactive, and that optimizes the operation of residential cooling systems and can provide feedback such as equipment runtime and fault detection and diagnosis.
(f) Not applicable to the suggested project – no appliances affected except HVAC systems.
(g) Effectively shaves residential peak load and provides the most cost-effective form of thermal storage by using existing building thermal mass.
(h) The suggested project would include providing consumers with information and offers a control option that is present only in a very limited number of homes.
(i) The project would utilize existing standards for communication (such as Zigbee and ethernet), and systems have the capability of being addressed by grid operators.
(j) The technology is highly compatible with smart grid strategies.