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California Energy Commission

DRAFT STAFF REPORT

Clean Energy in Low-Income Multifamily Buildings Action Plan

California Energy Commission

Edmund G. Brown Jr., Governor

May 2018 | CEC-300-2018-005-SD


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ENERGY COMMISSION


California
Public Utilities
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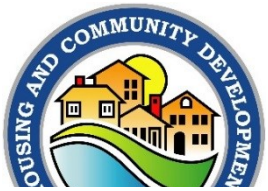
HOUSING AND COMMUNITY DEVELOPMENT


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California Energy Commission

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ABSTRACT

The Clean Energy in Low-Income Multifamily Buildings Action Plan (CLIMB Action Plan) will set forth early actions to implement energy and water efficiency, demand response, on-site renewable energy, electric vehicle infrastructure installation, and energy storage for multifamily housing in California. Key factors in program development will be cost-effectiveness, utility bill savings, greenhouse gas reductions, effectiveness in reaching multifamily buildings, effectiveness at achieving non-energy benefits, economic development, scalability and grid benefits, and equity considerations.

Figure AB-1: Clean Energy in Low-Income Multifamily Buildings

Source: California Energy Commission Staff

Keywords: Multifamily, low-income, energy efficiency, renewables, demand response, energy storage, electric vehicle infrastructure

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MESSAGE FROM COMMISSIONER ANDREW MCALLISTER

Multifamily buildings are a perfect platform for deployment and integration of the distributed energy technologies and practices of both today and tomorrow. This is certainly an elegant proposition from a technical point of view: buildings made healthier, more livable and more resilient by the presence of multiple distributed energy resources under one roof, working together seamlessly as a local system - and even providing benefits to the electric grid itself. This approach saves energy and reduces emissions, right in line with California's firm and long-term climate-oriented policy direction. Deep upgrades of multifamily buildings – particularly those in disadvantaged communities and with high proportions of low-income residents – also produce vast corollary benefits: positive health and safety outcomes; preservation of the low-income housing stock amidst a housing affordability crisis; reduction of urban heat islands; valuable technical and programmatic learning that may be transferred to other sectors; market development for key enabling technologies; and most important, the opportunity for local residents and contractors to benefit directly from and participate integrally in California's clean energy transition.

This plan fills a critical programmatic need, and its implementation is urgent. Collaboration will be essential between the many stakeholders working on housing access, finance, economic development and environmental justice, and across every level of government. If we cannot find ways for all Californians to benefit tangibly from the clean energy economy, we will not be able to claim true success, no matter what may otherwise have been accomplished overall by 2030 or 2050. With that in mind, let's get to work.

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EXECUTIVE SUMMARY

California has set ambitious climate and clean-energy goals to reduce air pollution and greenhouse gas emissions while creating a more resilient and reliable energy system. Most recently, Senate Bill 350 (de León, Chapter 547, Statutes of 2015) established new energy efficiency and renewable electricity targets for 2030 to support California's long-term climate goal of reducing greenhouse gas emissions by 40 percent below 1990 levels by 2030.

Recognizing the role that California's buildings play in energy use, the Energy Commission and partner agencies have used a variety of strategies to focus on improving building energy efficiency, generating renewable energy generation on-site, installing distributed energy storage systems, and providing electric vehicle charging infrastructure. However, significant obstacles remain in ensuring that all Californians have access to and benefit from these clean-energy opportunities.

In recognition of the barriers that exist for low-income and disadvantaged communities to access clean-energy technologies and solutions, SB 350 required the California Energy Commission, in coordination with other state agencies, to study the barriers for low-income customers to access clean-energy technologies and programs. Published in December 2016, the *Low-Income Barriers Study, Part A: Overcoming Barriers to Energy Efficiency and Renewables for Low-Income Customers and Small Business Contracting Opportunities in Disadvantaged Communities* (Barriers Study) identified barriers to and recommendations for increased access for low-income and disadvantaged communities to clean-energy solutions, as well as local small business contracting opportunities. One of the recommendations of the study included the following:

> *Develop a comprehensive action plan focused on improving opportunities for energy efficiency, renewable energy, demand response, energy storage, and electric vehicle infrastructure for multifamily housing, with attention to pilot programs for multifamily rental properties in low-income and disadvantaged communities.*

The *Clean Energy in Low-Income Multifamily Building (CLIMB) Action Plan* identifies current programs and policies, remaining challenges, and concrete actions that the State can take to accelerate the implementation of distributed energy resources (DERs)—energy and water efficiency strategies (including on-site water reuse and green infrastructure), demand response, on-site renewable energy, electric vehicle infrastructure installation, and energy storage—within California's multifamily housing stock. With a significant portion of Californians living in multifamily buildings, these buildings offer an opportunity and a challenge to accelerating the state's clean-energy progress.

Engaging Local Governments

Local governments are critical partners in reaching and engaging the multifamily sector. In recognition, the CLIMB Action Plan identifies several actions aimed at collaborating with local governments. See Strategies 2.1.2, 4.3.2, and 5.2.2.

With enhanced agency coordination, improved program design, committed public funding, tailored outreach and education, and increased understanding of the multifamily sector, the Energy Commission and partner agencies can effectively and efficiently improve access to clean energy for California's diverse multifamily housing owners and low-income residents.

CHAPTER 1:
Benefits of Distributed Energy Resources

Advancing the adoption of distributed energy resources (DERs)[1] within the multifamily building sector can make energy more affordable, improve health and safety for occupants, reduce greenhouse gas emissions, and help achieve other benefits:

- **Cost-effectiveness**. Program development and assessment will consider cost-effectiveness for the program administrator, as well as for the building owner and tenants. For programs specific to low-income and disadvantaged communities, additional factors should be included in cost-effectiveness, such as non-energy benefits, health, safety, and resilience.
- **Utility bill savings**. Energy efficiency programs reduce energy consumption and, subsequently, reduce energy costs. In addition, demand response[2] programs encourage a shift in energy use during nonpeak hours with lower energy rates, which can lead to reduced energy costs. With a focus on low-income and disadvantaged communities, the *Clean Energy in Low-Income Multifamily Building (CLIMB) Action Plan* will contribute to reducing utility bills, subsequently decreasing energy burden – when a significant portion of income goes toward energy expenses – and increasing energy equity, where all residents, including low-income residents, benefit from clean-energy government investments. Reduced utility bills can free up household financial resources and prevent households sacrificing other necessities, such as food, medicine, or clothing.
- **Greenhouse gas reductions**. Reducing greenhouse gas emissions is an environmental priority for California. The CLIMB Action Plan programs will reduce greenhouse gas emissions through renewable energy and energy efficiency programs and by supporting increased adoption of distributed generation technologies and electric vehicles with electric vehicle infrastructure development.
- **Multifamily sector adoption**. There are several characteristics of the multifamily sector that limit adoption of traditional energy efficiency programs, such as complex ownership structure, diverse building owner and resident demographics, and a wide range of building characteristics. The CLIMB Action Plan will address these barriers to significantly improve the energy efficiency of the multifamily sector.

1 For the purpose of the CLIMB action plan, DER encompasses distributed generation, energy efficiency, demand response, electrical storage, and electric vehicle infrastructure. It is acknowledged that other definitions for DER exist.

2 Demand response is customers changing their electricity usage (typically reducing use or shifting use to other times in the day) at certain times in response to economic incentives, price signals, or other conditions (http://www.cpuc.ca.gov/General.aspx?id=5924).

- **Economic development**. California is the fifth-largest economy in the world and a leader in clean-energy programs. Implementing the CLIMB Action Plan will support innovation, new jobs, and workforce development in the clean-energy industry.
- **Energy equity**. A goal of the CLIMB Action Plan is to ensure energy equity. All Californians can have access to essential energy services, particularly clean and affordable ones. With a focus on low-income and disadvantaged communities, the CLIMB Action Plan will increase access to and investment in clean energy, as well as improve community energy resilience.
- **Non-energy benefits**. Programs to increase DERs in multifamily buildings go beyond energy savings and will achieve non-energy benefits (NEB). Participant NEBs include reduced building operating costs and increased occupant comfort, health, and safety. Utility NEBs may include infrastructure savings and bill payment improvements. Societal NEBs may include job creation and other economic development, increased property values, reduced GHG and criteria pollutant emissions, and other environmental benefits.
- **Scalability and documented grid benefits**. Programs to increase DER deployments in multifamily buildings must move beyond historical program designs that treat buildings and customers as one-off, individual projects and move toward a "prosumer[3]" model that realizes the grid benefits of DER installations. Moreover, programs must be mindful that given the size of the multifamily market, current subsidized incentive levels are unsustainable should these programs be scaled to the greater market.

3 A *prosumer* is a person who consumes and produces a product, such as a utility customer with solar panels.

CHAPTER 2:
Progress to Date

Several state programs assist with implementing clean-energy projects in the multifamily sector and in low-income and disadvantaged communities. (See Appendix A.) There are also state agency activities related to strategies in the CLIMB Action Plan. (See Appendix B.)

In addition to the California Energy Commission (Energy Commission), several other state agencies are administering programs in the multifamily sector that increase the installation of distributed energy resources. These agencies include the California Public Utilities Commission (CPUC), the California Air Resources Board (CARB), the California Department of Community Services and Development (CSD), and the California Department of Housing and Community Development (HCD). A comprehensive plan will require interagency coordination among these agencies, along with supporting state and nongovernment organizations.

To date, the progress of these programs includes 345 electric vehicle charging stations installed in multiunit dwellings funded by the Energy Commission's Alternative and Renewable Fuel and Vehicle Technology Program (ARFVTP). Also, the CPUC oversees the Multifamily Affordable Solar Housing (MASH) Program which supported the installation of 29 megawatts (MW) of interconnected solar across nearly 400 projects statewide and has reserved funding for projects totaling an additional 23 MW. The CPUC also oversees energy efficiency programs administered by the investor-owned utilities (IOU), community choice aggregators (CCA), and regional energy networks (REN). In 2016, programs directly targeting multifamily buildings saved 55,260 MWh of electricity and 1.9 million therms of gas, reduced 38,000 ton of emissions, and provided nearly $42 million directly to the multifamily residential sector. Multifamily buildings also benefit from many so-called "upstream" and midstream" rebate programs and many other efficiency programs that do not target individual building types or sectors (codes and standards advocacy, workforce education and training, etc.).

The multifamily buildings sector poses many challenges to adopting energy-efficient and clean-energy technologies. However, implementing energy programs in the multifamily sector is necessary to achieve the state's goal of doubling energy efficiency savings by 2030. According to the U.S. Census Bureau,[4] 57 percent of multifamily buildings in California were built before 1979. These buildings have high potential for energy savings, as well as NEBs such as increased occupant comfort, health, and safety, as well as reduced emissions. Addressing the multifamily sector also serves low-income and disadvantaged communities.[5] According to the *Low-Income Barriers Study, Part A: Overcoming Barriers to Energy Efficiency and Renewables for Low-*

4 https://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t.

5 Disadvantaged communities are identified by CalEnviroScreen 3.0, 2017. https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-30

Income Customers and Small Business Contracting Opportunities in Disadvantaged Communities (Barriers Study), nearly half of low-income residents live in multifamily rental housing. Moreover, 40 percent of low-income multifamily customers in the Southern California Edison service territory experience energy burden in the summer (Indicators[6]). Improving the multifamily building stock will also improve utility cost savings and energy equity.

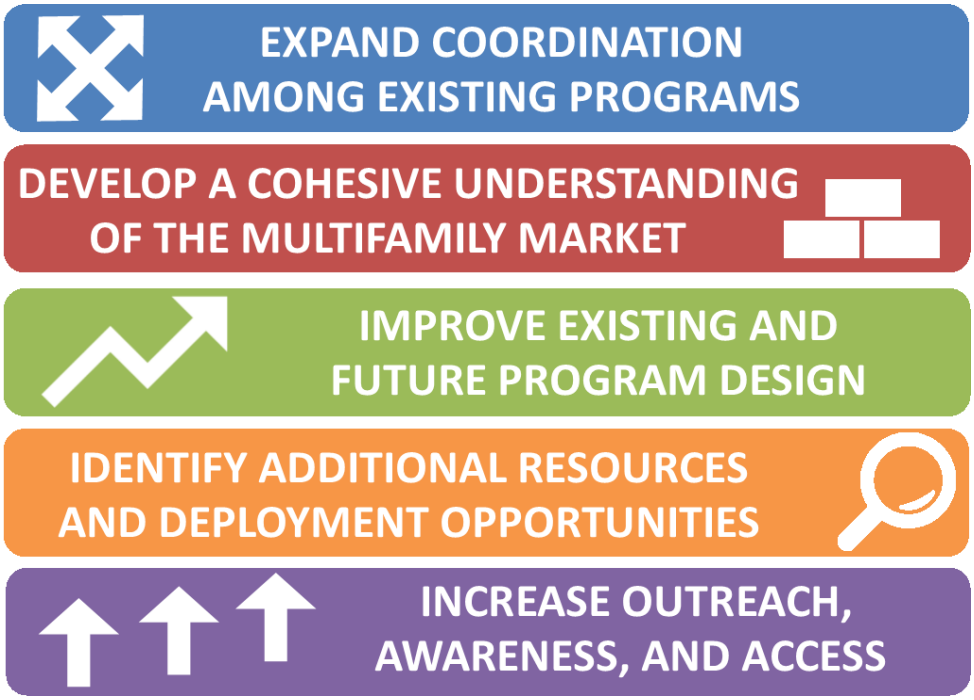
6 California Energy Commission. March 2018. "Tracking Progress – Energy Equity Indicators."

CHAPTER 3:
Structure of the 2018 CLIMB Action Plan

This action plan outlines early actions the state can take to improve clean-energy access within the low-income multifamily building sector, as well as to create a foundation for long-term transformational change in accelerating adoption of DERs in this sector. The scope of this plan covers all existing state programs, which are funded from various funding sources with differing restrictions. This action plan identifies achievable measures and activities that can be taken by state agencies to improve existing state programs and efforts, while collecting the data, conducting the research, and developing the tools needed to create a transformational shift in the market—one in which these clean-energy solutions are pursued more systematically in response to market factors or policy requirements that do not exist. As such, this action plan is necessary but not sufficient to improve clean energy access in California's low-income multifamily buildings. Additional planning, expanded legislative support, and coordinated effort among public and private groups will be needed in the long term.

The time frame dates for each strategy are tentative and intended for discussion purposes. Strategies included in this plan are intended to improve buildings in the multifamily sector, however may not be exclusive to this specific sector.

These state-driven early actions identified in this plan support five broad goals:



1. Expand coordination among existing programs

    1.1 Efficiently leverage efforts of existing working groups relevant to multifamily housing

    1.2 Align efforts across existing programs to maximize benefits

2. Develop a cohesive understanding of the multifamily market

    2.1 Gather data on the multifamily market sector

    2.2 Determine economic and energy savings potential of multifamily buildings

3. Improve existing and future program design

    3.1 Determine best practices and assess program effects on multifamily buildings and residents

    3.2 Leverage data and research to prioritize implementation actions

    3.3 Expand and improve current building efficiency program offerings

    3.4 Incorporate program features supporting small business and workforce development goals

4. Identify additional resources and deployment opportunities

    4.1 Understand and address financing obstacles facing affordable housing

    4.2 Secure state funding for successful programs

    4.3 Explore methods to mobilize capital

5. Increase outreach, awareness, and access

    5.1 Identify and follow successful outreach models

    5.2 Launch strategic marketing, education, and outreach

    5.3 Ensure consumer protection

CHAPTER 4:
Goal 1: Expand Coordination Among Existing Programs

Lack of program coordination across services can contribute to limited participation. Barriers to program integration, collaboration, and leveraging limit opportunities to streamline services and lock complementary funding sources into silos. These programs are implemented in parallel, and there is a need for a comprehensive plan. As stated in the Barriers Study, the lack of uniform qualifying criteria among available programs offered through retrofit programs complicates decision making with regard to selection of a program(s) best suited to the needs of a project. Better understanding is needed to identify program similarities, differences, and areas that can be leveraged as part of this action plan. The definition of "multifamily building" varies between different state programs. This can create conflicts in providing cohesive strategies to advance the sector. There is a need for effective coordination among agencies to avoid duplicative efforts and maximize resources allocated to multifamily programs.

Furthermore, differences in program requirements, along with program limitations to the types of building improvements allowed, can constrain program service providers in being able to address housing improvements holistically, particularly from health, safety, and indoor air and environmental quality standpoints. For example, a multifamily energy efficiency program may need to stop work if mold or dampness is discovered in a building, and the program would not be allowed to use program funds to address this issue. However, if programs are designed using a holistic approach that prioritizes overall energy efficiency, safety, health, and comfort, then it could allow funding sources to be combined and used to remediate health and safety issues that might arise (mold or dampness in this case) to result in healthier, safer, and more comfortable living environments—precisely the types of non-energy benefits desired from multifamily energy programs.

In addition, unique barriers exist to deploying electric vehicle infrastructure on multifamily building properties. Dedicated parking spaces are often a barrier as it can be logistically challenging to install shared electric vehicle charging infrastructure, and building owners are often unwilling to give up spaces or create enough spaces to make the project cost-effective. Owners also have competing Americans with Disabilities Act (ADA) and other code requirements that reduce space availability, in addition to bearing the high cost of creating surface or structured parking (Shoup, 2014)[7].

7 Shoup, Donald. (2014). The High Cost of Minimum Parking Requirements. *Transport and Sustainability, Volume 5*, 87-113. Retrieved from http://shoup.bol.ucla.edu/HighCost.pdf.

The following strategies will address the need for coordination, simplify participation, and maximize state efforts.

1.1	**Efficiently leverage efforts of existing working groups relevant to multifamily housing**	Lead	Supporting	Time Frame
1.1.1	Develop a collaborative working group with agencies supporting recently adopted affordable housing legislative package to identify pathways to integrate clean energy requirements and recommendations into planning and building efforts at a community level.	GO	CEC, CPUC, HCD, CSD, CARB	Ongoing
1.1.2	Coordinate and share knowledge with relevant working groups such as the Multifamily Working Group (D.16-11-022), the Disadvantaged Communities Advisory Group (SB 350), the Community Air Protection Program Consultation Group (AB617), and the Low-Income Oversight Board (SBX2 2, 2001).	CPUC, CARB, CEC, CSD	--	Ongoing

1.2	**Align efforts across existing programs to maximize benefits**	Lead	Supporting	Time Frame
1.2.1	Coordinate program eligibility and education and outreach efforts for all multifamily sector energy programs and for low-income and disadvantaged communities to simplify participation.	CPUC	CARB, CEC, CSD, HCD, SGC	2020
1.2.2	Ensure that IOU light-duty electric vehicle infrastructure program administrators to coordinate with multifamily housing developers to target newer buildings that have the capability of supporting electric vehicle charging and are consistent with the CALGreen Code.[8]	CPUC	CEC, CARB, HCD	2019
1.2.3	Coordinate EV car-sharing programs with new affordable housing developments with EV charging spaces.	CEC, CARB	HCD, SGC	2019
1.2.4	Coordinate multifamily building projects with the zero emission vehicle (ZEV) Investment Commitment,[9] which includes funding for projects installing zero-emission fueling infrastructure and car-sharing programs to increase access to ZEVs for low-income and disadvantaged communities.	CARB	CEC, CPUC	2019
1.2.5	Investigate the feasibility of including water assessments with energy audits to recommend water-saving improvements along with energy efficiency measures.	CEC, CPUC	SWRCB	2019
1.2.6	Review and align program guidelines and requirements to allow flexibility in using and combining funds to address health and safety issues (i.e., mold, dampness, indoor lead, etc.) if they are discovered during housing improvement.	CDPH	CPUC, CSD, SWRCB	2019

8 California Green Building Standards Code, http://www.bsc.ca.gov/Home/CALGreen.aspx.
9 https://www.arb.ca.gov/msprog/vw_info/vsi/vw-zevinvest/vw-zevinvest.htm.

CHAPTER 5:
Goal 2: Develop a Cohesive Understanding of the Multifamily Market

Data limitations impede innovative and adaptive approaches to reaching low-income residents and challenge collaboration. There is not a comprehensive inventory of multifamily buildings. The California Housing Partnership Corporation (CHPC) maintains the only comprehensive database of all federal and state subsidized affordable housing, including Housing and Urban Development (HUD) subsidized properties, U.S. Department of Agriculture Section 515–assisted rural properties, and properties financed with Low-Income Housing Tax Credits in California. The California Tax Credit Allocation Committee (TCAC) also maintains a publicly available list of low-income housing tax credit projects. These databases do not include market-rate, low-income housing, or locally subsidized affordable housing, including properties financed by local redevelopment or housing trust funds. The location, characteristics, tenant demographics, and ownership structure of multifamily buildings need to be known to reach and educate participants effectively. Tenant behavior and the effects of deploying DER technologies in multifamily buildings also need to be understood on the site level as well as the grid level, to assess the long-term effects. It is also important to ensure continued benefits of the measures after low-income residents move or building managers make changes. There is a lack of accurate information about the energy savings potential of building retrofits[10].

The strategies in the table below address the need to collect and gather data about the multifamily market sector, including the energy savings potential of existing multifamily buildings. Appendix C lists Energy Commission research projects relevant to multifamily buildings. Appendix D includes an interagency list of research knowledge gaps concerning the multifamily sector.

10 Scavo, Jordan, Suzanne Korosec, Esteban Guerrero, Bill Pennington, and Pamela Doughman. 2016. *Low-Income Barriers Study, Part A: Overcoming Barriers to Energy Efficiency and Renewables for Low-income customers and Small Business Contracting Opportunities in Disadvantaged Communities*. California Energy Commission. Publication Number: CEC-300-2016-009-CMF. Page 49.

2.1	**Gather data on the multifamily market sector**	Lead	Supporting	Time Frame
2.1.1	Collect data periodically and review DER pilot and demonstration activities in multifamily buildings.	CEC	CPUC, CSD	Ongoing
2.1.2	Work with academia, research institutes, multifamily housing organizations, and local governments to share multifamily building and occupancy data.	CEC	CSD, HCD, CHPC	2019
2.1.3	Establish a repository of multifamily building data for program development, implementation, and evaluation, including data such as that from the Building Energy Benchmarking Program (AB 802) and TCAC affordable housing inventory.	CEC, TCAC	CPUC, HCD, CSD	2019
2.1.4	Work with the Franchise Tax Board to obtain more specific income data for multifamily low-income residents.	CEC	FTB	2020
2.1.5	Work with the California Department of Finance to add housing feature questions to the American Housing and Community Survey.	GO	CEC	2021
2.1.6	Review previous and current IOU and Regional Energy Network (REN) programs and market characterization studies archived on the California Measurement Advisory Council (CALMAC) for data on the multifamily sector.	CEC	CPUC	2019

2.2	**Determine economic and energy savings potential of multifamily buildings**	Lead	Supporting	Time Frame
2.2.1	Leverage data from the Building Energy Benchmarking Program (AB 802) and results of the *Residential Appliance Saturation Study*[11] (RASS) to inform energy efficiency efforts in the multifamily sector.	CEC	CPUC	2019
2.2.2	Ensure that EE, DR, energy storage, and EV-charging infrastructure potential assessments identify multifamily properties with the most technical and economic potential.	CEC, CPUC	CARB, GO-Biz	Ongoing
2.2.3	Assess water-saving opportunities and strategies to benefit multifamily properties; identify barriers and gaps; understand water billing, metering characteristics, and how the usage amounts are determined between tenant and common areas and affect consumption.	CEC, CPUC	SWRCB	2020
2.2.4	Assess and determine ways to leverage data reported in the Water-Energy Nexus Registry (SB 1425).	CEC	CPUC, SWRCB	2019

11 http://www.energy.ca.gov/appliances/rass/.

CHAPTER 6:
Goal 3: Improve Existing and Future Program Design

Because of the way programs are designed, limitations exist statewide to reaching more multifamily buildings and residents effectively. Furthermore, investor-owned utilities (IOU) ratepayer-funded programs require cost-effectiveness assessments, which may limit the energy efficiency measures that can be implemented for customers, including low-income residents. (The cost-effectiveness requirements for the Energy Savings Assistance Program are different from requirements for core energy efficiency programs. The Energy Saving Assistance Program provides services designed to increase health, comfort, and safety for low-income customers.)

In California, there are three types of utilities: investor-owned, public utilities, and rural electric cooperatives. Though there are several statewide programs, each utility may also have its own program supporting distributed energy resources. Because of the number and diversity of utilities and the diverse building characteristics (for example, ownership model, building age, building size, and remote locations) of the multifamily sector, it is challenging to design clean-energy programs that will reach and be effective for all multifamily buildings statewide.

The split-incentive issue, described in the Barriers Study, is particularly acute within the low-income multifamily housing sector. Who decides on the changes being made, who will pay for the changes, and who will benefit from the changes made in multifamily rental housing? Ensuring low-income renters and property owners participate and benefit from energy upgrades poses a unique barrier. Property owners may hesitate to invest in unit upgrades because they will not directly benefit from these upgrades. On the other hand, tenants are often unauthorized of unwilling to invest in upgrades because, as renters, they may not live in the unit for the long term and therefore may benefit only temporarily. For either party, there may be a limited return on investment of an energy upgrade to a multifamily housing unit. For clean-energy programs to be effective in the multifamily sector, they need to be designed with these barriers in mind. The strategies below outline how to leverage successful multifamily program features to improve and design programs to achieve energy savings and other benefits in multifamily buildings.

3.1	**Determine best practices and assess program impacts on multifamily buildings and residents**	Lead	Supporting	Time Frame
3.1.1	Use evaluation, measurement, and verification (EM&V) reports to collect best practices and lessons learned for program success in the multifamily sector.	CPUC, CEC	CSD	Ongoing
3.1.2	Review previous and current IOU and REN program models and determine successful program features to apply to the multifamily sector and low-income/disadvantaged communities.	CPUC, CEC	CSD	2019
3.1.3	Assess the impact of current tariff structures, utility programs (for example, CARE or public utility low-income assistance programs), and split incentives on DER for this sector.	CPUC, CEC	--	Ongoing
3.1.4	In coordination with the CPUC's efforts to develop a Common Resource Valuation Method (CRVM), develop procedure to assess and quantify NEBs (such as health benefits and GHG reductions) of DER deployment in multifamily buildings, focusing on low-income and disadvantaged communities.	CPUC, CEC	CARB, SGC, CDPH	2019
3.1.5	Estimate costs and benefits of DER programs to occupants and building owners of multifamily properties.	CEC	CARB, CSD, CPUC	Ongoing

3.2	**Leverage data and research to prioritize implementation actions**	Lead	Supporting	Time Frame
3.2.1	Leverage research findings of multifamily market sector to determine which multifamily buildings or locations to prioritize for DER deployment.	CEC, CPUC	HCD, CSD, TCAC	2020
3.2.2	Provide a guidance document for local health departments to partner with weatherization programs (e.g., CSD LIWP, federal LIHEAP) to identify and prioritize weatherization and energy efficiency upgrades for low-income households that have existing health conditions, e.g., asthma, chronic obstructive pulmonary disease (COPD), etc.	CDPH, CSD	CEC, CPUC	2019
3.2.3	Review relevant strategies in the *Safeguarding California Plan: 2018 Update*[12] and incorporate climate resilience into energy and water programs for the multifamily sector, prioritizing projects with decarbonizing cobenefits.	CEC	CARB, SWRCB	2020

12 California Natural Resource Agency. January 2018. *Safeguarding California Plan: 2018 Update, California's Climate Adaptation Strategy*. http://resources.ca.gov/docs/climate/safeguarding/update2018/safeguarding-california-plan-2018-update.pdf.

3.3	**Expand and improve current building DER program offerings**	Lead	Supporting	Time Frame
3.3.1	Consider expanding current direct-install programs to offer resources for deep energy and water efficiency measures, including green infrastructure.	CEC, CPUC	CSD, SGC, SWRCB	2020
3.3.2	Explore the expansion of the solar equipment list[13] to include energy storage that will result in economic and grid benefits.	CEC, CPUC	CSD	2020
3.3.3	Continue to explore methods to expand the adoption of distributed energy storage in multifamily buildings, and identify buildings to prioritize by those with the most technical and economic potential, and locations that minimize grid integration costs and distribution system upgrades.	CEC, CPUC	CARB	2019
3.3.4	Explore opportunities to continue the New Solar Homes Partnership (NSHP) program for multifamily and affordable housing projects only (requires legislative action).	CEC	HCD, TCAC, CPUC	2019
3.3.5	Integrate new methods developed in strategy 3.1.4 into program evaluation by updating NEBs of DER deployment in multifamily buildings and ensuring NEBs are properly evaluated in cost-effectiveness determinations in the ESA Program.	CPUC, CARB	CEC, CDPH	Ongoing

13 http://www.gosolarcalifornia.ca.gov/equipment/pv_modules.php.

3.4	**Incorporate program features supporting small business and workforce development goals**	Lead	Supporting	Time Frame
3.4.1	Support contractor and installation companies to encourage the hiring, training, and long-term employment of people in low-income and disadvantaged communities.	CPUC, CEC	CARB	Ongoing
3.4.2	Coordinate with the California Workforce Development Board (CWDB) to streamline efforts in education and training supporting the deployment of distributed energy resources throughout the state, with a focus on multifamily buildings and low-income and disadvantaged communities.	CPUC, CEC, CWDB	CSD	Ongoing

CHAPTER 7:
Goal 4: Identify Additional Resources and Deployment Opportunities

Insufficient resources and funding source restrictions limit the amount and depth of energy-upgrade and clean-energy programs. Insecure, inadequate, or inequitable program funding can limit the transformative effect of low-income programs.

Cash flow in affordable housing is usually limited by loan underwriting and rent limit requirements from public agency funding sources used to construct the buildings. Affordable multifamily buildings are designed, contracted, built, and maintained with these cost controls in mind, and energy efficiency is usually the first sacrifice made to keep the building within budget (Hynek et al, 2012[14]). In addition, multifamily buildings typically operate around annual budgets, which make it difficult to invest in multiyear projects with long payback times.[15] Multifamily building owners can best avoid this problem when planning for the initial and ongoing investment in the design or rehabilitation plan for the building. Moreover, Henderson (2015[16]) observes that affordable housing owners typically have complicated financing arrangements that inhibit them from taking on any new debt except at the time of purchase or refinancing.

Outlined in the table below are strategies to gain funding resources to support clean-energy projects in multifamily buildings.

14 Hynek, Don, M. Levy, and B. Smith. 2012. *"Follow the Money": Overcoming the Split Incentive for Effective Energy Efficiency Program Design in Multi-family Buildings*. 2012 ACEE Summer Study on Energy Efficiency in Buildings.
15 NRDC, comments at the SB 350 Low-Income Barriers Study workshop, August 12, 2016.
16 Henderson, Philip. 2015. Program Design Guide: Energy Efficiency Programs in Multifamily Affordable Housing. Http://www.energyefficiencyforall.org/sites/default/files/Full%20Program%20Design%20Guide.pdf.

4.1	**Understand and address financing obstacles facing affordable housing**	Lead	Supporting	Time Frame
4.1.1	Build a comprehensive list of energy financing programs available to occupants and building owners of multifamily properties.	CEC	CPUC, HCD, TCAC, CAEATFA, CSD, CalHFA, CDLAC	2018
4.1.2	Research low-income housing tax credit properties and the building efficiency improvement opportunities during tax credit resyndication.[17]	CEC, TCAC	HCD, CSD	2018
4.1.3	Design a program that will offer incentives for multifamily building owners, especially those of low-income housing, to apply deep energy efficiency retrofits during tax credit resyndication events. This may include analyzing the use of the California Utility Allowance Calculator (CUAC) in rehabilitating housing, identifying funding sources, and leveraging market data.	CEC, TCAC	CPUC, CSD, HCD	2019

4.2	**Secure state funding for successful programs**	Lead	Supporting	Time Frame
4.2.1	Establish a stable funding source for the Low-Income Weatherization Program.	CSD	SGC	2019
4.2.2	Coordinate EV charging infrastructure programs with the California Capital Access Program (CalCAP) to determine funding potential and implementation pathways.	CEC, CARB	CPUC, CPCFA	2019

17 Resyndication is an existing tax credit project with a tax credit regulatory agreement that returns from a subsequent allocation of credits after the initial 15 year federal credit period has expired. http://www.treasurer.ca.gov/ctcac/compliance/manual/manual.pdf

4.3	**Explore methods to mobilize capital**	Lead	Supporting	Timeframe
4.3.1	Mobilize capital including grants, financing, and other payment solutions, prioritizing leverage match funding and private capital to the extent possible, to fund multifamily building efficiency programs and projects.	CEC	CPUC, CARB, TCAC, SGC, CAEATFA, CalHFA	2019
4.3.2	Collaborate with local government organizations and the National Association of State Energy Organizations (NASEO) Finance Committee to find ways to leverage private capital to fund efficiency projects in multifamily buildings.	CEC	CAEATFA	2019

CHAPTER 8:
Goal 5: Increase Outreach, Awareness, and Access

There is a need for strategic outreach to reach as many multifamily buildings statewide as possible. Effective market delivery can be hampered by insufficient or poorly calibrated outreach and delivery, high transaction costs imposed on low-income residents and/or multifamily building owners with limited time and resources, and slow rebate disbursals. Lack of internet connectivity (especially for rural and underserved locations across the state) may also be an issue for low-income residents. Fifty-four percent of low-income households use a primary language other than English (Barriers Study). Also, there is a lot of variation in types of multifamily building owners, such as nonprofit owners, owners with no government funding, or more profit-motivated private owners. The wide range of multifamily and low-income demographics poses a challenge to designing and implementing successful marketing, education, and outreach programs. Community-based organizations (CBO) or nongovernmental organizations (NGO) can be an excellent resource to reach specific target demographics as trusted messengers.

There are several reasons for building owners and tenants to hesitate or refuse to participate in energy upgrade programs. Some are unwilling to participate, which speaks to targeted-participant behavior and perception. Program fatigue or mistrust is an issue if the participant had a negative experience associated with similar programs. The CPUC notes that the energy retrofit industries need better regulation to prevent predatory sales practices, and it is an acute issue for low-income customers.[18] Tenants may also fear that energy upgrades to the property will cause disruption, relocation, or increases in rent. Besides being unwilling, some building owners and tenants are unable to participate. In some cases, they simply do not have the authority, capacity, understanding, or time to research energy-upgrade programs to determine eligibility and program requirements. Any of these issues can lead to the inability or unwillingness for building owners or tenants to participate in energy-upgrade programs.

To improve clean-energy program outreach, awareness, and access, the CLIMB Action Plan lays out the following strategies:

18 CPUC, comments at the SB 350 Low-Income Barriers Study workshop, August 12, 2016. Furthermore, as one step toward improving consumer decision-making processes CPUC Decision 16-001-004 directs the CPUC to issue information packets to consumers.

5.1	**Identify and follow successful outreach models**	Lead	Supporting	Time Frame
5.1.1	Document energy efficiency best practice business models and delivery approaches to specific customer segments, with a focus on service delivery from either utilities or third parties (nonprofit or private enterprise).	CEC	CPUC, CSD	2019
5.1.2	Develop a strategic education and outreach program that leverages the success of current rooftop solar markets to expand into both unserved building types and communities and integrate next-step technologies including electric vehicles and energy storage.	CPUC, CSD	CEC, HCD	2020

5.2	**Strategic marketing, education, and outreach**	Lead	Supporting	Time Frame
5.2.1	Develop a comprehensive set of targeted outreach materials to inform policy makers about the needs and benefits of low-income clean-energy programs benefiting multifamily residents.	Low-income program administrators	CARB, CEC, CSD	2019
5.2.2	Leverage relationships and provide targeted outreach and technical assistance, including through local governments, CBOs, and NGOs, to owners and tenants of multifamily buildings, especially in affordable housing and locations in low-income and disadvantaged communities.	CSD	CEC, CPUC, CDPH, HCD, TCAC	2020
5.2.3	Leverage established relationships with affordable housing developers and solar installers to expand installation of solar energy systems to all property types and communities and advance implementation of energy storage and smart demand management systems for multifamily properties that will result in economic and grid benefits.	CSD	CEC, CPUC, TCAC, AEA, HUD, HCD	2020
5.2.4	Leverage relationships and existing grant and incentive rebate programs for zero-emission-vehicle (ZEV) infrastructure throughout various public and private agencies to create highly visible sources of funding opportunities.	CARB, GO-Biz	CEC, CPUC, CSD	2020
5.2.5	Investigate redesigning the California Solar Initiative (CSI) thermal program or establish a new program to promote the cost-effective installation of photovoltaic systems coupled with high-efficiency heat pump water-heating technologies to defray environmental and bill impacts of natural gas (and other fuel source) residential domestic hot water heating to address the participation challenges linked to current and foreseeable economic barriers of the CSI thermal program cost-competitiveness with natural gas.	CPUC	CEC	2019

5.3	**Ensure consumer protection**	Lead	Supporting	Time Frame
5.3.1	Adopt, implement, and enforce responsible contractor policies to ensure that retrofits meet high-quality performance standards and reduce energy savings lost or forgone due to poor-quality workmanship, and establish consumer protection guidelines for energy efficiency products and services.	CEC	CPUC, CSD	2020
5.3.2	Coordinate with local authorities and consumer protection agencies to investigate the need for heightened consumer protection to help prosecute companies that use misleading information or engage in predatory practices to take advantage of low-income customers and small businesses seeking access to clean-energy benefits.	CSLB	CEC, CPUC	2020

CONCLUSION

Meeting California's ambitious climate and equity goals will require an accelerated deployment of clean energy resources in the state's fleet of multifamily buildings. A variety of key challenges currently limit DER adoption in this sector, including complex ownership structures, lack of uniform building characteristics, split incentives between owners and tenants, and cost effectiveness constraints that limit the use of market-rate financing, especially in deed-restricted affordable housing projects.

Within the multifamily sector, there are three primary market segments that present unique characteristics and challenges: 1) deed-restricted multifamily housing serving low-income households; 2) market-rate multifamily housing inhabited by low- or moderate-income households that pay a large portion of their income on rent; and 3) market rate multifamily housing where household income is generally sufficient to meet rent levels. Due to market segmentation, effective deployment of DERs in the multifamily sector will require a coordinated effort across market actors to enact an array of strategies and specific actions targeted to the needs of each market segment. With the publication of this action plan, the Energy Commission and partner agencies outline the following five primary goals and supporting strategies and early actions to improve existing programs in the multifamily sector and lay the foundation for developing long-term solutions in response to these challenges.

1. Expand coordination among existing programs
2. Develop a cohesive understanding of the multifamily market
3. Improve existing and future program design
4. Identify additional resources and deployment opportunities
5. Increase outreach, awareness, and access

Moving forward, it is essential for state agencies to coordinate with each other, and with local governments, community-based organizations, non-governmental organizations, and other entities working in the multifamily sector. Implementing the early actions described in the CLIMB Action Plan is expected to increase adoption of clean energy technologies in multifamily buildings, enabling low-income residents and renters to realize the clean energy benefits that have historically eluded them. Increased DER deployment will also contribute to California's vision of doubling energy efficiency savings by 2030 while strengthening the electricity grid, all while ultimately reducing greenhouse gas emissions and combating climate change.

List of Acronyms

Acronyms used throughout this document include:

AEA	Association for Energy Affordability
AHSC	Affordable Housing and Sustainable Communities
CAEATFA	California Alternative Energy and Advanced Transportation Financing Authority
CalCAP	California Capital Access Program
CalHFA	California Housing Financing Agency
CALMAC	California Measurement Advisory Council
CARB	California Air Resources Board
CDPH	California Department of Public Health
CDLAC	California Debt Limit Allocation Committee
CHEEF	California Hub for Energy Efficiency Financing
EE	Energy Efficiency
Energy Commission	California Energy Commission
CHPC	California Housing Partnership Corporation
CPCFA	California Pollution Control Financing Authority
CPUC	California Public Utilities Commission
CSD	California Department of Community Service and Development
CSLB	California Department of Consumer Affairs, Contractors State License Board
CWDB	California Workforce Development Board
DER	Distributed energy resource
DOE	U.S. Department of Energy
DOF	California Department of Finance
EV	Electric vehicle
FTB	California Franchise Tax Board

HCD	California Department of Housing and Community Development
HUD	U.S. Department of Housing and Urban Development
IOU	Investor-owned utility
GO	California Governor's Office
GO-Biz	California Governor's Office of Business and Economic Development
POU	Publicly-owned utility
SGC	Strategic Growth Council
SOMAH	Solar on Multifamily Affordable Housing Program
SWRCB	California State Water Resources Control Board
TCAC	California Tax Credit Allocation Committee
ZEV	Zero-emission vehicle

APPENDIX A:
Active Multifamily Building Programs (as of May 2018)

- **Advanced Home Upgrade Program** – This program offers incentives for increasing levels of energy efficiency over a 10 percent threshold in one- to four-unit residences.
- **Affordable Housing and Sustainable Communities (AHSC)** Program – Administered by the SGC and implemented by HCD, this GGRF-funded program integrates affordable homes and sustainable transportation by ensuring housing, jobs, and key destinations are accessible by walking, biking, and transit. In the application review, points are awarded for using construction companies with employees in or near disadvantaged communities, which supports local workforce development.
- **California Hub for Energy Efficiency Financing (CHEEF) –** This ratepayer-funded pilot program administered by CAEATFA provides a standardized statewide platform and credit enhancement to promote and leverage private capital (loans, leases, energy service agreements) -- providing better terms and broader access to financing – for energy efficiency retrofits. The Affordable Multifamily Pilot is expected to launch in Q1 2019. Other multifamily projects may be assisted under the U.S. Department of Energy's Small Business Pilot, expected to launch in Q1 2019. Gogreenfinancing.com
- **California Building Code, Title 24, Part 6 (California Energy Code) and Part 11 (California Green Building Standards Code)** – Building and appliance energy efficiency standards are a key tool for statewide energy conservation and have saved Californians billions in reduced electricity bills since 1977 and has contributed to greenhouse gas reduction. The standards apply to new buildings and additions, alterations, and repairs of existing buildings and are updated every three years. The 2022 update will focus on multifamily buildings, including electric vehicle charging infrastructure.
- **California Solar Initiative (CSI) Thermal Program** – This program is designed to significantly increase the adoption rate of solar thermal technologies by offering incentives to commercial and multifamily residential customers in the Pacific Gas and Electric (PG&E), San Diego Gas & Electric (SDG&E), and Southern California Edison (SCE) service territories. Low-income residential customers may qualify for higher incentives.
- **Community Development Block Grant Program (CDBG)** – The CDBG State Program allows states to award grants to smaller units of local governments that develop and preserve decent affordable housing, to provide services to the most vulnerable in these communities, and to create and retain jobs.

- **Energy Savings Assistance (ESA) Program** – This program offers no-cost energy efficiency measures and non-energy benefits for income-qualified households. Services provided include attic insulation, energy-efficient refrigerators, energy-efficient furnaces, weather-stripping, caulking, low-flow showerheads, water heater blankets, and door and building envelope repairs that reduce air infiltration.
- **ESA Common Area Measures program** – This program, directed by CPUC D.17-12-009, will offer no-cost efficiency measures for common areas in income-qualified, deed-restricted multifamily properties of five units or more.
- **Energy Upgrade California Multifamily Upgrade** – This program offers incentives for whole-building retrofits in buildings of five residential units or more.
- **Enhanced Fleet Modernization Program (EFMP) Plus-Up** – Funded through California Climate Investments, this program provides incentives for low-income drivers toward the purchase of an advanced technology replacement vehicle (for example, hybrid, plug-in hybrid, or zero-emission).
- **Home Upgrade Program** – This program offers incentive rebates for comprehensive energy efficiency improvements in one- to four-unit homes.
- **Joe Serna, Jr., Farmworker Housing Grant Program (JSJFWHG)** – The grant program finances the new construction, rehabilitation, and acquisition of owner-occupied and rental units for agricultural workers, with a priority for lower-income households.
- **Low-Income Weatherization Program (LIWP)** – LIWP supports owners and residents to lower utility costs, save energy, and reduce greenhouse gas emissions in multifamily properties. Funded by both state and federal sources, property assessments, design assistance, and contractor coordination are available, and incentives cover from 30 percent to 100 percent of energy efficiency upgrades and from 50 percent to 100 percent of solar installations. (See Solar Implementation Plan.) CSD administers funds from the U.S. Department of Health and Human Services' Low-Income Energy Assistance Program (LIHEAP) and the U.S. Department of Energy's Weatherization Assistance Program (WAP).
- **Marin Clean Energy (MCE) Energy Savings for Multifamily Properties** – This program offers a free energy assessment with a limited set of rebates and direct-install measures for energy and water savings.
- **Middle Income Direct Install (MIDI) Program** – This program offers no-cost home improvements that increase home comfort and conserve energy for income-qualified households.
- **Multifamily Affordable Solar Housing (MASH) Program** – This program offered solar incentives on qualifying affordable housing multifamily dwellings (exhausted funding).

- **Multifamily Energy Efficiency Rebate (MFEER) Program** – This program offers rebates for owners of existing multifamily properties (five units or more).
- **New Solar Homes Partnership (NSHP) Program** – A part of CSI, the NSHP program provides financial incentives to encourage the installation of eligible solar energy systems on new home construction.
- **Self-Generation Incentive Program** – This program is largely for energy storage; 10 percent of the program budget is dedicated to single- or multifamily buildings in low-income or disadvantaged communities.
- **Solar on Multifamily Affordable Housing Program (SOMAH)** – Implementing AB 693, this program provides incentives for the installation of solar distributed generation projects sited on existing multifamily affordable housing. (See Solar Implementation Plan.)
- **Veterans Housing and Homelessness Prevention Program (VHHP)** – The purpose of this program is the acquisition, construction, rehabilitation, and preservation of affordable multifamily housing for veterans and their families to allow veterans to access and maintain housing stability. About $75 million in VHHP funding is made available annually.

APPENDIX B:
Partner Agency Current Activities Relevant to CLIMB Action Plan Strategies

	Strategy	Current Activities
1.1	**Efficiently leverage efforts of existing working groups relevant to multifamily housing**	
1.1.1	Develop a collaborative working group with agencies supporting recently adopted affordable housing legislative package to identify pathways to integrate clean energy requirements and recommendations into planning and building efforts at a community level	• CEC is participating in the CPUC/IOU multifamily working group to develop EE upgrade strategies and guidelines among IOU programs to benefit low-income and disadvantaged communities. • CEC is coordinating with the California Tax Credit Allocation Committee (TCAC) to develop a protocol for EE upgrades at tax credit project resyndication events. • CEC and CPUC are participating in the multifamily Home Energy Retrofit Coordinating Committee (MF-HERCC) to overcome benchmarking challenges. • CPUC, IOUs, ORAs, and public representatives, participate in the directed Multifamily Working Group (D.17-12-009).
1.1.2	Coordinate and share knowledge with relevant working groups such as the Multifamily Working Group (D.16-11-022), the Disadvantaged Communities Advisory Group (SB 350), the Community Air Protection Program Consultation Group (AB 617), and the Low-Income Oversight Board (SBX2 2, 2001).	• A CPUC Decision (D.17-12-009), voted on December 14, 2017, directs the IOUs to develop new program designs in consultation with the multifamily working group and submit them to the CPUC for review and approval in March 2018. • CPUC Proceeding R.14-07-002 (NEM) will engage with utilities, state agencies, solar developers, installers, and environmental and ratepayer advocates, as well as housing organizations.
1.2	**Align efforts across existing programs to maximize benefits**	
1.2.1	Coordinate program eligibility and education and outreach efforts for all multifamily sector energy programs and for low-income and disadvantaged communities to simplify participation.	None
1.2.2	Ensure that IOU light-duty electric vehicle infrastructure program	• Investor-owned utilities (IOUs), regulated by CPUC, are implementing light-duty electric vehicle charging

	Strategy	Current Activities
	administrators to coordinate with multifamily housing developers to target newer buildings that have the capability of supporting electric vehicle charging and are consistent with the CALGreen Code[19]	infrastructure pilots, which include multifamily buildings. • The CPUC is considering additional electric vehicle infrastructure programs proposed by the IOUs. • CPUC oversees a settlement agreement with NRG Energy, Inc. that includes targeting residents of multifamily buildings both with EV charging infrastructure on-site and with DC fast-charging plazas built in communities with dense multifamily populations to serve these residents.
1.2.3	Coordinate EV car-sharing programs with new affordable housing developments with EV charging- spaces	• Updated building standards (AB 1092, 2013) set minimum requirements for EV charging-capable parking spaces at multifamily buildings. These requirements became effective in July 2015. • CARB has completed technical and cost analysis to support part of HCD's proposed code changes for multifamily buildings in the Green Building Standards (CALGreen) Code.
1.2.4	Coordinate multifamily building projects with the ZEV Investment Commitment,[20] which includes funding for projects installing zero-emission fueling infrastructure and car-sharing programs to increase access to ZEVs for low-income and disadvantaged communities	None
1.2.5	Investigate including water assessment with energy audits to recommend water-saving improvements along with energy efficiency measures	None
1.2.6	Review and align program guidelines and requirements to allow flexibility in using and combining funds to address health and safety issues (i.e., mold, dampness, indoor lead) if they are discovered during housing improvement.	None

19 California Green Building Standards Code, http://www.bsc.ca.gov/Home/CALGreen.aspx.
20 https://www.arb.ca.gov/msprog/vw_info/vsi/vw-zevinvest/vw-zevinvest.htm.

	Strategy	Current Activities
2.1	**Gather data on the multifamily market sector**	
2.1.1	Conduct periodic data collection and review of DER pilot and demonstration activities in multifamily buildings	• In response to AB 2868, the electric IOUs have filed applications to pursue solar + storage pilots in multifamily housing. Details can be found in CPUC proceedings A.18-03-001 (PG&E), A.18-03-002 (SCE), and A.18-02-016 (SDG&E).
2.1.2	Work with academia, research institutes, multifamily housing organizations, and local governments, to share multifamily building and occupancy data	• CSD's LIWP collects information on water heaters, HVAC, and other appliances in multifamily buildings in disadvantaged communities. • PG&E published, in February 2018, the *PG&E Multifamily Finance Opportunity Study,*[21] which includes key characteristics of the multifamily housing market in the PG&E service territory. • Existing IOU and REN programs have data on the units treated and associated energy savings. There are also evaluation, measurement, and verification (EM&V) reports available for past program cycles. • CPUC - Energy Savings Assistance Common Area Measures Pilots are set to begin in 2018 – properties will be benchmarked, and other metrics will be collected. • Leverage AB 802 Benchmarking data for larger multifamily buildings; requirement begins July 2019. • Southern California Gas Co. (SoCalGas) is leading the California Statewide Multifamily Boiler Market Assessment (final report expected in April 2019). • Through the potentially large footprint of participating properties, the SOMAH Program aims to collect and make publicly available a wide berth of program-, participant-, project-, and property-level multifamily data.
2.1.3	Establish a repository of multifamily building data for program development, implementation, and evaluation, including data such as that from the Building Energy Benchmarking Program (AB 802) and TCAC affordable housing inventory	• AB 693 mandates data collection and program evaluation for SOMAH, which will include performance indicators. • CSI thermal public datasets can be downloaded from csithermalstats.org and are updated every two weeks by each program administrator (PG&E, SCE, SoGalGas, and CSE). • For LIWP, CSD has secured data exchange agreements with IOUs to obtain energy usage information and is preparing to have similar data-sharing agreements with POUs. • IOU multifamily rebate and retrofit programs may be moving toward adopting a common DOE Building Energy Data Exchange Specification (BEDES) for program data collection and reporting. Similar efforts may occur for the adoption of the DOE Orange Button

21 https://pda.energydataweb.com/api/downloads/2015/PGE_MF_Opportunity_Results_Memo_FINAL.pdf.

	Strategy	Current Activities
		– Solar Bankability Data to Advance Transactions and Access (SB-DATA) for the SOMAH Program.
2.1.4	Work with the Franchise Tax Board to obtain more specific income data for multifamily low-income residents	None
2.1.5	Work with the California Department of Finance to add housing feature questions to the American Housing and Community Survey	None
2.1.6	Review previous and current IOU and Regional Energy Network (REN) programs and market characterization studies archived on the California Measurement Advisory Council (CALMAC) for data on the multifamily sector	None
2.2	**Determine economic and energy savings potential of multifamily buildings**	
2.2.1	Leverage data from the Building Energy Benchmarking Program (AB 802) and results of the Residential Appliance Saturation Study[22] (RASS) to inform energy efficiency efforts in the multifamily sector	• CEC is pursuing a 2017 update of the *Residential Appliance Saturation Survey* (RASS). The RASS surveys, which may provide great insight into the appliance end uses and demographic details of multifamily tenants, could be leveraged to glean better insight into this market sector. • CEC's *Residential Appliance Saturation Survey* (RASS) will collect information about building structure, water heaters, HVAC, and other appliances/July 2019.
2.2.2	Ensure that EE, DR, energy storage, and EV-charging infrastructure potential assessments identify multifamily properties with the most technical and economic potential	• CEC is developing a research agenda to scale up low-income and disadvantaged communities multifamily EE programs. • CEC and partner agencies compiled a research gap analysis on multifamily building demographics and characteristics. (See Attachment A.) • CEC is funding a portfolio of existing energy research, development, demonstration, and market facilitation projects for multifamily buildings in low-income and disadvantaged communities through the Electric Program Investment Charge (EPIC) program. Twenty-five percent of EPIC funding is allocated to research

22 http://www.energy.ca.gov/appliances/rass/.

	Strategy	Current Activities
		and implementation of pilot projects in disadvantaged communities. • CEC is developing projections of the need for EV charging infrastructure in multifamily buildings to support ZEV goals based on the Electric Vehicle Infrastructure Projections (EVI-Pro) Model. • CARB is funding research to inform programs to encourage adoption of advanced technology vehicles in low- and moderate-income households and assess the need for supporting infrastructure. • CARB is working with Google to locate EV-capable buildings statewide. • CARB is developing a work plan to measure the rate of electric vehicle infrastructure installations. • GO-Biz is developing an EV charging infrastructure guide (Executive Order B-48-18).[23] • Per AB 2868 and D.17-04-039, the electric IOUs have proposed energy storage for multifamily solar projects. The EM&V of these pilots may help inform the current list of unknowns about the perceived benefits of storage in this market sector. • The CEC's work authorization with Navigant will review POU model method and develop alternative scenarios of EE savings in POU service territories to complement CPUC's EE Potential and Goals Study for 2018 • Evaluation of current EV charging pilots will contribute to some of the questions noted
2.2.3	Assess water-saving opportunities and strategies to benefit multifamily properties; identify barriers and gaps; understand water billing, metering characteristics, and how the usage amounts are determined between tenant and common areas and affect consumption	• UC Davis published "The Estimated Impact of California's Urban Water Conservation Mandate on Electricity Consumption And Greenhouse Gas Emissions"[24] in January 2018. • The Water Research Foundation published the *Water Use in the Multi-Family Housing Sector* report in February 2018 • OEHHA is preparing a report on how to evaluate the safety, accessibility, and affordability of drinking water. • HCD will incorporate water submetering for multiunit structures into the California Building Standards Code effective July 15, 2021. This is a requirement of Chapter 623, Statues of 2016 (Senate Bill 7)

23 Executive Order B-48-18 (https://www.gov.ca.gov/2018/01/26/governor-brown-takes-action-to-increase-zero-emission-vehicles-fund-new-climate-investments/) states that the Governor's Office of Business and Economic Development shall publish a *Plug-in Charging Station Development Guidebook* and update the *2015 Hydrogen Station Permitting Guidebook*.

24 http://iopscience.iop.org/article/10.1088/1748-9326/aa9b89.

	Strategy	Current Activities
2.2.4	Assess and determine ways to leverage data reported in the Water-Energy Nexus Registry (SB 1425)	None
3.1	**Determine best practices and assess program impacts on multifamily buildings and residents**	
3.1.1	Use evaluation, measurement, and verification (EM&V) reports to collect best practices and lessons learned for program success in the multifamily sector	• CPUC maintains a report archive, including evaluation, measurement, and verification reports, as well as program data on CALMAC[25] EE Stats[26] and within the Energy Savings Assistance Program annual reports.[27]
3.1.2	Review previous and current IOU and REN program models and determine successful program features to apply to the multifamily sector and low-income/ disadvantaged communities	• CEC staff is reviewing pilot projects focused on low-income and disadvantaged communities to identify lessons learned and opportunities to scale toward programs. • (CPUC) Energy Savings Assistance Programs to use a single point of contact (SPOC) for program delivery to multifamily tenants and owners. • CPUC directed IOUs to use letter mailing to support tenant-landlord communications to enter IOU programs (D.17-12-009). • CARB's Clean Mobility Options for disadvantaged communities pilot project offers alternate modes of transportation that encourages the use of clean vehicles and includes installation of charging infrastructure to serve multifamily buildings in disadvantaged communities • CARB's Agricultural Worker Vanpools Pilot Project aims to provide clean transportation options for agricultural workers.
3.1.3	Assess the impact of current tariff structures, utility programs (for example, CARE or public utility low-income assistance programs), and split incentives on DER for this sector	• The CEC is working with LBNL to compare single-scale and community-scale solar thermal projects to determine which is the most feasible and/or cost-effective. • The CEC's work order with E3 and LBNL seeks to understand the range of energy supply options for ZNE homes and to estimate current and future anticipated costs. • CPUC requires IOUs to provide information in public monthly reports[28] on service delivery for Energy Savings Assistance Program and CARE. • CPUC staff is supporting the development of a net-energy-metering (NEM) disadvantaged communities

25 http://www.calmac.org/search.asp; CEDARS https://cedars.sound-data.com/.
26 http://eestats.cpuc.ca.gov/.
27 http://www.cpuc.ca.gov/iqap/.
28 http://www.cpuc.ca.gov/iqap/.

	Strategy	Current Activities
		alternatives decision (AB 327) to develop a new NEM tariff and specific alternative designed for renewable energy growth among residential customers of disadvantaged communities. • CPUC maintains a report archive and program data at CALMAC, http://www.calmac.org/search.asp; CEDARS, https://cedars.sound-data.com/; EE Stats, http://eestats.cpuc.ca.gov/; and Energy Savings Assistance Annual Reports at http://www.cpuc.ca.gov/iqap/. • CPUC to start study of residential default TOU rates through pilots/2018. • CARE/ESA-funded RFP will develop end-use disaggregation and usage profiles of CARE customers/2019. • CPUC Low-Income Needs Assessment (LINA) to provide information for ESA and CARE programs (final report expected in 2019) at http://www.cpuc.ca.gov/iqap/. • CPUC to ensure that analytical tools to assess the value of DERs support the review of NEM successor tariff (D.16-01-044)/2018. • CPUC to assess regulatory options to streamline Commission jurisdictional interconnection rules (Rule 21) and FERC interconnection rules for behind-the-meter DERs/2018.
3.1.4	In coordination with the CPUC's efforts to develop a Common Resource Valuation Method (CRVM), develop procedure to assess and quantify NEBs (such as health benefits and GHG reductions) of DER deployment in multifamily buildings, focusing on low-income and disadvantaged communities.	• CPUC's cost-effectiveness method in place for the ESA program includes NEBs. • CARB's research contract with UC Berkeley will evaluate the effect that building affordable housing in transit-oriented areas has on travel demand and resident health. • Non-energy benefits study/Dec. 2018. • Staff proposal in CPUC's IDER proceeding (R.14-10-003) considers framework and specific methods for certain NEBs (health benefits and GHG reductions) in DER evaluation.
3.1.5	Estimate costs and benefits of DER programs to occupants and building owners of multifamily properties	• SDG&E and SCE are designing pilot programs offering energy storage with solar programs MASH/SOMAH (AB 2868). The EM&V of these pilots may help inform the current list of unknowns about the perceived benefits of storage in this market sector.
3.2	**Leverage data and research to prioritize implementation actions**	
3.2.1	Leverage research findings of multifamily market sector to determine which multifamily	None

	Strategy	Current Activities
	buildings or locations to prioritize for DER deployment	
3.2.2	Provide guidance document for local health departments to partner with weatherization programs (e.g., CSD LIWP, federal LIHEAP) to identify and prioritize weatherization and energy efficiency upgrades for low-income households that have existing health conditions, e.g., asthma, chronic obstructive pulmonary disease (COPD), etc.	• CDPH is working on a pilot project with Contra Costa County to document the collaborative partnership between the county's home visitation nurse/health program and disseminating information about, and providing referrals to, LIWP/LIHEAP services that households are eligible for. • CDPH weatherization/EE pilot project guidance document, 2018/2019.
3.2.3	Review relevant strategies in the *Safeguarding California Plan: 2018 Update*[29] and incorporate climate resilience into energy and water programs for the multifamily sector, prioritizing projects with decarbonizing cobenefits	None
3.3	**Expand and improve current building efficiency program offerings**	
3.3.1	Consider expanding current direct install programs to offer resources for deep energy and water efficiency measures, including green infrastructure	• A CPUC decision, issued November 21, 2016, expanded the ESA Program in California to include common area measures for deed-restricted multifamily housing and allotted $80M across the four IOUs for this activity through program year 2020. • The CPUC is in the early stages of developing affordable energy solutions for low-income households in the San Joaquin Valley who do not have natural gas for heating; some of these households may be in multifamily buildings (AB 2672). • (CPUC) IOU programs offer MFEER, Home Upgrade, Advanced Home Upgrade, MIDI, and Energy Upgrade California Multifamily Upgrade Program, REEL, and Energy Savings Program (in-unit and common area). • The IOU Common Area Measures program is part of ESA direct-install measures (D.17-12-009). • The CPUC directed the IOUs to file their Energy Savings Assistance (ESA) Program Multifamily

29 California Natural Resource Agency. January 2018. *Safeguarding California Plan: 2018 Update, California's Climate Adaptation Strategy*. http://resources.ca.gov/docs/climate/safeguarding/update2018/safeguarding-california-plan-2018-update.pdf.

	Strategy	Current Activities
		Common Area Measures (CAM) Initiative Implementation Plans/March 2018. • ESA Common Area Measures pilots end in 2020.
3.3.2	Explore the expansion of the solar equipment list[30] to include energy storage that will result in economic and grid benefits	• Per AB 2868 and D.17-04-039, the electric IOUs have proposed energy storage for multifamily solar projects. The EM&V of these pilots may help inform the current list unknowns about the perceived benefits of storage in this market sector.
3.3.3	Expand the adoption of distributed energy storage with the most technical and economic potential in multifamily buildings, with priority given to locations that minimize grid integration costs and distribution system upgrades	• Per AB 2868 and D.17-04-039, the electric IOUs have proposed energy storage for multifamily solar projects. The EM&V of these pilots may help inform the current list unknowns about the perceived benefits of storage in this market sector.
3.3.4	Explore opportunities to continue the New Solar Homes Partnership (NSHP) program for multifamily and affordable housing projects only (requires legislative action)	• CEC is implementing the NSHP program that includes incentives and streamlined activities to encourage participation from multifamily projects with a focus on those in disadvantaged communities. • CPUC selected an administrator for the SOMAH program in April 2018.
3.3.5	Integrate new methods developed in strategy 3.1.4 into program evaluation by updating NEBs of DER deployment in multifamily buildings and ensuring they are properly evaluated in cost effectiveness determinations in the ESA Program	• CPUC Non-Energy Benefits study/Dec 2018.
3.4	**Incorporate program features supporting small business and workforce development goals**	
3.4.1	Support contractor and installation companies to encourage the hiring, training, and long-term employment of people in low-income and disadvantaged communities	• An additional component of the forthcoming SOMAH Program is a comprehensive local hiring plan for funded projects. • CPUC regulated utilities: Contracts must comply with General Order 156 to increase participation of women, minority, disabled veteran, and LGBT business enterprises. • In the mainstream EE proceeding, 60% of programs are to be outsourced to third parties. Due to GO 156,

30 http://www.gosolarcalifornia.ca.gov/equipment/pv_modules.php.

	Strategy	Current Activities
		the IOUs have incorporated bid weights that provide favorable points to minority, woman or disabled veteran-owned business enterprises. • A CPUC-proposed decision (A17-01-013 ET. AL.) would expand/initiate job placement, require placement experience, require "first source" hiring, and promote job connections.
3.4.2	Coordinate with the California Workforce Development Board (CWDB) to streamline efforts in education and training supporting the deployment of distributed energy resources throughout the state, with a focus on multifamily buildings and low-income and disadvantaged communities	• CEC is developing policies and programs for small businesses and workforce development through a contract with The Energy Coalition that may benefit multifamily buildings. • CARB is coordinating with SGC to help local small businesses in disadvantaged communities address workforce needs through technical assistance.
4.1	**Understand and address financing obstacles facing affordable housing**	
4.1.1	Build a comprehensive list of energy financing programs available to occupants and building owners of multifamily properties.	• The *PG&E Multifamily Finance Opportunity Study* explores the potential bill neutrality of measures that could be deployed in a multifamily setting. • CPUC to provide guidance regarding the appropriate investments utilities should make to accommodate and promote higher penetrations of DERs in 2017.
4.1.2	Research low-income housing tax credit properties and the building efficiency improvement opportunities during tax credit resyndication.	None
4.1.3	Design a program that will offer incentives for multifamily building owners, especially those of LI[31] housing, to apply deep energy efficiency retrofits during tax credit resyndication events. This may include analyzing the use of the California Utility Allowance Calculator (CUAC) in rehabilitation projects, identifying funding sources, and leveraging market data.	None

31 LI = Low-income

	Strategy	Current Activities
4.2	**Secure state funding for successful programs**	
4.2.1	Establish a stable funding source for the Low-Income Weatherization Program	None
4.2.2	Coordinate EV charging infrastructure programs with the California Capital Access Program (CalCAP) to determine funding potential and implementation pathways	None
4.3	**Explore methods to mobilize capital**	
4.3.1	Mobilize capital including grants, financing, and other payment solutions, prioritizing leverage match funding and private capital to the extent possible, to fund multifamily building efficiency programs and projects	• CEC is accelerating multifamily building upgrades and program development in local government jurisdictions. For example, through the Local Government Challenge program, the CEC is funding a $1 million grant for Energy Council to launch a project that will accelerate multifamily building upgrades in Bay Area jurisdictions and a $1.7 million grant with Marin Clean Energy to design and implement a program to remove barriers to deployment of distributed energy resources. • CPUC directed IOUs to reexamine OBF and on-bill repayment (OBR) to increase access and better integrate with ESA single point of contact (D.17-12-009). • As of 2017, the IOUs have updated their on-bill financing (OBF) programs to increase the maximum loan amount of energy efficiency financing available per property to $2M for multifamily customers. • CPUC staff is providing analytical support for the proposed decision of the IOU's 2018 Energy Resource Recovery Account (ERRA) forecasting applications that will set aside appropriate amounts of GHG revenue return proceeds to the SOMAH program. • SB 92 clarifies that the CPUC shall authorize the annual allocation of $100M or 2/3 of available funds, whichever is less, from the IOU's Clean Energy Programs greenhouse gas auction proceeds, to fund SOMAH. • CSD is meeting with IOU reps to establish funding accounts that will fund the installation of ESA program in-unit qualified measures in deed-restricted affordable housing located in disadvantaged communities. • CAEATFA is developing the Affordable Multifamily Energy Efficiency Financing Pilot under the CA Hub for Energy Efficiency Financing to offer incentives for

	Strategy	Current Activities
		more private capital into energy efficiency retrofits. Project eligibility will leverage IOU, REN, and CSD infrastructure and allow for a private market approach. • The draft study plan for the Bay REN Water Bill Savings Process Evaluation (March 2018) examines three water bill savings programs that allows municipal water utility customers to pay for efficiency improvements through a monthly charge attached to their water meter, with no upfront costs and assurance that their utility water and energy bill savings will exceed the program charge. Bay REN is planning to expand the offerings to a regional water bill Savings program.
4.3.2	Collaborate with local government organizations and the National Association of State Energy Organizations (NASEO) Finance Committee to find ways to leverage private capital to fund efficiency projects in multifamily buildings	None
5.1	**Identify and follow successful outreach models**	
5.1.1	Document energy efficiency best practice business models and delivery approaches to specific customer segments, with a focus on service delivery from either utilities or third parties (nonprofit or private enterprise)	• CEC is funding a work authorization with Navigant Consulting to review the current state of existing building DER investment in low-income and disadvantaged communities, identify case studies for further analysis, and offer recommendations to accelerate market adoption. • CPUC is engaged in studies and pilots regarding alternative financing mechanisms and strategies, including Residential Energy Efficiency Loan Assistance Program and the upcoming Affordable Multifamily Financing Program. • CPUC Multifamily Working Group will create a public report on Common Area Measures Program's progress/2019 and 2020.
5.1.2	Develop a strategic education and outreach program that leverages the success of current rooftop solar markets to expand into both unserved building types and communities and integrate next-step technologies including electric vehicles and energy storage	• CPUC to establish clear marketing, education, and outreach plans, informed by customer-usage segmentation, that maximize (via DERs or other means) the bill and grid benefits of time-varying rates for defaulted customers.
5.2	**Strategic marketing, education, and outreach**	

	Strategy	Current Activities
5.2.1	Develop a comprehensive set of targeted outreach materials to inform policy makers about the needs and benefits of low-income clean-energy programs benefiting multifamily residents	None
5.2.2	Leverage relationships and provide targeted outreach and technical assistance, including through local governments, CBOs, and NGOs, to owners and tenants of multifamily buildings, especially in affordable housing and locations in low-income and disadvantaged communities	• NSHP staff is working with multifamily project developers to encourage program participation through targeted outreach, including the distribution of guidance documents and training. • CSD keeps a list of multifamily owners that are interested in participating in LIWP and similar programs. • A key component of the forthcoming SOMAH Program is robust, concierge technical assistance to affordable property owner participants. • The Energy Assistance Program (CPUC/IOUs) includes technical assistance and marketing for building owners, as well as single-point-of-contact (SPOC) approach. • A CDPH pilot project is focused on leveraging existing local health department infrastructure/system to address household health issues and referral of eligible households to weatherization/energy efficiency services.
5.2.3	Leverage established relationships with affordable housing developers and solar installers to expand installation of solar energy systems to all property types and communities and advance implementation of energy storage and smart demand management systems for multifamily properties that will result in economic and grid benefits	• CEC is monitoring the development of the IOUs' EE business plans, related implementation plans, and budgets focusing on effective low-income and disadvantaged communities' activities benefiting multifamily buildings. • CEC is participating in the City of San Jose initiative aimed at developing and implementing strategies to overcome barriers to EE retrofits and other measures in multifamily buildings. • CEC is tracking and evaluating the success of incentive programs from IOUs, publicly-owned utilities (POU), air districts, and community choice aggregators (CCA).
5.2.4	Leverage relationships and existing grant and incentive rebate programs for zero-emission-vehicle (ZEV) infrastructure throughout various public and private agencies to create highly visible sources of funding opportunities	None

	Strategy	Current Activities
5.2.5	Investigate redesigning the CSI thermal program or establish a new program to promote the cost-effective installation of photovoltaic systems coupled with high-efficiency heat pump water-heating technologies to defray environmental and bill impacts of natural gas (and other fuel source) residential domestic hot water heating to address the participation challenges linked to current and foreseeable economic barriers of the CSI thermal program cost-competitiveness with natural gas.	None
5.3	**Ensure consumer protection**	
5.3.1	Adopt, implement, and enforce responsible contractor policies to ensure that retrofits meet high-quality performance standards and reduce energy savings lost or forgone due to poor-quality workmanship, and establish consumer protection guidelines for energy efficiency products and services	• CPUC is considering skilled workforce standards in the pending energy efficiency proceeding • As part of the SB 350 mandate, CEC is exploring strategies to develop a responsible contractor policy for use across all ratepayer-funded energy efficiency programs, as well as establishing consumer protection guidelines for energy efficiency products and services.
5.3.2	Coordinate with local authorities and consumer protection agencies to investigate the need for heightened consumer protection to help prosecute companies that use misleading information or engage in predatory practices to take advantage of low-income customers and small businesses seeking access to clean-energy benefits	• CSLB and CPUC are developing an information packet to be included in solar contracts to increase consumer awareness by July 1, 2018 (AB 1070) • CPUC is developing enhanced consumer protections in the net-energy-metering (NEM) proceeding for customers who install solar and use the NEM tariff. • CPUC is partnering with CSLB and others to host a workshop in July 2018 to solicit input from low-income customers and small businesses.

APPENDIX C:
List of California Energy Commission Research Projects Relevant to Multifamily

Agreement #	Company	Title	CEC Funds	Start Date	End Date	Website
EPC-14-010	Lawrence Berkeley National Laboratory	Solar-Reflective "Cool" Walls: Benefits, Technologies, and Implementation	$2,500,000	3/30/2015	6/30/2018	http://innovation.energy.ca.gov/SearchResultProject.aspx?p=30001&tks=636602545120515037
EPC-14-040	Glint Photonics, Inc.	Self-Tracking Concentrator Photovoltaics for Distributed Generation	$999,940	5/15/2015	3/31/2019	http://innovation.energy.ca.gov/SearchResultProject.aspx?p=30060&tks=636602545200387037
EPC-15-020	Electric Power Research Institute (EPRI)	Intelligent HVAC Controls for Low Income Households: A Low Cost Non-connected Device that Understands Consumer Preferences and Performs Adaptive Optimization	$2,705,759	3/1/2016	3/31/2020	http://innovation.energy.ca.gov/SearchResultProject.aspx?p=30810&tks=636602545298667037
EPC-15-025	Home Energy Analytics, Inc.	Plug Load Reduction App: RYPL	$884,100	4/11/2016	12/31/2019	http://innovation.energy.ca.gov/SearchResultProject.aspx?p=30956&tks=636602545386027037
EPC-15-026	Lawrence Berkeley National Laboratory	Unlocking Plug Load Energy Savings through Energy Reporting	$1,630,699	5/1/2016	4/30/2019	http://innovation.energy.ca.gov/SearchResultProject.aspx?p=30959&tks=636602545533135037

Agreement #	Company	Title	CEC Funds	Start Date	End Date	Website
EPC-15-083	OhmConnect, Inc.	Empowering Proactive Consumers to Participate in Demand Response Programs	$3,995,028	5/18/2016	6/28/2019	http://innovation.energy.ca.gov/SearchResultProject.aspx?p=31036&tks=636602545622835037
EPC-15-019	Regents of the University of California, Davis	Low Cost, Large Diameter, Shallow Ground Loops for Ground-Coupled Heat Pumps	$1,212,186	2/15/2016	9/30/2019	http://innovation.energy.ca.gov/SearchResultProject.aspx?p=30809&tks=636602545716279037
EPC-15-061	Regents of the University of California, Los Angeles	Using Data-Driven Approaches to Design Advanced Energy Communities for Existing Buildings	$1,497,996	6/13/2016	3/30/2018	http://innovation.energy.ca.gov/SearchResultProject.aspx?p=31032&tks=636602545799739037
EPC-15-081	Ghoulem Research	Historical Insights for Electricity Transition Scenarios in California and Flexible Energy Demand Modeling for Residential Air Conditioning with Improved Behavioral Specificity	$400,000	6/13/2016	6/28/2019	http://innovation.energy.ca.gov/SearchResultProject.aspx?p=31019&tks=636602545880391037
EPC-15-077	The Regents of the University of California, Irvine Advanced Power and Energy Program	Huntington Beach Advanced Energy Community Blueprint	$1,500,000	6/15/2016	7/31/2018	http://innovation.energy.ca.gov/SearchResultProject.aspx?p=31052&tks=636602545977111037
EPC-15-053	Electric Power Research Institute (EPRI)	Customer-Centric Approach to Scaling IDSM Retrofits	$3,894,721	6/30/2016	3/31/2020	http://innovation.energy.ca.gov/SearchResultProject.aspx?p=30924&tks=636602546080539037
EPC-15-097	Build It Green	Achieving Zero Net Energy in Multi-family Buildings	$1,955,811	7/1/2016	3/30/2021	http://innovation.energy.ca.gov/SearchResultProject.aspx?p=31078&tks=636602546224683037

Agreement #	Company	Title	CEC Funds	Start Date	End Date	Website
EPC-16-007	Regents of the University of California, Davis	Optimization of Energy Efficiency to Achieve Zero-Net Energy in Multifamily and Commercial Buildings	$1,000,000	8/1/2016	6/30/2020	http://innovation.energy.ca.gov/SearchResultProject.aspx?p=31080&tks=636602546315943037
EPC-15-044	Electric Power Research Institute (EPRI)	Certified Open-Source Software to Support the Interconnection Compliance of Distributed Energy Resources	$816,539	8/15/2016	3/29/2019	http://innovation.energy.ca.gov/SearchResultProject.aspx?p=31013&tks=636602546405175037
EPC-16-013	The Regents of the University of California on behalf of the Berkeley campus	Integrating Smart Ceiling Fans and Communicating Thermostats to Provide Energy-Efficient Comfort	$1,888,683	9/8/2016	3/30/2020	http://innovation.energy.ca.gov/SearchResultProject.aspx?p=30989&tks=636602546745723037
EPC-16-041	Lawrence Berkeley National Laboratory	Benefits and Challenges in Deployment of Low GWP A3 Refrigerants in Residential and Commercial Cooling Equipment	$500,000	5/8/2017	12/16/2019	http://innovation.energy.ca.gov/SearchResultProject.aspx?p=31330&tks=636602546838855037
EPC-16-068	Electric Power Research Institute (EPRI)	Integrated Community-Level Solutions for Resource Management for a Grid and Customer Benefits	$2,976,991	6/30/2017	6/30/2020	http://innovation.energy.ca.gov/SearchResultProject.aspx?p=31425&tks=636602546900943037
EPC-16-067	Lawrence Berkeley National Laboratory	Robust Super Insulation at a Competitive Price	$100,000	6/30/2017	12/2/2020	http://innovation.energy.ca.gov/SearchResultProject.aspx?p=31402&tks=636602547387507037
PIR-12-025	Electric Power Research Institute (EPRI)	Demonstrating Scalable Very Energy Efficient Retrofits for Low Income, Multifamily Housing	$1,351,283	6/30/2013	3/31/2017	http://innovation.energy.ca.gov/SearchResultProject.aspx?p=29557&tks=636602545000083037
EPC-14-039	TRC Engineers, Inc.	Cultural Factors in the Energy Use Patterns of Multifamily Tenants	$379,019	5/8/2015	12/22/2017	2017 EPIC Annual Report

Agreement #	Company	Title	CEC Funds	Start Date	End Date	Website
EPC-14-016	BIRAenergy	Cost- and Energy-Efficient Attic Designs for California Homes	$1,000,000	6/29/2015	6/30/2018	2017 EPIC Annual Report
EPC-14-032	Inova Energy Group, LLC	Capturing Cultural Diversity in California Residential Energy Efficiency Potential: An Energy Ethnography of Hispanic Households	$224,593	5/8/2015	5/8/2018	2017 EPIC Annual Report
EPC-15-058	The Regents of the University of California on behalf of the Berkeley campus	The Oakland EcoBlock - A Zero Net Energy, Low Water Use Retrofit Neighborhood Demonstration Project	$1,500,000	6/27/2016	3/23/2018	2017 EPIC Annual Report
EPC-15-064	Prospect Silicon Valley	Innovative Net Zero: ZNE Demonstration in Existing Low-Income Mixed-Use Housing	$2,995,653	6/30/2016	3/31/2020	2017 EPIC Annual Report
EPC-16-002	Lawrence Berkeley National Laboratory	Pathways to More Cost-Effective ZNE Homes	$1,000,000	9/1/2016	6/30/2019	2017 EPIC Annual Report
EPC-17-007	Center for Sustainable Energy	Integrated Community Solar and Storage at a Low Income Mobile Home Park	$2,005,923	7/13/2017	12/31/2021	2017 EPIC Annual Report

APPENDIX D:
Interagency Knowledge Gap Analysis for Multifamily Clean Energy Initiatives, April 2018

Purpose

This document is intended to help the California Energy Commission and its sister agencies plan research by articulating areas where research is needed. The document summarizes the knowledge needed for clean energy solutions in the multifamily sector. The Energy Commission led the effort in compiling this information, with contributions from the CPUC, HCD, ARB, and CSD from September 2017 through December 2017. The knowledge gaps are based on an initial list of research needs developed by the Natural Resources Defense Council (NRDC) and Energy Efficiency for All. It was expanded through feedback from staff at the contributing agencies. The Excel file below presents the consolidated responses from all agencies.

MF Needs Assessment_Consolid

Knowledge Gaps

For the state to plan effective clean-energy solutions for the multifamily sector, more information is needed about the measures most suitable to apartment buildings and an understanding of the characteristics of the market for clean-energy upgrades. Additional information on ways that energy-using equipment might affect the health and quality of life of multifamily tenants is also needed. And to pay for the clean-energy upgrades, California needs to better understand financing options, finance risk, and methods for leveraging private capital. To plan effective interventions, more research is needed on successful business models and program delivery approaches, including how the workforce for such upgrades can be developed. to track progress and evaluate success among interventions in the multifamily sector, it is necessary to agree on and adopt standard metrics.

Below are the knowledge gaps, by category, as identified by NRDC and the contributing state agencies.

Gaps by Category

The table below presents the knowledge gaps and known research for the 10 categories of information needed to better plan clean energy interventions for the multifamily sector.

1. Clean Energy Measures and Solutions
2. Understanding EE and DER Potential and Market Characteristics
3. Health, Quality-of-Life Dimensions
4. Mobilizing Capital – Grants, Financing, Other Payment Solutions
5. Business Model and Delivery Approaches
6. Assuring LI/Disadvantaged Communities Workforce Development and Placement
7. Progress Evaluation
8. Impact of Affordable Housing on Transportation-Related GHG Emissions
9. EV Charging Infrastructure Requirements in Building Standards
10. EV Charging Infrastructure in Affordable Housing

For details on which agency identified a specific gap or category, please see the Excel file with the consolidated agency responses.

Category	Identified Knowledge Gap/Need	Known Research Efforts
1. Technical Measures and Solutions	1.1 Common area measures of interest to owners/managers: water heating (whole building, currently gas primarily; potential for solar DHW or electric heat pump WHs); hall, garage, outdoor lighting; laundry rooms (HVAC, appliances, lighting); whole building; electric vehicle charging stations. Solar should also be included to reduce demand on grid and further net-zero-energy goals. Interior LED lighting replacements and retrofits; lighting controls for ingress/egress and other 24/7 loads; variable-frequency-drive (VFD) measures (constant to variable-speed controls); retrocommissioning control measures for buildings containing centrally controlled automation systems; airside economizer measures for centralized air handling equipment; waterside economizer measures for non-airside economized air-handling equipment; chiller plant energy measures (plant retrofit and	• CEC: R&D Division: Navigant contract work order NAV 15-004 will study potential for DERs in low-income and disadvantaged communities. Project tasks include describing the current state of DERs in LI/disadvantaged communities, technology adoption in those communities, identification of barriers and successes for installing DERs, and recommended strategies for DER programs.

Category	Identified Knowledge Gap/Need	Known Research Efforts
	replacement); boiler plant energy measures (plant retrofit and replacement).	
	1.2 List options for in-unit upgrades: "bang-for-buck" economics for energy and water savings; additional NEBs for occupant health or appeal factors. When defining options for in-unit upgrades, implementers should consider the responsible party paying the energy bill and distinguish between tenant or property owner/manager (i.e. individual- vs. master-metered buildings). This will help better define the benefits to the low-income community.	• CSD: CSD's LIWP could potentially provide data to support the economics and energy savings for in-unit data. • CSD: Possible use of consumption-driven weatherization/energy efficiency improvements in lieu of deemed or modeled energy savings. • CPUC: Cost-effectiveness method in place for ESA program, includes NEBS (e.g. health, safety, comfort)
	1.3 Calculate costs and incremental savings (energy and cash flow) depending upon timing considerations in multifamily buildings for retrofit/replacement equipment – "replace on burnout" and meet applicable standards, in-unit measures at individual tenant change out, or building-wide accelerated replacement – cost and convenience considerations?	None
	1.4 Programs (other than ESA) that might contribute to filling technical knowledge gaps regarding multifamily energy challenges and solutions	None
2. Understanding EE & DER Potential and Market Characteristics	2.1 Profiles of physical housing structures (age, size, floors, percentage of fenestration, construction types, climate zones); types of hot water and HVAC systems and choice of fuels; ownership arrangements (size of holdings, profit	• CEC, EAD: The *Residential Appliance Saturation Survey* (RASS) will collect information about building structure, water heaters, HVAC, and other appliances. RASS to be completed by July 2019.

Category	Identified Knowledge Gap/Need	Known Research Efforts
	vs. nonprofit); mortgage lengths and factors affecting debt levels and approvals; investment payback/ return tolerance; energy end uses paid by owner/manager vs. by occupants; de facto occupant energy bills after low-income discounts and effects when accounting for utility allowances, energy usage outside structure; effect of different low-income eligibility standards on number of eligible participants, including 80% area median income, 200% federal poverty guidelines, etc.; number of residents in the structure; types of lighting controls (indoor and outdoor); understand fuel mix at end use, focus on substitution; understand EV, solar, and storage in physical housing; availability of utility incentives; effect of different program cost-effectiveness/ROI standards, geographic location and climate; number of multifamily buildings that have undergone significant rehabilitation/energy efficiency and renewable energy.	• CSD: CSD's LIWP collects information on water heaters, HVAC, and other appliances in multifamily buildings in disadvantaged communities and information related to energy end uses paid by owner/resident. • CPUC: 2013 multifamily Segment Study consultant Cadmus identified some of the market characteristics gaps and resources. • CEC, CPUC: Put together historical and current summary of installations of solar and incentive program participation and structure; some early information on storage as well. • CPUC: California Solar Initiative Performance Review could identify availability of utility incentives for solar.
	2.2 Identify remaining energy savings potential by end use, capital vs. behavioral change, costs-bill savings-paybacks. Could expand to demand response and solar + storage as well.	• CEC, EAD: Potential and Goals Study; economic potential less savings goals adopted by CPUC. • CPUC: Potential and Goals Study.
	2.3 Calculate statewide cost of achieving technical or economic potential vs. current marketplace.	• CEC, EAD, CPUC's *Energy Efficiency Potential and Goals Study for 2018 and Beyond Final Public Report*.[32] The

32 Wikler, Greg, Amul Sathe, Surya Swamy, Carishma Menon, Debyani Ghosh, Matt O'Hare, Kristin Landry, Rosanna Ren, Julie Penning, Nicole Reed Fry, and David Bluestein (Navigant Consulting, Inc.). 2017. *Energy Efficiency Potential and Goals Study for 2018 and Beyond.* ftp://ftp.cpuc.ca.gov/gopher-

Category	Identified Knowledge Gap/Need	Known Research Efforts
	Include retrofit measures; replace-on-burnout measures, and new construction measures. Consider how to provide cost vs. benefit info for economic achieving potential (whether to use TRC, modified TRC [TRC w/GHG adder], and/or PAC test for cost-effectiveness).	September 2017 study by Navigant for CPUC developed estimates of energy and demand savings potential in the service territories of CA's major IOUs during the post-2017 EE rolling portfolio planning cycle. Navigant's work authorization with the Energy Commission was expected to start in November 2017. This WA will review POU model method, develop AAEE by sector and end use, and develop alternative scenarios for EE savings in POU-serving territories. • CSD: Use consumption-driven weatherization/EE to generate realized energy savings. This approach as opposed to deemed savings will allow programs to target high-value energy-using measures that are relatively low cost.
	2.4 Matching potential to relevant building/ownership "trigger points" or "events" (purchase/sale, renovation, mortgage refinance, equipment or system failure, change of occupant, discretionary upgrades, maintenance). Assess trigger points that may cause underground improvements and those that trigger ADA compliance.	• CPUC: Potential and Goals Study .
	2.5 Data on the pervasiveness of rooftops lacking the structural capacity for solar. (SB 350 Barriers Study , p.34)	• CSD: Low-cost financing where identified can help address structural integrity issues. Use solar PV to offset those costs in return. It is possible that solar PV coupled with fuel switching and appliance change-outs can help drive down operating costs and energy usage as well. Where allowable, building owners

data/energy_division/EnergyEfficiency/DAWG/2018_Potential%20and%20Goals%20Study%20Final%20Report_092517.pdf.

Category	Identified Knowledge Gap/Need	Known Research Efforts
		may be able to modestly increase their rents in exchange for lower-cost/free utilities to their customers. • CPUC: CalSEIA may have such data. • Sandia 2015 Studies (http://energy.sandia.gov/sandia-research-on-rooftop-structural-strength-gains-attention/).
	2.6 Identify and analyze the landscape of current shared/community solar policy options for multifamily tenants throughout CA. Analysis should include data about existing-program use and analysis of barriers to more widespread usage of the programs; add energy and water efficiency to landscape analysis scope; identify embedded energy in cold-water measures.	• CSD: Identify embedded energy in cold-water measures. CSD can possibly share information on current efforts in this area, if desired. • CEC: Update internal summary of current shared/community solar policy options for multifamily tenants in CA.
	2.7 Identify financing models to solve the first-cost barrier that low-income households face.	• The CPUC is engaged in studies and pilots regarding alternative financing mechanisms and strategies, including the Residential Energy Efficiency Loan Assistance Program and the upcoming Affordable Multifamily Financing Program.
	2.8 Costs of permits and inspections per city and county for DER upgrades.	None
	2.9 Study of property owner motivations for pursuing energy and water efficiency building improvements and renewable energy systems, as well as means of financing.	None

Category	Identified Knowledge Gap/Need	Known Research Efforts
3. Health, Quality-of-Life Dimensions	3.1 Quantify health risks and monetize damages from old, inefficient gas appliances.	None
	3.2 Quantify health risks and monetize damages from inefficient building shells.	None
	3.3 Quantify health risks and monetize damages from using "swamp coolers" (evaporative coolers) without adequate ventilation or mold prevention.	None
	3.4 Identify local, state, and federal sources of funding for health and structural improvements that could be leveraged with efficiency upgrades.	None
4. Mobilizing Capital – Grants, Financing, Other Payment Solutions	4.1 Quantify amount of EE and investment possible considering owner investment tolerance (e.g. via mortgage finance, energy service agreements, loans).	None
	4.2 Quantity of EE investment possible under occupant repayment schemes for EE measures on which occupants now pay utility costs, if favorable cash flow offered by repayment mechanisms (e.g. on-bill tariff or consumer appliance loan).	None
	4.3 Quantity of EE and investment possible if "full societal value" of energy use reduction (with GHG and non-energy benefits captured) can be combined with end-user savings.	None
	4.4 Identify applicable finance/capital cost recovery mechanisms, pros/cons, best circumstances to apply.	None
	4.5 Identify risks (performance and repayment) and how risks affect	None

Category	Identified Knowledge Gap/Need	Known Research Efforts
	capital availability and risk premiums at market rates and potential ways for government, utilities, or others to share risk.	
	4.6 Match finance/capital cost-recovery mechanisms to market characteristics and improvement trigger point opportunities (property sale, renovation, occupancy changes, equipment replacement) and for categories of measures (insulation, windows, etc.), including how to make available such finance products. (*2016 EBEE Action Plan Update,*[33] 5.1.5)	None
	4.7 Identify mechanisms to assure occupants of no net increase in rent/operating costs after building improvements or other EE/solar solutions.	None
	4.8 Consolidate energy efficiency performance data to enable more attractive financing terms and more correct assessment of risks among finance industry. Determine format to private data to financial institutions to be most useful. (*2016 EBEE Action Plan Update*, p. 61)	• CSD: CSD's LIWP data collection could contribute to this effort.
	4.9 Credit enhancement pilot project to test finance mechanisms in disadvantaged communities and multifamily housing (low-income and market rate) (SB 350 Barriers Study, Rec 4c, p7); determine how the	• CSD: CSD can provide insights and background on the pitfalls being encountered in the single-family program.

33 2016 Existing Buildings Energy Efficiency Action Plan Update. 2016. CEC-400-2016-023SD. http://www.energy.ca.gov/ab758/16-EBP-01/

Category	Identified Knowledge Gap/Need	Known Research Efforts
	existing financing program can be integrated into multifamily projects.	
	4.10 Evaluate the potential for social impact bonds to increase investments in energy upgrades for low-income customers (SB 350 Barriers Study, Rec 4d, p. 7)	None
	4.11 Research options for a tariffed on-bill finance pilot for POU and IOU customers to fund investments in energy efficiency for low-income customers, regardless of credit, and do not pass on a debt obligation to customers. (SB 350 Barriers Study, Rec 4a, p. 7) CPUC for IOUs? CEC for POUs?	None
5. Business Model and Delivery Approaches	5.1 Compile cohesive set of "best practices" for solutions delivery in CA and nationally from existing studies and compendia; apply to California market profile (as per A and B above).	None
	5.2 Derive metrics on California multifamily program delivery models with regard to breadth of measures taken, costs and cost-effectiveness, size of subsidy vs. leverage of private funds.	None
	5.3 Conduct focus groups among relevant cohorts of owners/managers to determine preferred models for service/solution delivery (selection of contractors; performance assurances; independent audits, technical assistance, quality assurance; choice of equipment models; stand-alone vs. integration with other building construction or repair projects). Include assessment of appeal (or not)	None

Category	Identified Knowledge Gap/Need	Known Research Efforts
	of current models including direct installation, incentives for owner-arranged projects, stand-alone EE and solar projects vs. measures incorporated into other construction projects, one-stop program entry	
	5.4 Conduct focus groups among relevant cohorts of owners/managers to determine acceptable finance/repayment mechanisms.	None
	5.5 Conduct interviews or focus groups among capital sources and finance providers to determine conditions (e.g. loan guarantees or other credit support mechanisms) and/or capital cost subsidies needed to provide EE investment capital to multifamily market segments (e.g. by building type, owners, and/or measure groups).	None
	5.6 Identify best practices for operational and behavioral savings approaches, and how to spur their use. Conduct interviews or focus groups with residents and tenants or affiliated organizations.	None
	5.7 Engage with the federal government to explore program development opportunities, share best practices, and leverage research and cofounding potential for all energy, water, and housing programs. (SB 350 Barriers Study Rec 1[e] p. 5)	None
	5.8 Identify best practices from current and past solar programs to aid in future program/policy design and implementation for low-	• CSD's LIWP efforts in multifamily affordable housing could contribute to this effort (LIWP installs solar).

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	income/disadvantaged community solar.	• CPUC: See low-income solar implementation plan and activities related to AB 693 and AB 327.
	5.9 Identify how to bring together financing and tax credit opportunities, building improvement, energy management, and peer-to-peer elements. (*2016 EBEE Action Plan Update*, 2.2.5 Strategic Energy Planning, p. 44)	None
6. Assuring LI/Disadvantaged Communities Workforce Development and Placement	6.1 Derive metrics on EE and clean-/green-energy training program costs, worker placement, and public (incl. utility) funds' investments per worker placed and per $10K or $100K of incremental compensation mobilized. Include classroom, field, and apprentice employment arrangements.	• CEC: Efficiency Division staff is working with the CPUC, IOUs, and the CCCCO on activities focused on workforce education and training. A contract that includes one objective aimed at developing a workforce alignment action plan is pending execution with the Energy Coalition.
	6.2 Map dollar value and numbers of employment hours/years provided by disadvantaged communities and for relevant employment/unemployment geographic metrics.	None
	6.3 Assess degree of specialized/advanced EE and solar equipment availability and installer skills possession in disadvantaged communities and statewide.	• CEC: Possibly through CEC as part of SB 350 Barriers Study work, though not yet certain.
	6.4 Research evidence-based models for replicating and scaling transformative workforce system changes. (*2016 EBEE Action Plan Update*, p. 50)	None
	6.5 Identify technical assistance needs to help local small businesses in disadvantaged communities meet certification and solicitation	• CARB: Coordination with SGC on its Technical Assistance program. Additional findings may also result from the SB 350

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	requirements and address workforce training, recruitment, and retention issues. (SB 350 Barriers Study, p. 4)	community-based needs assessments and outreach.
7. Progress Evaluation	7.1 Develop metrics to measure progress in improving energy efficiency savings and demand reduction for multifamily rental properties in low-income and disadvantaged communities.	• CEC: EAD is using a technical support contract to assess progress in reaching EE savings and DR targets. May be appropriate to include metrics to assess progress in multifamily low-income apartments and disadvantaged communities. Pam Doughman in CEC Commissioner McAllister's office is leading. • CSD: CSD's LIWP efforts can help provide metrics to assess program efforts in multifamily low-income apartments in disadvantaged communities.
	7.2 Develop metrics to measure progress in the energy program contribution to increasing/promoting growth of EV infrastructure.	None
8. Impact of Affordable Housing on Transportation-Related GHG Emissions	8.1 Affordable housing in transit-oriented developments has been recognized as a potential travel demand reduction strategy. However, to date very limited empirical, peer-reviewed research has evaluated the impact of preserving or building affordable housing on travel behavior and associated GHG emissions.	• CARB: 30-month research contract ($300,000) with UC Berkeley (PI: Karen Chapple) to evaluate the impact that preserving and building affordable housing in transit-oriented areas has on travel demand and vehicle miles traveled (VMT), and to assess the economic, health, and well-being impacts on the associated residents. Research methods include surveys, GIS data collection (via a smartphone application), and focus groups to assess the health, economic, and well-being impacts of affordable housing (CARB project manager: Maggie Witt, maggie.witt@arb.ca.gov, [916] 324-9061). San Joaquin Valley affordable housing survey was conducted by UC Davis Institute of Transportation Studies in January 2017. The findings from this

Category	Identified Knowledge Gap/Need	Known Research Efforts
		survey are critical to understanding travel behavior and signaling the potential focus of affordable housing (new build) toward cleaner mobility options, access to charging infrastructure on site, etc. The report will be released soon.
9. EV Charging Infrastructure Requirements in Building Standards	9.1 Research for building code standard changes regarding accessibility of EV charging infrastructure for all income levels. Mandatory building standards help ensure EV charging infrastructure is accessible for multifamily buildings.	• CARB – Research Division: CARB staff is working with HCD, CEC, CPUC, GovOps, and GoBiz to support code changes for the 2020 CALGreen Code.
	9.2 What is the need for EV charging infrastructure in multifamily housing to support on-road ZEVs by 2025? What is the benefit of L1 versus Level 2 charging infrastructure? There are cost considerations, and the state agencies want to maximize access to clean transportation infrastructure. How can the state agencies overcome some of the challenges with EV charging installation in MUDs that are rent-controlled (see AB 2565)? This would include considerations for MUDs with no dedicated off-street parking.	• CEC – Fuels and Transportation Division: Developing projections based on the Electric Vehicle Infrastructure Projections (EVI-Pro) Model
	9.3 What is being done to meet the need for EV charging infrastructure? Comprehensive review of what's existing, funded, planned and proposed for Level 2 electric vehicle infrastructure and DC fast-charging stations in multifamily housing.	• CARB, Research Division: Technical and cost analysis to support suggested code changes for multifamily housing in the Green Building Standards (CALGreen) Code.[34] • CARB: Carl Moyer Memorial Air Quality Standards Attainment Program provides incentive funding for cost-effectively

34 http://www.bsc.ca.gov/Home/CALGreen.aspx.

Category	Identified Knowledge Gap/Need	Known Research Efforts
		replacing, repowering, or converting engines, equipment, and other sources of air pollution to cleaner technologies. A new funding area as of 2017 is for clean vehicle infrastructure projects. Air districts may suggest project types such as residential battery charging stations for low-income and multiunit dwellings, which CARB will consider on a case-by-case basis. Website: https://www.arb.ca.gov/msprog/moyer/moyer.htm. • CARB: Agricultural Worker Vanpools in the San Joaquin Valley Pilot Project. This $3 million pilot project funded in FY 2016-17 expands access to clean transportation vanpools for agricultural workers in the San Joaquin Valley's disadvantaged communities. This project supports the statutory goals of SB 1275 and SB 350 by prioritizing funding for clean transportation, increasing access to vanpools in disadvantaged communities, and funding installation of charging infrastructure at multiunit dwellings in disadvantaged communities. • CARB: Financing Assistance for Lower-Income Consumers pilot project. Designed to help overcome the significant barrier of obtaining vehicle financing by improving access to affordable clean new and used vehicles through low-cost loans and vehicle price buy-downs. Supports the statutory goals of SB 1275 and SB 350 by prioritizing funds for clean transportation and mobility options. Implementing programs that expand the new and used vehicle ownership programs with point-of sale incentives (price buy-downs) and low-cost loans; increasing awareness of

Category	Identified Knowledge Gap/Need	Known Research Efforts
		clean transportation and mobility options by educating consumers of clean transportation options and infrastructure investments; and offering incentives for charging infrastructure for low-income residents. Website: https://www.arb.ca.gov/msprog/aqip/ldv_pilots.htm • CARB: Clean Mobility Options for Disadvantaged Communities. Designed to help individuals in disadvantaged communities benefit from the use of an automobile without the responsibility of car ownership costs and to offer alternate modes of transportation that encourage the use of zero-emission and plug-in hybrid vehicles, vanpools, and other mobility options. Includes installation of charging infrastructure to serve multiunit housing in disadvantaged communities. Website: https://www.arb.ca.gov/msprog/aqip/ldv_pilots.htm. • CARB: Enhanced Fleet Modernization and Plus-Up Project. The Enhanced Fleet Modernization Program (EFMP) is a voluntary vehicle retirement (scrap) and replacement incentive program with the goal of offering incentives to lower-income California motorists to scrap their older, high-emitting vehicles and replace them with newer, cleaner and more fuel efficient vehicles. EFMP Plus-up (Plus-up) provides incentives for lower-income consumers living in and near disadvantaged communities who scrap their old vehicles and purchase new or used hybrid, plug-in hybrid, or ZEV replacement vehicles. Plus-Up provides an incentive for basic Level 2 (BL2) electric

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		vehicle infrastructure necessary for a program participant to safely charge a battery-electric vehicle (BEV) at a home. The electric vehicle infrastructure incentive is available only to EFMP participants who purchase a BEV through the Plus-Up program. Website: https://www.arb.ca.gov/msprog/aqip/efmp/efmp.htm.
	9.4 Should the current building standards to install EV charging infrastructure in multifamily housing be revised? Considerations: unit size threshold, percentage of parking spaces, infrastructure needs.	None
	9.5 What are the statewide costs and benefits with proposed code changes?	None
10. EV Charging Infrastructure in Affordable Housing	10.1 Map of newly constructed multifamily housing, showing proximity to disadvantaged communities.	• CARB – Research Division: Working with Google on layer to locate EV-capable buildings statewide.
	10.2 Installation rates of EV charging stations in newer multifamily buildings.	• CARB – Research Division: Developing work plan to measure the rate of electric vehicle infrastructure installations. CARB: Please see the information provided on the San Joaquin Valley Affordable Housing survey in 8.1.
	10.3 Statewide level of access to EV charging stations to serve multifamily residents in disadvantaged communities.	• CEC: Could be a subset of EVI-Pro analysis for building standards.
	10.4 Quantify statewide investment needed to promote EV charging installations in newly constructed affordable housing projects.	None