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California Energy Commission

THE ELECTRIC PROGRAM INVESTMENT CHARGE: PROPOSED 2018 – 2020 TRIENNIAL INVESTMENT PLAN

Appendices A-D: Stakeholder Comments and Energy Commission Staff Responses

California Energy Commission

Edmund G. Brown Jr., Governor

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APPENDIX A: Summary of Stakeholder Comments and Energy Commission Staff Responses on the February 3, 2017, Scoping Webinar

The California Energy Commission held a public webinar to seek input from stakeholders and the public on the scope of the Electric Program Investment Charge Proposed 2018 – 2020 Triennial Investment Plan (EPIC 2018-2020 Investment Plan) on February 3, 2017, in Sacramento, California. Participants offered verbal public comments during this webinar, and many others submitted written comments to the Energy Commission for consideration. In this appendix, staff summarizes and responds to all written comments submitted through February 17, 2017.

This appendix organizes comments from the February 3, 2017 scoping webinar by themes of the *EPIC 2018 – 2020 Investment Plan*:

- Theme 1 - Advance Technology Solutions for Deep Energy Savings in Building and Facilities
- Theme 2 - Accelerate Widespread Customer Adoption of Distributed Energy Resources
- Theme 3 - Increase System Flexibility from Low –Carbon Resources
- Theme 4 - Increase the Cost-Competiveness of Renewable Generation
- Theme 5 - Create a Statewide Ecosystem for Incubating New Energy Innovations
- Theme 6 - Maximize Synergies in the Water-Energy-Food Nexus
- Theme 7 - Develop Tools and Analysis to Inform Energy Policy and Planning Decisions
- Theme 8 - Catalyze Clean Energy Investments in California's Underrepresented and Disadvantaged Communities

Theme 1 Advance Technology Solutions for Deep Energy Savings in Building and Facilities

Building Envelope

TN215830 Scott Samuelsen:[1]

Scott Samuelsen proposes an initiative to optimize the use of residential and commercial building rooftop space to reduce building energy footprints in cities. Technologies can include reflective roofs, green roofs, solar roofs, and thermal rooftops.

Discussion and Staff Response to TN 215830

The roofing materials listed in Dr. Samuelsen's comment (e.g., reflective roofs) could be considered as part of an integrated demonstration project with the building envelope measures described in Subtheme 1.2 if the resulting project enhances the overall energy efficiency of the building, and increases the cost effectiveness of all the envelope measures. This type of project could also be part of Subthemes 2.1 and 2.4. In addition, the Energy Commission has on-going research with Lawrence Berkeley Laboratory on Cool Walls (EPC-14-010) to study the implications to the environment from highly reflected surfaces.

HVAC

TN215944 Lawrence Berkeley National Laboratory:[2]

LBNL proposes an initiative to develop HDAC systems to match the climate they are placed in, in order to maximize energy savings, and provide data for future interpretation.

Discussion and Staff Response to TN215944

Hot-Dry Climate-optimized Air Conditioning (HDAC) was the subject of past Energy Commission research and this area is the not a high priority area for the third investment plan unless it falls within Initiative 1.3.1. This initiative will develop and test advanced electric California climate appropriate electric heat pumps for space and/or water heating that are capable of performing at low-ambient temperature without adversely impacting performance, energy efficiency or operating costs.

The Energy Commission previously funded a project to evaluate the energy savings and market potential for hot, dry air conditioning systems for the residential and commercial market sectors, involving SCE, PG&E, Proctor Engineering Group. The purpose of the research was to develop and test practical specifications for Hot-Dry Climate-optimized AC systems, and encourage manufacturers to make them. The results from laboratory and field testing of standard air conditioners and their hot, dry air conditioning system replacements

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1 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215830_20170209T205442_Scott_Samuelsen_Comments_Building_Rooftop_Space_to_Reduce_Build.pdf
2 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215944_20170213T110035_Mary_Ann_Piette_Comments_BTUS_Division_Consolidated_Comments_1.pdf

demonstrated energy savings of up to 20 percent and peak demand reductions of up to 35 percent. The conclusion from the report was that air conditioner manufacturers are not inclined to produce HDAC units that meet the hot, dry air conditioning system specifications unless there is a market and the market is supported by utility and state incentives. A copy of the Energy Performance of Hot, Dry Optimized Air Conditioning Systems report can be downloaded at: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.406.4295&rep=rep1&type=pdf

TN215948 Lawrence Berkeley National Laboratory:[3]

LBNL proposes an initiative involving integrated building thermal load management in order to reduce capital expenditure on HVAC equipment and save energy.

Discussion and Staff Response to TN 215948

The Energy Commission's EPIC Subtheme 1.2 proposes measures to make building envelopes tighter for both existing and new construction. By so doing, this would impact HVAC energy use while also making buildings more comfortable to building occupants. Since Subtheme 1.2 heavily emphasizes cost effectiveness while maximizing energy efficiency, we believe that LBNL's proposal to analyze thermal load management and HVAC expenditure could be considered during solicitation development.

Research related to HVAC load management utilizing thermal storage as a way to save energy, integrate renewables, and/or respond to grid needs would be consistent with and could be included under Subthemes 2.1 (Increase the Cost-effectiveness of Highly Efficient Buildings and Communities) and 3.1 (Accelerate Broad Adoption of Automated Demand Response Capabilities that Provide the Grid Flexible Response Services).

In addition, the Energy Commission is proposing an initiative in its 2017 – 2018 natural gas budget plan to improve building envelopes in existing buildings. The goal is to develop and demonstrate cost effective retrofit opportunities to reduce thermal loads and control flow of air and moisture in buildings.

TN215929 Richard Brown:[4]

Richard Brown suggests an initiative on dynamic management of variable-speed HVAC. Systems for load and energy reduction energy efficient and zero-net energy (ZNE) buildings are increasingly using variable speed HVAC systems, such as mini-split and variable refrigerant flow (VRF) systems, to save heating and cooling energy.

Discussion and Staff Response to TN215929

The Energy Commission is currently funding research in this area and will wait for the results before funding additional research. The following is information on these projects:

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3 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215948_20170213T111058_Mary_Ann_Piette_Comments_BTUS_Division_Consolidated_Comments_6.pdf
4 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215929_20170210T180640_Richard_Brown_Comments_Dynamic_Management_of_VariableSpeed_HVAC.pdf

- Electric Power Research Institute, EPC-15-004. This project will develop and demonstrate a Climate Appropriate Air Conditioning system for commercial buildings. The project will use both a variable refrigerant flow system and indirect evaporative cooling system in conjunction with an intelligent HVAC controller that processes signals from building sensors and system feed-back to maximize system efficiency.

- Electric Power Research Institute, EPC-14-021. This project will develop a next-generation residential space-conditioning system optimized for California climates. The advanced efficiency solutions integrated into the HVAC system will include: variable-capacity compressor and variable-speed fans; integrated ventilation to harness fresh air for "free cooling;" intelligent dual-fuel technology; zonal control to prevent conditioning of unoccupied rooms; demand-response interactivity to grid flexibility and reliability; advanced fault detection and diagnostics; and alternative refrigerants.

TN215841 Jovan Pantelic:[5]

Jovan Pantelic proposes an initiative to investigate possible solutions using information about outdoor air quality and outdoor air temperature, communicate that information to people living especially in the low-income housing, inform them when to use natural ventilation and when to use alternative ways for indoor cooling like ceiling mounted fan and estimate energy savings compared to combine optimize natural ventilation use and ceiling fan cooling to standard use of air conditioning.

Discussion and Staff Response to TN215841

This type of project could be included in future solicitations developed under Subtheme 2.1 and the research under Initiative 7.3.2.

Currently, the Energy Commission has a research project involving the use of ceiling fans and smart thermostats (EPC-16-013). The project will develop optimal system configuration for smart comfort controlled ceiling fans integrated with learning thermostats to be tested and evaluated for energy performance and occupant acceptance in low income multi-family residential and small commercial buildings in disadvantaged communities in California.

The Energy Commission has also funded past research on use of natural ventilation in commercial buildings under a research project entitled “Natural Ventilation for Energy Savings in California Commercial Buildings,” CEC-500-2016-039, 2016. This past research indicates that retrofitting natural or mixed-mode ventilation into California buildings will provide significant energy savings and improved occupant indoor environmental satisfaction. Sick building syndrome may also be reduced, but caution is needed where exposure to excessive particulate matter or ozone may increase the risk of long-term health problems.

5 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215841_20170210T102716_Jovan_Pantelic_Comments_Idea_for_20182020_EPIC_Triennial_Invest.pdf

TN215835 Tom Hoff:[6]

Tom Hoff proposes research to examine the potential benefits of building pre-cooling with residential PV that can shift load from evening to daytime and take advantage of the built-in thermal mass of the building. Research needs to determine the most effective strategies for pre-cooling that may include evaluation of the optimal amount of pre-cooling based on customer comfort, using solar and temperature forecasting, learning algorithms for building performance, non-intrusive data collection, retrofits for thermal insulation, phase change materials, and improved sealing, and deployment of heat pumps instead of A/C units.

Discussion and Staff Response to TN215835

Research related to HVAC load management utilizing thermal storage as a way to save energy, integrate renewables, and/or respond to grid needs would be consistent with and could be included under Subthemes 2.1 (Increase the Cost-effectiveness of Highly Efficient Buildings and Communities) and 3.1 (Accelerate Broad Adoption of Automated Demand Response Capabilities that Provide the Grid Flexible Response Services).

TN215867 Theresa Pistochini:[7]

Theresa Pistochini suggested research to consider thermal storage, including thermal storage air conditioning, as a unique way to handle the duck curve and increase use of PV; also consider use of low global warming refrigerants and use of evaporative cooling.

Discussion and Staff Response to TN215867

The Energy Commission is not considering thermal storage at this time under Theme 1. The technology is commercially available and the issues appear to be regulatory and tariff related. However, research related to HVAC load management utilizing thermal storage as a way to save energy, integrate renewables, and/or respond to grid needs would be consistent with and could be included under Subthemes 2.1 (Increase the Cost-effectiveness of Highly Efficient Buildings and Communities) and 3.1 (Accelerate Broad Adoption of Automated Demand Response Capabilities that Provide the Grid Flexible Response Services).

With respect to low global warming refrigerants, the Commission has included this topic in Initiatives 1.7.1 and 7.3.2. In addition, the Commission has funded several recent projects in this area:

- EPC-15-004: This project is conducting research on low global warming refrigerants for commercial buildings. The purpose is to enable high efficiency refrigerants that could have toxicity/flammability issues in the refrigeration cycle, and use a benign secondary fluid (preferably a refrigerant) to circulate inside the conditioned space.
- EPC-16-041: This project will develop test procedures for alternative refrigerants for flammability and energy savings characterization and to develop a "favorability" index

6 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215835_20170209T171043_Tom_Hoff_Comments_Suggestion_for_Flexible_Load_Grant_Funding_Op.pdf
7 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215867_20170210T150654_Theresa_Pistochini_Comments_Comments_on_proposed_EPIC_Framework.pdf

of end-use market segments and equipment types based on potential GHG savings impact and commercial feasibility and adoption.

TN215883 Glen Gallagher:[8]

Glen Gallagher proposes research on using 100% CO_2 as a refrigerant, known as transcritical CO_2 refrigeration to better understand energy performance, especially for small CO_2 refrigeration systems and impact on high ambient temperature climates. Testing of actual units need to be performed in California climate zones to ascertain if this low GWP technology can be adopted.

Discussion and Staff Response to TN215883

The use of 100% CO_2 as a refrigerant could be considered in Initiatives 1.3.1, 1.7.1 and 7.3.2. The challenge in switching to CO_2 is dealing with the higher pressure of a CO_2 refrigerant, which requires more robust components, heat exchangers, compressors, gaskets and oils, to account for the higher pressure. A report from Department of Energy suggests that CO_2 supermarket refrigeration systems is a viable alternative to HFC-refrigerant-based systems on a case by case basis when considering climate impacts, especially in cooler climates. The energy performance of CO_2 refrigeration systems varies substantially with climate. Colder regions could be better suited to cost-effective implementation of a CO_2 system.

Heat Pumps

TN215920 Solar City:[9]

Solar City suggests development of a study that identifies the absolute and relative costs and benefits of deploying electric resistance, heat pump, and natural gas water heaters under various consumption and water heater control profiles. Specifically, evaluate intelligently controlled or grid enabled electric resistance as well as heat pump water heaters to determine their performance using California's time dependent valuation (TDV) metric, greenhouse gas emissions (GHG) and the total cost of ownership.

Discussion and Staff Response to TN215920

This type of analysis could be considered as part of Initiatives 1.3.1 for electric heat pump water heaters and 2.1.1 if program participants elect to utilize electric resistance or electric heat pump water heaters as part of its community renovation for high efficiency and grid resources.

8 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215883_20170210T162706_Glenn_Gallagher_Comments_Energy_Efficiency_Study_for_lowGWP_Tra.pdf
9 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215920_20170210T170419_Francesca_Wahl_Comments_SolarCity_Comments_EPIC_20182020_Invest.pdf

TN215895 Stephanie Jumel:[10]

Stephanie Jumel proposes research and demonstration projects be conducted targeting waste heat recovery for reducing primary energy demand in buildings and industrial processes. The research would target both the methodologies (advanced pinch that can now address both energy and water use within commercial and industrial sites) and technologies, including heat pumps that can now run in a large range of temperatures and be coupled to medium temperature heat and cooling networks.

Discussion and Staff Response to TN215895

Waste heat recovery generally targets natural gas use and is not the subject of EPIC research. In the Energy Commission's proposed 2017 – 2018 Natural Gas Budget Plan, waste heat recovery has been identified as a research initiative for natural gas using buildings and industrial facilities. Look for future research solicitations at the following website: http://www.energy.ca.gov/contracts/pier.html

TN215836 Tom Hoff:[11]

Tom Hoff proposes a project that focuses on heat pumps for water that will decrease residential CO_2 emissions by 2300 lbs. Heat pumps use much less power and can be combined with PV. The goal is to replace traditional natural gas water heaters.

Discussion and Staff Response to TN215836

This proposal could be considered in Initiative 1.3.1, Develop and Test California Climate Appropriate Electric Heat Pump Space and Water Heaters.

Building and Equipment Controls

TN215854 SLAC National Accelerator Laboratory:[12]

SLAC proposes research in transactive energy approaches to resource integration in both planning and operations, including research to support development and dissemination of an open source modeling platform, research in various transaction security, validation and authentication technologies, research to enable development and approval of new real time tariffs and research to enable understanding of the social, regulatory, economic and technical underpinnings of the transition from the conventional utility business model to a transactive utility business model.

10 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215895_20170210T164915_Stephanie_Jumel_Comments_Commercial__Industrial_Sector_Energy_I.pdf
11 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215836_20170209T170715_Tom_Hoff_Comments_Suggestion_for_Heat_Pump_Water_Heater_Grant_F.pdf
12 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215854_20170210T132137_David_P_Chassin_Comments_Supporting_Transactive_Energy_Research.pdf

Discussion and Staff Response to TN215854

The Commission values transactive energy projects such as modeling platforms, research on economics, business models, policy level development, and technology such as blockchain that would enable these new types of energy transactions. Initiative 1.4.3 includes these types of projects.

TN215881 Brian Kelley:[13]

Brian Kelley proposes modeling and simulation (M&S) tools are needed to address and better understand problems introduced by emerging technologies on the grid. The M&S tool will provide electric utilities a platform to model its transmission and distribution systems and run various simulations to understand the operational impact and performance of cybersecurity controls.

Discussion and Staff Response to TN215881

Initiative 1.4.3 addresses technologies that enable new approaches to cybersecurity and studies their potential effects on how buildings and the grid can interact with each other. A transactive energy approach to resource integration could be an element of a proposal under Subthemes 2.1 and 3.1.

Smart Devices

TN215949 Lawrence Berkeley National Laboratory:[14]

LBNL proposes an initiative to study the usage and energy consumption of "smart" (i.e., Internet-connected) appliances (such as light bulbs, coffee makers, or refrigerators). The purpose of the initiative would be twofold: (1) estimate the impact of the propagation of such devices on energy consumption in California, based on changes in usage patterns compared to non-smart devices and any power consumption associated with smart devices, and (2) estimate the potential for improved or more cost-effective field metering techniques using smart devices.

TN215951 Lawrence Berkeley National Laboratory:[15]

LBNL proposes an initiative to look at the energy impact of smart devices (Power over Things) overall usage, and find if it results in overall energy savings.

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13 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215881_20170210T162847_Brian_Kelley_Comments_Interaction_and_Impact_Studies_for_Distri.pdf
14 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215949_20170213T111229_Mary_Ann_Piette_Comments_BTUS_Division_Consolidated_Comments_8.pdf
15 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215951_20170213T111354_Mary_Ann_Piette_Comments_BTUS_Division_Consolidated_Comments_10.pdf

TN215896 Liang Ma:[16]

Liang Ma proposes an initiative to find what would be the best artificial intelligence (AI) solution to building energy efficiency or at the very least evaluate if AI is a good fit for building energy efficiency.

TN215871 Lawrence Berkeley National Laboratory:[17]

LBNL proposes research on appliances and components installed by builders during construction and prior to occupancy, such as garage door openers, ground fault interrupter receptacles, smoke detectors, HVAC controls, security systems remote control building components and ovens. This initiative involves field measurements to understand the scope of the consumption and research to improve the efficiency of very low power components and development test methods.

Discussion and Staff Response to TN215959, TN215951, TN215896, and TN215871

Smart devices, artificial intelligence solutions, and builder installed plug-ins are included under Initiative 1.5.1. Many of these devices listed have low power modes, but are left on 24/7. Many of these devices have no power management capabilities. These types of devices lack any test procedures for measuring their idle and active mode. This information will be essential into decreasing a building's overall energy use. This initiative will include measurements of energy savings resulting from the developed zero to near zero idle power mode devices and development of test procedures for measuring idle mode and active mode.

Appliances

TN215838 Susan Mazur-Stommen:[18]

Susan Mazur-Stommen comments that water and energy usage associated with laundry can be lowered. Susan proposes research involving attitudes around laundering practices, and what kinds of equipment and instrumentation consumers currently possess.

Discussion and Staff Response to TN215838

Stand-alone behavior research is not part of the energy efficiency research portfolio. However, advanced social science research approaches could be incorporated as part of an overall strategy to evaluate the usage patterns, design, acceptability to consumers and potential impact of particular advanced or pre-commercial technologies identified in future solicitations resulting from Theme 1. Research that expands understanding of use practices for other plug load and consumer electronics devices, to the extent they can improve duty cycle estimates, could be included under Subtheme 1.5.

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16 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215896_20170210T164913_Liang_Ma_Comments_AI_for_Building_Energy_Efficiency.pdf
17 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215871_20170210T155150_Alan_Meier_Comments_Reducing_BuilderInstalled_Loads_in_New_and.pdf
18 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215838_20170210T090525_Susan_MazurStommen_Comments_Suggestion_UX_in_the_Laundry_room_f.pdf

In addition, Initiative 7.1.2 focuses on applied social science research to inform technology development and adoption for deep decarbonization of the energy system. Research under this subtheme will target applied behavioral research and/or some level of behavioral components to facilitate the deep penetration of technologies supported by EPIC.

Also, research on behavioral issues associated with demand response and distributed electricity generation could be included in Subthemes 2.1 and 3.1.

DC Buildings

TN215952 Karl Johnson:[19]

Karl Johnson suggests an initiative to target both new construction as well as DC retrofit markets for residential and small commercial applications. They want to integrate ZNE buildings with electric vehicle charging and storage as well.

TN215915 Richard Brown:[20]

Richard Brown proposes side-by-side, carefully controlled tests of DC versus AC in buildings to quantify cost, energy and operational savings, along with non-energy benefits such as power quality and resilience, and covering all building end-uses with and without battery storage. Field demonstrations of DC power distribution in new construction and retrofit for both Zero Net Energy (ZNE) buildings and ZNE-ready buildings, to determine practical barriers to deployment and energy savings under actual usage conditions; as well as development and standardization of key interoperability features that will make DC a plug-n-play option in buildings (particularly at voltages >48 VDC).

Discussion and Staff Response to TN215952 and TN215915

Both suggestions have been included in Initiatives 1.6.1 and 1.6.2. These initiatives target development of DC building distribution systems to enable ZNE buildings by 2030. Many DC technologies crosscut between commercial and residential buildings and have potential for application in existing building retrofits and new construction. Integration of DC buildings with on-site energy storage and EV charging is included in this initiative. The test bed scenario provides opportunities to compare DC to AC systems in a controlled environment supporting demonstration of energy and operational savings, non-energy benefits, and establishment of industry and Title 24 standards. Field demonstrations of native DC electronics and targeted appliances, directly connected to DC power sources in niche markets, are supported in Initiative 1.6.2.

19 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215952_20170213T121117_Karl_Johnson_Comments_20182020_EPIC_plan.pdf
20 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215915_20170210T165925_Richard_Brown_Comments_Research_Initiative_for_DC_Power_Distrib.pdf

Industrial and Building Electrification

TN215877, TN215880 Brian Yanity:[21]

Brian Yanity comments that there is a great need to electrify freight railroads in the United States. The most established way is installing overhead catenary wires over existing railroad tracks. While the up-front capital costs may be substantial, all-electric freight rail with overhead catenary is a tried-and-true technology that would pay for itself with significant reductions in emissions and transport energy costs.

Discussion and Staff Response to TN215877 and TN215880

Staff agrees that electrification of freight railroads could be beneficial to California and the nation alike. However, electric freight rail technology that is "tried-and-true" would not be in scope for the EPIC program as there is limited research needed to commercialize or deploy. The focus for the proposed EPIC Investment Plan prioritizes smart charging, bi-directional power flow, and battery second use research. These priorities are based on the most urgent need to ensure that plug-in electric vehicles that are accelerating in deployment do not contribute to increase in peak load.

Data Centers

TN215866 Paul Royere:[22]

Paul Royer suggested an initiative to deploy, test, and validate water-borne and landside data centers with an advanced water cooling system that removes heat produced by server racks using an internal closed loop system in combination with an open loop heat transfer system, utilizing the natural water surrounding the ship.

TN215888 Dale Sartor:[23]

Dale Sartor proposes a comprehensive data center initiative to address new technology, emerging technology, best practices and market transformation opportunities. A portfolio approach would initiate new technology research and development while transform the market for emerging technologies and best practices. Examples of potential research could include warm water compressor-less cooling and use of waste heat; integration of data centers into micro-grids including demand response and DC, standardization of new technologies, standard retrofit packages for small data centers and fail safe systems and demonstrations.

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21 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215877_20170210T161854_Brian_Yanity_Comments_Feasiblity_study_of_freight_rail_electrif.pdf
22 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215866_20170210T144612_Paul_Royere_Comments_WaterCooled_Data_Centers.pdf
23 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215888_20170210T163459_Dale_Sartor_Comments_Data_Center_Efficiency_Initiative.pdf

Discussion and Staff Response to TN215866 and TN215888

Though staff agrees that data centers are a major consumer of electricity, it is not a focus of research for the *EPIC 2018 – 2020 Investment Plan.* The Energy Commission's R&D program under the Public Interest Energy Research and EPIC programs have extensively funded past data center research and the focus is now on other areas that have received less funding and attention. Based on the Energy Commission's past research, it appears that:

- The technology/data center industries have the funds to do their own research sufficiently without public funds. Also, it is difficult to justify many demonstration projects in industry that can clearly afford to upgrade their server farms.
- The technology changes so fast in data centers and by the time proposals are submitted through a competitive process to the EPIC program and awarded, a new and better technology could have already been developed by the private market and the state funded research may no longer be relevant. As a result, technologies that are developed may only be viable for a limited time and there is limited potential for replication of projects to others.

Building Performance Analysis and Tools

TN215848 Rishee Jain:[24]

Rishee Jian proposes an initiative to spawn the development of new data-driven methods and models that can harness the power and information in new emerging data streams and help drive sustained and deep energy savings from our existing buildings and facilities.

TN215899 Slaven Peles:[25]

Slaven Peles proposes a project to deliver an open source sensitivity and uncertainty analysis framework for building energy models that can assess sensitivities with respect to design parameters, such as insulation thickness, as well as uncertain processes, such as weather. In addition, the framework will provide model calibration capability to improve models by incorporating sensor and observation data into building energy models.

TN215890 Liang Min:[26]

Liang Min proposes research to develop an open source sensitivity and uncertainty analysis framework for building energy models. Examples of sensitivities to assess include design parameters, such as insulation thickness, and areas of uncertainty, such as weather. The framework could provide model calibration to improve models based on observation data from energy models.

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24 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215848_20170210T130103_Rishee_Jain_Comments_Datadriven_benchmarking_of_building_energy.pdf
25 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215899_20170210T164640_Slaven_Peles_Comments_Uncertainty_Analysis_for_Buildings.pdf
26 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215890_20170210T163352_Liang_Min_Comments_Integrated_Transmission_and_Distribution_Cos.pdf

Discussion and Staff Response to TN215848, TN215899, TN215890

The commenters propose developing different approaches to utilizing data and modeling to assess building performance and identify optimization strategies. Subthemes 1.2 (Develop Advanced Building Envelope Materials and Designs for Healthy, Comfortable and Highly-Efficient Buildings), 1.4 (Enable Integration of Building and Equipment Controls and Automation), 1.5 (Increase the Energy Efficiency of Plug Loads and Consumer Electronics Devices), 1.6 (Accelerate the Transition to Direct Current Powered Buildings and Facilities), 1.7 (Develop Technologies that can Assist in Decarbonizing Key California Industries), 2.1 (Increase the Cost-effectiveness of Highly Energy Efficient Buildings and Communities), and 3.1 (Accelerate Broad Adoption of Automated Demand Response Capabilities that Provide the Grid Flexible Response Services) include strategy development that could utilize data and modeling specific to the proposed projects.

TN215953 Lawrence Berkeley National Laboratory:[27]

LBNL proposes research to develop technologies for organizing and managing electricity production, use and distribution in buildings from the bottom-up, on a network model, fully digitally controlled. The research will aim toward enabling more optimal use of local generation and storage, make microgrids cost effective and gain energy savings from appropriate use of direct DC power.

Discussion and Staff Response TN215953

Subtheme 3.1 (Accelerate Broad Adoption of Automated Demand Response Capabilities that Provide the Grid Flexible Response Services) includes research elements that could utilize data-driven modeling approaches such as those LBNL suggests.

Existing Building Retrofits

TN215834 Tom Hoff:[28]

Tom Hoff comments that retrofits should not be done to existing buildings because it creates large amounts of waste and requires occupants to vacate the building for an extended period of time. Mr. Hoff recommends:

- Development of alternative approaches to deep energy retrofits in addressing thermal problems in existing buildings
- Determination of thermal performance of the building, and losses throughout the structure through low cost techniques without inconveniencing occupants.

27 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215953_20170213T130455_Bruce_Nordman_Comments_Local_Power_Distribution.pdf
28 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215834_20170209T171323_Tom_Hoff_Comments_Suggestion_for_Alternatives_to_Deep_Energy_Re.pdf

Discussion and Staff Response to TN215834

Initiative 2.1.1 will develop and pilot test innovative strategies for investing in efficiency renovations, distributed generation and storage resources within the community. This initiative will consider the cost effectiveness of various strategies.

Technology Packages

TN215950 Lawrence Berkeley National Laboratory:[29]

LBNL supports the development and deployment of packages of technologies or systems of technologies, along with the tools and process to support their selection, specification and assessment. To achieve aggressive energy reductions in new building construction and especially building retrofits, combinations of technologies are often required which leverage each other to create greater energy savings reductions than a single technology could produce on its own. This R&D program would aim to identify and develop deployable systems or packages of technologies with controls as required to deliver on the deeper savings levels.

Discussion and Staff Response to TN215950

These proposals could be included as part of the technologies resulting from Theme 1 or Initiative 2.1.1.

29 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215950_20170213T111310_Mary_Ann_Piette_Comments_BTUS_Division_Consolidated_Comments_9.pdf

Theme 2 Accelerate Widespread Customer Adoption of Distributed Energy Resources

Increase the Cost-effectiveness of Highly Energy Efficient Buildings and Communities

TN215750 Charla A Gomez:[30]

Charla Gomez proposes an initiative focusing on planning, entitlements approval, and commitment to construction (via Development Agreements) of master-planned neighborhoods or districts. Focus approval on distributed-energy solutions at the neighborhood level that integrate all sub-components: micro-grids, energy storage, demand management.

Discussion and Staff Response to TN215750

Subtheme 2.1 includes those issues for existing buildings/communities; Subtheme 2.4 could include proposals that address those issues for new construction.

TN215916 Solar City:[31]

Solar City proposes an initiative that evaluates and recommends a mechanism(s) to credit load shifting and energy storage technologies for the value they can provide for Title 24 building code compliance to meet Zero Net Energy (ZNE) goals for residential buildings by 2020. If possible, the study should utilize field or lab verification/testing.

Discussion and Staff Response to TN215916

Subtheme 2.1 specifically calls for projects that field test portfolios of demand-side approaches and identify value streams that include grid operations and infrastructure. Proposals under Subtheme 2.1 could include additional value streams in the cost-effectiveness analysis, as suggested.

TN215947 Lawrence Berkeley National Laboratory:[32]

LBNL proposes an initiative to develop and demonstrate validated investment grade risk-management tools and processes to identify, quantify, and mitigate performance risk for the purpose of financing and guaranteeing energy performance, particularly in under-served sectors such as small- and medium-sized commercial buildings.

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30 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215750_20170202T192158_Charla_A_Gomez_Comments_Planning_and_implementation_framework_f.pdf
31 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215916_20170210T170046_Francesca_Wahl_Comments_SolarCity_Comments_EPIC_20182020_Invest.pdf
32 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215947_20170213T110959_Mary_Ann_Piette_Comments_BTUS_Division_Consolidated_Comments_5.pdf

Discussion and Staff Response to TN215947

While not specifically identified, a tool to evaluate investment risk and value streams resulting from investments in energy efficiency, DERs and load management could be an element of the more comprehensive research and demonstration projects anticipated under Subtheme 2.1, 2.4, and 3.1.

Microgrids

TN215859 Aimee Bailey:[33]

Aimee Bailey proposes an initiative on "thermal microgrids," which are all-electric, fossil-free district energy systems that utilize heat-recovery and distributed energy resources to provide both power and thermal services to a community. This initiative builds on existing optimization and control technologies to harmonize thermal and power systems to efficiently and safely maximize the penetration of DERs, and facilitate interoperability of the thermal microgrid with the surrounding distribution system.

TN215979 Clean Coalition:[34]

This initiative should include community scale microgrids. Clean Coalition comments that they are conducting a Community Microgrid Initiative (CMI). Clean Coalition comments that grid sectionalization and customer shedding equipment is needed for achieving real-time, and potentially autonomous, isolation of feeder segments that ensure local renewables, energy storage, and other DER and dedicated to critical loads for provisioning indefinite renewables-driven power backup to critical facilities.

Discussion and Staff Response to TN215859 and TN215979:

Initiative 2.2.1 is being proposed to demonstrate cost effective and beneficial microgrids. The ideas expressed in these two comments are considered consistent with this initiative. It is currently anticipated that community scale microgrids are consistent with the intent of this initiative.

TN215862 James Zoellick:[35]

James Zoellick proposes an initiative to develop and demonstrate cost effective solar, storage, and genset technology packages to be deployed at fire and police stations and other critical facilities to provide energy resiliency for critical services. The initiative should include plans for scaling-up this technology, including: a market assessment, standardized design package, energy efficiency upgrade strategy, standardized permitting/interconnection package, potential funding strategies, and a technology/knowledge transfer plan.

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33 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215859_20170210T140415_Aimee_Bailey_Comments_Proposed_initiative_for_EPIC_20182020_Tri.pdf
34 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215979_20170213T171921_Craig_Lewis_Comments_Clean_Coalition_Comments_Community_Microgr.pdf
35 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215862_20170210T140958_James_Zoellick_Comments_Lowcost_Microgrid_Controller.pdf

Discussion and Staff Response to TN215862

Under the *EPIC 2012 – 2014 Investment Plan* the Energy Commission funded seven microgrid demonstrations including one at fire stations in the city of Fremont. Additional microgrid demonstration projects will be covered under Subtheme 2.2. The deployment strategies mentioned by the commenter will fall under Subtheme 2.4.

TN215882 Rishee Jain:[36]

Rishee Jain proposes an initiative to develop a data-driven microgrid planning model and tool for schools to achieve community resilience. This initiative could leverage the data created by Proposition 39 on energy usage in schools to develop data-driven models for the sizing and placement of strategic microgrids at schools around the state. School facilities are already seen as community centers and shelters and thus providing them with an independent energy source after natural disasters could prove vital recovery and emergency services provision. By quantifying the additional benefits of microgrid and DER for schools, this initiative would help accelerate their widespread adoption across the state. And, because schools are ubiquitous, it could also prioritize tools targeted for disadvantaged communities.

Discussion and Staff Response to TN215882

This is covered in Initiative 2.2.1, Advance Microgrids to the Tipping Point of Broad Commercial Adoption that will demonstrate the value a microgrid can bring to the end use customer while at the same time providing critical services to the grid operator when needed. A tool for planning and sizing a microgrid for a specific location is already available, DER-CAM.[37] This tool provides a cost-optimal configuration of distributed generation technologies that a specific customer can install as part of a microgrid. This topic can be discussed and recommended for inclusion at the April and June workshops on developing the *Roadmap for the Commercialization of Microgrids in California.* Information on the Microgrid Roadmap can be accessed at: http://www.energy.ca.gov/research/microgrid/

Distributed Storage

TN215887 Advanced Microgrid Solutions:[38]

Advanced Microgrid Solutions proposes an initiative to accelerate market adoption of storage through decreasing balance of system (BOS) costs and streamlining and standardizing permitting. This initiative could study the impact of zoning exemptions for solar – if the impact of these exemptions is found to be net positive, it sets a precedent for similar exemptions for storage systems.

36 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215882_20170210T162730_Rishee_Jain_Comments_Datadriven_microgrid_planning_for_communit.pdf
37 https://building-microgrid.lbl.gov/projects/microgrid-design-using-der-cam
38 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215887_20170210T163523_Pam_Seidenman_Comments_Advanced_Microgrid_Solutions_EPIC_Trienn.pdf

Discussion and Staff Response to TN215887

NYSERDA in RFP 3407 announced in 2017 a desire to develop a comprehensive strategy to reduce soft costs associated with distributed energy storage systems in New York State by 25 percent per kWh by 2019 and 33 percent or more by 2021 compared to a 2015-16 baseline of approximately $220/kWh (Soft costs is defined as: permitting guidance, customer acquisition and best fit customer data analytics, customer and industry education and data collection and analytics). The Energy Commission has an active working relationship with the NYSERDA staff and California will benefit from this effort and be able to transfer this knowledge to California energy storage applications. Subtheme 2.3 will address the additional information needed to transfer these cost saving ideas to California.

TN215889 Advanced Microgrid Solutions:[39]

Advanced Microgrid Solutions proposes an initiative to improve the business proposition by identifying and eliminate barriers that prevent advanced energy storage systems from providing multiple functions for multiple stakeholders: e.g. capacity, back up generation, demand response, Volt/VAR, reactive power, integration with solar and other clean energy sources, and other ancillary services.

Discussion and Staff Response to TN215889

Initiative 2.3.1 will address developing solutions to these barriers.

Incentivize DER Adoption through Innovative Strategies at the Local Levels

TN215861 Peter Alstone:[40]

Peter Alston proposes an initiative to develop and pilot test combined market, policy, and technology tools that can deliver DER to rural areas. Develop targeted technology packages that meet unique needs of rural customers (residential, commercial, and industrial) and the required market and policy mechanisms to deliver them.

Discussion and Staff Response to TN215861

Under the *EPIC 2012 – 2014 EPIC Investment Plan* the Energy Commission funded the Zero Net Energy Farms Project (EPC-15-071) which seeks to develop innovative planning, permitting and finance models to increase deployment of DERs in agricultural settings. This project was part of the Energy Commission's EPIC Challenge solicitation which sought to increase deployments of Advanced Energy Communities. Initiative 2.4.1 seeks to continue funding for Advanced Energy Communities, which can include projects in rural and agricultural settings.

39 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215889_20170210T163451_Pam_Seidenman_Comments_Advanced_Microgrid_Solutions_EPIC_Trienn.pdf
40 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215861_20170210T140715_Peter_Alstone_Comments_Development_of_Rural_Distributed_Energy.pdf

TN215873 Sarah Outcault:[41]

Sarah Outcault proposes expanding the scope of Initiative 2.4 to include energy efficiency and the "customer" be broadened to include all key stakeholder groups. Energy efficient technologies require adoption by stakeholders at multiple levels in the supply chain. Many technologies, particularly for commercial buildings, have complicated and varied paths to market in which adoption by supply chain actors (e.g., distributors, design engineers) is a necessary pre-condition for customer adoption. Furthermore, "customer" and "end user" are often used interchangeably when in fact they may be different.

Discussion and Staff Response to TN215873

The CPUC's DER Action Plan includes energy efficiency in its definition of distributed energy resources. The goal of Theme 2 is to accelerate customer adoption of DER technologies. The term "customer" is meant to be inclusive of all stakeholders who wish to adopt DER technologies.

DER Aggregation

TN215886 Philip L. Top:[42]

Philip L. Top proposes an initiative to refine requirements by which automatically responding load can enhance and replace existing regulation, spinning, and non-spinning reserves, establish a mechanism to monitor, verify, and develop appropriate valuations and incentive structures to encourage participation.

TN215919 Solar City:[43]

Solar City proposes developing a pilot project(s) pairing DER providers with utilities to test aggregated deployments of homes and businesses with DERs for new grid services. A project could include 2,000 – 10,000 homes and businesses, each with solar PV, storage and controllable loads, aggregated into a portfolio to provide grid services and wholesale revenues. The grid services that could be tested include dynamic and scheduled capacity, voltage and reactive power support, and frequency regulation, among other items. This is also an opportunity to target partnerships with potential publicly owned utilities and community choice aggregators.

Discussion and Staff Response to TN215873 and TN215919

Staff agrees that aggregating DERs can enhance their value, especially in response to changing load conditions. The technology and strategies needed to aggregate and control various DERs is included in Initiative 1.4.1 and Initiative 2.2.1. The ability of these aggregated DERs to be

41 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215873_20170210T155354_Sarah_Outcault_Comments_Expanding_scope_of_adoption_initiative.pdf
42 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215886_20170210T163854_Philip_L_Top_Comments_Frequency_Responsive_Load.pdf
43 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215919_20170210T170313_Francesca_Wahl_Comments_SolarCity_Comments_EPIC_20182020_Invest.pdf

properly valued and participate in energy markets can be incorporated into the innovation financial strategies which are proposed under Initiative 2.4.1.

DER Communications

TN215898 Srinivasulu Badri:[44]

Srinivasulu Badri proposes an initiative for developing software platforms for easily integrating data sources with advanced analytics to facilitate better planning and operations of energy resources by utility providers, and building and facilities owners.

TN215913 Derek Jones:[45]

Derek Jones proposes an initiative to demonstrate a Transactive Energy System (TES) utilizing distributed intelligent computing resources. The proposed initiative is to demonstrate the information exchange between the utility and select customers about satisfaction and energy flexibility, and test technology using that data to optimize real-time and day-ahead energy and capacity operations.

TN215946 Lawrence Berkeley National Lab:[46]

LBNL proposes an initiative to streamline grid signaling communication technology pathways to communicate with responsive loads, storage and other DER systems. There is a need to improve and standardize methods to communicate with DERs. There needs to be a more common set of methods for end-use loads, storage (e.g., thermal and electrical), PV and related DERs.

TN216037 Solar City:[47]

Solar City proposes developing a platform for utilities to share grid data with DER providers and other interested stakeholders in a standardized, machine readable format. For DER providers to identify instances where DERs could defer traditional utility investment, they need access to data collected by the utilities on the operational characteristics of their distribution grid. There is a lack of access to grid data for DER providers and other interested stakeholders which would enable them to propose DER solutions to meeting grid needs. This type of data is already available to utilities but not third party providers.

Discussion and Staff Response to TN215898, TN215913, TN215946 and TN216037

Staff agrees that advance communication and control technologies that leverage intelligent computing power are vital to integrating DERs. Standardizing platforms, protocols, and interoperability of technologies is covered under Initiative 1.4.1. Furthermore, integrating

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44 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215898_20170210T164655_Srinivasulu_Badri_Comments_Analytics_for_Energy_Resource_Planni.pdf
45 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215913_20170210T165903_Derek_Jones_Comments_20182020_EPIC_Triennial_Plan_Project_Descr.pdf
46 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215946_20170213T110857_Mary_Ann_Piette_Comments_BTUS_Division_Consolidated_Comments_4.pdf
47 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216037_20170215T104829_Francesca_Wahl_Comments_SolarCity_Comments_EPIC_20182020_Invest.pdf

control technologies with DERs is an implicit objective covered under Theme 2 and could be included in proposals under Subtheme 3.1 as well.

Theme 3 Increase System Flexibility from Low –Carbon Resources

Grid Monitoring and Communications

TN 215847 Mitch Boretz:[48]

Mitch Boretz proposes an initiative on Advanced Grid Monitoring and Communications (AGMC) Technologies. Situational awareness through proper data acquisition is the key for Smart Grid development. It is necessary to upgrade our state's existing grid monitoring and sensor data communication capabilities at power distribution level and power transmission system to maintain grid reliability.

Discussion and Staff Response to TN 215847

Subtheme 3.3 and specifically Initiative 3.3.1 *Optimize and Coordinate Smart Inverters Using Advanced Communication and Control Capabilities* cover this topic area. Both the Energy Commission and the IOUs have funded research and demonstration projects in grid monitoring and communications and the use of sensors. The next steps in this development is the integration of DERMS to utilize the new functions of smart inverter technology to help maintain grid reliability.

Electric Vehicles

TN215855 Kanok Boriboonsomsin:[49]

Kanok Boriboonsomsin proposes the development of a suite of smart and energy efficient fleet solutions to support future people and goods movement scenarios where fleets of battery electric vehicles and/or plug-in hybrid electric vehicles can take advantage of real-time information and predictive analytics to optimize their operations that leads to energy efficiency and emissions reductions.

Discussion and Staff Response to TN215855

Initiative 3.2.1 addresses the comment's call for real-time information and predictive analytics to optimize battery electric vehicle fleet operations. Past investments by the EPIC program as well as the Alternative and Renewable Fuel and Vehicle Technology Program (ARFVTP) have funded research into electric vehicle fleet scheduling and electricity market participation, and future EPIC investments are envisioned to build on these results. Research into electrified goods movement vehicles such as drayage applications is feasible under Initiative 3.2.1. Additionally, Initiative 3.2.1's discussion of autonomous, connected, electric and shared (ACES)

48 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215847_20170210T124424_Mitch_Boretz_Comments_EPIC_topic_suggestion.pdf
49 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215855_20170210T133227_Kanok_Boriboonsomsin_Comments_Smart_and_Energy_Efficient_Fleet.pdf

vehicles addresses the comment's discussion of connected and automated vehicle (CAV) technologies.

TN215897 Satyajit Patwardhan:[50]

Satyajit Patwardhan proposes an initiative to develop the first conductive hands-free charger for electric vehicles in order to make it easy and convenient for everyone to own an electric vehicle thus appealing to a broader audience.

Discussion and Staff Response to TN215897

The hands-free conductive EV charger technology could be featured in proposed research projects envisioned in Initiative 3.2.1 if deployed in conjunction with vehicle-grid integration capabilities. Specifically, the technology's inclusion would be to improve PEV adoption, address grid integration barriers, and benefit electricity ratepayers.

TN215912 CALSTART:[51]

CALSTART proposes an initiative to develop regional roadmaps for rollout of EV charging infrastructure for medium and heavy-duty vehicles, study strategic and phased approaches for "grid friendly" charging solution for electric buses and trucks, and demonstrate energy management solution as case studies of electrified bus and truck fleets.

Discussion and Staff Response to TN215912

The Fuels and Transportation Division is the Energy Commission's principal group with responsibility for regional PEV charging infrastructure and needs assessments. The EPIC program is responsible for technology applied research, demonstration, and deployment projects. There is coordination across these groups, and several current and proposed demonstration projects focus on vehicle fleet energy management solutions. Proposed awards under the *EPIC 2015 – 2017 Investment Plan* include energy management demonstrations for electric bus transit fleets. Continuing focus on fleet energy management demonstration projects, including for transit and commercial fleets, is envisioned under Initiative 3.2.1.

TN215917 Rohini Raghunathan:[52]

Rohini Raghunathan proposes an initiative to promote products and solutions that enable the use of solar for charging electric vehicles by deploying an innovative and mobile vehicle attached solar charging solution that can generate over 20 miles of charge per day.

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50 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215897_20170210T164852_Satyajit_Patwardhan_Comments_HandsFreeCharging_of_EVs.pdf
51 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215912_20170210T165809_Jasna_Tomic_Comments_CALSTART_Comments_to_EPIC_for_IdeasInitiat.pdf
52 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215917_20170210T225639_Rohini_Raghunathan_Comments_Enable_products_and_solutions_that.pdf

Discussion and Staff Response to TN215917

Initiative 3.2.1 "Grid-Friendly PEV Mobility" is intended to explore and demonstrate grid integration solutions for grid-connected PEVs. Focusing on technologies and programs for grid-connected EVs is the most direct path to realizing benefits for utility ratepayers. While the comment highlights grid benefits to be realized by displacing grid charging with the off-grid solar charging equipment, the comment mentions the equipment costing "a few thousand dollars" per PEV and providing approximately 20 or 25 miles of range per day. While a research or demonstration project could be viable, the cost-effectiveness of demonstrating the solution with EPIC funds would be questionable compared to demonstrations that would help PEV drive access programs to save on charging costs and shift PEV charging demand to optimal times to maximize renewable power integration. However, as the comment notes, the equipment would offer additional benefits to individual purchasers including a reduction of range anxiety and enhanced energy independence.

TN215911 Emre Can Kara:[53]

Emre Can Kara proposes an initiative to address knowledge gaps in modeling the interconnected dynamics between human mobility and power systems, spatial-temporal dynamics of electric vehicle charging and its impacts on the distribution system, and EV charging demands.

Discussion and Staff Response to TN215911

The comment's discussion of alternative business approaches enabled by ridesharing services, communication connectivity, and potentially self-driving vehicles is addressed in Initiative 3.2.1 "Grid-Friendly PEV Mobility." Initiative 3.2.1 explores the comment's topics including combining value streams from mobility, electricity markets, and enhanced visibility of spatio-temporal dynamics of PEV charging. Please also see the response to TN215855 above.

TN215981 Greenlots:[54]

Greenlots proposes an initiative to have a measureable impact on the growth and penetration of EV in disadvantaged communities across California by installing high power DCFC stations combined with storage and collaborating with automakers or ride sharing services to coordinate strategies to increase access in disadvantaged communities.

Discussion and Staff Response to T215981

The comment emphasized multi-layer value streams for disadvantaged communities and enhancement of PEV penetration. The comment also discussed infrastructure and demonstrated a need for additional infrastructure for residents of multi-unit dwellings. Per the response to comment TN215912 above, the Fuels and Transportation Division is the Energy Commission's principal group with responsibility for regional PEV charging infrastructure and

53 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215911_20170210T165709_Emre_Can_Kara_Comments_Mobility_of_the_Future_In_the_Context_of.pdf
54 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215981_20170213T174932_Brandon_Oldham_Comments_Greenlots_Comments_on_EPIC_Investment.pdf

needs assessments. This comment's concept of DCFC installations paired with storage that could act as community back-up power could be pursued in Initiative 3.2.1. The concept also applies to investigating second-life batteries in Initiative 3.2.2 and applications of PEV ride-sharing services under Initiative 3.2.1 that provide value and enhance clean transportation access in disadvantaged communities.

Energy Storage

TN215918 Solar City:[55]

Solar City suggests an initiative to develop a pilot project to test multi-use optimization of energy storage systems that includes storage paired with renewables and other load control technologies, such as grid enabled electric water heating, advanced smart inverters, and smart thermostats. This can be seen as a successor to the September 2016 grant funding opportunity entitled "Solar +: Taking the Next Steps to Enable Solar as a Distribution Asset."

TN215914 Solar City:[56]

Solar City proposes an initiative to develop a pilot program to study the ability of distributed energy resources and energy storage to be paired with renewables, to defer transmission projects.

Discussion and Staff Response to TN215918 and TN215914

Staff agrees with the suggestion that microgrids with storage and renewable can supply multiple benefits to the larger grid. This will be included in solicitations under Subthemes 2.2 Advance Microgrids to the Tipping Point of Broad Commercial Adoption and 2.3 Define and Improve the Customer's Business Propositions on Integrated Distributed Storage.

TN215864 Brian Yanity:[57]

Brian Yanity proposes an initiative to investigate Wayside Energy Storage System (WESS) at passenger train stations and freight yards that would have a minimum energy storage capacity of 1 MWh and be couple with a locomotive battery charging system with a minimum output of 1 MW.

Discussion and Staff Response to TN215864

The Investor-Owned Utilities are planning on proposing a similar concept in their EPIC 2018-2020 Triennial Investment Plan. In order to avoid duplication, the Energy Commission's EPIC Investment Plan will not include this topic.

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55 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215918_20170210T170205_Francesca_Wahl_Comments_SolarCity_Comments_EPIC_20182020_Invest.pdf
56 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215914_20170210T165905_Francesca_Wahl_Comments_SolarCity_Comments_EPIC_20182020_Invest.pdf
57 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215864_20170210T144436_Brian_Yanity_Comments_Heavyrail_Wayside_Energy_Storage_System_W.pdf

Transmission and Distribution

TN215870 Nanpeng Yu:[58]

Nanpeng Yu proposes an initiative to enhance the modeling, monitoring, and maintenance of electric power distribution systems with big data analytics to transform the California power grid to a decentralized, bidirectional network supporting large penetrations of distributed energy resources and renewables.

Discussion and Staff Response to TN215870

Initiative 3.3.2 Advance Distribution Planning Tools to Reduce the Cost and Time Needed for Interconnection to the Grid and Improve Interoperability covers this topic area. Both the Energy Commission and the utilities have funded research and demonstration projects in grid monitoring and communications and the use of sensors. The next steps in this development is the integration of DERMS to utilize the new functions of smart inverter technology to help maintain grid reliability as covered in this initiative.

TN215857 Douglas Ian Stewart:[59]

Douglas Ian Stewart comments that the employment of high temperature superconducting (HTS) wire in overhead, underground and subsea cables can hold 100 times the power density of copper with zero losses to resistance when kept below its critical temperature with liquid nitrogen.

Discussion and Staff Response to TN215857

High Temperature superconducting wire is not a topic that being covered in this investment plan. An overview of the market indicates that a number of manufacturers have fully commercialized superconducting cables on the market. The Energy Commission agrees with DOE that after multiple successful on-grid demonstrations, the superconducting cable technology is ready for commercial deployment.

TN215907 Brian Yanity:[60]

Brian Yanity proposes an initiative to study new transmission lines along freight railroad right-of-ways in Southern California to understand potential new revenue sources for railroads, increased renewable energy deployment in California, and better power grid reliability.

58 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215870_20170210T155116_Nanpeng_Yu_Comments_Big_Data_Applications_in_Smart_Power_Distri.pdf
59 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215857_20170210T134616_Douglas_Ian_Stewart_Comments_Wattershed_HTS_Cable_Transmission.pdf
60 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215907_20170210T165120_Brian_Yanity_Comments_Feasiblity_study_of_freight_railroad_righ.pdf

Discussion and Staff Response to TN215907

Transmission corridor studies are outside the scope of the EPIC program. Transmission corridor planning is a function of the Energy Commission's Strategic Transmission Planning and Corridor Designation Office located within the Siting, Transmission, and Environmental Protection Division. The process for transmission studies is coordinated between the Energy Commission, CPUC, and California ISO. The California ISO leads the Transmission planning process. This process is explained in this document: http://www.energy.ca.gov/assessments/documents/CEC-CPUC-ISO_Process_Alignment_Text.pdf

To engage in this process please visit this website: https://www.caiso.com/planning/Pages/TransmissionPlanning/Default.aspx

Hydrogen

TN215839 Steve Jones:[61]

Steve Jones proposes funding for large scale electrolysers deployed at strategic CAISO locations to provide grid stabilization, renewable energy storage and curtailment avoidance, zero carbon vehicle fuels, gird ancillary services like demand response, and zero carbon fuel to help decarbonize natural gas in California.

TN21875 Mikael Sloth:[62]

Mikael Sloth proposes an initiative that encourages the construction and operation of a pilot plant at-scale to produce renewable electricity-based hydrogen fuel. This initiative would reduce curtailment of fluctuating renewable electricity to help manage the integration of increased renewables on the grid and providing a zero-emission fuel for transportation.

Discussion and Staff Response to TN215839 and TN21875

Implementation strategies for production of renewable hydrogen in California is currently being investigated by the Energy Commission's Alternative and Renewable Fuel & Vehicle Technology Program in the Fuels & Transportation Division http://www.energy.ca.gov/altfuels/2017-HYD-01/

On January 30, 2017, a pre-solicitation workshop was held on this topic. http://www.energy.ca.gov/altfuels/2017-HYD-01/documents/. Information on how to participate in this upcoming solicitation is available at the websites listed above.

61 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215839_20170210T101438_Steve_Jones_Comments_Large_scale_renewable_hydrogen_generation.pdf
62 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215875_20170210T161629_Mikael_Sloth_Comments_Grid_balancing_in_California_through_rene.pdf

Theme 4 Increase the Cost-Competiveness of Renewable Generation

Solar

TN215752 Gennady Medvedkin:[63]

Gennady Medvedkin proposes an initiative to develop a newly designed solar glass texture to increase sunlight collection by 10 percent at oblique angle in the morning and afternoon hours.

Discussion and Staff Response to TN215752

Staff agrees that development of new encapsulating materials for photovoltaic solar panels is important for increasing PV efficiencies and reducing overall costs of solar energy generation. This subject is addressed in Subtheme 4.1.

Wind

TN 215766 Kari Appa:[64]

Kari Appa proposes an initiative to evaluate the design of Axial Flow Helical Bladed rotors by using a CFD simulation model to estimate the power performance and cost details versus the conventional radial bladed rotor model.

Discussion and Staff Response to TN215766

Staff identified in Initiatives 4.2.1 and 4.2.2 the research need to reduce the cost and increase the performance of wind energy through advances in manufacturing and installation and developing real-time monitoring systems.

Marine Testing

TN215844 Rob Shalhoub:[65]

Rob Shalhoub encourages investment in a deep-water clean energy testing facility with a minimum depth of 200 meters to test new wave energy generation technologies for performance, durability, and scalability.

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63 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215752_20170203T005045_Gennady_Medvedkin_Comments_Solar_Panels_on_NonOptimized_Surfaces.pdf
64 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215766_20170204T100834_Kari_Appa_Comments_Next_Generation_Wind_Turbine_Rotor_Design_Po.pdf
65 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215844_20170210T105554_Rob_Shalhoub_Comments_Suggestion_to_Invest_in_a_Deepwater_Offsh.pdf

TN215991 Nick:[66]

Nick proposes an initiative aimed at utilizing existing off-shore oil platforms to facilitate the deployment and demonstration of small scale floating wind energy research facilities, establish a deep water marine science research facility and observation station, and establish a research and monitoring facility for the purpose of monitoring California's MPA network and other nearby sensitive coastal and marine habitats using a combination of traditional methods and advanced environmental monitoring technologies.

Discussion and Staff Response to TN215844 and TN215991

The CalWave project, funded largely by the U.S. Department of Energy, has designed a wave energy test facility on the central California coast. The project is currently in the environmental permitting phase and hopes to begin construction in 2019, pending continued DOE funding.

The offshore oil platforms are relatively close to shore, and not in areas with the best wind resources. Therefore staff believes that observations made there would be of limited value for wind energy.

Discussion of proposed research on environmental impacts of energy, including potential impacts of offshore wind, is included in Theme 7.

It is important to mention also that a preliminary study estimating the potential levelized cost of energy (LCOE) of Pacific offshore floating wind energy was recently published by the National Renewable Energy Laboratory (NREL.) For more information go to: http://www.nrel.gov/docs/fy17osti/67414.pdf

Wave Energy

TN215843 Rob Shalhoub:[67]

Rob Shalhoub encourages investment into advanced research and development of wave energy conversion technologies.

Discussion and Staff Response to TN215843

Staff understands that wave energy technologies are further from commercial deployment than offshore wind, and therefore research on these technologies is a low priority for this EPIC investment period.

66 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215991_20170213T212652_Nick_Comments_Offshore_Wind_Energy_Research_Deployment_and_Demo.pdf
67 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215843_20170210T105411_Rob_Shalhoub_Comments_Suggestion_to_Invest_in_Wave_Energy_Gener.pdf

Concentrating Solar Power

TN215756 Cara:[68]

Cara proposes an initiative to integrate thermal energy storage with concentrating solar power to provide flexible, carbon-free energy to the grid that can be developed as a base load, intermediate, or peaking power resource.

Discussion and Staff Response to TN215756

Staff agrees that concentrating solar power with thermal energy storage can contribute significantly towards achieving the state's renewable energy goal while providing the generation flexibility to support the intermittent renewables like PV and wind. In the past two investment plans, EPIC had focused on supporting the development of components critical to the CSP-TES namely the thermal storage systems and the reflectors and receivers. Prior to EPIC, the Energy Commission under the previous Public Interest Energy Research program also supported both modeling studies and small scale technology development on CSP and TES. Initiative 4.3.1 proposes to leverage the advancements from the prior Energy Commission programs and the DOE's SunShot program on CSP.

Bioenergy

TN215593 Astron Solutions Corporation:[69]

Astron Solutions Corporation proposes an initiative that establishes the need for collection and transportation infrastructure for biomass in the state. There is a current bottleneck that exists in the logical infrastructure of getting feedstock to the production facilities at a steady and reliable rate. Current qualification procedures make it difficult for smaller and more innovative bioenergy companies to develop their projects.

TN215827 Astron Solutions Corporation:[70]

Astron Solutions proposes an initiative scale-up a supertorrefaction technology that immerses any form of biomass under molten salt at a temperature of 450°C to convert the organic matter into char and volatile organic compounds.

TN215860 Mark Severy:[71]

Mark Severy proposes an initiative to encourage the development of techniques, technologies, or business models to create and utilize co-products like biochar, bio-oil, or district heat, from biomass electricity generation technologies.

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68 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215756_20170203T100201_Cara_Comments_Concentrating_Solar_Power_with_Thermal_Energy_Sto.pdf
69 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215593_20170127T111953_Astron_Solutions_Corporation_Comments_On_Electric_Program_Inves.pdf
70 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215827_20170209T151006_Frank_H_Shu_Comments_Astron_Solutions_Corporation.pdf
71 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215860_20170210T140437_Mark_Severy_Comments_Biomass_Energy_CoProduct_Development.pdf

Discussion and Staff Response to TN215593, TN215827, and TN215860

Staff recognizes the challenges associated with managing feedstock including the need for efficient and cost-effective delivery of feedstock to the biomass power plant and its impact to the overall cost of generation. Ideally, feedstock should be available at a short distance to reduce the cost and emissions from transporting the feedstock. Bioenergy initiatives from previous EPIC plans as well as the requirement of SB 1122 (Rubio, Chapter 612, Statutes of 2012) have limited the bioenergy systems to a community scale to sustainably supply the facility with feedstock from within the community. Initiative 4.4.2 will address this issue by exploring technologies and strategies that will make the delivery of feedstock to biomass power plants more cost effective. Similarly, the creation of valuable co-products like biochar or bio-oil while focusing on electricity generation as a primary product is important opportunity to reduce bioenergy costs and is considered in the proposed initiative.

Theme 5 Create a Statewide Ecosystem for Incubating New Energy Innovations

Entrepreneur Support

TN215742 Mike Layne:[72]

Mike Layne encourages the funding of demonstration projects from companies that have solutions past the research and development phase, with a viable product whose utility has not been fully demonstrated.

TN215842 Ben Norris:[73]

Ben Norris encourages funding smaller, innovative projects that fall outside of the current EPIC solicitation requirements, but in line with the Triennial Investment Plan and state energy goals. Funding would be available on a quarterly or half-year basis over a three year period. Funding for these smaller projects would enable more innovative, exploratory analysis to prove research concepts.

TN215879 Joseph Gallegos:[74]

Joseph Gallegos proposes an initiative to fund a micro incubator that decouples the heavy lifting of startups by acting like a workshop for product development and moving creative innovations to beta and market testing.

Discussion and Staff Response to TN215742, TN215842, and TN215879

Staff incorporated these recommendations into Initiatives 5.1.1 and 5.1.2.

Manufacturing Support

TN215960 Alex Vallejo Luce:[75]

Alex Vallejo Luce proposes an initiative to support a comprehensive effort for the scale-up, development, manufacturing, and deployment of advanced energy storage technologies. This would include access to shared research and development infrastructure, leveraging and increasing the utilization of existing assets while providing a platform for hands-on workforce development.

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72 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215742_20170202T094535_Mike_Layne_Comments_Future_EPIC_Projects.pdf
73 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215842_20170210T103307_Ben_Norris_Comments_Exploratory_Funding.pdf
74 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215879_20170210T162109_Joseph_Gallegos_Comments_Micro_Incubator__high_volume_innovatio.pdf
75 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215960_20170213T134711_Alex_Vallejo_Luce_Comments_Advanced_Manufacturing_Capacity__Wor.pdf

Discussion and Staff Response to TN215960

Staff agrees that integrating manufacturing considerations early in the technology development process can have significant benefits towards reduced time and costs associated with bringing the technology to market. These recommendations are incorporated into Initiative 5.2.2.

Open Solicitation

TN215924 Solar City:[76]

Solar City suggests setting aside a portion of the funding for open solicitations, which can focus on any of the themes laid out in the strategic framework category. Initial funding for open solicitations could be set at 10% of expected program awards for the Energy Commission's triennial investment plan, recognizing that the 2018-2020 program years would be the first opportunity to apply this concept.

Discussion and Staff Response to TN215924

Initiative 5.2.1 proposes a competitive funding mechanism similar to an open solicitation that is available to any project funded under EPIC or ARPA-E (assuming the projects will provide EPIC ratepayer benefits). The initiative is intended to establish a mechanism to provide follow-on funding for the most promising innovations that come out of EPIC or ARPA-E. Additionally, Initiative 5.1.1 seeks to continue the CalSEED Initiative which acts as a type of open solicitation.

76 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215924_20170210T170625_Francesca_Wahl_Comments_SolarCity_Comments_EPIC_20182020_Invest.pdf

Theme 6 Maximize Synergies in the Water-Energy-Food Nexus

Supplying and Treating Water

TN215863 Joseph Gallegos:[77]

Joseph Gallegos proposes an initiative to increase water filtration as a means of increasing the height of the water table and lowering the energy needed to pump the water to the surface.

Discussion and Staff Response to TN215863

The assumption here is that more on-site water filtration means more recycled water will be used and this would result in less water being extracted from the water table. If so, by inference the water table would be higher. Initiative 6.1.3 proposes to increase on-site water reuse at industrial sites. However, water filtration would be necessary as part of a treatment approach which would make on-site water reuse possible. The degree of water filtration would depend upon the intended function of the water reuse. Advanced membrane filtration would be a technology that could be considered for funding under Initiative 6.1.3.

TN215878 Prakash Rao:[78]

Prakash Rao proposes an initiative to make an assessment of energy consumption from water use in the industrial sector. The research would focus on quantifying water and energy associated with industrial processes, such as water conveying, pressurizing, treating, heating/cooling. The initiative would aim to lead to potential opportunities for water and energy savings.

Discussion and Staff Response to T215878

This topic is covered in Initiative 6.1.3 which proposes to increase on-site water reuse at industrial sites. Data on industrial water use will be collected, as applicable, to advance development and adoption of specific water-related energy-saving technologies and strategies.

Energy and Water Efficiency in the Food and Agriculture Sector

TN215829 Scott Samuelsen:[79]

Scott Samuelsen proposes an initiative aimed at exploring the potential vulnerabilities of energy system operations to disruption from transitions in the food and water systems in California.

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77 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215863_20170210T141612_Joseph_Gallegos_Comments_Water_Table_Management_for_Agricultura.pdf
78 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215878_20170210T162224_Prakash_Rao_Comments_Input_for_20182020_EPIC_Triennial_Plan.pdf
79 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215829_20170209T210014_Scott_Samuelsen_Comments_Vulnerabilities_of_Energy_System_Opera.pdf

Couplings between the energy, food, and water systems exist and each is individually evolving to improve the cost and reliability of their respective infrastructures under climate change.

Discussion and Staff Response to TN215829

This topic is covered in Subthemes 7.1 and 7.2. Subtheme 7.1 will map and project potential amplifications of interconnected risk across sectors. Subtheme 7.2 will develop decision-support tools to manage that risk. Although agriculture is not specifically highlighted in those initiatives, it is one of many sectors—such as water and telecommunications—which have direct input to and reliance on the energy sector.

TN215858 Joseph Gallegos:[80]

Joseph Gallegos proposes an initiative based on the large volume of crops that always needs to be irrigated and the ability of soil to hold water. The goal of the initiative is to find technologies that will allow agricultural land to be used as a low-cost energy grid load shaping tool, with the ability to provide demand response and help absorb over generation of renewable energy.

Discussion and Staff Response to TN215858

Subtheme 3.1, Accelerate Broad Adoption of Automated Demand Response Capabilities that Provide the Grid Flexible Response Services, could include agricultural related demand response research.

TN215867 Theresa Pistochini:[81]

Theresa Pistochini suggests research into indoor growing operations and potential for increased energy use.

Discussion and Staff Response to TN215867

Subtheme 6.2 could include energy and/or water efficiency projects for indoor growing operations.

TN215885 Joseph Gallegos:[82]

Joseph Gallegos proposes an initiative to decouple the current trend for pressurized systems to irrigate crops and look for new technology that can decrease the pressurization cost, such as low pressurized systems or eliminating all pressure and relying one hundred percent on gravity. This initiative aims to eliminate or severely lower energy demand when irrigating crops.

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80 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215858_20170210T134710_Joseph_Gallegos_Comments_Load_Shaping_for_renewable_energy_vari.pdf
81 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215867_20170210T150654_Theresa_Pistochini_Comments_Comments_on_proposed_EPIC_Framework.pdf
82 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215885_20170210T163944_Joseph_Gallegos_Comments_Decoupling_energy_from_irrigation__A_n.pdf

Discussion and Staff Response to TN215885

This idea falls under the scope of Subtheme 6.2.

Water Energy Management Practices

TN215846 Joseph Gallegos:[83]

Joseph Gallegos proposes an initiative to drive innovation toward improving the ETo (evapotranspiration), rate to 100 percent water efficiency through subsurface irrigation and other solutions that go beyond standard soil moisture monitors.

Discussion and Staff Response to TN215846

This idea falls under the scope of Subtheme 6.2.

TN215852 Dr. Nina Bergan French:[84]

Dr. Nina Bergan French comments that there is a unique opportunity to capture reliable, base load renewable energy using in-conduit, hydropower technology from municipal water pipes.

Discussion and Staff Response to TN21852

In the *EPIC 2015-2017 Investment Plan*, Strategic Objective S3.3 highlighted the opportunity to capture renewable energy from existing water conveyance structures. The initiative focused on developing solutions to expand California's use of in-conduit hydrokinetic power and was implemented under the grant solicitation GFO-16-301. Four projects were recommended for funding and one of them will update the generation potential of small hydro resources in California, including possibly from municipal water pipes. Staff will await the results of these new projects before considering additional research in this area.

TN215867 Theresa Pistochini:[85]

Theresa Pistochini suggests that water energy nexus theme include other areas besides food and agriculture, such as evaporative cooling which may or may not be related to agriculture or food production.

Discussion and Staff Response to TN215867

Subtheme 6.2 could include pre-commercial, energy efficient, cooling technologies for the agricultural and food processing sectors. As for consideration of evaporative cooling in the non- food and agriculture sectors, this is not included in Subtheme 1.3, Meeting the Demand

83 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215846_20170210T122245_Joseph_Gallegos_Comments_Advance_the_WaterEnergyFood_Nexus_with.pdf
84 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215852_20170210T130327_Dr_Nina_Bergan_French_Comments_Midstream_InConduit_Hydropower_f.pdf
85 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215867_20170210T150654_Theresa_Pistochini_Comments_Comments_on_proposed_EPIC_Framework.pdf

for Efficient and Environmentally Friendly Heating, Ventilation and Air Conditioning and Refrigeration Systems. The reason is because the Energy Commission is currently funding two evaporative cooling research projects with UC Davis. One agreement is researching compressor free evaporative cooling and the other is combining variable refrigerant flow with indirect evaporative cooling. Both of these projects are associated with buildings. We will await the results of these research projects before considering additional research in the building sector.

Theme 7 Develop Tools and Analysis to Inform Energy Policy and Planning Decisions

Modeling

TN215909 Slaven Peles:[86]

Slaven Peles proposes an initiative to build upon federal and state investments in open source software and create and improve open source tools for use in the state planning and analysis activities. It has been identified that an open source platform would provide a path for novel techniques and strategies to be brought into the larger community and reviewed by a broad set of stakeholders.

TN215892 Dian Grueneich:[87]

Dian Grueneich proposes an initiative to leverage new data streams being collected by cities as part of their energy, water, and other disclosure requirements, and their participation in Community Choice Aggregation to understand the interdependencies between such systems at the city scale. After data collection, the initiative can design programs and policies that leverage the synergies between water, energy, and food systems.

TN216015 Jovana:[88]

Jovana proposes an initiative to develop a methodology that will consistently measure and quantify risk across different hazards to provide information for utility owners, operators, and regulators in order to prioritize investments and mitigate the risks from hazards.

TN215945 Lawrence Berkeley National Laboratory:[89]

LBNL proposes an initiative to fill the technical, market, and informational gaps necessary to scale the adoption of advanced analytics, diagnostic, and control technologies in California's commercial building stock.

TN215868 Felicia Federico:[90]

Felicia Federico proposes an initiative to research and prioritize statewide energy conservation investments for commercial and industrial sectors based on coupled analysis of sector-specific demand and supply considerations. The initiative would identify investments with sector-

86 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215909_20170210T165514_Slaven_Peles_Comments_Open_source_Modeling_and_optimization_too.pdf
87 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215892_20170210T163042_Dian_Grueneich_Comments_Smart_cities_enabling_municipalities_to.pdf
88 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216015_20170214T125650_Jovana_Comments_Quantitative_Risk_Analysis.pdf
89 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215945_20170213T110811_Mary_Ann_Piette_Comments_BTUS_Division_Consolidated_Comments_3.pdf
90 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215868_20170210T150825_Felicia_Federico_Comments_Commercial__Industrial_Sector_Energy.pdf

specific estimates of both energy intensity of operations and compatibility of renewable generation to advance community-wide zero-net-energy goals.

TN215910 More than Smart:[91]

More than Smart proposes that the Energy Commission develop a state grid modernization research initiative. This initiative would analyze the research needs to support California's approach to three rapidly evolving functions: grid planning, grid operations, and DER integration. This would be a comprehensive literature review, and gaps analysis comparing the various research assessed through the literature review with the advanced needs of grid modernization, and a database of past, present, and potential future research related to grid modernization should be developed and maintained.

Discussion and Staff Response to TN215909, TN215892, TN216015, TN215945, TN215868, and TN215910

Staff agrees on the importance of open source software for studies informing climate-energy policies. Subtheme 7.1 includes this recommendation.

Staff agrees with the need for research to leverage synergies across water, energy, and food systems and to consistently measure and quantify risks across hazards. Subtheme 7.2 lays the foundation for addressing these research recommendations by providing for analysis of vulnerabilities and resilience strategies (Initiative 7.2.1). Subtheme 7.2 has been revised to explicitly indicate the potential for funding research that would integrate results across different hazards to provide a comprehensive, cost-effective framework for managing risk and guiding investments.

Subtheme 7.1 includes research dealing with behavior and technology deployment and adoption. However, the development and testing of control technologies would fit in Subtheme 1.4 dealing with technologies for buildings. Subtheme 7.1 would complement the technology work making sure the technology or systems are designed taking human behavior into account.

Regarding the comment suggesting analysis of sector-specific demand and supply considerations, this type of research could fall within Initiative 7.1.1, which is broadly scoped to consider how California's energy system must evolve to meet the state's long-term energy and climate-related goals as well as address challenges posed by changing climate and intermittency of renewables.

Regarding the comment concerning a comprehensive literature review and gaps analysis on grid planning, grid operations, and DER integration, this work could potentially fit under the scope of Initiative 7.1.1 but may be better suited to the Energy Commission's planned efforts to develop research roadmaps for DERs and renewable integration. The DER roadmap titled *Research Roadmap for System Transformation to Enable High Penetration of Distributed Energy Resources* and the renewable energy roadmap, titled *Research Roadmap for Cost and Technology Breakthroughs for Renewable Energy Generation* were part of the *EPIC 2015-2017*

91 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215910_20170210T165549_Tony_Brunello_Comments_More_Than_Smart_Comments_on_EPIC_Plan_fo.pdf

Investment Plan under initiative S21.1: Conduct Analyses on Different Technology Options and Strategies for the Electricity System.

Renewable Potential

TN215869 Marc J. Perez:[92]

Marc J. Perez proposes an initiative to yield a high-level strategic plan for minimizing the environmental and economic costs of integrating high penetrations of variable renewables into the state's energy mix and will yield a set of proposed regulatory and market policies that would guide California.

TN215894 Suzanne L. Singer:[93]

Suzanne L. Singer proposes an initiative to identify tribal lands with clean energy potential, as well as communities with lack of grid-tied energy and communications access and would evaluate the energy mixture and alternatives available.

Discussion and Staff Response to TN215869 and TN215894

Staff agrees with the suggestion for a strategic plan that minimizes environmental and economic costs while integrating high penetrations of renewables, especially on tribal lands. To implement this idea, the tribal lands would need to be in a service territory of PG&E, SCE, or SDG&E. This idea is covered under Subtheme 7.1.

Public Health and Safety

TN215763, TN215790 Claire Ann Warshaw:[94, 95]

Claire Ann Warshaw proposes an initiative to identify the health role that modern electrical devices play in the lives of humans, and bring health awareness to communities.

TN215831 Scott Samuelsen:[96]

Scott Samuelsen proposes an initiative that intends to leverage available tools for modeling microgrid and electric grid system operation in conjunction with developing additional tools, perform an assessment of the potential benefit of increased microgrid deployment on the state's ability to meet long-term greenhouse gas reduction, renewable utilization, and air quality compliance goals, and compare these benefits to a centralized electricity system.

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92 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215869_20170210T154716_Marc_J_Perez_Comments_High_Penetration_Renewables_in_CA_at_Mini.pdf
93 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215894_20170210T165010_Suzanne_L_Singer_Comments_Tribal_Energy_Program_for_California.pdf
94 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215763_20170203T160844_Claire_Ann_Warshaw_Comments_Public_Health_Education_Advertising.pdf
95 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215790_20170207T085557_Claire_Comments_Public_Health_Education_Advertising_for_Electri.pdf
96 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215831_20170209T205059_Scott_Samuelsen_Comments_Assessment_of_Air_Quality_and_Emission.pdf

TN215832 Scott Samuelsen:[97]

Scott Samuelsen proposes an initiative that intends to study the emissions and air quality impacts of renewable resource integration in tandem with emerging electricity sector technologies and strategies to identify how the state can maximize air quality and greenhouse gas emission reduction co-benefits.

TN215932 Lawrence Berkeley National Laboratory:[98]

LBNL proposes an initiative focused on indoor environmental quality (IEQ) as a critical enabling technology for state goals regarding zero net energy buildings and deep reductions in energy usage in existing buildings. IEQ includes air quality, thermal comfort, noise, and lighting.

Discussion and Staff Response to TN215763, TN215790, TN215831, TN215832, and TN215932

Under Subtheme 7.3, staff proposes to implement at least parts of a public health roadmap being developed under the *EPIC 2015 – 2017 Investment Plan*. Development of the roadmap is in progress.

Staff agrees with the suggestion for a study that leverages available modeling tools for microgrid and electric grid system operation. This idea is included in Subtheme 7.1.

Regarding a study of emissions and air quality impacts of renewables integration, this idea could fit under Subtheme 7.1. However, because air pollutant emissions from power plants such as oxides of nitrogen are relatively low, the proposed research initiatives focus more on the air quality benefits of electrification.

The suggestion to study indoor environmental quality in zero net energy buildings is addressed under Subtheme 7.3., as well as the *EPIC 2015 – 2017 Investment Plan* and the Energy Commission's PIER Natural Gas Research Program.

Offshore Research

TN215782 Benjamin Ruttenberg:[99]

Benjamin Ruttenberg proposes an initiative to assess habitat and environmental impacts, economic and social impacts, potential desalination inclusion, and optimized spatial distribution and planning for offshore renewables.

97 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215832_20170209T204617_Scott_Samuelsen_Comments_Emissions_and_AQ_impacts_of_Renewable.pdf
98 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215932_20170213T095644_Lawrence_Berkeley_National_Laboratory_Comments_On_EPIC_Triennia.pdf
99 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215782_20170206T160134_Benjamin_Ruttenberg_Comments_Science_and_information_needs_to_e.pdf

TN215809 Crow White:[100]

Crow White proposes an initiative to conduct marine spatial planning with ecosystem service tradeoff analysis for offshore renewable energy development in relation to energy production, environmental impacts, fisheries displacement, viewshed impairment, and other ecosystem service values/impacts of biological and socio-economic importance.

TN215833 Bureau of Ocean Energy Management, Pacific Region:[101]

The Bureau of Ocean Energy Management, Pacific Region proposes an initiative to conduct marine environmental research in order to assist the development, planning, and permitting of emerging wind and wave energy generation.

TN215845 Daniel Pondella:[102]

Daniel Pondella proposes an initiative to evaluate the biological state and contribution of manmade reef habitats off the coast of California. It has been identified as crucial to understand how the location of a project that will create a new reef habitat will impact the local biological communities and associated productivity, as well as other environmental and habitat factors that are important to fishery focal species.

Discussion and Staff Response to TN215782, TN215809, TN215833, and TN215845

Subtheme 7.3 discusses the idea of supporting environmental research for the potential deployment of offshore wind. Subtheme 7.3 proposes environmental research to fill knowledge gaps identified by the Task Force as it conducts marine spatial planning. Staff will continue to coordinate with the Bureau of Ocean Energy Management staff on specific research needs to avoid duplication.

Subtheme 7.1 indirectly opens the possibility of considering desalination in the development of long-term energy scenarios for California. Marine spatial planning will be conducted by the Task Force.

Regarding the suggestion to evaluate manmade reef habitats, the EPIC connection is not strong in this proposed initiative. Most existing artificial reefs are associated with oil platforms. Most offshore wind for California is expected to use floating platforms that will have a much smaller and different role as artificial reefs than oil platforms. Marine and Hydrokinetic platforms may have an artificial reef role, but this is a low research priority at this time because the technology is still far from the commercial stage.

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100 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215809_20170208T103444_Crow_White_Comments_Marine_Spatial_Planning_of_Offshore_Renewab.pdf
101 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215833_20170209T175420_Donna_Schroeder_Comments_BOEM_comments_for_EPIC_Investment_Plan.pdf
102 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215845_20170210T114440_Daniel_Pondella_Comments_Modeling_manmade_reefs_for_optimizing.pdf

Life Cycle Sustainability

TN215828 Scott Samuelsen:[103]

Scott Samuelsen proposes an initiative to understand the life-cycle sustainability aspects of the future energy resource portfolios being developed to meet California's energy goals to optimize the design of California's energy system.

Discussion and Staff Response to TN215828

This idea is included in Subtheme 7.3.

Research Centers

TN215874 Energy Institute at Haas:[104]

The Energy Institute at Haas proposes funding a research center focused on developing new social science tools and strategies to move the state toward a more reliable and lower cost electricity sector that achieves the state's environmental objectives. The center could focus on four areas: 1) the integration of renewable energy; 2) climate change impacts on the energy system; 3) reducing petroleum use for transportation through electrification; and 4) data-driven energy analytics.

TN215876 Energy Institute at Haas:[105]

The Energy Institute at Haas comments that research centers can pursue multiple projects within a related theme. A funding commitment to research centers from the Energy Commission will attract researchers and students to address energy and environmental topics of specific importance to California.

TN216100 John Grosh:[106]

John Grosh proposes an initiative to stand-up a multi-institutional computing center for electric grid planning to address the increasingly complex regulatory, technological, and hazard environments. The center would provide computing system resources for advanced analysis and planning studies performed by grid stakeholders.

Discussion and Staff Response to TN215874, TN215876, and TN216100

While Theme 7 does not include initiatives that call for formation or support of research centers, some of the ideas included in these comment are being addressed in Theme 7.

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103 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215828_20170209T210418_Scott_Samuelsen_Comments_LifeCycle_Sustainability_Aspects_of_th.pdf
104 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215874_20170210T155729_Andrew_Campbell_Comments_EPIC_Idea_Social_Science_Research_Cent.pdf
105 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215876_20170210T161531_Andrew_Campbell_Comments_The_Value_of_Research_Centers_and_Path.pdf
106 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216100_20170217T161751_John_Grosh_Comments_California_Grid_Planning_Computing_Center.pdf

Theme 8 Catalyze Clean Energy Investments in California's Underrepresented and Disadvantaged Communities

TN215840 California Housing Partnership Corporation:[107]

The California Housing Partnership Corporation recommends prioritizing project proposals that include tailored solutions for affordable housing. Solutions and technologies must be tailored for and demonstrated specifically on affordable housing properties to ensure that these solutions and technologies will be deployed in this sector.

TN215891 Advanced Microgrid Solutions:[108]

Advanced Microgrid Solutions proposes an initiative to address barriers to providing multifamily affordable housing, especially disadvantaged communities, with clean energy and resiliency through energy efficiency and renewable energy combined with energy storage.

Discussion and Staff Response to TN215840 and TN215891

These recommendations are addressed in Initiative 8.2.1.

107 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215840_20170210T100249_Collin_Tateishi_Comments_Re_Docket_No_17EPIC01_%E2%80%93_Comments_in_Su.pdf
108 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN215891_20170210T163351_Pam_Seidenman_Comments_Advanced_Microgrid_Solutions_EPIC_Trienn.pdf

APPENDIX B: Summary of Stakeholder Comments and Energy Commission Staff Responses on the March and April 2017 Scoping Workshops

The EPIC administrators held three joint workshops on March 9 and March 14, 2017 in Northern California and March 24, 2017 in Southern California to provide an overview and solicit public comment on each of the administrators' draft Investment Plans. The Energy Commission also held four topical workshops that feed into Investment Plan development: Distributed Energy Resources Scoping Workshop on March 13, 2017 in Sacramento, Potential Areas of Research on Climate Change for the Electricity and Natural Gas Systems on March 16, 2017 in Sacramento, and Incorporating Community Focused Equity in Research Funding on March 20, 2017 in Fresno and on March 27, 2017 in Los Angeles.

Participants offered verbal public comments during these workshops, and many others submitted written comments to the Energy Commission for consideration. In this appendix, staff summarizes and responds to all written comments related to these workshops submitted to the Energy Commission through March 24, 2017.

This appendix organizes comments by themes of the *EPIC 2018 – 2020 Investment Plan*:

- Theme 1 - Advance Technology Solutions for Deep Energy Savings in Building and Facilities
- Theme 2 - Accelerate Widespread Customer Adoption of Distributed Energy Resources
- Theme 3 - Increase System Flexibility from Low –Carbon Resources
- Theme 4 - Increase the Cost-Competiveness of Renewable Generation
- Theme 5 - Create a Statewide Ecosystem for Incubating New Energy Innovations
- Theme 6 - Maximize Synergies in the Water-Energy-Food Nexus
- Theme 7 - Develop Tools and Analysis to Inform Energy Policy and Planning Decisions
- Theme 8 - Catalyze Clean Energy Investments in California's Underrepresented and Disadvantaged Communities

Theme 1 Advance Technology Solutions for Deep Energy Savings in Building and Facilities

Building Envelope

TN216627 Lawrence Berkeley National Laboratory:[109]

LBNL proposes applied research and development to advance energy saving window and envelope technologies for existing or new buildings, include development of non-energy functionality or benefits likely to increase deployment –such as building envelope materials, air and liquid sealing, dynamic windows and window films and highly insulating roofs. This initiative will create low cost, high performance building envelope technology solutions that can be retrofitted in inefficient existing buildings.

Discussion and Staff Response to TN216627

LBNL's proposed initiative is included in Subtheme 1.2, Showcase Benefits of Advanced Window and Building Envelope Systems. One of the areas targeted in this subtheme is on demonstration and deployment efforts for next generation windows and envelope systems. Development work that would increase deployment of a proposed technology could be considered, the majority of the effort must focus on technology demonstration and deployment activities.

HVAC

TN216627 Lawrence Berkeley National Laboratory:[110]

LBNL proposes to develop and assess the system-level performance of all electric heating and cooling systems with novel architectures that utilize solar thermal, geothermal, and thermal energy storage technologies and can be integrated with district scale thermal energy networks. The goal is to develop system level solutions for heating and cooling of buildings that are net zero energy, grid friendly and cost effective.

Discussion and Staff Response to TN216627

These areas could be considered in Subthemes 2.1 and 2.4. Both of these subthemes focus on developing and demonstrating integrated approaches for buildings that are grid friendly through use of distributed energy resources.

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109 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216627_20170320T165041_Purabi_Thakre_Comments_Berkeley_Lab_comments_on_EPIC_20182020_T.pdf
110 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216627_20170320T165041_Purabi_Thakre_Comments_Berkeley_Lab_comments_on_EPIC_20182020_T.pdf

TN216627 Lawrence Berkeley National Laboratory:[111]

LBNL proposes research on integrated building thermal load management to reduce capital expenditure on HVAC equipment and save energy. The research will include identification of integrated sets of complementary measures that would permit elimination, downsizing, or delaying replacement of HVAC equipment in buildings.

Discussion and Staff Response to TN216627

Subtheme 1.2 proposes measures to make building envelopes tighter for both existing and new construction. By so doing, this would impact HVAC energy use while also making buildings more comfortable to building occupants. Because Subtheme 1.2 heavily emphasizes cost effectiveness while maximizing energy efficiency, LBNL's proposal to analyze thermal load management and HVAC expenditure could be considered during solicitation development for this subtheme.

In addition, the Energy Commission proposed an initiative in its 2017 – 2018 natural gas budget plan to improve building envelopes in existing buildings. The goal is to develop and demonstrate cost effective retrofit opportunities to reduce thermal loads and control flow of air and moisture in buildings.

TN216627 Lawrence Berkeley National Laboratory:[112]

LBNL proposes to develop and test new water heating systems. The purpose is to determine components and operational strategies of heat pump water heaters that contribute to higher efficiency, smarter control, lower cost and greater system reliability. The study could include field implementation in various CA regions to understand impacts of seasonal patterns, extreme conditions, and other household characteristics.

Discussion and Staff Response to TN216627

This area is addressed in Initiative 1.3.1. This initiative will develop and test advanced, California-climate appropriate electric heat pumps for space and/or water heating that are capable of performing at low-ambient temperature without adversely impacting performance, energy efficiency or operating costs. This initiative focuses on high efficiency heat pumps for various regions of the state, include hot and cold climates.

The Commission is currently performing significant research on water heaters and distribution efficiency under grant PIR-14-006 with subcontractor Pacific Gas and Electric.

111 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216627_20170320T165041_Purabi_Thakre_Comments_Berkeley_Lab_comments_on_EPIC_20182020_T.pdf
112 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216627_20170320T165041_Purabi_Thakre_Comments_Berkeley_Lab_comments_on_EPIC_20182020_T.pdf

TN216627 Lawrence Berkeley National Laboratory:[113]

LBNL proposes research and development of reliable, low maintenance combined heat and power (CHP) systems that will integrate into (retrofit) or replace building air and/or water heating furnaces. These building air and/or the water heating furnaces will generate heat and electricity.

Discussion and Staff Response to TN216627

This could be an area under the Energy Commission's natural gas research program. Please review the following website for future information on initiatives and solicitations: http://www.energy.ca.gov/contracts/pier.html

Building Controls

TN216627 Lawrence Berkeley National Laboratory:[114]

LBNL comments that strategies 1.1 through 1.6 will benefit from additional incorporation of physical safety and cyber-security-enhanced solutions. These solutions will contribute to the realization of the Internet of Things (IoT) as an enabling mechanism for building energy management, outdoor lighting, and aggregated sets of components (like exterior lighting or shared HVAC and waste heat recovery) as a managed demand grid resource. Solutions will need to be networked and adaptive.

Discussion and Staff Response to TN216627

The integration of technologies, including deep sensor technologies, into a platform with standard protocols is addressed in Initiative 1.4.1. Easy and seamless data capture, cheaper integration, and scaled adoption of advanced control strategies could be the results of research and demonstration of a standard protocol.

TN216627 Lawrence Berkeley National Laboratory:[115]

Complementing proposed Initiatives 1.4.1, 1.4.2 and 1.4.3, LBNL proposes to focus on filling the technical, market and informational gaps needed to scale the adoption of advanced analytics and control technical in commercial buildings. The recommendation is to encompass segment specific delivery and usage models for technology and services, all in cost benefit assessments, software performance testing and validation and barrier-focused technology development. This initiative focuses on overcoming adoption barriers and advancing the state of technology solutions to maximize the value of Initiatives 1.4.1, 1.4.2 and 1.4.3.

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113 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216627_20170320T165041_Purabi_Thakre_Comments_Berkeley_Lab_comments_on_EPIC_20182020_T.pdf
114 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216627_20170320T165041_Purabi_Thakre_Comments_Berkeley_Lab_comments_on_EPIC_20182020_T.pdf
115 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216627_20170320T165041_Purabi_Thakre_Comments_Berkeley_Lab_comments_on_EPIC_20182020_T.pdf

Discussion and Staff Response to TN216627

The demonstration of a comprehensive approach that includes consideration of the viability and application of advanced building energy controls is an important part of Subtheme 1.4.

TN216627 Lawrence Berkeley National Laboratory: [116]

LBNL proposes research to develop a mobile phone platform and application that can be used to collect survey data on household usage behavior of consumer appliances. Analyzed data can be used to provide recommendations to users on how to lower energy bills.

Discussion and Staff Response to TN216627

Technical, market, and informational gaps have been considered and addressed in Subtheme 1.4.1.

Industrial and Building Electrification

TN216627 Lawrence Berkeley National Laboratory: [117]

LBNL proposes research to address building electrification in existing and new buildings through development of comprehensive studies to understand wide scale transition to building electrification and delineate implementation options and strategies for building electrification across multiple building types.

Discussion and Staff Response to TN216627

This proposed research for buildings is not in the investment plan because the Energy Commission already has a number of planned or on-going studies on this subject and will await the results before pursuing additional research. This ongoing research includes:

- Real World Electrification Options of Energy Services and Environmental Justice (EPC-15-028). The research team will conduct a statewide assessment - at the zip code level - of the potential for electrification (e.g., use of electricity for space heating) to generate benefits to customer cost savings, socio-economic, climate, and air quality. The assessment will feed a comprehensive climate and energy model and a subsequent air quality analysis that will help determine very precise environmental benefits--with a focus on Environmental Justice (EJ) areas.

116 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216627_20170320T165041_Purabi_Thakre_Comments_Berkeley_Lab_comments_on_EPIC_20182020_T.pdf
117 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216627_20170320T165041_Purabi_Thakre_Comments_Berkeley_Lab_comments_on_EPIC_20182020_T.pdf

Data Centers

TN216627 Lawrence Berkeley National Laboratory:[118]

LBNL comments that data centers consume 1.8 percent of the US power and likely more in "high tech" states like California. The demand for computations doubles every 18-24 months and efficiency is critical to keep the energy consumption in check. The energy intensity or density in data centers continues to rise leading to new electrical and cooling system demands that should be met with more efficient and reliable systems.

Discussion and Staff Response to TN216627

Though staff agrees that data centers are a major consumer of electricity, it is not a focus of research for any of the initiatives in the *EPIC 2018 – 2020 Investment Plan.* The Energy Commission's R&D program under the Public Interest Energy Research and EPIC programs have extensively funded past data center research and the focus is now on other areas that have received less funding and attention. Based on our past research, it appears that:

- The technology changes fast in data centers. By the time proposals are submitted through a competitive process to our programs and awarded, a new and better technology could have already been developed by the private market and the state-funded research may no longer be relevant. As a result, technologies that are developed may only be viable for a limited time and there is no potential for replication of projects to others.

Building Performance Analysis and Tools

TN216627 Lawrence Berkeley National Laboratory:[119]

LBNL proposes to develop new data and tools to support and inform stakeholders for the planning, design and operation of viable, sustainable, resilient cities with healthy economies and optimized systems to reduce building energy consumption by 50 percent. The focus is at a district level—or urban building energy systems. LBNL asserts there is a need for a "city-scale" perspective to achieve aggressive energy goals and suggests district heating as an example of the kind of integrated systems that could be optimized to reduce total energy and GHG impacts, measured at the neighborhood, community or city level.

Discussion and Staff Response to TN216627

Initiatives 2.1.1 and 2.4.1 anticipate solicitations focused on analyzing, developing and demonstrating efficiency and load management strategies that would be conducted and evaluated at the community level. The analysis suggested by LBNL and the focus on urban energy systems could be elements of proposals submitted in response to solicitations under Initiatives 2.1.1 and 2.4.1.

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118 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216627_20170320T165041_Purabi_Thakre_Comments_Berkeley_Lab_comments_on_EPIC_20182020_T.pdf
119 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216627_20170320T165041_Purabi_Thakre_Comments_Berkeley_Lab_comments_on_EPIC_20182020_T.pdf

TN216627 Lawrence Berkeley National Laboratory: [120]

LBNL proposes research to perform market monitoring and data analysis to provide a more robust understanding of the impacts of Energy Commission appliance efficiency standards. The research would include estimates of true consumer costs and benefits of CA appliance standards.

Discussion and Staff Response to TN216627

This topic is not a research area under consideration in Subtheme 1.5, Increasing Plug Loads and Consumer Electronics Efficiency which focus mainly on the development of new technologies, methods, and approaches from early bench scale to full scale demonstrations. The research resulting from Subtheme 1.5 will include estimates of savings and benefits to California ratepayers and could help to inform future California appliance efficiency standards. Energy Commission R&D Division staff have referred this suggestion to the Energy Commission's Efficiency Division staff for consideration as part of its appliance rulemaking proceedings.

TN216626 Willdan Group: [121]

The Willdan Group proposes an initiative to leverage existing systems such as LEED or PEER or implementing new ones to engage and incentivize deep energy savings at the non-residential consumer/user level. The Willdan Group recommends employee-engagement technologies and programs to improve end-user knowledge and awareness in non-residential buildings to reduce facility energy consumption.

Discussion and Staff Response to TN216626

The approach suggested by the Willdan Group is consistent with the intent of Subthemes 2.1 and 2.4 in that they seek innovative approaches to coordinate and incentivize individual participation and engagement at the community level.

Technology Packages

TN216627 Lawrence Berkeley National Laboratory: [122]

LBNL proposes research on developing residential retrofit packages that are cost effective for the most common CA housing types whose energy efficiency falls below required current standards. This research will develop retrofit packages for common house types and remove some of the up-front design costs.

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120 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216627_20170320T165041_Purabi_Thakre_Comments_Berkeley_Lab_comments_on_EPIC_20182020_T.pdf
121 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216626_20170320T165222_Mehdi_Ganji_Comments_Willdan_Group_EPIC_Comments.pdf
122 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216627_20170320T165041_Purabi_Thakre_Comments_Berkeley_Lab_comments_on_EPIC_20182020_T.pdf

This research can include tool development, system specifications and performance metrics, assessment methodologies to determine energy savings potentials, market alliances and M&V methods.

Discussion and Staff Response to TN216627

Staff agrees that there is a need for developing packages of technologies for retrofit solutions. The best way to develop practical packages is for research-oriented groups to work together with commercial builders and renovation contractors to balance energy development with practical issues of cost, permitting, finance, and construction. Staff expects that these areas would be within the scope of Subtheme 2.4. More experimental, early-stage approaches, including synergies from combinations of technologies, could be developed under initiatives in Theme 1.

Low Global Warming Potential Refrigerants

TN216819 Tom Hutchinson:[123]

Tom Hutchinson commented support for transitioning to low-GWP refrigeration technologies

TN216820 Kevin Davis:[124]

Kevin Davis commented support for transitioning to low-GWP refrigeration technologies

TN216826 Tristam Coffin:[125]

Tristam Coffin urged the Energy Commission to prioritize funding for low-GWP refrigeration technology

TN216832 Keilly Witman:[126]

Keilly Witman commented support for the transition from high GWP refrigerants to natural refrigerants.

TN216838 Joe Kokinda:[127]

Joe Kokinda commented support for transitioning to low-GWP refrigeration technologies

123 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216819_20170406T083227_Tom_Hutchison_Comments_Support_funding_for_transition_to_lowGWP.pdf
124 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216820_20170406T084627_Kevin_Davis_Comments_Support_funding_for_transition_to_lowGWP_t.pdf
125 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216826_20170406T093334_Tristam_Coffin_Comments_Support_funding_for_transition_to_lowGW.pdf
126 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216832_20170406T110418_Keilly_Witman_Comments_funding_for_research_on_natural_refrigerant_use_in_supermarkets.pdf
127 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216838_20170406T122509_Joe_Kokinda_Comments_Support_Low_GWP_Refrigerants_Action.pdf

T216865 Howell Feig:[128]

Howell Feig urged the Energy Commission to prioritize funding for low-GWP refrigeration technology

TN216875 North American Sustainable Refrigeration Council:[129]

The North American Sustainable Refrigeration Council (NASRC) encouraged the Energy Commission to support the adoption of low-GWP refrigeration technologies. The NASRC comments that adoption of low-GWP technologies has substantial long-term effects on avoided emissions and will help California meet its greenhouse gas reductions goals.

TN216876 Shira Norman:[130]

Shira Norman urged the Energy Commission to prioritize funding for low-GWP refrigeration technology

TN216877 Ky Gruenfeldt-Roy:[131]

Ky Gruenfeldt-Roy commented support for funding the transition to low-GWP refrigeration technologies.

TN216878 Andrew Chandler:[132]

Andrew Chandler commented support for funding low-GWP refrigeration technologies for grocery store industry.

TN216890 Geoff Amos:[133]

Geoff Amos commented support for funding low-GWP refrigerant solutions for grocery stores.

TN216895 Scott Mitchell:[134]

Scott Mitchell commented support for transitioning to low-GWP refrigeration technologies.

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128 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216865_20170407T063202_Howell_Feig_Comments_Support_funding_for_transition_to_low-GWP_technologies.pdf
129 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216875_20170407T115200__NASRC_Comments_Support_funding_for_transition_to_low-GWP_technologies.pdf
130 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216876_20170407T120220_Shira_Norman_Comments_Prioritize_Funding_for_LowGWP_Refrigerati.pdf
131 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216877_20170407T115909_Ky_GruenfeldtRoy_Comments_Support_funding_for_transition_to_low.pdf
132 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216878_20170407T131341_Andrew_Chandler_Comments_Support_funding_for_transition_to_lowG.pdf
133 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216890_20170407T144225_Geoff_Amos_Comments_Funding_for_low_GWP_Refrigerant_solutions_for_Grocery_Stores.pdf
134 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216895_20170407T152741_Scott_Mitchell_Comments_Support_funding_for_transition_to_low-GWP_technologies.pdf

TN216903 Sumner Tison:[135]

Sumner Tison commented support for transitioning to low-GWP refrigeration technologies.

TN216915 Joseph Semiklose:[136]

Jose Semiklose commented support for transitioning to low-GWP refrigeration technologies.

TN216926 Clay Rohrer:[137]

Clay Rohrer urged the Energy Commission to prioritize funding for low-GWP refrigeration technology

T216972 Jim Geers:[138]

Jim Geers commented support for transitioning to low-GWP refrigeration technologies

T216976 Liz Whiteley:[139]

Liz Whiteley urged the Energy Commission to prioritize funding for low-GWP refrigeration technology

Discussion and Staff Response to TN216819, TN216820, TN216826, TN216832, TN216838, T216865, TN216875, TN216876, TN216877, TN216878, TN216890, TN216895, TN216903, TN216915, TN216926, T216972, and T216976

Research on alternative refrigerants and low global warming potential refrigeration technology is considered under Initiative 1.7.1.

135 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216903_20170407T155004_Sumner_Tison_Comments_Support_funding_for_transition_to_lowGWP.pdf
136 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216915_20170410T101411_Joseph_Semiklose_Comments_Low_GWP_refrigerants.pdf
137 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216926_20170410T151902_Clay_Rohrer_Comments_Low_GWP_Technology.pdf
138 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216972_20170411T202329_Jim_Geers_Comments_Support_funding_for_transition_to_low-GWP_technologies.pdf
139 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216976_20170412T093142_Liz_Whiteley_Comments_Support_for_natural_refrigerants.pdf

Theme 2 Accelerate Widespread Customer Adoption of Distributed Energy Resources

Increase the Cost-effectiveness of Highly Efficient Buildings and Communities

TN216626 Willdan Group:[140]

The Willdan Group recommends demonstrating advanced DER integration into transportation sectors such as ports, railways, and airports, to identify challenges and to build better business cases for emerging DER applications while benefiting surrounding communities and their daily commuters/cargo/customers. The Willdan Group also recommends development, deployment, and demonstration of plug and play DER packages that are inherently designed to minimize grid impact and are usable by single-family or multi-family homes to address voltage-related and power quality issues.

TN216630 Alice Sung:[141]

Alice Sung proposes an initiative that includes consideration of identifying K-12 public school districts, and community colleges, to be specified as one of the priorities to serve as the subjects of Theme 2. Alice comments that K-12 school districts serve as a good model for natural integration of DER throughout neighborhoods; serving as distributed energy storage fully integrated as part of the grid, while allowing the full public benefits of first use of its self-generated electricity, as well as preservation of local storage back-up, and fair sources revenue generation at full value of peak periods.

Discussion and Staff Response to TN216626 and TN216630

The comments focus on the types of projects the Energy Commission intends to fund, however, the initiatives do not typically distinguish by the building type or the use of the demonstration site. Ports, railways, and airports are broadly included under Subtheme 2.2. For some solicitations that will result from this investment plan, such as those under Theme 1 and Subtheme 2.1 and 2.4, K-12 schools and buildings and communities may be eligible demonstration sites.

TN216631 Solar City:[142]

Solar City proposes an initiative to focus on addressing the barriers to widespread customer adoption of DERs. This initiative would explore research opportunities to advance hardware and software technologies that facilitate community solar transactions and demonstrate the ability of community solar arrays combined with battery storage and smart inverters to act as a

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140 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216626_20170320T165222_Mehdi_Ganji_Comments_Willdan_Group_EPIC_Comments.pdf
141 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216630_20170320T165514_Alice_Sung_Comments_%E2%80%9CCitizen_Advocacy_for_EPIC_funding_initiati.pdf
142 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216631_20170320T180059_Francesca_Wahl_Comments_SolarCity_Comments_Draft_Funding_Initia.pdf

microgrid, defer transmission and distribution projects, and provide other benefits, particularly for new communities.

Solar City also proposes developing a study that evaluates and recommends a mechanism(s) to credit load shifting and energy storage technologies for the value they can provide for Title 24 building code compliance to meet ZNE goals.

Discussion and Staff Response to TN216631

Subtheme 3.1, anticipates completing behavior research studies and developing pilot projects to better understand customer participation in next-generation electricity markets. Distributed generation and storage technologies in combination with load-management technologies are explicitly identified as potential elements of projects that would be funded under this initiative. Integrated demand-side solutions such as those mentioned by Solar City could also be addressed under Initiative 2.4.1. Microgrids are included in Initiative 2.3.1

TN216627 Lawrence Berkeley National Laboratory: [143]

LBNL proposes to develop, demonstrate and automate behind-the-meter distributed energy resources. This includes development of component technologies and integrated systems that allow buildings to shift their loads for several hours within a day to balance variable renewable generation. Solutions could include: advanced lighting controls, solar control/thermal envelop, HVAC systems and water heating. Miscellaneous loads and controls and automation could also be included, along with onsite renewable, thermal and electric storage, and automated demand response technologies.

Discussion and Staff Response to TN6627

Subthemes 2.1 and 2.4 anticipate solicitations focused on analyzing, developing and demonstrating efficiency and load management strategies that would be conducted and evaluated at the community level. The behind the meter system development and analysis proposed by LBNL could be included as elements in those solicitations.

Integrated Distributed Storage

TN216623 Mark Bailey: [144]

Mark Bailey proposes the Energy Commission fund projects to improve the energy density of supercapacitors. Microgrids must be able to store significant amounts of energy, and to harvest and deliver this energy at a high rate. Today's energy storage components are typically capable of high energy or high power but not both. For example, battery storage energy density is higher than its power density. In contrast, commercial supercapacitors have low energy

143 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216627_20170320T165041_Purabi_Thakre_Comments_Berkeley_Lab_comments_on_EPIC_20182020_T.pdf
144 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216623_20170320T161628_Mark_Bailey_Comments_Request_Funding_for_High_Rate_Energy_Stora.pdf

densities (of 5 Wh/kg) and high power densities (of 2,000-20,000 W/kg). Increasing the energy density of supercapacitors would augment the ability to address many research areas in this report, namely Subthemes 1.6, 2.1, 2.2 and 2.3, and also other aspects such as electrification of diesel powered vehicles and cranes.

Discussion and Staff Response to TN216623

The *EPIC 2018 – 2020 Investment Plan* is focused on demonstration activities with emerging energy storage technologies as part of a system under Initiative 2.1.1 for community renovation, and Initiative 2.2.1 for Microgrids. Supercapacitors have been evaluated in the past and research to further advance this technology is expected to be included in future solicitations related to energy storage. Both DOE and NYSERDA are completing research to advance specific energy storage technologies. To avoid duplication of research, the Energy Commission will work actively with DOE and NYSERDA to ensure California is able to apply the results of their efforts. Also, the Energy Commission recently started the California Sustainable Energy Entrepreneur Development (CalSEED) Initiative, continuing under Subtheme 5.1 which can fund the advancement of specific technologies and bring them to market.

Detailed information on CalSEED can be found at http://calseed.fund/.

Power-to-Gas

TN216619 Southern California Gas:[145]

Southern California Gas proposes an initiative to fund investment in demonstration projects of renewable gas from electrolysis, known as Power-to-Gas (P2G). This technology has the potential to provide a large-scale, cost-effective solution for storing excess energy produced from renewable sources. Excess renewable energy is used to electrolyze water to produce hydrogen gas to provide excellent load-following capabilities and to store utility-scale quantities of energy indefinitely without self-discharge.

TN216710 California Hydrogen Business Council:[146]

The CHBC would encourage the Energy Commission to include Power-to-Gas demonstration projects for funding consideration under Theme 2. P2G technology has the potential to provide a large-scale, cost-effective solution for storing excess energy produced from renewable sources.

Discussion and Staff Response to TN216619 and TN216710

The EPIC Program currently has no plans to address Power-to-Gas research or demonstrations in the *EPIC 2018 – 2020 Investment Plan*. The Energy Commission may consider adding this

145 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216619_20170320T153309_Tim_Carmichael_Comments_SoCalGas_Comments_on_the_2018_%E2%80%93_2020_EP.pdf
146 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216710_20170324T123427_Comments_on_EPIC_Investment_Plan_by_California_Hydrogen_Business_Council.pdf

research category into the PIER Natural Gas research program in future budget plans where it can be better addressed.

Theme 3 Increase System Flexibility from Low –Carbon Resources

Advanced Demand Response

TN216631 Solar City:[147]

Allocate funding towards adoption of demand response (DR) services that use energy storage. Focusing on energy storage as a DR technology is important because: 1) California is likely to see greatly increased deployment of batteries sited behind the meter due to the Self Generation Incentive Program (SGIP); and 2) Batteries face issues that are unique from other demand response technologies, such as the inability of batteries to get credit for energy exported to the grid from behind the meter. Solving this constraint would improve the ability of distributed batteries to serve as dispatchable "virtual power plants" capable of providing zero-carbon renewable integration.

Discussion and Staff Response to TN216631

Direct subsidies of commercially available technologies is not within the purpose of the EPIC R&D program unless those investments are elements of an innovative strategy that is being developed and evaluated under applied research, technology demonstration and development or market facilitation initiatives. Subthemes 2.1, 2.4 and 3.1 all intend to include development of cost effective behind-the-meter and community-scale approaches to integrate load management, distributed generation and storage to meet grid needs.

Electric Vehicles

TN216603, TN216608 Rohini Raghunathan:[148, 149]

Rohini Raghunathan requests the inclusion of funding for technological innovation that drives the use of solar for charging electric vehicles; specifically, he requests an initiative to develop an EV charging system that is attached to the vehicle and can generate over 25 miles of charge per day.

Discussion and Staff Response to TN216603 and TN216608

Please also see the response to the comment from Rohini Raghunathan in Appendix A. These comments from the March DER workshop emphasize that the vehicle-attached off-grid solar

147 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216631_20170320T180059_Francesca_Wahl_Comments_SolarCity_Comments_Draft_Funding_Initia.pdf
148 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216603_20170319T153905_Rohini_Raghunathan_Comments_Requesting_funding_for_applications.pdf
149 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216608_20170320T113318_Rohini_Raghunathan_Comments_Requesting_funding_for_applications.pdf

PEV charging equipment could address a new application for solar energy as the market for rooftop solar begins to saturate. The principal focus of Initiative 3.2.1 "Grid-Friendly PEV Mobility" is integrating solutions for grid-connected PEVs given the potential for programs, markets, and technologies to shift PEV charging grid demand to optimal times to maximize renewable power integration. However, demonstrations of the off-grid solar PEV charging equipment could be viable if shown to reduce system costs for ratepayers. As the comment points out, other benefits, including cost competitiveness compared to other distributed energy resources (DERs), may be evaluated as part of Theme 2 in the proposed EPIC Third Triennial Investment Plan.

TN216607 CALSTART:[150]

CALSTART recommends that electric vehicle grid integration (VGI) should be an even higher priority, as advances in VGI are vital to effectively transitioning vehicles from internal combustion to electric drive. CALSTART recommends bolstering VGI investments by specifically focusing on medium-and heavy-duty vehicles (MHDVs).

Discussion and Staff Response to TN216607

Please also see the response to the comment from CALSTART in Appendix A. Activities in the proposed *EPIC 2018 – 2020 Investment Plan* under Subtheme 3.2 are envisioned to significantly advance progress toward long-term solutions in the medium- and heavy-duty PEV segment including suites of control technologies, sustainable programs, and combinations of distributed generation and on-site energy storage.

TN216627 Lawrence Berkeley National Laboratory:[151]

LBNL proposes an initiative assessing the effects of VGI services on battery life. The battery on a PEV is one of the more expensive components. Plausible VGI services could lead to a myriad of uses of the vehicle's battery. As part of the cost/opportunity analysis and the warranty process one must factor in the effect on battery life as a result of different use scenarios.

Discussion and Staff Response to TN216627

The comment emphasizes finding preferred use cases given that the duty cycles on a PEV battery pack vary depending on the grid services it performs. This type of cost/opportunity analysis can help establish appropriate warranties for PEVs performing vehicle-grid integration services, and thereby expand vehicle-grid integration and PEV adoption. These activities are highly feasible under Subtheme 3.2.

150 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216607_20170320T105000_Cory_Bullis_Comments_CALSTART_Comments_on_EPIC_3rd_Triennial_In.pdf
151 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216627_20170320T165041_Purabi_Thakre_Comments_Berkeley_Lab_comments_on_EPIC_20182020_T.pdf

TN216660 California Infrastructure Institute:[152]

The California Infrastructure Institute proposes an initiative to develop an integrated automated transportation network that will be all electric, reduce energy use and GHG emissions, and provide a model for improved transit in low-income areas as well as being commercially efficient, socially just and cost effective.

Discussion and Staff Response to TN216660

The comment discussed automated transportation networks (ATNs), personal driverless vehicles or cabins on their own guideway or track. These systems have the potential to be more energy efficient per mile traveled than PEVs, avoid traffic congestion and the need for parking spaces, and support light freight in addition to passenger traffic. While installation of guideway and other infrastructure would be capital intensive and not suitable for EPIC funding, a demonstration under Initiative 3.2.1 investigating methods to optimize the ATN electric load profile and integrate renewable generation may be feasible.

Energy Storage

TN216627 Lawrence Berkeley National Laboratory:[153]

LBNL comments that energy storage prioritizes maximum energy density which typically requires operation outside the thermodynamic stability window of the materials. Since energy density is not as critical as cost and life for energy storage on the grid, an enormous opportunity presents itself to develop batteries that start from a minimal cost perspective that have a much greater ability to provide extremely large lifetimes by not being stressed beyond their thermodynamic limits.

LBNL recommends research to address the changing shape of net load as penetration for renewables increases. This includes utilizing statewide locational heat maps of DER availability co-located with distribution system needs to enable use cases that direct system investments. LBNL also recommends support for research that seeks to understand mobility patterns of major urban environments such that charging stations can be deployed in locations that satisfy the increased demand for PEVs and maximize opportunities to provide grid services.

LBNL recommends developing initiatives to support grid modeling and technical analysis such as providing recommendations for optimal storage placement and sizing, optimizing storage dispatch logic based on circuit needs, assessments of stacked storage benefits, and fast interconnection requirements.

Discussion and Staff Response to TN216627

The *EPIC 2018 – 2020 EPIC Investment Plan* includes demonstration activities with emerging energy storage technologies as part of a system under Initiative 2.1.1 for community

152 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216660_20170322T141212_CALII_Comments_Inglewood_Proposal.pdf
153 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216627_20170320T165041_Purabi_Thakre_Comments_Berkeley_Lab_comments_on_EPIC_20182020_T.pdf

renovation, and Initiative 2.2.1 for Microgrids. Batteries have been evaluated in the past and are expected to be an acceptable technology for future solicitations that include energy storage. Both DOE and NYSERDA are completing research to advance specific energy storage technologies. To avoid duplication of research, the Energy Commission will work actively with DOE and NYSERDA to build on results of their efforts.

As for the changing shape of net load with increased renewables and charging stations deployed on the grid, the Energy Commission staff will consider these areas under Subthemes 2.2, 2.3, and Initiative 3.2.1. Also, Initiative 3.3.2 Advance Distribution Planning Tools addresses the utilization of statewide locational maps to direct DER system investment. As for grid modelling and the optimization of energy storage location and size, Subtheme 3.4 addresses this area.

TN216631 Solar City:[154]

Solar City proposes defining revenue opportunities for and the benefits of energy storage in California. Solar City comments that there is a need to further refine multi-use optimization for DERs including storage.

Discussion and Staff Response to TN216631

The comment's discussion of defining revenue opportunities for energy storage and further refining multi-use optimization for DERs is addressed in Subthemes 2.3 and 3.1. Subtheme 2.3 explores key commercial business case actions defined in the State's Energy Storage Roadmap, *Advancing and Maximizing the Value of Energy Storage Technology, A California Roadmap*, including defining and expanding revenue opportunities for energy storage. Refining multi-use optimization for DERs is included in Initiative 3.1.3's discussion of iDERs and Load Management Systems.

154 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216631_20170320T180059_Francesca_Wahl_Comments_SolarCity_Comments_Draft_Funding_Initia.pdf

Theme 4 Increase the Cost-Competiveness of Renewable Generation

Wind Energy Development

TN216620 Distributed Wind Energy Association:[155]

The Distributed Wind Energy Association proposes an initiative to support small and distributed wind systems. Small and medium scale wind turbine technology is not as advanced as utility-scale wind technology, with significant LCOE gains to be made through development of advanced components and installation techniques.

TN216632 Institute for Advanced Technology and Public Policy at Cal Poly San Luis Obispo:[156]

The Institute for Advanced Technology and Public Policy at Cal Poly San Luis Obispo recommends the clarification of Initiative 4.2.2 that eligible work on technology advances could include testing of prototypes of new designs, and that work on logistics could include analysis of potential improvements of existing ports, such as reinforcement of port structures to handle the weight of turbine components. The Institute also recommends the clarification in Initiative 4.2.3 that relevant monitoring systems could be designed to monitor environmental impacts, such as noise levels and effects on avian and marine life, as well as performance testing relating to energy generation.

Discussion and Staff Response to TN216620 and TN216632

EPIC funding for research on distributed wind energy is available in the second EPIC investment plan. Staff do not believe additional EPIC funding on this topic is a high priority for the third EPIC investment plan.

DOE and private developers are supporting prototype testing of new designs and performance testing of offshore turbines. Staff is not proposing to include this activity in this EPIC investment plan, although it may become more urgent in the future. BOEM has previously funded studies of port readiness. Staff believes it is premature, and likely very expensive, to put much effort into studying potential port improvements while the California offshore wind industry is in its infancy. The suggestion for environmental monitoring of offshore wind is part of Initiative 7.3.1.

155 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216620_20170320T153639_Michael_Bergey_Comments_Comment_on_Electric_Program_Investment.pdf
156 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216632_20170320T195931_Nick_Osterbur_Comments_Nick_Osterbur.pdf

Geothermal

TN216627 Lawrence Berkeley National Laboratory:[157]

LBNL proposes the inclusion of broader strategies for making geothermal more efficient such as combining geothermal energy and desalination or geothermal and waste-heat use.

Discussion and Staff Response to TN216627

The focus of geothermal research under the *EPIC 2018 – 2020 Investment Plan* is to improve existing geothermal facilities' ability to provide increased renewable generation and serve as a flexible resource to backup intermittent renewables. Making geothermal more efficient, as recommended in the comment, is a natural fit to achieve this goal for geothermal. While the focus of the initiative for making geothermal more cost effective is on capturing value products and boosting geothermal production, other strategies such as integration of geothermal with other economic uses may also be explored.

Wave Energy

TN216602 Joseph Santos:[158]

Joseph Santos recommends the use of tidal fluctuation to produce predictable and reliable clean energy. He states that tidal fluctuation could also be used for desalination.

Discussion and Staff Response to TN216602

Staff understands that tidal fluctuation could be harnessed as a form of wave energy technology and has demonstrated potential. However, the focus of offshore-related research for this EPIC investment period is to improve understanding of environmental impacts. The results of this research will be available to inform siting and permitting processes.

Bioenergy

TN216609 Bioenergy Association of California:[159]

The Bioenergy Association of California urges the priority of funds for forest biomass projects as required by the Governor's Emergency Proclamation and Order on tree mortality and to help meet the requirements of SB 1122 to develop small-scale forest biomass facilities. The Bioenergy Association of California recommends additional research into: comparing the emissions and benefits of various gasification technologies, piloting and comparing different technologies for biomass interconnection, developing tools to standardize and reduce interconnection costs, quantifying climate emission and reduction from forest biomass

157 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216627_20170320T165041_Purabi_Thakre_Comments_Berkeley_Lab_comments_on_EPIC_20182020_T.pdf
158 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216602_20170319T202421_Joseph_Santos_Comments_Per_Laurie_ten_Hope's_instruction__Lette.pdf
159 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216609_20170320T122359_Julia_A_Levin_Comments_BAC_Comments_on_the_Electric_Program_Inv.pdf

projects, including sequestration benefits of biochar, identifying market potential for biochar and biosolids produced during bioenergy generation and how these byproducts can help reduce forest biomass costs, identifying the potential for biomass power to be converted to gas for energy storage and other benefits, and increasing understanding of grid benefits of forest biomass energy and how to maximize those benefits.

TN216615 Tom Price:[160]

Tom Price recommends continued and expanded support for biomass energy research and projects. Biomass energy can address multiple state priorities like clean energy, clean air, climate change, dispatchability and resource adequacy.

TN216618 Jim Zoellick:[161]

Jim Zoellick recommends the expansion of Initiative 4.4.2 to include other community-scale biomass fueled electricity generation technologies such as an advanced stoker boiler technology with steam power cycle. All technologies should be required to meet common performance criteria like air emission rates and energy conversion efficiencies, but should not single out particular technologies for inclusion or exclusion.

TN216625 Placer County Air Pollution Control District:[162]

The Placer County Air Pollution Control District offers several recommendations including: looking at how small scale projects can handle direct transfer trips in a more affordable fashion; research on gasification technology and feeder system sensitivity to feedstock density and size; research on biochar production to reduce transportation costs associated with bioenergy; studying water use in implementing technologies such as Selective Catalytic Conversion, in addition to air pollution control technologies when considering direct combustion technology; funding studies that focus on forest management practices in terms of water storage, sedimentation, soil moisture content and uptake to the vegetation; and analysis of local regulatory challenges and opportunities for renewable energy.

Discussion and Staff Response to TN216609, TN216615, TN216618, and TN216625

The Energy Commission appreciates suggestions submitted for bioenergy research, development, demonstration and deployment. The comments indicate there are many challenges that need to be addressed to make bioenergy cost competitive.

Biochemical feedstock conversion processes such as anaerobic digestion have funding support from multiple government agencies. In this plan, EPIC bioenergy initiatives emphasize thermochemical feedstock conversion processes due to the state's tree mortality issue. The

160 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216615_20170320T133911_Tom_Price_Comments_Support_biomass_energy_development.pdf
161 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216618_20170320T134950_Jim_Zoellick_Comments_Comments_on_the_EPIC_2018_%E2%80%93_2020_Triennia.pdf
162 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216625_20170320T164114_PCAPCD_Comments_to_EPIC_Draft_20182020_Triennial_Investment_Plan.pdf

closure of biomass power plants has impacted the forest sector and the agriculture sector, particularly in the Central Valley where orchard waste management has become a problem.

Energy Commission staff recognizes that opportunities remain in the area of improving emissions rates, energy efficiency and reduction in water use. Gasification has demonstrated potential but has not been commercially successful and requires further focused research to help realize benefits. Gasification produces a fuel gas with a usable heating value that provides ability to employ a number of gas-based prime movers for power generation.

Regarding cost-effective interconnection technologies and bioenergy co-products, staff generally agrees these are important areas that will help move bioenergy projects forward. The description of Initiative 4.4.2 has been modified to include these two topics.

Regarding comments related to air and greenhouse gas emissions, EPIC Technology Deployment and Demonstration projects for bioenergy typically require measurement and verification plans to include an assessment of air and climate change emissions. Projects that include biochar are likely to include an evaluation of the sequestration benefits.

The potential for biomass power to be converted to gas (Power-to-Gas) for energy storage and other benefits may be eligible for EPIC funding as long as the main focus of research is on electricity generation. However, power-to-gas research to advance alternative fuels fits better with the Energy Commission's Natural Gas RD&D program or the Low Carbon Fuel program.

Staff generally agrees that Initiative 4.4.2 should be open to modular biochar production systems or other biomass conversion systems as long as they meet certain environmental, economic, and performance targets. Staff replaced references to "gasification technologies" with "thermochemical technologies." Also, Initiative 4.4.2 was expanded to include "co-products," as long as the primary focus is on electricity generation.

Generally speaking, modular bioenergy projects should meet the specifications of the CPUC's BioMat program, in particular, a nameplate capacity of up to 5 MW while restricting grid delivery to 3 MW.

Metrics and performance indicators for 4.4.1 and 4.4.2 have been expanded to include:

- Capital cost per kilowatt of installed system
- Levelized cost of electricity ($/kWh) including revenue generated from co-products

Theme 5 Create a Statewide Ecosystem for Incubating New Energy Innovations

SEED Funding

TN216611, TN216613 Stephanie Yanchinski:[163, 164]

Stephanie Yanchinski comments that The Rocket Fund, established by Emerging Technology Coordinating Council consortium of California utilities, CalTech, and the Moxie Foundation provides funds in the form of small grants to accelerate cleantech products to market. The Rocket Fund model is technology and region agnostic, to provide a unique vehicle for industry to work with the tech community to bring Cleantech products to market. Stephanie recommends integrated support for Rocket Fund efforts into the EPIC Triennial Plan.

Discussion and Staff Response to TN216611 and TN216613

Staff appreciates learning about the development and progress of The Rocket Fund. Theme 5 includes an initiative to work with investment funds like the Rocket Fund to advance competitive funding opportunities for California's Energy Innovation Ecosystem.

TN216616 Thomas Jensen:[165]

Thomas Jensen asks what services Innovation Cluster mentors provide and how they are organized, sourced, trained and managed. Mr. Jensen also comments that the Energy Commission's Connecting Emerging Energy Technologies and Strategies to Market Needs and Opportunities contract is an excellent venue to providing open and free access to information and people who can support energy entrepreneurs – improving the diversity and inclusiveness of the energy innovation ecosystem.

Discussion and Staff Response to TN216616

Services provided by Innovation Cluster mentors include business model development, intellectual property considerations, and first market selection, among others. The mentors are recruited, organized and managed by the Innovation Clusters with oversight from the Energy Commission.

Regarding the Energy Commission's Connecting Emerging Energy Technologies and Strategies to Market Needs and Opportunities project, staff appreciates the comments and suggestions provided and will take them into consideration as it implements the agreement.

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163 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216611_20170320T132006_Stephanie_Yanchinski_Comments_The_ETCC_Rocket_Fund_Also_Helps_C.pdf
164 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216613_20170320T133129_Stephanie_Yanchinski_Comments_Caltech_Rocket_Fund_Funding.pdf
165 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216616_20170320T140131_Thomas_Jensen_Comments_Comments_on_Market_Facilitation_Aspects.pdf

TN216626 Willdan Group:[166]

The Willdan Group proposes innovative financing options development similar to DOE loan guarantees for projects with high technology risk that reduce GHG emissions, increase system reliability, and employ new or significantly improved technologies with the intention of encouraging early commercial use of new or significantly improved technologies. The Willdan Group also encourages workforce training and development of local community, utility, and industry partnerships for market facilitation of emerging technologies.

Discussion and Staff Response to TN216626

Innovative financing options are addressed in Initiative 2.4.1 which seeks to develop new financing methods to encourage adoption of DER technologies. Workforce development is addressed in Initiative 5.2.2, which seeks to advance California manufacturing of clean energy technology innovations.

TN216627 Lawrence Berkeley National Laboratory:[167]

LBNL proposes additional support for early-stage, lower TRL research to bridge the gap between California's 2030 and 2050 clean energy goals.

Discussion and Staff Response to TN216627

The CalSEED Initiative targets early-stage clean energy technology innovations with Technology Readiness Levels 1 through 5. Initiative 5.1.1 seeks to continue the CalSEED Initiative to provide more opportunities for entrepreneurs with technologies at these TRL levels.

TN216631 Solar City:[168]

Consider an open solicitation funding category within the EPIC 2018-2020 investment plan.

Discussion and Staff Response to TN216631

To help project progress through the energy innovation pipeline, Initiative 5.2.1 proposes a competitive funding mechanism for projects previously funded under EPIC or ARPA-E. The initiative is intended to establish a mechanism to provide follow-on funding for the most promising innovations that come out of EPIC or ARPA-E (assuming the projects will provide EPIC ratepayer benefits). Additionally, Initiative 5.1.1 seeks to continue the CalSEED Initiative which acts as a type of open competitive solicitation.

166 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216626_20170320T165222_Mehdi_Ganji_Comments_Willdan_Group_EPIC_Comments.pdf
167 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216627_20170320T165041_Purabi_Thakre_Comments_Berkeley_Lab_comments_on_EPIC_20182020_T.pdf
168 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216631_20170320T180059_Francesca_Wahl_Comments_SolarCity_Comments_Draft_Funding_Initia.pdf

Entrepreneurial Support

TN216770 Los Angeles Cleantech Incubator:[169]

The Los Angeles Cleantech Incubator (LACI) encourages the Energy Commission to continue support for local stakeholder networks and engagement opportunities which can be leveraged to quickly transform an initial modest investment by the Energy Commission into multi-stakeholder, long-term environmental, economic and social impacts. LACI also recommends that the Energy Commission should take a holistic approach to energy stakeholder engagement that includes engaging and supporting market adoption among key clean energy customer segments.

LACI recommends the Energy Commission continue regularly convening stakeholders, raising awareness of the clean energy sector, hosting workshops to educate interested investors about clean energy, and publishing case studies and technical "roadmap" reports that inform investors about the state and future of the clean energy sector in California.

LACI recommends the Energy Commission explore supporting organizations or partnerships that have a specific focus on and method of funneling clean energy innovation into DACs. As well as build infrastructure and a mechanism for follow-on scaling and replication support after a successful DAC pilot.

Discussion and Staff Response to TN216770

The recommendations provided by LACI fall under the scope of initiatives under theme 5 and theme 8. Theme 5 seeks to expand the energy innovation ecosystem to reach a broader network of stakeholders and support greater clean energy entrepreneurship. Theme 8 seeks to expand clean energy investments in California's disadvantaged communities.

169 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216770_20170330T164922_LACI_Comments_2018-2020_Triennial_Investment_Plan.pdf

Theme 6 Maximize Synergies in the Water-Energy-Food Nexus

Supplying and Treating Water

TN216596 Sungtaek Ju:[170]

Sungtaek Ju proposes the inclusion of exploration/development/demonstration of thermal desalination for energy conservation and water-energy nexus. Sungtaek comments that thermal desalination driven by waste heat or solar energy is an attractive option to treat groundwater and/or wastewater.

Discussion and Staff Response to TN216596

This type of research could be considered in Initiative 6.1.1, "Develop and Test Novel Energy Efficient Treatment Methods for Conventional and Non-conventional Sources of Water Supply." This initiative focuses on developing and testing low energy water treatment approaches for conventional and non-conventional water sources. Specific proposals would need to address energy savings over existing methods of desalination.

TN216605 Krishnan Thosecan:[171]

Krishnan Thosecan recommends utilizing the San Francisco Bay and coastlines along California for new energy sources, energy storage, and generation on-demand for DER needs with freshwater. Krishnan also recommends funding innovative technologies for desalination to encourage hybrid water treatment and energy generation technologies that reduce GHG emissions.

Discussion and Staff Response to TN216605

Initiative 6.1.1 focuses on developing and testing novel energy efficient treatment methods. One of the areas of interest is low energy intensity desalination for brackish water, including the use of advanced membrane materials that can reduce energy consumption by 20 percent.

TN216627 Lawrence Berkeley National Laboratory:[172]

LBNL proposes an initiative to assess water use and associated energy consumption within California's industrial sector. The assessment would be based on primary data collection gathered through field visits using a representative statistical sample of California industry. Results would quantify how much water California industry uses and for what purposes. It

170 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216596_20170317T111051_Sungtaek_Ju_Comments_Thermal_desalination.pdf
171 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216605_20170320T084735_Krishnan_Thosecan_Comments_Energy_and_water_solutions_with_DER.pdf
172 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216627_20170320T165041_Purabi_Thakre_Comments_Berkeley_Lab_comments_on_EPIC_20182020_T.pdf

would quantify the associated energy consumption for conveying, pressurizing, treating, heating/cooling, or other end uses.

Discussion and Staff Response to TN216627

This topic is covered in Initiative 6.1.3 which proposes to increase on-site water reuse at industrial sites. However, data on industrial water use will be collected on a case-by-case basis, as applicable, to support measurement and verification of technological advances funded through this initiative.

Energy and Water Efficiency in the Food and Agriculture Sector

TN216626 Willdan Group:[173]

The Wildan Group encourages the development of industry-specific research and tools for batch processes in the food and agricultural sector to better leverage energy and water efficiency processes and technologies. The tool will allow businesses to support technology implementation and accelerate decision making and planning related to food-energy-water nexus synergies.

Discussion and Staff Response to TN216626

Subtheme 6.2 will focus on technology demonstration and deployment in the agriculture and food processing sectors. Product-specific market acceptance and adoption tools could be considered as part of a project to demonstrate and deploy a specific technology.

TN216627 Lawrence Berkeley National Laboratory:[174]

LBNL highlights the need for tools such as soil and plant moisture sensing devices, commercial irrigation-scheduling services, and computer simulation models to assist with water-energy management decisions. LBNL encourages use of smart demand-response schemes, deployment of renewable energy sources, and increased understanding of water policy's effects on water-use efficiency to reduce energy costs.

Discussion and Staff Response to TN216627

Subtheme 6.2 will focus on technology demonstration and deployment in the agriculture and food processing sectors. Product-specific market acceptance and adoption tools could be considered as part of a project to demonstrate and deploy a specific technology.

173 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216626_20170320T165222_Mehdi_Ganji_Comments_Willdan_Group_EPIC_Comments.pdf
174 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216627_20170320T165041_Purabi_Thakre_Comments_Berkeley_Lab_comments_on_EPIC_20182020_T.pdf

Theme 7 Develop Tools and Analysis to Inform Energy Policy and Planning Decisions

Modeling

TN216604 Ahmed Abdulla:[175]

In addition to Initiative 7.1.2, Ahmed Abdulla recommends further study of the use of electric vehicles, society's attitudes to electric vehicles, and how public perceptions of EV risks and benefits have evolved over the past five years.

TN216607 CALSTART:[176]

Under Theme 7, CALSTART recommends the following technical studies: 1) study of lessons learned from the $60 million portfolio of fast-track pilot projects currently being proposed in the CPUC's SB 350 proceeding by IOUs; 2) a study of opportunities for existing commercial EVs to increase their utilization of grid infrastructure in periods of high renewable energy generation; and 3) a study of potential regional benefits for pilot projects for regional freight, drayage, and last-mile transport.

TN216627 Lawrence Berkeley National Laboratory:[177]

LBNL encourages the engagement of market actors with clear market signals and valuation methods to develop scalable solutions to meet climate goals. LBNL identifies critical path needs such as: development and testing of resiliency and climate risk assessment and financial models; development of efficiency as an asset class and new capital revenue scenarios and flows for efficiency investments; and engagement with financial sector stakeholders, such as insurance providers, financial institutions, banks and accounting firms.

Discussion and Staff Response to TN216604, TN216607, and TN216627

Consumer attitudes and preferences regarding electric vehicles could potentially fit under Initiative 7.1.2.

The long-term scenarios work to be explored under Subtheme 7.1 will consider the technical and policy implications of a variety of pilot projects as well as opportunities for smart integration of EVs with grid infrastructure.

Research under Subtheme 7.1 could potentially explore possible implications of various policies regarding California's long-term energy goals, including market signals.

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175 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216604_20170318T130621_Ahmed_Abdulla_PhD_Comments_Improving_modeling_efforts_to_reflec.pdf
176 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216607_20170320T105000_Cory_Bullis_Comments_CALSTART_Comments_on_EPIC_3rd_Triennial_In.pdf
177 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216627_20170320T165041_Purabi_Thakre_Comments_Berkeley_Lab_comments_on_EPIC_20182020_T.pdf

Regarding stakeholder engagement, each EPIC project has a technical advisory committee. Staff strives to include broad representation and participation of experts and stakeholder groups to help advance each project's success, value, and path to market.

Social Science Research on Clean Energy

TN216629 Energy Institute at Haas: [178]

The Energy Institute at Haas comments that social science approaches that apply advanced data analysis and econometric approaches can help research administrators, demand and supply modelers, technology developers and policy makers better understand the real-world impacts of energy technologies, practices, and policies. The Energy Institute at Haas recommends funding economic research to assess wholesale markets, design cost-effective energy policy, and advance commercialization of new technologies.

TN216693 Mithra Moezzi, Loren Lutzenhiser, Aaron Ingle: [179]

The commenters state there is a need to develop and apply social science, including transitions research, to inform technology RD&D, deep carbonization of the energy system, sustainability, and socio-technical resilience. Ms. Moezzi recommends the use of transitions research to anticipate and thoroughly explore preferred alternatives.

Discussion and Staff Response to TN216629, and TN216693

Staff appreciates comments regarding the importance of social science research in the EPIC portfolio. Subtheme 7.1 is intended to provide holistic, interdisciplinary analyses to inform transformation of California's electricity sector, with particular attention to equity and diversity considerations in strengthening community resilience.

Urban Heat

TN216676 Altostratus Inc.: [180]

Altostratus proposes an addition under Subtheme 7.2 to address research on urban-heat reduction measures by holistically accounting for various interrelated factors and pathways including regional climate, urban micro-meteorology, and energy use. The goal is to carry out observations and modeling based research to arrive at a city-specific cooling target at which the energy and climate benefits are maximized. The proposal will address the detailed analysis of land-use, fine-scale characterizations of urban fabric and morphology, and fine-resolution urban meteorological modeling to determine the feasible site and city specific potentials for mitigation of urban heat and develop an assessment of the technical potential that can be realistically attained.

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178 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216629_20170321T081201_Energy_Institute_at_Haas_Comments_On_Draft_Funding_Initiatives.pdf
179 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216693_20170323T162114_Mithra_Moezzi_Comments_Moezzi_Lutzenhiser_Ingle_Comments_on_EPI.pdf
180 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216676_20170323T133519_Altostratus_Inc._Comments_Proposed_initiative_under_sub-theme_7.2.pdf

TN216677 Altostratus Inc.:[181]

Altostratus recommends the inclusion of research that will develop detailed understanding of the mechanisms through which urban areas in California can exacerbate excessive heat events and heat waves and to quantify impacts on electric demand under current and future climates. The proposal will assist in the development of a next generation fine-resolution projection set that will include improved risk assessments for infrastructure from heat events.

TN216692 Lawrence Berkeley National Lab, University of Southern California, Altostratus Inc.:[182]

The commenters recommend addressing research to evaluate urban-heat mitigation potentials of various techniques under present conditions and in a changing climate. The commenters recommend extending climate/weather modeling and monitoring parameters to evaluate the effects of reduced energy use within cooler neighborhoods on emissions of precursors and on ozone air quality. The proposal would carry out detailed land-use analysis, in-depth urban fabric and morphological characterizations, and fine-resolution urban meteorological modeling to determine the technical potential for mitigation of urban heat and to assess how much of that technical potential could realistically be attained.

Discussion and Staff Response to TN216676, TN216677, and TN216692

Initiative 7.2.1 "Improved Understanding of Climate- and Weather-Related Risks and Resilience Options", provides for development of improved projections and probabilistic forecasts that could improve IOU operations and planning as well as resilience measures that foster electricity sector anticipation and preparedness for climate change. The first and second investment plans are supporting research on the interactions with urban areas and urban heat effects as they relate to the electricity sector. These research projects will inform the modeling efforts under Subtheme 7.2 to identify climate risks to electricity system. Furthermore, activities to mitigate urban heat are being implemented by the California Natural Resources Agency through the Urban Greening program, and may be included under the Strategic Growth Council's Transformative Climate Communities.

Regarding the comment that emphasizes the inter-relatedness of the energy system with climate change, urban form, air quality emissions and public health impacts, and efforts to address urban heat effects, prospective consideration (under a changing climate) of potential electricity sector resilience measures falls under the domain of Subtheme 7.2 "Increase the Resiliency of the Electricity System to Climate Change and Extreme Weather Events" while a holistic analysis of the potential contribution of various technologies and approaches to overall goals is addressed by Subtheme 7.1 "Identify Pathways for Achieving California's Energy and Climate Goals", specifically the first initiative in this subtheme.

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181 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216677_20170323T134654_Altostratus_Inc._Comments_Research_suggestion__Initiatives_7.2.1_and_7.2.2.pdf
182 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216692_20170323T162003_LBNL_University_of_Southern_California_and_Altostratus_Inc_Comm.pdf

Materials Recycling

TN216627 Lawrence Berkeley National Laboratory:[183]

LBNL comments that today's Li-ion batteries, mass produced for energy density, have become the default solution for the grid. What is needed are aqueous based systems that are inherently safer and have greater transport properties which result in components closer to millimeters in thickness (as in the electrodes designed for lead acid batteries where recycling occurs at a rate of over 95%.) that are either easily recovered and recycled or rejuvenated and put back into operation with minimal treatment.

Discussion and Staff Response to TN216627

Initiative 7.3.3 is focused on assessing the life-cycle environmental performance of emerging energy technologies, which could include aqueous based batteries. This comment seems to propose research and development of new battery technologies, which are more appropriately considered in Subtheme 2.3.

Carbon Capture Sequestration

TN216627 Lawrence Berkeley National Laboratory:[184]

LBNL proposes research to analyze paths that establish carbon capture sequestration (CCS) as a viable demonstrated solution to help achieve California's climate goals. LBNL suggests funding to develop a CCS pilot or demonstration project; develop geological storage hubs in strategic locations; and R&D to develop geological storage solutions.

Discussion and Staff Response to TN216627

The California Energy Commission has previously funded CCS studies with PIER Natural Gas funds, rather than electricity public interest research program. The commenter notes that ARB is targeting the refinery sector for GHG emissions reductions with CCS as part of their strategy. Although staff agrees with the comment about the research need, the refinery sector is outside the scope of the EPIC program.

183 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216627_20170320T165041_Purabi_Thakre_Comments_Berkeley_Lab_comments_on_EPIC_20182020_T.pdf
184 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216627_20170320T165041_Purabi_Thakre_Comments_Berkeley_Lab_comments_on_EPIC_20182020_T.pdf

Theme 8 Catalyze Clean Energy Investments in California's Underrepresented and Disadvantaged Communities

TN216539 Nehemiah Stone:[185]

Nehemiah Stone proposes research into the causal link between improved indoor air quality in low-income housing and improved health outcomes to identify cost-effective ways of reaching low-income households and economically sound ways of upgrading their homes, rented or owned. Nehemiah comments that the majority of equity issues in energy efficiency are economic in nature.

Discussion and Staff Response to TN216539
This recommendation is incorporated into subthemes 7.1 and 7.3 which include examining ways to improve indoor air quality.

TN216622 College of the Desert:[186]

The College of the Desert proposes an initiative to address environmental justice for disadvantaged communities through demonstration and education of Zero Net Energy affordable homes and renewable energy resources to equip students with the knowledge and skills needed for employment in future home construction. The goals of this initiative would include training students in construction related programs at community colleges on energy efficiency and on-site clean energy generation methods supporting ZNE home construction.

Discussion and Staff Response to TN216622

Initiative 8.2.1 addresses this comment by seeking to increase demonstrations of emerging clean energy technology solutions in low-income and disadvantaged communities. Additionally, the Energy Commission's SB 350 Barriers Report recommends that the EPIC program target at least 25 percent of technology demonstration and deployment funds to projects with demonstration sites located in these communities.

TN216627 Lawrence Berkeley National Laboratory:[187]

LBNL proposes that research is needed to help disadvantaged communities participate in citizen science to measure air quality in their communities (indoor and outdoor) that relate to energy choices (e.g., heating, ventilation, air conditioning), including the development of new low-cost air sensors, such as for pollutants like black carbon that contribute to climate change and severe health impacts. Citizen science will increase community engagement and understanding of linkages between climate and energy policies on air pollution and health.

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185 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216539_20170313T184554_Nehemiah_Stone_Comments_economics_of_equity.pdf
186 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216622_20170320T161705_Larry_McLaughlin_Comments_S82_Demonstrate_Emerging_Clean_Energy.pdf
187 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN216627_20170320T165041_Purabi_Thakre_Comments_Berkeley_Lab_comments_on_EPIC_20182020_T.pdf

Discussion and Staff Response to TN216627

This topic is covered under subthemes 7.1 and 7.3 which propose to fund research addressing ways to improve indoor air quality.

APPENDIX C: Summary of Verbal Stakeholder Comments and Energy Commission Staff Responses on the Electric Program Investment Charge Proposed 2018 – 2020 Triennial Investment Plan

The EPIC administrators held public workshops to discuss scoping for the *EPIC 2018 – 2020 Investment Plan* on February 3, 2017, in Sacramento, California, and held three joint workshops on March 9 and March 14, 2017 in Northern California and March 24, 2017 in Southern California to provide an overview and solicit public comment on each of the administrators' draft Investment Plans. The Energy Commission also held five topical workshops that feed into Investment Plan development: Distributed Energy Resources Scoping Workshop on March 13, 2017 in Sacramento, Potential Areas of Research on Climate Change for the Electricity and Natural Gas Systems on March 16, 2017 in Sacramento, Incorporating Community Focused Equity in Research Funding on March 20, 2017 in Fresno and on March 27, 2017 in Los Angeles, and Customers of Climate Science Research on April 11, 2017 in Sacramento.

Participants offered verbal public comment during the workshops, most of which provided written comments as well. Many others submitted written comments to the Energy Commission for consideration. Below is a summary of oral comments presented during the workshop. During the workshop, panelists and Energy Commission staff provided responses to many of these comments. Staff has considered verbal comments, along with those submitted in writing, in preparing the staff final proposed *EPIC 2018 – 2020 Investment Plan*.

Verbal Comments from the February 3, 2017 Scoping Webinar on Development of the EPIC 2018 – 2020 Investment Plan

Electric Vehicles

Summary of Comments

A representative from CONNECT MYED asked if customer adoption of DER is one possible category under the investment plan and if it includes EVs.

Satyajit Patwardhan suggested the Energy Commission consider hands-free charging as part of the investment plan. Mr. Patwardhan commented that hands-free EV charging can make EVs more attractive to consumers and users with disabilities. Additionally, EVs could be more widely deployed as a distributive resource with hands-free charging systems.

Panelists and Staff Response

The Energy Commission responded that customer adoption of DERs is covered under Theme 2 and electric vehicle research is covered under Subtheme 3.2.

Research Institutes

Summary of Comments

David Lehrer, Center for Built Environment at the University of California Berkeley asked the IOUs to define the concept of research institutes and how it will be interpreted going forward.

Panelists and Staff Response

SCE responded that in the past there has been a need for institute type work at the IOUs, but IOU EPIC funding is limited to demonstration projects. The challenge is finding memberships specific to demonstrations.

Building Occupant Research

Summary of Comments

A stakeholder commented that as better technologies and strict codes make buildings more efficient, behavior of building operators and occupants becomes an increasingly important consideration and largely untapped resource to further improve energy efficiency.

Panelists and Staff Response

The Energy Commission staff responded that this area is covered under Subthemes 1.4 and 1.5 which examines advance building controls and plug load efficiencies and how they relate to occupant behavior.

Federal Collaboration

Summary of Comments

Ling Min asked if the EPIC administrators have coordinated with DOE, especially the new DOE grid modernization initiatives. She noted DOE is making a huge investment in grid modernization research.

Panelists and Staff Response

The Energy Commission responded that it is tracking DOE grid modernization efforts. The Energy Commission has federal cost share opportunities under the EPIC program. EPIC provides opportunities for cost share on federal solicitations that fit with the Energy Commission's EPIC Investment Plans. The Energy Commission monitors what DOE and other research institutions and government agencies are funding to make sure EPIC investments are complementing their work.

SCE responded that they coordinate with DOE. SCE is aware that the EPIC cycle is on the same cycle as DOE's recent grid modernization efforts and SCE has worked with DOE on demonstration projects in the past.

Investment Plan Administration

Summary of Comments

Theresa from the University of California Davis asked if comments submitted to the Energy Commission are considered public information.

Theresa also asked if there is any guidance on when the Energy Commission will begin awarding funds from the *EPIC 2018 – 2020 Investment Plan*.

Rob Shalhoub, from Wavebase asked the IOUs if they have a form that stakeholders should be filling out, and how should they submit comments by February 17th.

Panelists and Staff Response

The Energy Commission responded that any written comments submitted to the Energy Commission will be publicly accessible.

Regarding the timeline for implementing the *EPIC 2018 – 2020 Investment Plan*; after the EPIC administrators submit their proposed plans to the CPUC there is a number of steps before solicitations are released. The CPUC considers, modifies, and determines whether to adopt the four proposed EPIC investment plans; a CPUC decision on the 2018-2020 proposed plans is expected in December 2017. The Energy Commission must also get approval from the Legislature. If the Investment Plans are approved, solicitations addressing topics in the approved plans would be released in 2018.

SCE responded that they do not have a form like the Energy Commission; the IOUs have an open ended form that should be sent to the utility contact.

Research Partnerships

Summary of Comments

Mariah asked if the EPIC administrators can elaborate on any current research partnerships within the UC system or research departments of other universities outside of California that are applying to these California programs.

Panelists and Staff Response

The Energy Commission responded that the University of California, as well as other universities and national labs, are frequent applicants to the EPIC program. There are many EPIC-funded partnerships between public and private entities.

EPIC Eligibility

Summary of Comments

Mike Lane asked if tribes are eligible for EPIC funding.

Willdan Energy Solutions asked if applicants who receive EPIC funding for a project will be eligible to receive utility incentives for the same project.

Panelists and Staff Response

The Energy Commission responded that if you are a customer of PG&E, SCE, SDG&E the demonstration project would be eligible for EPIC funding.

The Energy Commission responded that applicants need to look at solicitations carefully to see what the research dollars are allowed to fund. As part of the solicitation process, the Energy Commission always holds a pre-bid workshop to provide an opportunity for stakeholders to ask clarifying questions about solicitations. The Energy Commission responds in writing to questions after each workshop and posts the questions and answers on the Energy Commission website.

Microgrid Research

Summary of Comments

Craig Lewis commented that EPIC should push forward with community microgrids. Mr. Lewis also commented that community microgrid projects are the perfect follow-on for the Energy Commission's Advanced Energy Communities and Solar+ Group 6 grant funding opportunities.

Panelists and Staff Response

The Energy Commission responded that community microgrids are covered under Initiative 2.2.1.

Verbal Comments from the March 13, 2017 DER Workshop

Workforce Development

Summary of Comments

Willdan Energy Solutions commented that workforce training is an important aspect to achieve replicable and scalable solutions for wide-scale DER adoption.

Panelists and Staff Response

The Energy Commission responded that workforce training is part of the Energy Commission's Market Facilitation efforts; elements of workforce training have been included in Initiative 5.2.2, involving expanding manufacturing capabilities within California.

Grid Resiliency and Cybersecurity

Summary of Comments

John Grosh from Lawrence Livermore National Labs (LLNL) asked what the Energy Commission's plans are to address grid resiliency. Mr Grosh also suggests looking for ways to address cybersecurity issues from a threat-agnostic standpoint to help alleviate some concerns about cybersecurity research that publicly identifies vulnerabilities.

Panelists and Staff Response

The Energy Commission responded that resiliency can be customer specific and defined at different levels. Different users such as military bases, hospitals, etc. will need different capabilities. Microgrid and DR research efforts are looking at cost and the resilience to the customer. Standardizing value has been brought up by stakeholders repeatedly, and is incorporated in Subtheme 2.2.

Simon Baker from the CPUC responded that under the distribution deferral framework underway as part of the Distributed Resources Plan (DRP), a set of grid services were defined – capacity, voltage support, resiliency, and microgrids. Resiliency is included as part of these efforts of the DRP.

Customer Participation

Summary of Comments

Rick Brown asked for research to examine ways to increase customer participation rates in markets for microgrids. Even if the technologies and associated tariffs and rates are created, there needs to be specific strategies on getting customers engaged and willing to adopt these technologies.

Panelists and Staff Response

The Energy Commission responded that NYSERDA is currently conducting research on customer adoption. The Energy Commission will be following that effort for lessons learned.

Simon Baker from the CPUC responded that there needs to be a balance between customer value and ratepayer value. Mr. Baker encouraged stakeholder participation to further refine ratemaking to support DER deployment.

Research Addressing Customers' Needs

Summary of Comments

Merwin Brown from the California Institute for Energy and Environment at UC Berkeley commented that research working hand-in-hand with vendors or utilities is very valuable. Research can often be conducted in silos and needs input from real world experiences.

Panelists and Staff Response

Energy Commission staff agreed with Mr. Brown that, where appropriate, research should be done in coordination with end-users in mind so that the research being conducted is adequately addressing the needs faced by the users and implementers.

Telemetry and Metering Alternatives

Summary of Comments

John Grosh from LLNL commented that there is great interest in lowering the cost of telemetry and metering alternatives. Mr. Grosh also asked about the extent to which the Energy Commission coordinates with the California ISO.

Panelists and Staff Response

The Energy Commission responded that it participates in a working group with the California ISO. Market solutions exist for increased telemetry, but can vary in cost depending on the type of communications technology used. The Energy Commission is working with the California ISO to bring down the cost of the technologies that meet the California ISO's requirements.

Verbal Comments from the March 14, 2017 Scoping Workshop Development of the EPIC 2018 – 2020 Investment Plan

Workforce Development

Summary of Comments

Larry McLaughlin from the California Community Colleges recommended that an outreach/education program is needed within the Market Facilitation component of the EPIC Investment Plan. Such a plan would include data, education, information, and training, to encourage stakeholders to adopt proven EPIC technologies.

Panelists and Staff Response

Workforce training is part of the Energy Commission's Market Facilitation efforts; elements of workforce training have been included in Initiative 5.2.2 involving expanding manufacturing capabilities within California.

Electric Vehicle Research

Summary of Comments

Cory Bowles, with CalSTART, commented on clean technology electric vehicle (EV) grid services mentioned in the Investment Plan's Theme 3. Mr. Bowles said SB 350 will help increase growth in the electric vehicle market. Mr. Bowles called for an EV needs assessment to analyze where spikes may appear on the electricity grid. He also called for demonstration projects and regional EV charging roadmaps to understand EV integration issues.

Panelists and Staff Response

The Energy Commission responded that this comment emphasizes the importance of vehicle-grid integration research, particularly for medium- and heavy-duty plug-in electric vehicles, with specific recommendations for the Applied Research & Development, Technology Demonstration & Deployment, and Market Facilitation program areas. Activities in the proposed *EPIC 2018 – 2020 Investment Plan* are envisioned to significantly advance progress toward long-term solutions in the medium- and heavy-duty PEV segment including suites of control technologies, sustainable programs, and combinations of distributed generation and on-site energy storage.

Offshore Wind Energy

Summary of Comments

Nick Osterberg, with the Institute of Advanced Technology and Public Policy at CalPoly San Luis Obispo, spoke on the need for offshore floating wind energy. Mr. Osterberg suggested research should be conducted to understand environmental and marine impact along the Central Coast; a physical test facility should be created to understand permitting and operations; and an economic impact analysis and needs assessment should be conducted for communities.

Panelists and Staff Response

The Energy Commission responded that DOE and private developers are supporting prototype testing of new designs and performance testing of offshore turbines. Energy Commission staff is not proposing to include this activity in this EPIC investment plan, although it may become more urgent in the future. The Bureau of Ocean Energy Management has previously funded studies of port readiness.

Energy Commission staff believes it is premature, and likely very expensive, for EPIC to fund potential port improvements while the California offshore wind industry is in its infancy.

The suggestion about environmental monitoring is part of Initiative 7.3.1.

Disadvantaged Communities

Summary of Comments

David Wong, with the CPUC, asked if the Energy Commission considered a more targeted metric examining Initiative 8.1, rather than increased policies for disadvantaged communities. Mr. Wong also asked how innovative financing products will work under Initiative 8.3.1.

CPUC Commissioner Guzman-Aceves, asked the IOU representatives at the workshop if the IOUs will provide a 25 percent funding "set-aside" for technology demonstration and deployment (TD&D) projects located in disadvantaged communities.

Panelists and Staff Response

Energy Commission staff responded that Subtheme 8.2 will fund demonstration of new technologies in disadvantaged communities.

Energy Commission staff also responded that they expected to learn more about the needs of disadvantaged communities at two upcoming workshops in the Central Valley and Los Angeles.

Julie Cerio with PG&E responded that IOUs were not providing a specific set-aside of funds for projects located in disadvantaged communities.

Bioenergy

Summary of Comments

Angie Lottes, from the Watershed Research and Training Center, expressed concern about Initiatives 4.4.1; 4.4.2; and 4.4.3. Ms. Lottes pointed out the importance of reducing tar in the gas stream and said more focus should be placed on energy generated from biomass.

Julia Levin from the Bioenergy Association of California, said that more EPIC investment is needed related to forest biomass due to the Governor Edmund G. Brown Jr.'s proclamation on Tree Mortality. Ms. Levin also asked if bioenergy production from wastewater facilities would qualify under Initiative 6.1 or 6.2.

Panelists and Staff Response

Energy Commission staff responded Subthemes 6.1 and 6.2 focus on water and energy efficiency and bioenergy production from wastewater facilities would not qualify for funding under those Subthemes. However, Initiative 4.4.3 includes bioenergy production from wastewater treatment plants. Additionally, Subtheme 4.4 includes technology demonstration and deployment projects for bioenergy.

Demonstrations for Schools

Summary of Comments

Alice Sung from Greenbank Associates spoke about the importance of K-12 school districts. She stressed that the K-12 sector needs statewide partnerships with IOUs and needs a database to assess energy management in California's public schools.

Panelists and Staff Response

Energy Commission staff responded that under Theme 1, Subtheme 2.1, and Subtheme 2.4, K-12 schools, buildings, and communities may be eligible demonstration sites.

ZNE Market Barriers

Summary of Comments

Kathy Higgins from the Buildings Institute requested the Investment Plan show more ZNE adoption and market studies on ZNE market barriers for the private sector. Additionally, she asked staff to characterize buildings with their grid interface as they relate to distributed energy resources. Under Theme 6, she asked if indoor growing (hydroponics for food and crops) is being considered under this plan.

Panelists and Staff Response

Energy Commission staff responded that barriers to ZNE adoption are included under Theme 1 and Subtheme 2.1 and hydroponics research for food and crops could be considered under Subtheme 6.2.

Verbal Comments from the March 16, 2017 Potential Areas of Research on Climate Change for the Electricity and Natural Gas Systems Workshop

Natural Gas Use

Summary of Comments

Gerold Kirnin from the Bay Area Center for Regional Disaster Resilience commented that much of natural gas is used to generate electricity and there is not an expected reduction for the need of baseload power anytime soon. However, to meet climate goals the state needs to reduce reliance on carbon based fuels. Increased electrification will also increase electricity demand which can result in increased natural gas use.

Panelists and Staff Response

Staff agreed that the topic Mr. Kirnin brings up is a challenge for California. Increased deployment of DER technology is meant to increase clean generation of energy while still maintaining the power quality and reliability that fossil fuels affords.

Information Technology Sector

Gerold Kirnin from the Bay Area Center for Regional Disaster Resilience commented that as our society becomes more reliant on information technology and big data, data centers will represent an increasing source of energy and water use.

Hilda Blanco from the University of Southern California commented that because the IT sector has advanced so much in recent years, the physical grid infrastructure is not the only area of concern for researchers. Ms. Blanco asked what the virtual infrastructure will look like in the future and how will that impact resiliency.

Panelists and Staff Response

The Energy Commission responded that under previous EPIC Investment Plans, the Energy Commission has funded projects that seek to increase the energy efficiency of data centers (EPC-14-088 and EPC-16-030).

Regarding advances in the IT sector, Subtheme 1.4 is examining advanced communication and control technologies that leverage developments made in the information technology sector, and how these technologies can be applied to the energy sector.

Systems-level Research

Summary of Comments

George Ban Weiss commented that systems-level research is important for meaningful adaptation. Mr. Weiss noted that it appears the Energy Commission is already engaged in this type of analysis and strongly supports it.

Panelists and Staff Response

The Energy Commission responded that this topic is incorporated in Subtheme 7.2.

Scenario Reliance

Summary of Comments

George Ban Weiss commented that as California moves to "actionability," sometimes uncertainty can increase in part due to reliance on scenarios. It is important to be cognizant of limitations of scenarios as well as sensitivity to different parameters.

Panelists and Staff Response

The Energy Commission responded that staff is aware of this issue and is working on multiple approaches to handle uncertainties. For example, differences in climate and/or sea-level-rise projections between models provide an indication of uncertainty on the scope, scale, and timing of impacts. With regard to the long-term energy scenario work, our multi-team and multi-model approach is designed to help clarify which conclusions are fairly robust and which might be outgrowths or artifacts of a particular modeling approach. These issues are reflected in Subtheme 7.1.

Emergency Preparation

Summary of Comments

Hilda Blanco commented that California is a very vulnerable environment. Ms. Blanco recommended that when the Energy Commission plans to integrate climate readiness into emergency preparation and response, the Energy Commission should consider earthquake readiness as well.

Panelists and Staff Response

The Energy Commission responded that this topic is difficult to integrate due to funding constraints. However, Subthemes 7.1 and 7.2 are intended to consider co-benefits which include earthquake and hazard preparedness.

Community Microgrids

Summary of Comments

Hilda Blanco commented that studies and projects on community microgrids should be integrated with water systems. Water access is a basic human right in California and thousands of homes lost water during the drought. Ms. Blanco commented that California needs to provide and protect both services for resilience.

Panelists and Staff Response

The Energy Commission responded that to some extent this is covered in Subthemes 7.1 and 7.2's integration of cross-sector work.

Resiliency

Summary of Comments

Paula Scalingi commented that the Energy Commission needs to define what is meant by resiliency. The Department of Energy failed to do so, but the Energy Commission has a real opportunity to set the path toward resilience with a clear definition with definable benchmarks.

Panelists and Staff Response

The Energy Commission responded that resilience is currently an undefined term for the energy sector. Variations on the definition and its connection to "visible" and measurable benchmarks may be elements of tools developed under Subtheme 7.2.

Disadvantaged Communities

Summary of Comments

Laiseng Sechao commented that it is critical to adopt a place-based approach if we are to address disadvantaged communities (DACs). For example, DACs in the Bay Area are very different from those in Fresno.

Stephanie Wang commented that if the Energy Commission wants meaningful engaged participation from disadvantaged communities and vulnerable populations, it should consider incorporating procedural equity metrics into its scoring criteria.

Panelists and Staff Response

The Energy Commission staff agreed that geographic scale is a major issue in addressing the needs of disadvantaged communities.

The Energy Commission agrees that Ms. Wang's suggestion is in line with recommendations from the SB 350 Barriers Report and the two Equity and Energy Workshops held in Fresno and Los Angeles. Energy Commission staff will consider incorporating equity metrics into its scoring criteria for remaining solicitations under the *EPIC 2015 - 2017 Investment Plan* and solicitations for Theme 8 under the *EPIC 2018 – 2020 Investment Plan*.

Verbal Comments from the March 20, 2017 Incorporating Community Focused Equity in Research Funding Workshop

Indoor Air Quality

Summary of Comments

Margaret Gordon commented that an increasing amount of affordable housing is located near freeways, ports, and refineries resulting in increased exposure to air pollution. Ms. Gordon suggests that air filtration should be adapted into those buildings to protect the residents

Panelists and Staff Response

The Energy Commission responded that this topic is covered under Subthemes 7.1 and 7.3 which propose to fund research addressing ways to improve indoor air quality.

Energy Commission Funding for Low-Income and Disadvantaged Communities

Summary of Comments

A Webex participant asked when does the Energy Commission plan to release a new solicitation for energy efficiency projects for low income and disadvantaged communities?

A Webex participant asked how the Energy Commission will divide up the funding for projects targeting disadvantaged communities and those that do not.

Panelists and Staff Response

The Energy Commission responded that stakeholders can check the Energy Commission's website to see a list of current and planned solicitations: http://www.energy.ca.gov/contracts/epic.html.

Additionally, Theme 1 of the proposed *EPIC 2018 – 2020 Investment Plan* focuses on energy efficiency research, which can benefit low-income and disadvantaged communities.

Funding for each solicitation varies; each solicitation will have its own terms for deciding how much funding will be available per region. Additionally, at least 25 percent of technology demonstration and deployment projects will be targeted toward disadvantaged communities.

Electricity and Natural Gas Funding

Summary of Comments

A Webex participant asked if EPIC is focused on electricity and the PIER natural gas program is focused on natural gas, how is research that has a significant impact on both funded, for example, researching the societal value of fuel switching.

Panelist and Staff Responses

The Energy Commission responded that EPIC funding is solely for electric ratepayers of investor owned utilities. For projects that impact both electricity and natural gas, the project could be funded with two separate funding sources. The electric portion could be funded by EPIC and the natural gas portion could be funded by PIER.

Verbal Comments from the March 27, 2017 Incorporating Community Focused Equity in Research Funding Workshop

Case Study of Methods for Engaged Community Driven Research and Technology

Summary of Comments

Kara Crowning from EMI Consulting asked how the perception by researchers that data is inaccurate when collected by citizens can be overcome.

Stephanie Gonzalez of the University of California, Los Angeles asked what practices help facilitate bringing political or community leaders to environmental and climate science workshops.

Panelist and Staff Responses

Emiliano Rodriguez Nuesch of Pacifico responded that the largest bias against citizen science is that it is thought to have inaccuracies. Mr Nuesch recommends two possible approaches- educate those conducting the research and/or use larger systems to collect data. Mr. Nuesch suggests that thousands of individuals contributing data will increase the pool size and diminish doubts of data accuracy. Mr. Nuesch suggests that transparency is vital to building trust.

Emiliano Rodriguez Nuesch of Pacifico also responded that most of the time there is no single stakeholder that provides everything to leaders to be sure they're making the best choices for their community. Workshops can provide input to help leaders make informed decisions.

Challenges and Solutions for Overcoming Issues with Split Incentives and Retrofitting Multi-Family Housing

Summary of Comments

Representatives of the Environmental Defense Fund posed a question to Maria Stamas of the Natural Resources Defense Council, Blanca de La Cruz of the California Housing Partnership, Walker Wells of Global Green, and John Perfitt of Los Angeles Better Buildings Challenge: what can help facilitate a portfolio-level, rather than building-level, approach to clean energy interventions beyond net metering.

Panelist and Staff Responses

Panelists including Maria Stamas of the Natural Resources Defense Council, Blanca de La Cruz of the California Housing Partnership, Walker Wells of Global Green, and John Perfitt of Los Angeles Better Buildings Challenge responded that local disclosure and energy efficiency ordinances could really help. Panelists also responded that technical assistance at the portfolio-level should be offered to overcome barriers arising from different properties managing different incentives.

Equity and Community Driven Energy Research

Summary of Comments

Ron Kent from Southern California Gas asked Sonya Ziaja of the Energy Commission, Raquel Mason of Physicians for Social Responsibility, Darryl Molina Sarmiento of Communities for a Better Environment, and Ben Russak of the Liberty Hill Foundation if California possesses the technical knowledge needed, or if there is still a technical knowledge gap that must be addressed to equitably introduce clean energy into California's low-income and disadvantaged communities.

Panelist and Staff Responses

Panelists responded that examples of best practices for information sharing and co-learning between industry and communities are needed. Panelists responded that there is a need for defined metrics, specifically for community participation.

Verbal Comments from the April 11, 2017 Customers of Climate Science Research Lead Commissioner Workshop

Cost-benefit Analysis of Resiliency Options

Summary of Comments

SCE, SDG&E, and PG&E all requested help with developing and evaluating methodologies for cost-benefit analysis of adaptation strategies.

Panelist and Staff Responses

The Energy Commission responded that this type of research is explicitly identified in Initiative 7.2.3.

Interdependencies and Interactions Among Extreme Events

Summary of Comments

SCE and PG&E both identified a need to account for interdependencies and interactions between climate impacts (e.g., severe drought followed by severe flood… what are the risk factors and ways to adapt?).

Panelist and Staff Responses

The Energy Commission responded that this research area could be addressed in Initiative 7.2.1.

Interactions Across Sectors and Geography

Summary of Comments

PG&E identified a need to account for interdependencies throughout the supply chain across sectors and geography. PG&E also recommended coordinating local community vulnerability assessments to include other services besides energy.

Panelist and Staff Responses

The Energy Commission responded that this type of research on interdependencies could be addressed in Initiative 7.2.3, such as between water and energy sectors. Energy Commission staff acknowledges the importance of cross-sectoral assessments, but the research must ensure that any proposed cross-sectoral work is focused on the electricity system and fits within the scope of EPIC research. Forthcoming state guidelines from The Governor's Office of Planning and Research will address how these climate change impacts should be considered in local general plans.

Equity Metrics and DAC Vulnerability

Summary of Comments

The Los Angeles Department of Water and Power (LADWP) and the Asian Pacific Environmental Network (APEN) made suggestions for new equity metrics. LADWP suggested metrics related to adaptation spending, energy services, and outages within DACs to look for patterns. APEN suggested metrics such as the percent of households with air conditioners. APEN also recommended research on sensitivity of DACs to power outages and surges, advanced energy storage in DACs, identification of key infrastructure in need of reliable electricity (e.g., food banks, shelters) and of retired energy infrastructure that may pose hazards, as well as more case studies.

Panelist and Staff Responses

The Energy Commission responded that this type of research is consistent with Initiative 7.2.3.

Visualization Through Cal-Adapt

Summary of Comments

Panelists offered suggestions to facilitate expanded use of Cal-Adapt by utility and community decision-makers. There were comments about granularity, and the desire to obtain higher resolution. SDG&E would also like to see Cal-Adapt collaborate with the National Oceanic and Atmospheric Administration to link to their climate change data. There were several comments about wanting Cal-Adapt data to be compatible with management and planning models used by the IOUs, and that integrating it into their GIS databases is a challenge that sometimes requires the assistance of consultants. Utilities recommended establishing an agreed upon set of climate change planning factors for utility infrastructure investments.

Panelist and Staff Responses

The Energy Commission responded that this type of research is consistent with Initiative 7.2.3, which aims to generate actionable science. In the 2016 Integrated Energy Policy Report, the Energy Commission recommended energy research and planning incorporate the four models used in California's Fourth Climate Change Assessment: HadGEM2-ES (warm/dry); CNRM-CM5 (cool/wet), CanESM2 (average), and MIROC5 (spans range of variability). These models are available through the beta site for Cal-Adapt 2.0 (http://beta.cal-adapt.org/). Also, the 2016 IEPR recommended energy planning efforts implement updated guidance from the Ocean Protection Council regarding sea level rise, consistent with the climate guidance document the Governor's Office of Planning and Research plans to release in the summer of 2017.

Hydropower and Water

Summary of Comments

PG&E commented on the need to monitor and study snowpack and streamflow at high resolution because this energy resource varies significantly across time and space. This is also an issue for LADWP and SCE.

Panelist and Staff Responses

The Energy Commission responded that this type of research is consistent with Initiatives 7.2.1 and 7.2.2.

Predicting Extreme Events

Summary of Comments

SDG&E asked for better predictions of when extreme events will occur.

Panelist and Staff Responses

The Energy Commission responded that this type of research is consistent with Initiative 7.2.1, which mentions atmospheric rivers that generate a large proportion of California's rainfall in short periods as one example of extreme events that affect the electricity system.

APPENDIX D: Summary of Stakeholder Comments and Energy Commission Staff Responses on the *Electric Program Investment Charge Proposed 2018 – 2020 Triennial Investment Plan*

HVAC

TN217243 Paul Raftery: [188]

Paul Rafterty comments that the supported HVAC technologies identified in Initiatives 1.2.2 and 1.2.3 are often only technologically and economically feasible to deploy in new construction. The median building in the US is about four decades old, and thus these improvements will not have a large impact on building energy consumption until far into the future, even if those technologies gain a large market share immediately. The only initiative that focuses on existing buildings (Initiative 1.2.1) artificially constrains applicants to one particular type of solution; that of improving the building envelope. However, there are other approaches that may yield comparable or larger reductions in HVAC energy use at lower cost. For example, expanded indoor temperature ranges enabled by personal comfort systems and air movement, fault detection and diagnosis and improved control sequences for HVAC systems, even gamification of energy consumption for building operators.

Mr. Rafterty proposes that the Energy Commission support solutions that explicitly focus on reducing HVAC energy use in the existing building stock through another subtheme under Theme 1. Given the challenge of finding economically and technically feasible ways to improve the efficiency of the existing building stock, the solicitations should not be constrained to any one particular technology. It may be most effective to have an open call for solutions to this problem. This way, potential applicants will not be deterred from submitting an application, or constrained in how they approach the problem, and the Energy Commission can assess each proposal on its merit - based on its impact, practicality, and economic feasibility. For example, a subtopic such as: Develop Tools and Technologies to Improve Energy Efficiency in Existing Buildings.

Discussion and Staff Response to TN217243

The Energy Commission has expanded Initiative 1.3.1 to include other types of HVAC systems that are appropriate for California climates.

188 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN217243_20170421T134705_Paul_Raftery_Comments_More_focus_on_technically_and_economicall.pdf

TN217247 Carlos Duarte:[189]

Carlos Duarte comments that the energy consumption for cooling has steadily increased over the years due to more buildings becoming internally load driven and hence the need for Subtheme 1.3 (HVAC systems). However, this section focuses only on improving the efficiency of the vapor-compression cycle. The vapor compression cycle is not only energy intensive but also requires a high capital investment to install the needed HVAC components. Mr. Duarte suggests the Energy Commission also focus on addressing mechanical plant and overall building designs that will not require the vapor-compression cycle.

The adiabatic cooling process, as seen in cooling towers, is one potential replacement for the vapor-compression cycle but is highly dependent on weather conditions and the requirements of the distribution system that it serves. Therefore, it can be coupled with the advantages of radiant systems that include: 1) larger heat transfer areas that directly cool occupants through radiation; 2) higher thermal energy transport efficiency and; 3) the ability to effectively engage the building's thermal mass to store and move cooling loads to more favorable weather conditions. Precedent has already been set with the David Brower Center building located in Berkeley, CA, which is a medium-sized commercial office building that does not require a compression cycle for cooling. Instead, it relies on a cooling tower and radiant system approach to provide a comfortable environment to the occupants. However, this is one case, and additional research is needed in the building design and radiant system controls to export this concept to other climates and applications in California. Eliminating the vapor-compression cycle from HVAC systems will reduce energy and water consumption far more significantly than technologies that incrementally improve the efficiency of those existing systems.

Discussion and Staff Response to TN217247

The Energy Commission has expanded Initiative 1.3.1 to include other types of HVAC systems that are appropriate for California climates.

TN217248 Fred Bauman:[190]

Fred Bauman suggests the Energy Commission focus on development of advanced low energy, innovative HVAC system solutions and a broader system based approach than the three areas listed in Subtheme 1.3. Mr. Bauman proposes that Energy Commission include another initiative under Subtheme 1.3 (or create a separate Subtheme), with a suggested title of "Development of Advanced Low-Energy, Innovative HVAC System Solutions for Comfortable and Healthy Buildings." There are several advanced low-energy HVAC systems that could be candidates for additional focused research. These include: personal comfort systems, natural ventilation and mixed mode, radiant cooling and heating, chilled beams, underfloor air distribution, and displacement ventilation, systems. Proposals would be aimed at improving fundamental understanding of the technology and using this knowledge to develop new and practical design tools, provide guidance for efficient operation and control that maintains a high indoor environmental quality, and updating of relevant standards and codes.

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189 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN217247_20170421T141920_Carlos_Duarte_Comments_More_focus_on_mechanical_plant_designs_w.pdf
190 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN217248_20170421T141110_Fred_Bauman_Comments_Development_of_Advanced_LowEnergy_Innovati.pdf

Discussion and Staff Response to TN217248

The Energy Commission has expanded Initiative 1.3.1 to include other types of HVAC systems that are appropriate for California climates.

Also Initiative 7.3.2 identifies potential research in the public health research roadmap to include energy performance and indoor air quality of passive versus active ZNE building designs.

In addition, the comment proposed several initiatives including a few ventilation solutions including natural ventilation and displacement ventilation. The Energy Commission recognizes the importance of ventilation to indoor air quality and the overall energy efficiency of the building. The Energy Commission has funded many ventilation research projects to improve indoor air quality through both its EPIC and Natural Gas Research Programs. For example, EPC-15-033, Ventilation Solutions for Energy Efficient California Schools: Improving Indoor Air Quality through Advanced, High Performance HVAC. This project will develop and demonstrate approaches to improving ventilation and indoor environmental quality in California Schools. Displacement ventilation is one of the approaches under study in this project. Another project funded under the Natural Gas research program, PIR-14-003, is studying the control of minimum outdoor air ventilation rates in existing and new commercial buildings in California. The Energy Commission also funded a project with UC San Diego (500-10-025, Natural Ventilation for Energy Savings in California Commercial Buildings) that concluded that retrofitting natural or mixed-mode ventilation into California buildings provides both significant energy savings and improved occupant satisfaction with the indoor environment. However, they also found that caution is needed where exposure to excessive particulate matter or ozone may increase the risk of long term health problems.

TN217257 Shichao Liu:[191]

Shichao Liu comments that developing innovative HVAC solutions for the sleep environment is crucial for both energy reduction and occupant health outcomes. However, the proposed HVAC initiatives focus little on sleep environment. Shichao Liu proposes that the Energy Commission support innovations focusing on HVAC solutions for the sleep environment to reduce energy consumption in residential buildings. Contact base heating (electric blankets) can be an order of magnitude more efficient that air heating. The Energy Commission should also encourage initiatives under Theme 1 to enhance occupants' thermal comfort and sleep quality. Shichao Liu suggests that solicitations encourage smart HVAC solutions (for example, incorporating occupants' feedback in the loop using IoT) to control the micro-environment of a sleeping occupant rather than to heat/cool the entire space.

Discussion and Staff Response

The National Sleep Foundation recommends that room temperatures be set between 60° and 67° F for optimal sleep. Lower temperatures promote deep continuous sleep. The Energy Commission suggests this is a better fit in a consumer education program.

191 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN217257_20170421T164023_Shichao_Liu_Comments_Smart_energyefficient_HVAC_solutions_for_c.pdf

Healthy Buildings

TN217249 Stefano Schiavon: [192]

Stefano Schiavon comments that the proposed draft subthemes under Theme 1 recognize that California needs healthy and comfortable buildings. However, there are three major limitations:

(a) The goals of healthy and comfortable buildings should be applied to all the solutions that may have an influence on people. For example, Subthemes 1.3 (HVAC systems), 1.4 (control and automation), 2.1 (efficient communities), 3.1 (demand response), 8.1 and 8.2 (disadvantaged communities) do not take into explicit account the building occupants and how they may respond to the proposed solution. Mr. Schiavon suggests having health and comfort in the titles of the sections above, in particular for Subtheme 1.3 and 1.4.

(b) In commercial buildings, the cost of employees is roughly two orders of magnitude higher than the cost of energy, and building management knows this. When applied to commercial buildings, the Energy Commission should assess the impact of energy efficient technologies on worker productivity. This is a key parameter that the private sector would like to know because an energy efficient solution that may have a real (or perceived) negative impact on people will not be implemented. Conversely, if any of a number of types of productivity gain can be documented, a technology will gain an irresistible market driver assuring widespread implementation. Mr. Schiavon suggests adding productivity as a metric and/or performance indicator in all the solutions that could be applied to commercial buildings and that may have an influence on people.

(c) Only occupant satisfaction is present as a "Metrics and/or Performance indicators" in Subtheme 1.2. People well-being, comfort and productivity metrics should be present in all the sections mentioned above.

Discussion and Staff Response to TN217249

For item (a), the Energy Commission can include the goals of healthy and comfortable buildings to Subthemes 1.2, 1.3 and 1.4. Subtheme 1.4.2 addresses the human aspect of design thinking including strategies such as human-in-the-loop controls. Although not explicitly stated, health and comfort are considered part of the human paradigm.

For items (b and c), the Energy Commission can consider including these goals in solicitations that address occupant comfort.

In addition, the Energy Commission has previously funded projects focused on healthy indoor environment. For example, through the Natural Gas Research Program, PIR-14-007, a project titled Health and Efficient New Gas Homes. This project included field study and analysis activity to investigate the changes in indoor air quality associated with further air-tightening. The Energy Commission recognizes the importance on healthy buildings and the need to directly estimate the health effect at various ventilation levels. This topic has just been identified as a future research topic in the February 2017 special issue of Indoor and Built

192 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN217249_20170421T135918_Stefano_Schiavon_Comments_More_focus_on_health_wellbeing_and_pr.pdf

Environment editorial on ventilation. Additionally, this area could be considered in Initiative 7.3.2 for the public health research roadmap.

Natural Ventilation

TN217250 Jovan Pantelic:[193]

Jovan Pantelic proposes that the Energy Commission support the use of natural ventilation, through the development of strategies, sensing technologies, and tools that can provide key information in the decision-making process affecting new construction and retrofit in the residential and commercial sector. Jovan Pantelic also proposes that the evaluation matrix takes into account energy, air quality, and thermal comfort.

Discussion and Staff Response to TN217250

The Energy Commission has previously funded a project on natural ventilation (500-10-025, Natural Ventilation for Energy Savings in California Commercial Buildings) for energy saving in commercial buildings. As indicated in response to TN217248, this study concluded that retrofitting natural or mixed-mode ventilation into California buildings would provide both significant energy savings and improved occupant satisfaction with the indoor environment. However, caution is needed where exposure to excessive particulate matter or ozone may increase the risk of long term health problems. As the comment correctly pointed out and the report findings indicate, outdoor pollution levels have a significant impact on use of natural ventilation and that strategies that restrict window use on high-pollution days could reduce negative health impacts and associated costs from exposure to outdoor air ozone and particulates. The Energy Commission has funded a project on smart ventilation (EPC-15-037). This project will include a study on smart control of ventilation based on indoor and outdoor conditions, including pollution levels.

Electric Vehicles

TN217264 CALSTART:[194]

CALSTART suggests analysis to establish a viable business case, mitigate high peak charging loads, and recommend adding enough intelligently planned charging infrastructures for medium- and heavy-duty electric and plug-in hybrid electric vehicles (MHDEVs). Given the recent advancements in technology, along with proposed investor-owned utility combined investments totaling $1 billion in transportation electrification, most of it concentrated on MHDEVs, the timing of such an assessment is critically important to the success of wide spread transportation electrification.

193 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN217250_20170421T142741_Jovan_Pantelic_Comments_Use_of_natural_ventilation_considering.pdf
194 http://docketpublic.energy.ca.gov/PublicDocuments/17-EPIC-01/TN217264_20170421T170313_William_Van_Amburg_Comments_CALSTART_Supplemental_Comments_to_D.pdf

Discussion and Staff Response to TN217264

The California Energy Commission's Alternative and Renewable Fuel and Vehicle Technology Program is tasked with determining the statewide charging station deployment strategy and is performing modeling and analysis that considers where the vehicles are being deployment and vehicle travel patterns. This analysis will inform charging station deployment plans.

In this EPIC investment plan, the Energy Commission will continue to develop and demonstrate advanced communication controls for PEVs and grid infrastructure, which could facilitate greater charging station rollout and develop a VGI-enabled business case for greater market adoption. There is coordination across these groups.

Proposed awards under the *EPIC 2015 – 2017 Investment Plan* include energy management demonstrations for electric bus transit fleets. Continuing focus on fleet energy management demonstration projects, including for transit and commercial fleets, is envisioned under Initiative 3.2.1. Activities in the proposed *EPIC 2018 – 2020 Investment Plan* under Subtheme 3.2 are envisioned to significantly advance progress toward long-term solutions in the medium- and heavy-duty PEV segment including suites of control technologies, sustainable programs, and combinations of distributed generation and on-site energy storage.