

CA | Energy Efficiency Strategic Plan

New Residential Zero Net Energy Action Plan 2015-2020

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California Energy Commission
Efficiency Division



California Public Utilities Commission
Energy Division

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Action Plan Funding

The key initiatives in this Action Plan represent what stakeholders have prioritized as those that will result in direct or indirect energy savings to help achieve the state's energy policy goals. However, not all of these initiatives are mandated, nor do they all have the funding necessary for execution. Possible funding sources for these initiatives could come from investor-owned utility (IOU) programs, publicly owned utility (POU) programs, state and federal government programs, public-private partnerships and other potential sources.

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Blu Homes	International Living Futures Institute	UC Irvine
BKI	Itron	United States Department of Agriculture
BPC Inc.	KB Home	UTC Power Corp.
Benningfield Group, Inc.	KEMA	Valley Climate Action Center
Brookfield Homes	Keyes, Fox & Wiedman, LLP	Wathen Castanos Hybrid
Build it Green	kW Engineering	Waypoint Building
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California Association of Realtors	Low Carbon Productions	WSP Flack + Kurtz
California Building Industry Association (CBIA)	McHugh Energy Consultants Inc.	Z I A
California Center for Sustainable Energy	Meritage Homes	Zero Net Energy Working Group
CA Dept. of General Services	National Renewable Energy Laboratory (NREL)	
CA Dept. of Housing and Community Development	Navigant	
California Environmental Protection Agency	New Buildings Institute (NBI)	
CA Real Estate Transactors	Net-Zero Energy Homes Coalition	
City of Berkeley	National Resource Defense Council (NRDC)	
City of Sebastopol	One Sky Homes	
Clinton Foundation	Opinion Dynamics	
Cobalt Power System	Pacific Gas & Electric Company (PG & E)	
ConSol	P2S Engineering	
County of Los Angeles	PowerDown	
CPUC Energy Division	Proctor Engineering Group	
Davis Energy Group	Redwood Coast Energy Authority	
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ABBREVIATIONS AND ACRONYMS

AB	Assembly Bill (California)	IEPR	Integrated Energy Policy Report
BIG	Build it Green	IOU	Investor Owned Utility
C&S	Codes & Standards	LBNL	Lawrence Berkeley National Laboratory
CABEC	California Association of Building Energy Consultants	LGC	Local Government Commission
CAISO	California Independent System Operator	LGP	Local Government Partnership
CALBO	California Building Officials	MELS	Miscellaneous Electric Loads
CalPlug	California Plug Load Research Center	NAA	National Association of Appraisers
CEESP	State of California Long-Term Energy Efficiency Strategic Plan	NBI	New Buildings Institute
CAHP	California Advanced Homes Program	NSHP	New Solar Homes Partnership
CAR	California Association of Realtors	OIR	Order Instituting Rulemaking
CBIA	California Building Industry Association	PG&E	Pacific Gas & Electric
CEA	Certified Energy Analyst	PIER	Public Interest Energy Research
CEC	California Energy Commission	PIP	Program Implementation plan
CEPE	Certified Energy Plans Examiner	POU	Publicly Owned Utility
CPUC	California Public Utilities Commission	REN	Regional Energy Network
CSI	California Solar Initiative	RESNET	Residential Energy Services Network
CSLB	Contractors State License Board	RD&D	Research, Development and Demonstration
DG	Distributed Generation	RNC	Residential New Construction
DR	Demand Response	RFI	Request for Information
ED	Energy Division (CPUC)	RPS	Renewable Portfolio Standards
EE	Energy Efficiency	SB	Senate Bill (California)
EM&V	Evaluation, Measurement, & Verification	SCE	Southern California Edison
EPIC	Electric Program Investment Charge	SCG	Southern California Gas
ETCC	Emerging Technology Coordinating Council	SDG&E	San Diego Gas & Energy
ETP	Emerging Technologies Program	SEEC	Statewide Energy Efficiency Collaborative
EUI	Energy Use Intensity	SMUD	Sacramento Municipal Utility District
EV	Electric Vehicle	TDV	Time Dependent Valuation
GhG	Greenhouse Gas	U.S. DOE	United States Department of Energy
GWh	Gigawatt hour	USGBC	United States Green Building Council
HERS	Home Energy Rating System	WE&T	Workforce Education and Training
HVAC	Heating, Ventilation, & Air Conditioning	WHPA	Western HVAC Performance Alliance
ICC	International Code Council	ZNE	Zero Net Energy
IDSMD	Integrated Demand Side Management		

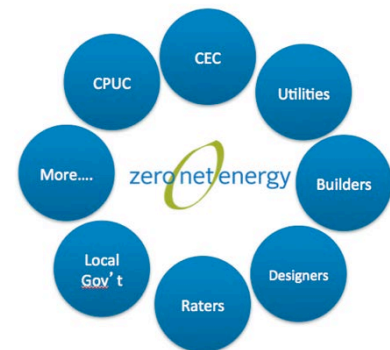


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CHAPTER I. INTRODUCTION AND OVERVIEW

INTRODUCTION

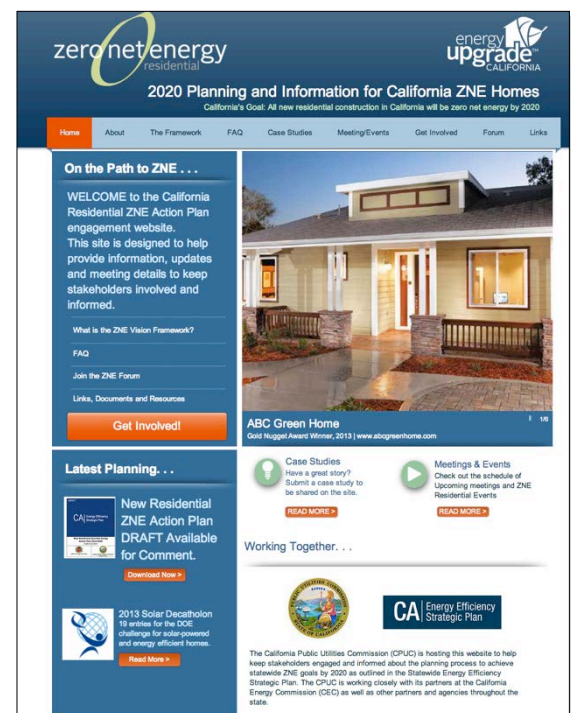
The Residential New Construction Zero Net Energy (ZNE) Action Plan (Action Plan or the Plan) is designed to operationalize the California Long-term Energy Efficiency Strategic Plan's (CEESP) goal to have 100% of new homes achieve ZNE beginning in 2020.¹ The Action Plan provides a foundation for the development of a robust and self-sustaining ZNE market for new homes over the next six years, supports future codes and standards for ZNE, and inspires voluntary actions to meet the State's goal. Further, the Action Plan will be a living document subject to ongoing updates and refinements to help address the changing environment, technology advances, and the State's needs. In order to do this, the Plan must be supported by multiple market actors; act as a guide for state agencies, local government, and the utilities; and motivate industry.



Engaging and inspiring multiple actors

To develop the Action Plan, a comprehensive stakeholder outreach process was employed. While a benefit of this process will be increasing activity and potential advocates to implement the Plan, the purpose of the stakeholder engagement was to ensure that strategies and metrics are feasible and that the overall plan will stimulate independent action and provide a higher level of certainty and understanding for the market to build their own path to ZNE. The following are the key stakeholder activities:

- ✓ In Fall 2012, a stakeholder survey was conducted to better understand the market, key actors, potential issues, and gaps and opportunities.
- ✓ From Fall 2012 to Fall 2013, four public stakeholder workshops were held; three in San Francisco at the CPUC and one at the Energy Commission in Sacramento. Each workshop built on the information of the previous meeting. The process began with goal setting and visioning and progressed to the development of strategies and metrics.
- ✓ Two rounds of five separate subcommittee meetings were conducted and organized by the six Action Plan goals. Each meeting was used to refine and develop the Plan.
- ✓ Additional stakeholder engagement included meeting with builders at the Pacific Coast Builders Conference (PCBC) and in Sacramento and conducting a local government statewide webcast.
- ✓ A planning website was launched to share information about the plan, solicit case studies, and share documents and information about relevant events: www.CaliforniaZNEhomes.com.



www.californiaZNEhomes.com

¹ California Energy Efficiency Strategic Plan, 2008, adopted by the California Public Utilities Commission in D. 08-09-040 and the 2011 update, adopted in D. 10-09-047. www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/eesp.

ACTION PLAN APPROACH

For this Action Plan to be successful it is critical that the strategies and tactics identified are responsive to the needs, interests, and ideas of industry leaders, key actors, partner agencies, and utilities. This means that the Plan is focused on achieving milestones and being as feasible as possible in the breadth and depth of the proposed strategies and tactics. The “ZNE Action Plan: Commercial Building Sector” focuses on activating champions for implementation. However, this Plan has been developed with an expectation that the state agencies, specifically the CPUC and Energy Commission, or the utilities, will initiate or lead a majority of the strategies. At the same time, this realistic approach is designed to encourage and inspire other market actors to participate and leverage the action taken by state agencies and utilities to achieve the 2020 goal.

The Plan is organized for ease of use, with a straightforward presentation of strategies, metrics, and associated leads or partners. This Action Plan, with a six-year timeframe, is a longer outlook than many CEESP-related action plans. Due to this longer view, some strategies are more high level and will be prioritized in the future. A three-year work plan is being developed separately to direct Plan implementation, identify resources, and enable a more dynamic and streamlined process for updating the specific actions.

Finally, this Action Plan is focused on new residential construction, including single-family and low-rise multifamily (3 stories or less)² buildings, as well as low and moderate income housing within these categories. Multifamily projects have a number of unique requirements that differ to some extent from single-family construction. The Action Plan has devoted Chapter 4 to outline and focus on the key multifamily building areas that are not covered within the main goals section in Chapter 3. It is anticipated that many of the differences in the markets will be addressed in specific implementation activities. For example, a key strategy is to launch ZNE awareness and outreach activities. This strategy applies to both housing types, but will look different and address different audiences for single-family and low-rise multifamily.

² Energy Commission, “2013 Integrated Energy Policy Report”, CEC-100-2013-001-CMF, January 2014, pg. 36.

ACTION PLAN VISION FRAMEWORK

The following Vision Framework is a guiding structure for the Plan to achieve the State's 2020 goal and key objectives. On the following two pages, additional details are provided on the Guiding Principles and Goals with the detailed strategies provided in Chapter 3.

VISION

100% of all New Homes in California will be Zero Net Energy starting in 2020

GUIDING PRINCIPLES



GOALS & GOAL RESULTS

Builders and homeowners are inspired to voluntarily adopt ZNE through a market driven process starting in 2014 and increasing steadily until 2020.

1. Create awareness of the value and benefits of ZNE and build demand

4. Quantify value of ZNE, support robust financing and ensure affordability

By 2017, create a systematic way to value ZNE homes to enable underwriters, appraisers and financial institutions to support financing and a strong and affordable ZNE housing market.

Industry workforce and professionals (existing and entering) are equipped to create quality ZNE homes at a production scale starting in 2015 and increasing steadily to 2020.

2. Increase participation and improve the quality of ZNE education and training

5. Drive future grid infrastructure and technological improvements

By 2017, investor owned utility distribution resources plans to evaluate locational benefits and costs of distribution resources are adopted, as directed in Assembly Bill 327. These plans support the goal that ZNE buildings connect and integrate with the grid effectively.

By mid-2016, designers, builders and developers have access to an integrated suite of technical tools that facilitates their ability to bring ZNE homes to market successfully.

3. Ensure availability, effectiveness and efficiency of technical tools

6. Align regulations, policies, incentives and codes

By 2015, California has a consistent, integrated and clear ZNE policy framework (regulations, incentives and codes) due to continuous multi-agency coordination and collaboration efforts.

Guiding Principles

This Action Plan is driven by a vision to make all new homes zero net energy starting in the year 2020. To reach that vision, the following guiding principles are important crosscutting concepts that stakeholders and policy makers identified during this process to ensure the Plan's feasibility and broad adoption. These principles are reflected throughout the Plan in individual strategies.

Market Driven

To achieve a mainstream ZNE Building Future, support a robust industry by empowering key market actors through appropriate policies, regulation, incentives and effective program design. This will drive innovation, new projects, workforce development, marketing and awareness.

Flexible

Technology, policy and understanding about ZNE buildings are evolving at a rapid pace. The Action Plan will be a "living document" that will allow for the evolution in business models, rate structures, construction techniques, demand and consumer needs over the coming years.

Leverage

Existing programs, projects and information on techniques, training, incentives and industry products related to zero net energy are recognized as important resources, and should be leveraged to achieve the Action Plan's goals.

Consistent

The number of state and local agencies involved in implementation, and the diversity and number of private industry and utility companies engaged, complicates the path to ZNE. The Action Plan supports strategies that achieve the highest level of consistency possible in policy, regulations, and incentives to reach the State's goals.

Measureable

Quantifying the impacts, costs and value of ZNE is essential to its long-term support by consumers, legislators, utilities, the financial market, and the industry as a whole. The Plan should inform the development of transparent and broadly accepted mechanisms for measuring the value of ZNE.

Multiple Paths

The diversity of housing stock in California and trends for more compact land use scenarios, multifamily housing and community-scale renewables, requires that future ZNE building policies and programs support multiple paths and approaches.

Action Plan Goals

Each goal area was identified in collaboration with stakeholders and verified through the planning process as a key area for action and focus. Each goal is critical to ultimate success of reaching the 2020 goal, and priorities for implementing each goal are reflected in the Overall Critical Path diagram on page 7. Following is a brief summary of the purpose for each goal.

1 Demand and Awareness

Create deep awareness of the value and benefits of ZNE with homebuyers and builders to spur demand and drive broader industry involvement.

Demand and awareness is one of the key goals for this plan, particularly over the next few years as a foundation for ZNE is developed. It is recognized that there is a lack of understanding of the benefits of zero net energy among potential homeowners and critical sectors of the housing industry, including real estate professionals, the financial community (most notably underwriters and loan officers), developers, and building trades organizations.

2 Technical Training and Education

Adopt a residential workforce sector strategy³ to increase participation in and improve the quality of education and training for industries related to planning, designing, constructing and developing ZNE homes.

This goal focuses on creating a robust and well-trained industry that is able to implement and adapt to the technological innovations and integrated business strategies that are required to effectively meet the ZNE goals. In addition, this goal seeks to develop a well-informed support industry including building inspectors, financial and real estate professionals, and other industries central to the advancement of ZNE.

3 Technical Tools

Ensure availability, effectiveness and efficiency of technical tools for designing, modeling, constructing, and monitoring ZNE buildings.

While there are a number of design and modeling technical tools available on the market, it is critical to develop an integrated suite of tools specific to ZNE that provides consistent data, informs all steps of the design and construction of ZNE homes, and translates that data into homeowner feedback tools to improve performance of the ZNE homes.

4 Financing, Affordability and Value of ZNE

Develop specific approaches and standards to quantify the value of ZNE homes, support a robust financing market and ensure that ZNE homes are affordable.

To reach scale, it is important to ensure there are mechanisms to appropriately value ZNE homes and to ensure long-term affordability of ZNE. This goal incorporates the need for a labeling system for built homes, as well as efforts to develop an acceptable appraisal standard that will remove a major barrier to market adoption. Finally, this goal informs the creation of various financing and incentive products that will support the market.

5 Future Infrastructure

Drive future grid infrastructure and technological improvements to support State distributed generation goals and a ZNE Building Future.

An underlying need for mainstream ZNE is a grid and infrastructure that can effectively manage distributed generation energy. This goal informs research and the direction for utilities and state agencies to update policies and programs to meet this need.

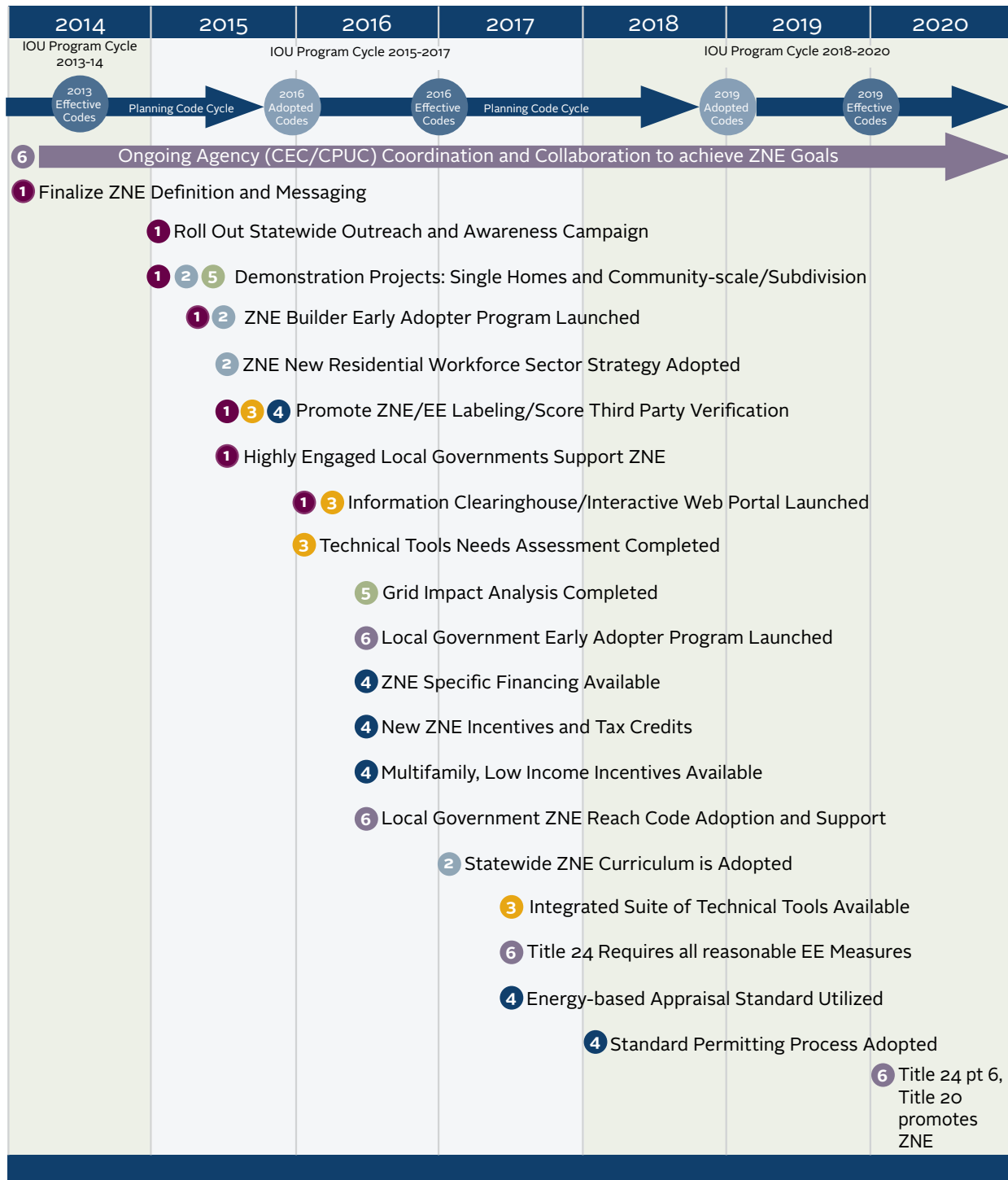
6 Alignment

Align the development and implementation of regulations, policies, plans, incentives, and codes related to ZNE buildings.

Aligning and coordinating all of the agencies, municipalities, and market actors that are involved in achieving the ZNE goal is critical to the success of this Plan and is a constant throughout the Plan's implementation. In addition, the goal for ZNE to be regulated by Codes and Standards beginning in 2020 provides the coordination and steps to reach that important step. Finally, this goal encourages the alignment of state goals with local policies and planning.

OVERALL CRITICAL PATH

The following graphic highlights the key milestones and metrics that must be achieved to meet the 2020 ZNE goal and to ensure that this Action Plan is effectively implemented. Each item corresponds to a goal area (identified by the number in the colored circles) and strategy in the Action Plan. Some strategies apply to more than one goal.



OVERARCHING BENCHMARKS

To measure the effectiveness and provide clear benchmarks for progress of the Action Plan, the following overarching benchmarks have been developed.

- ☐ By 2020, all new homes are ZNE Code or ZNE Ready homes (single-family and low-rise multifamily).³
- ☐ By early 2016, utility new construction activities include fully subscribed ZNE Builder Early Adopter Programs that address incentives, training, market adoption, and demonstration projects, etc.
- ☐ An Updated California Residential Building Rating and/or Labeling System (Updated HERS or equivalent) is in place by 2016.
- ☐ Between 2013 and 2017, California sees a 5 to 10% decrease in the cost of implementing ZNE on production homes.
- ☐ By 2017, a nationally recognized appraisal standard, accepted by underwriters and funders for ZNE homes is in place and utilized in California.
- ☐ An adequate pool of trained and educated professionals in design, engineering and construction to support ZNE demand in California is in place by 2018.



³ New Construction Housing Start Projections are based on the 2013 Integrated Energy Policy Report for single-family and multifamily households. ZNE home projections are based on conservative uptake for ZNE for the next few years, starting with single-family homes and then subdivisions. It then assumes that 5% of new homes are ZNE, associated with the advent of Local Government Reach Codes in 2017, and 10% in 2018. Thereafter, ZNE buildings increase to 20% in 2019 and finally to 100% in 2020 with the implementation of Title 24, Part 6 requiring ZNE for all new residential buildings.



CHAPTER 2. POLICY CONTEXT

CALIFORNIA LONG-TERM ENERGY EFFICIENCY STRATEGIC PLAN

Published in 2008 and updated in 2011, the California Long-Term Energy Efficiency Strategic Plan outlines goals and strategies for key market sectors (commercial, residential, industrial, and agricultural) and crosscutting initiatives (such as heating, ventilation, and air conditioning, codes and standards, research and technology).⁴ In order to reduce barriers to the adoption of energy efficiency measures (to the point where publicly-funded intervention is no longer appropriate or necessary), the CEESP embraces four specific programmatic goals, known as the Big Bold Energy Efficiency Strategies.⁵ The CEESP focuses on market transformation and recognition that deep energy savings can be achieved only through a common vision and coordinated efforts of both utility and non-utility entities. This Action Plan is focused on Goal 1 of the CEESP – all new homes will reach ZNE by 2020.

Big Bold Energy Efficiency Strategic Plan Goals

Zero Net Energy Homes Goal:

New construction will reach "zero net energy" (ZNE) performance (including clean, onsite distributed generation) for all new single and multifamily homes by 2020.

Achieving the goals in the CEESP requires involvement of stakeholders outside of investor owned utilities (IOUs) and stretching beyond the scope and participation of the existing ratepayer-supported utility programs. The New Residential ZNE Action Plan is a way to operationalize the new residential sector ZNE goals. Not only does this document help the broader California community establish a sound foundation for achieving the Strategic Plan's ZNE future, but it also provides meaningful and sustained engagement opportunities for stakeholders.

The CEESP does not provide a ZNE goal for existing homes and so this Action Plan is focused on the new construction residential market for single-family homes and low-rise (three stories and under) multifamily projects, reflecting Title 24, Part 6 definitions for residential standards. Stakeholder input suggests that there is a potentially large market for ZNE existing homes, however, particularly in urban areas. Existing homes will be addressed through the Energy Commission's existing homes Action Plan, authorized via AB758.⁶

Another important vision presented by the CEESP is related to Integrated Demand Side Management (IDSM) and the need to implement a more holistic approach to energy efficiency, energy conservation and management, demand response, on-site storage, renewable generation, and advanced metering. The CEESP envisions these elements as part of integrated solutions that support energy and carbon reduction goals and eventually water and other resource conservation goals. This vision is important to achieving ZNE as it recognizes the complex nature of high performance buildings and the need to support market development of such buildings through comprehensive marketing of IDSM services, coordinated demand side management program delivery and technology and systems integration.⁷

⁴ CPUC, "California Long-Term Energy Efficiency Strategic Plan", January 2011 update: www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/eesp, page 6.

⁵ CPUC Decision 07-10-032, (D.07-10-023), http://docs.cpuc.ca.gov/word_pdf/FINAL_DECISION/74107.pdf

⁶ www.energy.ca.gov/ab758

⁷ CPUC, "California Long-Term Energy Efficiency Strategic Plan", January 2011 update: www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/eesp, page 71.

POLICY CONTEXT FOR ZNE

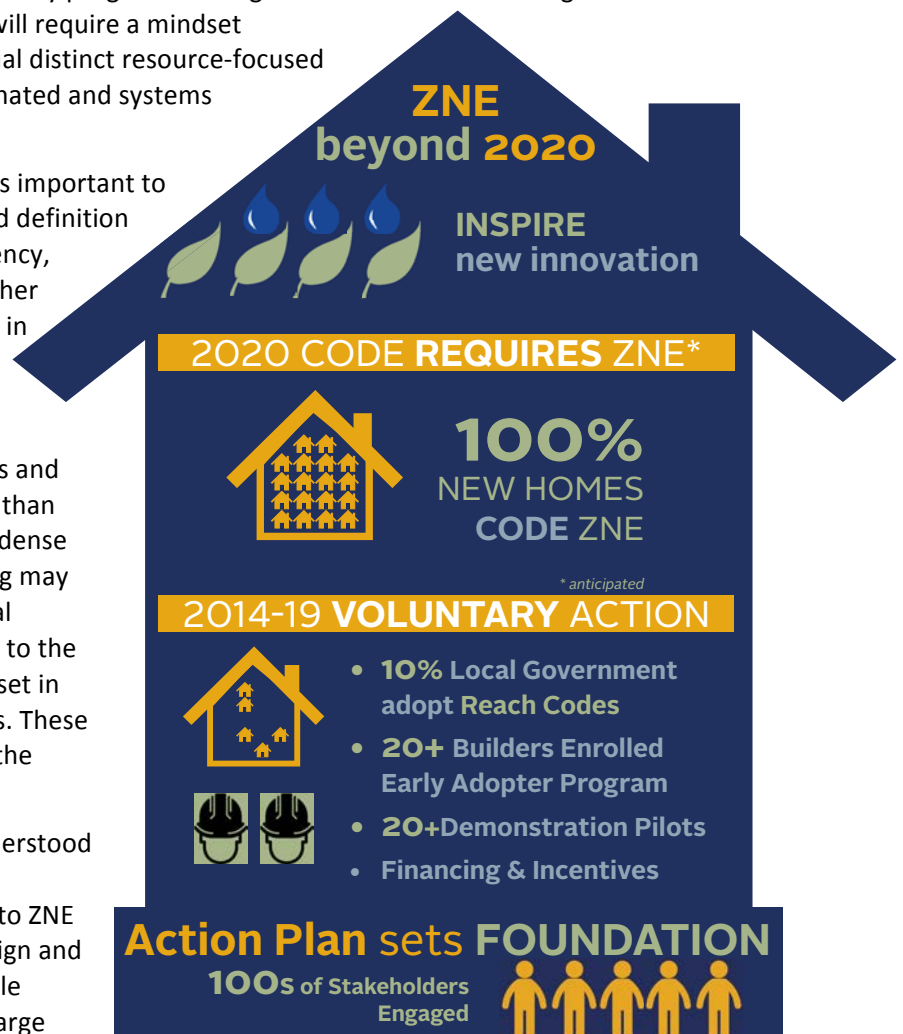
In meeting the CEESP goal, this Action Plan focuses on enabling ongoing code enhancements, which are anticipated to require ZNE Code Buildings (TDV based metric) starting in 2020 (see page 12 for additional details). However, it is recognized that there is an opportunity to engage the market and prepare for, support, and expand upon that goal by creating a robust foundation for market-driven action. The graphic below illustrates this concept – the action plan sets the foundation; sets forth strategies for voluntary action for 2014-2019; effectively supports the implementation of new codes in 2020; and then enables and inspires new innovation and approaches from 2020 and beyond.

Creating an Integrated Demand Side Management (IDSM) Approach

California's demand side programs have historically been widget- or technology- oriented, and have operated in silos within regulatory and policy environments. While the CEESP presents a vision for a more integrated approach to energy efficiency and ZNE buildings via IDSM, and virtually all ZNE buildings take an IDSM approach, there have been limited in roads to achieving coordinated utility delivery of demand side management programs or comprehensive utility IDSM marketing. But a lack of an IDSM approach to ZNE and the high performance building market could lead to unintentional consequences, lack of clarity along the path to achieve goals, and a higher cost of doing business. This plan strives to create an enhanced level of awareness of IDSM for agencies and utility programs through its strategies and continued stakeholder coordination. ZNE success will require a mindset transformation from employing individual distinct resource-focused actions to embracing a strategic, coordinated and systems approach.

As articulated by many stakeholders, it is important to consider and plan for a future, expanded definition of ZNE, such as considering water efficiency, transportation/land use impacts, and other sustainability principles that are missing in a strict, building code focused definition of ZNE. This is particularly true for more urban areas, where infill development with more compact homes and smaller rooftops will be more prevalent than new subdivision development. In those dense areas, achieving ZNE building-by-building may be more difficult. However, the potential reduction in transportation impacts due to the walkability of these areas may be an offset in terms of overall greenhouse gas impacts. These tradeoffs should continue to be part of the ongoing dialogue for ZNE policy.

Another element that will be better understood in the future will be the ability and effectiveness to support multiple paths to ZNE including considering passive house design and incorporating a broad range of renewable technologies such as biogas, small and large



distributed wind power, and other clean renewable sources. Storage, flexible load management strategies, Home Energy Management (HEMs) systems, advanced metering, smart metering and smart inverter systems will play an increasing role in ZNE systems and building design and must be considered at every stage. See page 26 for further discussion.

State regulatory agencies and key sponsors can only take an IDSM effort so far and will require ongoing innovation and buy in by key market actors, local government and utilities to achieve the Plan's goals.

Integrated Energy Policy Report

The Energy Commission released its 2013 Integrated Energy Policy Report (IEPR), covering both new and existing buildings, in January 2014. The IEPR is an annual report that provides a comprehensive assessment of essential energy issues in California along with recommendations for how to address market and regulatory challenges. In addition, the IEPR provides a forecast of energy supply and demand that is used as baseline planning data by key state agencies including the Energy Commission, CPUC and the California Independent System Operator Corporation (ISO).

In the 2013 IEPR, a basic definition of ZNE is provided in preparation for future code cycles requiring ZNE buildings. This definition, provided on page 13, is also referred to as the ZNE Code Building or ZNE TDV definition and will be the baseline ZNE definition for the Energy Commission, the CPUC, and California's utilities.

DEFINING ZERO NET ENERGY

What is Zero Net Energy? The process of defining what it means to be a ZNE building has consumed many meetings and discussions related to this Plan, as well as State ZNE policy. The California Public Utilities Commission (CPUC) and California Energy Commission (Energy Commission) worked collaboratively to refine and finalize a specific definition for ZNE Code, as well as discussing ways to provide a “common sense” definition to the marketplace. On January 15, 2014, the Energy Commission adopted its 2013 Integrated Energy Policy Report (IEPR), which contained a refined definition of ZNE and details regarding the definition of ZNE buildings and the role of off-site renewables. It is expected that the CPUC will adopt a definition similar, if not exactly as written below, in 2015.



This Action Plan, along with the IEPR, embraces the potential and need for multiple paths to achieve what is embodied in “ZNE”. The graphic above illustrates the concept that the path to zero will take many forms and will be evolving over the next six plus years. Separate marketing messages and tools need to be developed to help raise awareness and understanding of the concept of ZNE with consumers, irrespective of the technical definition. The “definitions” presented below are designed to illustrate different potential ways to consider ZNE buildings for technical audiences – not mainstream consumers.

ZNE Code Building Definition - Time Dependent Valuation (TDV)

“A Zero Net Energy (ZNE) Code building is one where the net of the amount of energy produced by on-site renewable energy resources is equal to the value of the energy consumed annually by the building, at the level of a single “project” seeking development entitlements and building code permits, measured using the California Energy Commission’s Time Dependent Valuation (TDV) metric. A ZNE Code Building meets an Energy Use Intensity⁸ (EUIs) value designated in the Building Energy Standards by building type and climate zone that reflect best practices for highly efficient buildings.”⁹

What is TDV?

“The concept behind TDV is that energy efficiency measure savings should be valued differently depending on which hours of the year the savings occur, to better reflect the actual costs of energy to consumers, to the utility system, and to society. The TDV method encourages building designers to design buildings that perform better during periods of high energy costs.”

--CEC report: “Time Dependent Valuation of Energy for Developing Building Efficiency Standards”, February 2011

ZNE Code does not mean Zero Bill

The idea that Zero Net Energy could be interpreted as a zero bill is a concern with some of the major stakeholders, as there will continue to be costs (and therefore, at least a potential need for fees) associated with connecting to the grid and because building performance and utility rates will vary depending on occupant behavior. Without proper messaging and education, this misperception could be a potential threat to developing consumer trust for ZNE homes. Equally, other misconceptions regarding ZNE, such as “it means just adding solar panels,” could negatively impact the policy. Therefore it is critical to ensure future marketing and messaging appropriately distinguishes what it means to be Zero to mainstream customers. As indicated in the IEPR, “[p]ublic education should clarify the correct expectations for ZNE Code Buildings, and should also illuminate the benefits of ZNE Code Buildings in achieving optimum energy performance, reduced criteria pollutants, and reduced greenhouse gas emissions, as well as non-energy benefits such as improved comfort and building functionality.”¹⁰

Additional ZNE Terms

In addition to the ZNE Code Building definition, several other terms may help categorize buildings that are close to ZNE but do not conform to that definition exactly. Below are some proposed terms.

ZNE Ready Building¹¹

ZNE Ready Buildings meet the same high efficiency EUIs as ZNE buildings, but lack on-site renewables.

Zero Net Electric Building

A building where the amount of electricity provided by on-site renewable energy sources is equal to the amount of electricity consumed by the building annually. A Zero Net Electric Building meets EUI by building type and climate zone that reflect best practices for highly efficient buildings. As with ZNE Code and ZNE

⁸ EUI: Energy Use Intensity represents the energy per square foot of gross building floor area expended per year. To determine EUI, divide the total energy consumed by the building in one year by the total gross square area.

⁹ Energy Commission, “2013 Integrated Energy Policy Report”, CEC-100-2013-001-CMF, January 2014, pg. 36.

¹⁰ Ibid, pg. 37.

¹¹ ZNE Ready is comparable, if not the same, to “ultra-low energy” buildings, defined by NBI in the 2014 ZNE Status Update, “Ultra-low energy buildings are comparable to ZNE buildings based on energy use, design strategies and efficiency technologies but do not have a stated goal of ZNE using onsite renewable energy.”

http://newbuildings.org/sites/default/files/2014_Getting_to_Zero_Update.pdf

Ready Buildings, these EUIs will include both the electric and natural gas used at the building, such that best practice energy efficiency addresses all the energy used at the building, not just the electricity expected to be offset by a renewable energy source.

Net Positive Building

A net positive building meets or exceeds requirements for a ZNE Code Building but produces *more* renewable energy on-site than it consumes over a typical year.

Zero Net Energy Community (or Community-scale ZNE)

A Zero Net Energy Community refers to an adjacent group of buildings that individually are ZNE Ready Buildings and where the net amount of energy provided by a community-scale, off-site renewable energy source associated with the community is equal to the value of the energy consumed by the buildings in aggregate. The 2013 IEPR indicates “the ZNE Code Building definition anticipates the need for ‘development entitlements’ for off-site renewable energy resources, such as community based renewable energy generation, to be a viable option for builders and developers. Such options must be enforceable by the applicable enforcement agency and must enable tracking and matching to the specific buildings for which the energy consumption is being offset.”¹² This type of shared renewables is similar to the “enhanced community renewables programs” envisioned by SB43 and under consideration in early 2014 at the CPUC.¹³

UTILITY ZNE PROGRAMS AND PILOTS

Utility residential new construction programs offer incentives, design assistance and training, and operate pilot projects to advance California’s Zero Net Energy Building goals. The IOUs operated separate Zero Net Energy and Sustainable Communities Pilot Programs in 2010-12, and undertook two major studies on Zero Net Energy Buildings. Below is a summary of the major programs related to residential ZNE or programs that support the goal for ZNE:

Through a pay-for-performance incentive structure and a whole building approach, the residential, statewide **California Advanced Home Program (CAHP)** aims to increase market demand for energy efficient multifamily and single-family homes by encouraging builders to exceed Title 24, Part 6 building energy efficiency standards by 15 to 45 percent. In 2010-12, the program also offered performance bonus adders to encourage green building initiatives and compact homes, and offered technical designing and energy modeling assistance.

PG&E’s 2010-12 **Zero Net Energy Pilot Project** was a pilot that worked to advance California’s ZNE goals in four ways. A *ZNE Communities* activity that offered design and technical assistance to master-planned and advanced commercial and residential projects; a *ZNE Demonstration Project* activity supported monitoring and performance assessments and developed case studies; a *ZNE Technology Advancement* activity assessed integrated high-efficiency building systems level technologies; and a *ZNE Design Integration* activity developed best practice information for design of ZNE buildings.

SCE and Sempra companies’ **Sustainable Communities** non-resource pilots similarly offered design and technical assistance to master planned communities and ZNE buildings.

¹² Energy Commission, “2013 Integrated Energy Policy Report”, CEC-100-2013-001-CMF, January 2014, pg. 39.

¹³ http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201320140SB43

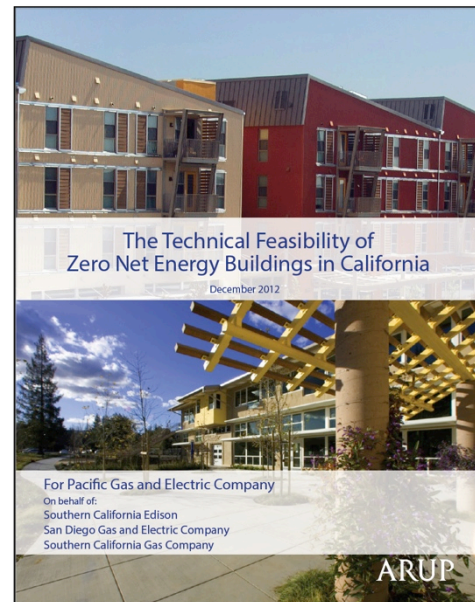
PG&E led a **Residential New Construction Measure Optimization Tool Update** study aimed at assessing incremental costs to build single-family homes between 20-40% > Title 24, Part 6 (2008). SCE led a study entitled **Market Research on Builder's Selling Practices and Strategies for Energy Efficiency Homes** aimed at supporting the development of a best practice residential builder sales training module and tools to help CAHP builders increase their understanding of green purchase drivers to improve sales of efficient homes.

Highlights for these programs include:¹⁴

- ✓ The CAHP program treated 18,371 single and multifamily newly constructed housing units in 2012.
- ✓ Most of the single-family units treated in PG&E and SCE's CAHP program in 2012 exceeded Title 24, Part 6 (2008) by 20-29% whereas most of the single-family units in SDG&E and SCG's programs saved just 15-19% more than Title 24, Part 6 (2008).
- ✓ Multifamily units across the IOUs generally achieved between 15 – 29% better efficiency levels than Title 24, Part 6 (2008).

In mid-2013, PG&E's ZNE Pilot projected reported progress completing 14 of 16 high level program performance metrics.¹⁵

- ✓ PG&E ZNE pilot activities still in progress include: establishing a roadmap and market characterization by building type for ZNE; completing and distributing the residential "BeOpt" tool to assist in ZNE home design; and developing 2-5 best practice guidelines for the commissioning, operation and maintenance of ZNE buildings.
- ✓ Completed activities include delivering consultations to three community-level ZNE project teams; providing design, technical and financial consultations to 10 residential and commercial building projects; monitoring five ZNE projects to measure actual performance; completing four advanced ZNE technical studies and five technology assessments; coordinating several ZNE workshops; operating commercial and residential ZNE building design training classes; and, operating a ZNE architectural design competition.



PG&E also managed the completion of two significant ZNE planning studies: *The Road to ZNE: Mapping Pathways to ZNE Buildings in California* (HMG, 2012); and *The Technical Feasibility of Zero Net Energy Buildings in California* (Arup, 2012) (see below for high level findings). In mid- 2013, SCE's Sustainable Communities Program reported:¹⁶

- ✓ Providing 16 separate master planned community, campus, municipal, affordable housing and single-family home projects that were > 20% more efficient than Title 24, Part 6 (2008) with design and technical assistance.

¹⁴ Based on statewide program performance metrics, filed by the IOUs with the CPUC on June 20, 2013.

¹⁵ Pacific Gas and Electric, 2010-2012 Energy Efficiency Portfolio, Program Year 2012 Pilot Program Target Updates, June, 2013.

¹⁶ Pilot Program Target Updates, Reporting for Year End 2012, Southern California Edison, June, 2013.

- ✓ SCE completed an “ABC” Zero Net Energy Green Home (Affordable, Buildable, Certified) in 2012, and offered tours of the home to thousands of visitors in 2012-13. The 1700 sf, three bedroom home projects annual usage of 7,107 kWh/year, using 100% LED lights, and including a 5.25 kW PV system.

In early-2013, the Sempra companies' Sustainable Community project reported:¹⁷

- ✓ SDG&E's Sustainable Communities program faced challenges when a major master- planned community developer (Rancho Mission Viejo) dropped out of the project after three years of involvement.
- ✓ SDG&E supplemented this effort with the completion, in partnership with KB Home, of a “first of its type” Zero Net Energy production home in Rancho Santalina, San Marcos.
- ✓ SCG completed a Near ZNE “Smart Gas” home in Downy to showcase the complement of gas and electric technologies in ZNE homes. It also undertook a demonstration project and three case studies of homes exceeding Title 24, Part 6 (2008) by >40% (MF, SF, and SF duplex).

In 2010-2012, Los Angeles Department of Water and Power (LADWP) supported California's ZNE building goals by:

- ✓ Joining the IOUs statewide Codes & Standards program to support Title 24, Part 6 Building Energy Code and Title 20 Appliance Standards development and enforcement
- ✓ Sponsoring the University of Southern California's entry into DOE's Solar Decathlon in Oct 2013

Sacramento Municipal Utility District (SMUD) supported California's ZNE building goals in the following way:

- ✓ Elliott Homes/SolarSmart: Through this program, SMUD incentivize a large production home builder to build one of the most efficient communities (over 50 homes committed) with an average ResNet Index Score of 18 (roughly +35-40% over the 2008 Title 24, Part 6 standard).
- ✓ Northwest Land Park-SolarSmart: Six model homes, including a duplex within Northwest's 206 unit planned community. The models are designed as Zero electric. Program included technical and marketing assistance, advanced energy efficiency measures and a combined solar PV/water heating system.



Elliott Homes. Photo: Courtesy of SMUD.

- ✓ 2500R-SolarSmart: Close to ZNE project (Over 40-45% 2008 Title 24, Part 6), with Battery Storage technology and Demand Response features.
- ✓ SMUD is actively participating in the statewide Codes & Standards Enhancement (CASE) program.

¹⁷ Report to Energy Division, Chip Fox, March 2013.

STATE OF THE MARKET

"Homebuyers now expect a new home to be energy efficient, and we believe that they will increasingly demand a net-zero energy home over the next 10 or 20 years. KB Home is making this heightened level of energy efficiency an option for our buyers who are ready for this kind of future, today"
- Vince DePorre, Regional President for KB Home

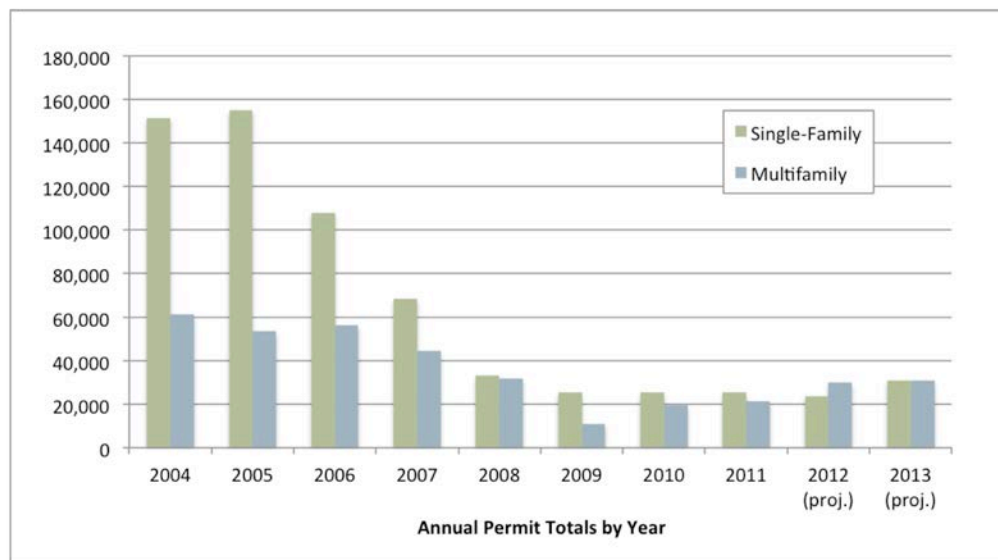


KB Home, ZNE Model Home. Photo: Mindy Craig

After six plus years of a depressed housing market nationwide and in California, the building industry is beginning to see a strong increase in new housing starts and buyer interest. Single-family new housing starts have increased over 20% in 2013 from 2012 and when multifamily units are included, there has been over a 30% increase from July 2012.¹⁸ The Construction Industry Research Board (CIRB) estimates that in 2013 single-family and multifamily housing starts will nearly reach 2008 permit levels with 62,000 permits projected. However, this is still considerably lower than 2004 when there were over 210,000 permits (see chart below).

Mortgage rate uncertainty has created some short-term fluctuation in demand. However, a recent survey reported by the New York Times indicated "confidence among builders of single-family houses remained near an eight-year high in September (2013), with builders upbeat about prospective buyer traffic."¹⁹

California Housing Production 2004-2013



Source: Construction Industry Research Board, 10/20/2012

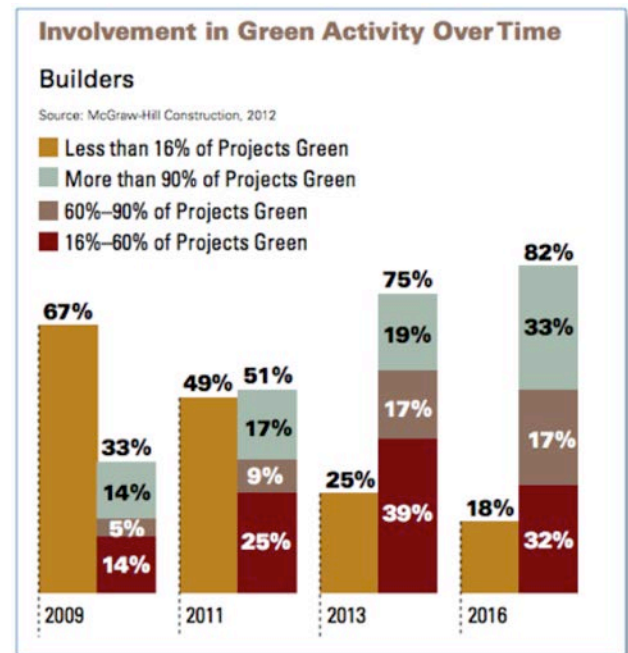
¹⁸ "CHF|CIRB July 2013 California Construction Review", Monthly Report, July 2013, CBIA, www.cbia.org.

¹⁹ "Home Construction Rises, As Do Building Permits", New York Times, September 19, 2013.

Green Building

The McGraw-Hill 2012 SmartMarket Report on new and remodeled green homes reports that the demand and interest by homebuilders to develop green homes is increasing substantially and is forecasted to represent 90% of all homes by 2016 nationally (see adjacent table). These builders are reporting an advantage to offering greener homes with 46% indicating it is easier to market them. 84% of new homebuilders are primarily engaged in energy efficiency elements of green building.²⁰

In California, several large- and mid-scale builders are beginning to capitalize on green homes and on the opportunity to differentiate themselves in the marketplace with increased offerings of ZNE homes. In addition, the provision of solar and high efficiency home options is becoming more common as code requirements increase. Engaged builders include, but are not limited to KB Home, ZETA Zero Energy Communities, DeYoung Properties, Wathen Castanos Hybrid Homes, Inc., Elliot Homes and Meritage Homes.



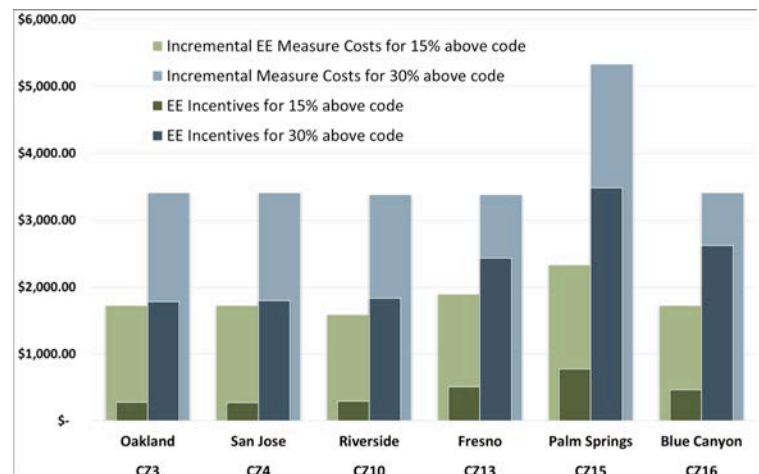
Source: "New and Remodeled Green Homes: Transforming the Residential Market", McGraw-Hill Construction SmartMarket Report, 2012

Incremental Costs of ZNE

The incremental costs to achieve ZNE homes include energy efficiency measures and renewable energy generation costs, typically solar. Builder standard practice costs are the baseline for assessing such costs. To motivate higher market adoption levels for these measures and practices, energy efficiency and solar incentive programs are typically designed to offset a portion of these costs.

Each update to California's Building Energy Efficiency Standards resets the baseline cost for standard practice buildings, which are typically at or slightly above code. The figure at right shows an approximate incremental cost of achieving building efficiencies of 15% and 30% above the 2013 Title 24, Part 6 building energy code and the corresponding incentives²¹ to offset some of that cost. After reducing the cost with program incentives, the net incremental cost for 15% above code is in the \$1,500 range, whereas the 30%

Incremental Costs for achieving 15% and 30% above Code



Source: Based on data from the Energy Commission for 2100 sq. ft. single family home using 2013 standards – NSHP Workshop Dec. 2012 presentation

²⁰ "New and remodeled Green Homes: Transforming the Residential Marketplace", McGraw-Hill Construction SmartMarket Report, 2012, pg. 5.

²¹ IOU Residential New Construction Programs 2010-12.

above code cost is only slightly higher at \$1,600 to \$1,800 (and even lower in some climate zones given the higher incentives).

The cost of photovoltaics (PV) to achieve ZNE buildings is highly dependent on whether the system is owned or leased. The cost of purchased systems for new construction is usually bundled with the cost of the home and therefore becomes a part of the monthly mortgage payments. However, with the increasing proliferation of solar lease options even in the new construction market, first costs of rooftop PV systems have been dramatically reduced. Monthly lease payments are usually offset by a reduction in utility bills through net metering arrangements. The overall lifetime economic benefits of leased versus owned systems are currently uncertain due to a new law (AB327) that is expected to result in significant changes in utility rates and California's net metering rules, as well as the scheduled changes to state and federal renewable generation incentives.

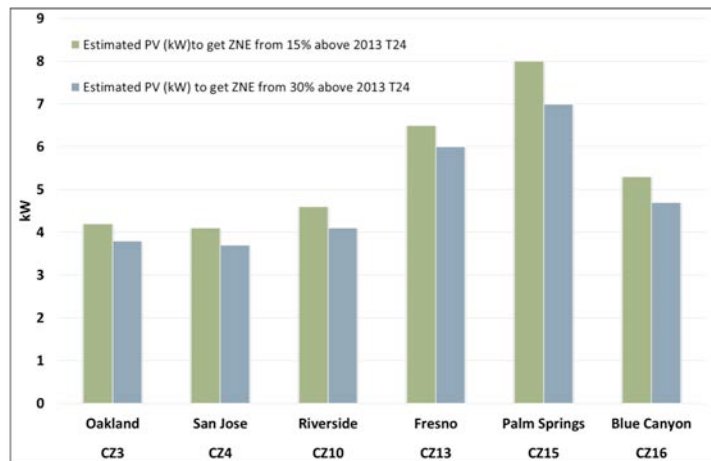
These costs for achieving ZNE do not include the grid level costs for any supporting infrastructure. Infrastructure costs still need to be determined along with the approach to allocating costs (i.e. will costs be applied to all ratepayers equally or solely covered by individual ZNE homes). Such costs may be embedded in the utility tariffs or fixed fees.

Cost of Photovoltaics (PV) as recorded by the New Solar Homes Partnership Program

Type	System Size (kW)	System Price	Price per Watt	NSHP Incentive	Final System Price	Final Price per Watt
Lease	5.07	\$23,099	\$4.56	\$11,237	\$11,862	\$2.34
Lease	3.92	-	-	\$10,415	\$12,493	\$3.19
Lease	2.6	\$9,318	\$3.58	\$5,000	\$4,318	\$1.66
Purchase	4.71	\$31,580	\$6.70	\$8,060	\$23,520	\$4.99
Purchase	1.93	\$12,075	\$6.26	\$4,371	\$7,704	\$3.99
Purchase	6.96	\$40,620	\$5.84	\$17,873	\$22,747	\$3.27

Source: The California Energy Commission – NSHP workshop Dec 2012

Estimated PV (kW) to get to ZNE from above code Energy Efficiency levels



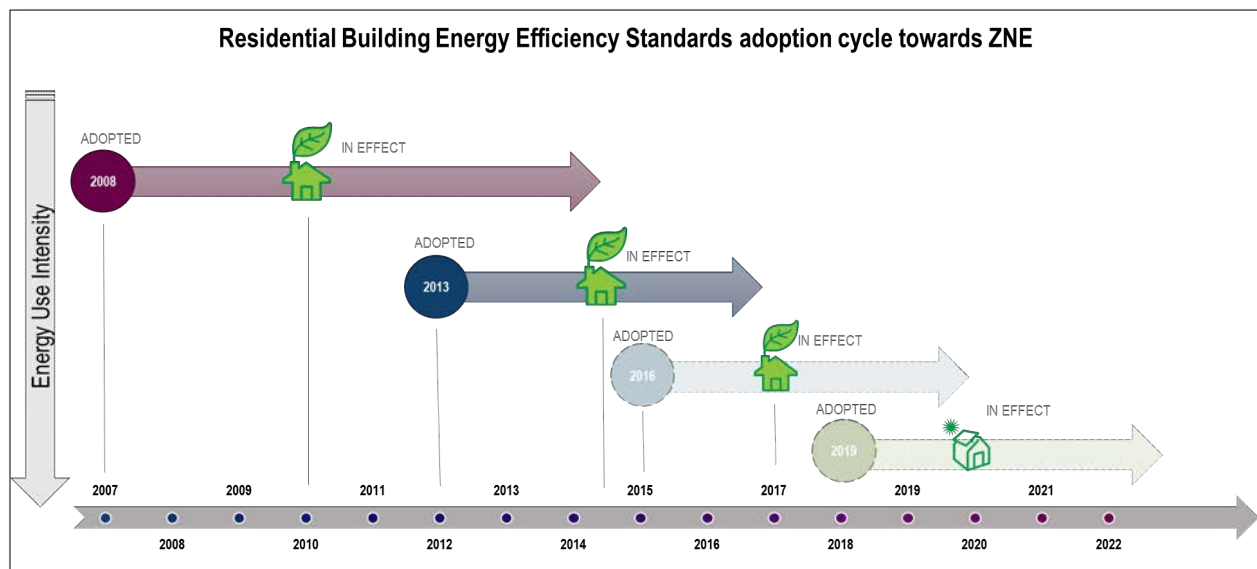
Source: Estimation based on raw data from the Energy Commission

CODES AND STANDARDS

California Building Energy Efficiency Standards (Title 24, Part 6)

The Warren-Alquist Act, enacted in 1976, mandated that the Energy Commission create and periodically update Building Energy Efficiency Standards (Standards) for the State of California. These Standards address newly constructed buildings and additions and alterations to existing buildings. The Standards have, in combination with appliance efficiency standards and utility-sponsored incentive programs, substantially contributed to California's per capita electricity consumption levels remaining relatively flat since the mid-1970s. First adopted in 1977, the Standards have been periodically updated approximately on a three-year cycle. The 2008 Building Energy Efficiency Standards went into effect on January 1, 2010 and were updated in 2013 with Standards that go into effect July 1, 2014. Typically the Standards' stringency increases at the rate of 12-15% in each cycle (see chart below).

The upcoming triennial update cycles (2016 and 2019 standards) will need to address ZNE in response to the policy goals for 2020. Codes and Standards are the most important push mechanism available for implementing policy goals. Highlights of the potential areas under consideration for the upcoming 2016 and 2019 Residential Standards development cycle include: high performance walls and attics with increased continuous insulation; high efficacy lighting; energy efficient water heating system requirements; conditions under which solar can be offered as a compliance credit; and defining a ZNE tier for CALGreen, which implements California's green building standard.



Source: Itron, December 2013

California Appliance Energy Efficiency Standards (Title 20)

The Energy Commission's Appliance Standards Program sets cost-effective efficiency requirements for appliances, equipment, and electronic devices. These efficiency standards transform the market by removing inefficient products from the market. Since 1976, the Energy Commission has adopted standards covering a wide range of appliances, including all major household appliances, air conditioners, furnaces, and water heaters. In many instances, Congress and Department of Energy (U.S. DOE) have adopted the more stringent California appliance standards for the nation.

The Energy Commission is contributing to achieving ZNE goals by regularly updating its appliance standards, including electronic equipment and other plug in devices, such as TVs, gaming systems and battery charger systems, which represent an increasing portion of California's energy use. In 2010, Appliance Standards alone saved an estimated \$2.6 billion in energy costs and 19,684 Gigawatt hours of electricity, representing nearly seven percent of California's electric load. Nearly 50% of residential electricity consumption is from appliances, such as refrigerators, dryers and plug in devices.²²

Energy Commission Upcoming appliance standards (OIR) schedule

Topic	Phase 1: (Q2 2012 – Q3 2014)	Phase 2: (Q2 2013 –Q4 2015)	Phase 3: (Q2 2014 – Q4 2016)
Consumer Electronics	Displays; Video game consoles; Computers; Network Equipment	Servers; Imagery equipment	Low power modes; Power factor
Lighting	Dimming ballasts; Light-emitting diode (LED) lamps	Lighting accessories; Outdoor lighting; EISA exempt lamps	Linear Fluorescent fixtures
Water and Other	Air filter labeling; Faucets; pool and spa pump standards; commercial clothes dryers	Plug-in Luminous signs; irrigation equipment	Recirculation pumps; Commercial dishwashers; Refrigeration condensing units

Codes and Standards Enhancement (CASE) Studies

Advocacy for more stringent building and appliance standards is one of the major activities of the IOUs' Codes and Standards (C&S) statewide program as well as some Publicly Owned Utilities (POUs). A major part of the advocacy work is the research and technical analysis to justify and support the Energy Commission's proposed changes to existing Standards. This research, which evaluates the feasibility and lifecycle cost effectiveness of potential standards, is presented in reports referred to as Codes and Standards Enhancement (CASE) reports. The calculation methodology that estimates the energy savings of the measures is critical to the process and important when showing compliance with the performance standards.

²² California Energy Commission, "2011 Integrated Energy Policy Report", CEC-100-2011-001-LCF, <http://www.energy.ca.gov/2011publications/CEC-100-2011-001/CEC-100-2011-001-CMF.pdf>, page 66.

LOCAL GOVERNMENT POLICY CONTEXT

There are 482 incorporated municipalities within 58 counties, totaling 540 local governments, in the State of California, representing nearly 38 million people in 16 different climate zones. The magnitude and complexity of the work done by local governments differs from place to place, but in general requires a broad range of policies, plans and procedures to effectively manage resources and to comply with state policies. Local government's role is integral to new construction and includes developing general plans, zoning ordinance, design guidelines, development guidelines, as well as ensuring compliance with codes and regulations. The following is a brief synopsis of the policies and areas that are most relevant to the ZNE Residential Action Plan.

Reach Codes/Local Ordinances

California jurisdictions can adopt ordinances and enforce more stringent building codes, or "Reach Codes" than provided in the State's Title 24, Part 6 Mandatory Building Standards by applying to the Energy Commission for approval, documenting the supporting analysis for how the local government has determined that their proposed Standards will save more energy than the current statewide standards and their basis for showing cost effectiveness. With increasingly more stringent Title 24, Part 6 energy efficiency requirements anticipated for 2014 and beyond, the level of reach codes/local ordinances available to local jurisdictions may be more limited than before. In addition, the difficulty of validating the cost effectiveness of new measures is a barrier to some interested agencies. At the same time, moving forward into the next two code cycles before ZNE is required, there will likely be an opportunity for the most interested cities and counties to enact a reach code/local ordinance that requires ZNE in 2017. Other advanced standards programs, such as GreenPoint Rated that incorporate ZNE goals, may be adopted by local governments in coming years.

Reach Codes/local ordinances are an important policy tool as they establish a precursor to the adoption of future Mandatory Standards, and provide a vehicle to "test drive" the market readiness of new, innovative measures, and help drive down the cost of those measures. Reach Codes/local ordinances include requirements for newly constructed buildings, as well as additions and alterations to existing buildings, for both residential and nonresidential construction.

To date, Reach Codes/local ordinances have been used by local governments, the Energy Commission and utilities to push the market to adopted higher levels of energy efficiency and towards ZNE Code levels. Reach Codes/local ordinances are also used as a basis for incentives by utility programs. Reach Codes/local ordinances have also been adopted for all newly constructed affordable housing projects by the California Tax Credit Allocation Committee as "minimum construction standards" to qualify for federal and state tax credits.

Climate Action Plans (AB 32)

In 2006 California adopted AB 32 – the Global Warming Solutions Act of 2006, which set greenhouse gas (GHG) emission reduction targets of approximately 15% for 2020.²³ The Air Resources Board (ARB) is leading the implementation of AB 32 with the development of scoping plans (2008 and 2014) to outline how to meet these goals. As part of the scoping plan, local governments are encouraged to adopt similar targets as the state, through the development and implementation of Climate Action Plans.

The energy sector represents approximately 50% of California’s GHG emissions.²⁴ Addressing and enhancing energy efficiency in the jurisdiction’s building stock is a major element of many, if not all, plans. Climate Action Plans have become a more prevalent policy tool for local governments with strategies, goals, and resources allocated on a regular basis. Connecting ZNE goals to GHG reductions identified in the Climate Action Plans could assist local governments to more easily implement elements of this Plan, leveraging existing dollars and staffing.²⁵

“California has a track record of decades of rigorously evaluated, cost-effective energy efficiency improvements across all sectors of the economy. The initial Scoping Plan continued these priorities by advancing a host of innovative and aggressive building, appliance, electronic, and water-efficiency standards that are certain to maintain California’s leadership in this area.”

First Update to the Climate Change Scoping Plan, May 2014

Sustainable Communities and Climate Protection Act of 2008 (SB 375)

The Sustainable Communities and Climate Protection Act is a companion law to AB 32 that focuses primarily on reducing greenhouse gases emissions from passenger vehicles. Although it does not directly impact ZNE homes, it does connect to new construction in terms of the potential impacts related to the location and density of housing, associated with trip miles and availability of transit.

General Plans, Housing Element and Policy Planning

Every local government is required to adopt a long-term general plan for the physical development of their community (city or county). There are seven mandated sections of a general plan: circulation, land use, safety, open space, conservation, noise, and housing. The housing element is the one section of the general plan that must be reviewed by the state [the Department of Housing and Community Development (HCD)] to ensure it is in compliance with state law and adequately meets existing and projected housing needs for the entire community. Zoning codes and urban design guidelines are often updated as part of the general plan process. Each of these documents offer an opportunity to align with the State’s ZNE goals and to help streamline the adoption of the strategies identified.

²³ California Air Resources Board, <http://www.arb.ca.gov/cc/localgovernment/localgovernment.htm>, October 2013.

²⁴ California Air Resources Board, *First Update to the Climate Change Scoping Plan Update*, May 2014, pg. 36.

²⁵ The February 10, 2014 Draft ARB California Scoping Plan notes progress on and supports the CPUC and Energy Commission’s Zero Net Energy Building goals. Its Green Buildings Chapter calls for establishing target dates and pathways to transition to zero net carbon buildings in a way that expands upon and complements the CPUC and Energy Commission’s adopted ZNE building goals. (p. 92). <http://www.arb.ca.gov/cc/scopingplan/document/updatedscopingplan2013.htm>

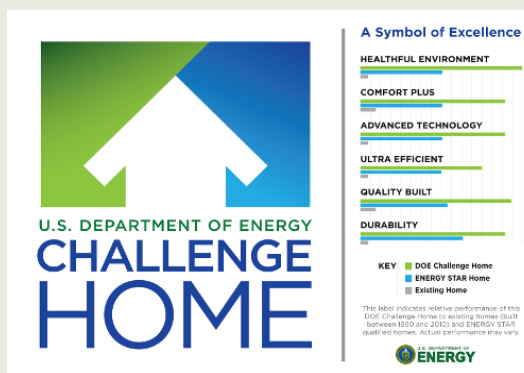
always relative to the size, shape and type of house. A lower index score is given to homes that are more energy efficient than the reference home. A “0” rating or index score (equivalent to ZNE) is attributed to homes that include on-site electric generation that offsets all energy use. RESNET HERS is used by many large production builders outside of California and is the standard in other states.

Other Home Ratings

There are a number of alternative green rating and labeling programs available in California including: GreenPoint Rated, US Building Challenge, Living Building Challenge, LEED for Homes and California Green Builder, that focus on residential new construction. Most of these programs include considerations for energy efficiency, as well as water use, solid waste, construction waste diversion, indoor environmental quality and other factors. These ratings help to raise overall awareness and should continue to be a part of achieving ZNE energy goals and broader sustainability goals. This Plan recommends having these programs and any new ones work in concert towards the same goal, reducing confusion and potential conflicts between systems, and making it easier for consumers to embrace ZNE.

U.S. DOE Challenge Home – Zero Energy Ready Home (ZERH)

The US Department of Energy (DOE) Building Technologies Office manages and promotes the Challenge Home Program. To date over 14,000 homes have participated resulting in millions of dollars of energy savings. In general, the program promotes high efficiency homes that are verified by a third-party and are at least 40%-50% (mid-50 RESNET HERS score) more energy efficient than a typical new home. The program requires a set of key steps and encourages additional building best practices including water efficiency (see graphic to the right). These homes are designed to be zero net energy ready by being as efficient as possible and allowing for a PV system to offset energy use, if desired.



As part of the program, the DOE has developed and is promoting a new labeling system, which compares existing homes to Energy Star homes and a Challenge Home. The label provides six separate criteria for comparison including comfort, durability and health. (see graphic above) (Source: US DOE www.1.eere.energy.gov/buildings/residential)

INTEGRATED DEMAND SIDE MANAGEMENT

The Strategic Plan recognizes the integration of demand-side management (IDSM) options including energy efficiency (EE), demand response (DR), and distributed generation (DG) as fundamental to achieving California's strategic energy goals.²⁷

The Strategic Plan describes the IDSM vision as:

"Energy efficiency, energy conservation, demand response, advanced metering, and distributed generation technologies are offered as elements of an integrated solution that supports energy and carbon reduction goals immediately, and eventually water and other resource conservation goals in the future."²⁸

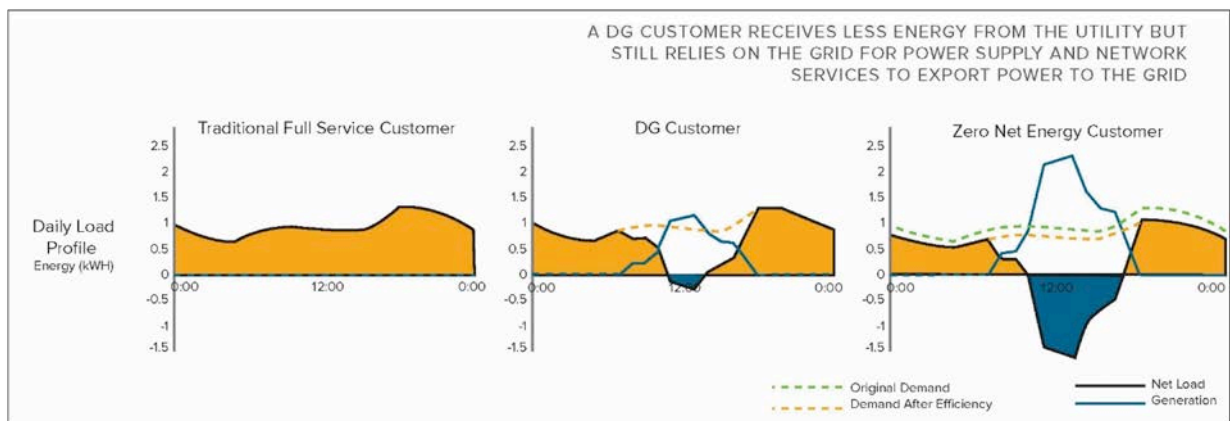
Effective implementation of an IDSM approach will play a critical role in increasing the efficiency and reliability of the power system, reducing costs, and integrating increasing levels of renewables like solar. IOU programs for 2013-14 have filed budget allocations that will cover technologies, audits and marketing related to IDSM.

Distributed Generation (DG)

Typically, electricity generation is centralized at power plants and transmitted to electrical substations located near demand centers for further distribution to end users. Distributed generation (DG) is typically referred to as the electricity generation that is on the distribution side of the electricity grid system, which is the final stage in delivery of electricity to the end users.

DG can be located on either customer or utility (wholesale) side of the electric meter. Customer-side of the meter DG is also sometimes called "on-site generation," "self-generation" or "behind the meter" generation. Utility-side of the meter DG is sometimes called "wholesale" or "system-side generation" because it is intended to feed into the electrical system side of the customer's electric meter.²⁹

The most common form of residential customer-side DG is solar PV. Regulatory and utility planning surrounding DG policy will be critical to the ultimate success of ZNE at scale. The increase in ZNE buildings associated with meeting ZNE goals will require significant upgrades to distribution circuits and possibly the



Source: Rocky Mountain Institute, "Zero Net Energy 2.0", March 7, 2012, blog.rmi.org/zero_net_energy_2.0.

²⁷ CPUC, www.cpuc.ca.gov/NR/rdonlyres/1A990EF9-1D4F-4BE4-9B3E-0B8DE4700726/0/201314IDSMProgramFactSheet.pdf

²⁸ CPUC, "California Long-Term Energy Efficiency Strategic Plan", January 2011 update: www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/eesp, page 71.

²⁹ www.cpuc.ca.gov/PUC/energy/DistGen/

transmission grid in order to manage the demand and supply fluctuations associated with renewable energy production. Energy storage, demand response (DR) and other demand management tools and strategies will be needed to help flatten demand and supply peaks and to maintain a more consistent and reliable load on the grid (see charts above). Other unanswered questions relating to DG and ZNE buildings include interconnection and inverter requirements and fees, net-metering rules and tariffs, and the option of feed in tariffs or meter aggregation (virtual net metering).

Utility DG counts towards the state's Renewable Portfolio Standards (RPS).³⁰ DG also contributes towards the Global Warming Solutions Act (AB32)³¹ that requires reduction in greenhouse gas emissions. Renewable DG incentive programs for new homes include the New Solar Homes Partnership (NSHP) for solar PV and the Self-Generation Incentive Program (SGIP) for all other eligible clean technologies including advanced energy storage.

Demand Response

DR is a resource that allows end-use electric customers to modify their electricity usage in a given time period, or shift that usage to another time period, in response to a price signal, a financial incentive, an environmental condition or a reliability signal. DR saves ratepayers money by lowering peak time, high-cost, energy usage. This lowers the price of wholesale energy, and in turn, retail rates. DR may also prevent rolling blackouts by offsetting the need for more electricity generation and can mitigate generator market power.³²

Currently, DR programs are administered by California's three regulated investor-owned utilities: PG&E, SCE, and SDG&E. Most utility demand response programs at this time target large commercial and industrial customers that are equipped with meters that are capable of measuring and reporting energy usage in one hour intervals or less. However, IOUs and POUs have offered residential Air Conditioning (AC) cycling programs for years and as of 2010 have offered pilot programs to explore the effectiveness of price responsive DR for residential customers. Since ZNE code and policy definitions are related to reducing peak load and the overall load, DR residential strategies including flexible load shifting, AC cycling, price responsive IOU programs, time of use and dynamic rates, Home Energy Management (HEM), feedback devices and smart appliances will be important strategies in achieving the ZNE goals.

Energy Storage

Electric energy storage has historically been used as a backup source or in an off-grid application. However, with recent developments in technology and reduced costs, storage will become a player in IDSM to reduce peak usage and act as a demand response strategy. Storage can also act as a stabilizing resource for renewable generation, mitigating intermittence and reliability issues associated with DG. In a recent decision, the CPUC has set storage targets for all the IOUs including customer-sited storage.³³ Solar installers are now pairing storage with solar systems to, in some configurations, capture energy during off peak hours to use during peak hours. Energy storage is a critical component to ZNE and the management of grid impacts.

³⁰ RPS was established in 2002 under SB1078, accelerated in 2006 under SB107 and expanded in 2011 under SB2. It requires the IOUs and other qualified providers to increase eligible renewable procurement of energy resources to 33% of total by 2020. The DG on utility side of the meter counts towards RPS. www.cpuc.ca.gov/PUC/energy/Renewables.

³¹ California Air Resources Board, <http://www.arb.ca.gov/cc/ab32/ab32.htm>

³² CPUC, www.cpuc.ca.gov/PUC/energy/Demand+Response.

³³ CPUC, <http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M079/K171/79171502.PDF>



CHAPTER 3. NEW RESIDENTIAL ZNE ACTION PLAN

INTRODUCTION

The following section provides the heart of the Plan in two parts:

Part 1: An overview of key catalytic projects and programs that will be integral to achieving ZNE goals.

The identified catalytic projects and programs offer overarching concepts that impact multiple Plan goals and are reflected in a number of the strategies and tactics in Part 2.

Part 2: Strategies, tactics and metrics for achieving the Plan's goals.

The second part of the chapter is organized under the six main Plan goals. Under each goal the following is provided: the critical path to achieve the strategies organized around approximate start dates, a summary of relevant current activities and detailed strategies, metrics, and leads and partners. An important piece of the Plan is the articulation of strategies to supporting ongoing enhancements to Codes and Standards.

In Part 2, catalytic strategies are noted by the “★” and code-specific strategies are noted by the “🏠”.

CATALYTIC PROJECTS AND PROGRAMS

Third Party Verification System (Rating/Labeling)

The implementation of a third party verification system for ZNE homes has been identified as a critical element to quantify the value of a ZNE home for homebuyers, appraisers, the financial market, as well as builders. Skepticism, particularly with some builders, paired with the perceived and real costs for building ZNE homes creates concern that ZNE homes are not “worth it.” A third party verification system to clearly articulate and measure the value and extent that a home is ZNE is essential to combating this skepticism and to building a strong market. The form that this system takes is to be determined (see page 24).

There are a number of existing and developing systems that may be effective, particularly as they are better designed to address ZNE. The Energy Commission will begin a process to update California’s Home Energy Rating System in 2015, the United States Green Building Council (USGBC) is considering adding a ZNE level to its LEED standards, Build It Green is planning to integrate ZNE into its GreenPoint Rated system in 2014, and the national RESNET HERS standard could be considered for establishing equivalences as well. Production builders desire a system that is consistent nationally so they can develop ZNE homes that work in California and across the nation.

Early Adopter Program

For Builders

Builders are a primary audience and catalyst to developing a robust and mainstream market for ZNE homes. However, making the move to ZNE includes some perceived risks and faith that there will be adequate demand. To assist, reward and encourage as many large and medium scale builders as possible to build ZNE homes, the Plan recommends the development of an Early Adopter Program supported by the CPUC, IOU and Publicly Owned Utility (POU) programs. The Early Adopter Program should include incentives, technical assistance, training, as well as other services to bring builders into the program and make them more comfortable and experienced in the delivery of ZNE homes. The Early Adopter Program should include elements related to marketing (Goal 1), training and education and pilot projects (Goal 2), and financing (Goal 4). The Early Adopter Program provides the opportunity to help builders understand and implement a new business model that is more supportive of the development of high performance homes with integrated management strategies from project conception to homeowner customer care (see graphic below from US DOE Building America).

For Local Government

Local governments provide critical resources and services to builders and communities related to code compliance, building permits and building safety. In addition, local government planning has an important role in ZNE success. The increase in energy efficiency code requirements and the outlook to ZNE code buildings increases the amount and complexity of the work that the local governments need to address and manage. The capabilities and funding for these activities vary greatly from one city or county to another. To help with meeting these needs and smoothing a potential barrier to ZNE, the Plan envisions a peer-to-peer Local Government Early Adopter program where leading government entities develop technical assistance programs directly related to ZNE and provide these early adopters with the tools to address ZNE homes.

Integrated Business Management Strategy

In order to successfully compete and develop high performance ZNE homes, production builders need to revamp their approach to projects by integrating each step in the process, breaking down silos and ensuring organizational coordination. By doing this they can achieve cost savings, higher performance and effectiveness.

Planning and Development	Product Design and Purchasing	Marketing and Home Sales	Home Construction	Customer
Company Analysis	Market/Consumer Research	Market/Consumer Research	Permits	Customer Relations/Communications
Market Evaluation	Initial Design	Marketing Plan/Positioning	Scheduling	Service Requests/Resolution
Vision/Program Definition	Value Engineering	Promotional Campaign	Contractor Relations	Customer Satisfaction Surveys
Land Acquisition, Development, and Construction	Budgeting/Development	Options and Upgrades	Home Construction	First-Year Warranty
Governmental Approvals	Final Design	Model Homes	Inspections	Ongoing Warranty
Financial Pro Forma	Specification	Sales Team Development	Customer Communications	
Team/Resource Coordination	Scopes of Work	Realtor Program/Relations	Closing/Home Handover	
	Bidding/Contracts	Sales/Design Center		
		Customer Financing		
		Customer Education/Communications		

Source: "Strategy Guideline: Partnering for High Performance Homes", DOE, 2013 pg. 7.



Sebastopol, CA has adopted Reach Codes for 2008 Standards. Photo Credit: enphase.com/eblog/2013/sebastopol-goes-solar-with-grid-alternatives/

Local Government Reach Codes/ Advance Codes/Local Ordinances

As outlined in Chapter 2, utilizing Reach Codes and Standards is important to moving the market towards higher energy efficiency and ZNE. Currently 45 different jurisdictions in California have Reach Codes that require varying levels of higher energy efficiency than the 2008 Standards.³⁴ This Action Plan invites leading cities and counties to adopt local ordinances to achieve higher performing homes and ZNE buildings sooner than 2020 through the Energy Commission's process. Rolling out ZNE level requirements will help to build the market, prepare builders and homeowners for a more widespread adoption of these standards and provide needed models for people to evaluate and better understand the value of ZNE. In addition, local governments may

choose to adopt other similar local ordinances such as GreenPoint Rated, LEED, CALGreen or others that support and move the municipality towards ZNE.

Demonstration Pilots



ABC Greenhome demonstration ZNE project developed with SCE. Photo Credit: ABCgreenhome.com

ZNE demonstration projects are already being actively developed in all utility regions. However, it is important to continue to encourage and expand the number of ZNE pilot homes to achieve several goals: increased awareness (Goal 1), hands on training (Goal 2), and testing and evaluation of tools and techniques (Goals 3 and 5). Most ZNE pilots today are focused on single-family homes, although some pilots include production builders and the use of technologies that are applicable at a subdivision level. This Action Plan anticipates the development of more custom single-family homes,

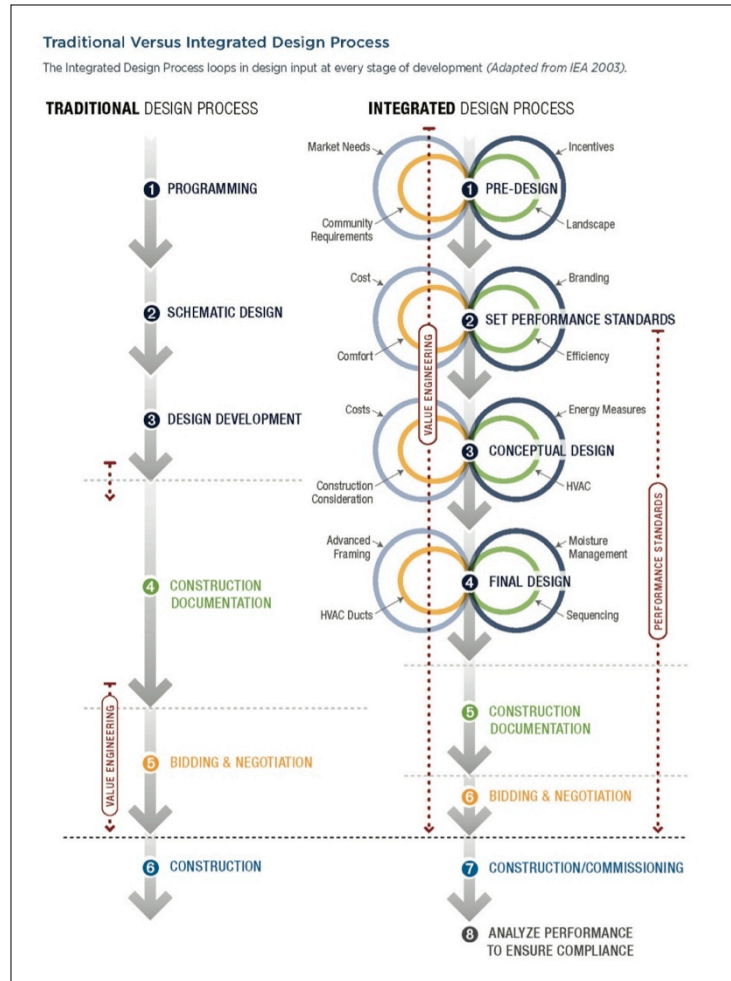
multifamily pilots, ZNE subdivisions and community-scale ZNE pilots, as well as demonstration pilots for community-scale renewable distributed generation and microgrids. These demonstration pilots are best done in partnership with industry with the purpose of building capacity for builders, helping to reduce startup costs and to establish a deeper understanding of best practices. Local governments will also be engaged in the effort.

³⁴ www.energy.ca.gov/title24/2008standards/ordinances/

Integrated Building Design

Effectively achieving ZNE for new construction requires new approaches to building design and construction to maximize efficiencies at each step in the process. Integrated design requires a commitment by the design and building team to a communication and planning process that bridges traditional silos between design professionals and the trades, and between trades. The Plan recognizes this approach as an important concept to further, influencing the Early Adopter Program, Education and Training, as well as future policy decisions. While the Plan does not mandate this approach, it is encouraged as a best practice.

A key idea behind integrated building design is that decisions about all building systems, including equipment selection, sizing, and installation are made as part of the planning process, not as afterthoughts in the field. The decisions are made with the help of analytical tools and the input of all relevant trades and professionals. Rather than a linear traditional process, the integrated process involves looping in ongoing input from relevant sources. As shown in the design process comparison figure to the right, a series of design loops exists for each step of the design process, separated by transitions (gray arrows) during which decisions are made about milestones.

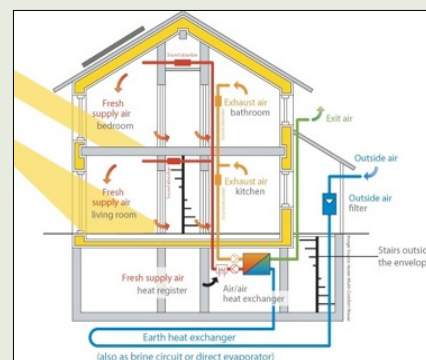


Source: DOE Building America Best Practices Series, September 2011

An Approach to Integrated Design: Passive Design Houses

(Source: www.passivehouse.us)

A Passive House, as defined by the Passive House Institute US, is a very well-insulated, virtually air-tight building that is primarily heated by passive solar gain and by internal gains from people and electrical equipment. Energy losses are minimized. Any remaining heat demand is provided by an extremely small source. Avoidance of heat gain through shading and window orientation also helps to limit any cooling load, which is similarly minimized. An energy recovery ventilator provides a constant, balanced fresh air supply. The result is a system that can save substantial space heating costs and provide good indoor air quality.



STRATEGIES AND METRICS

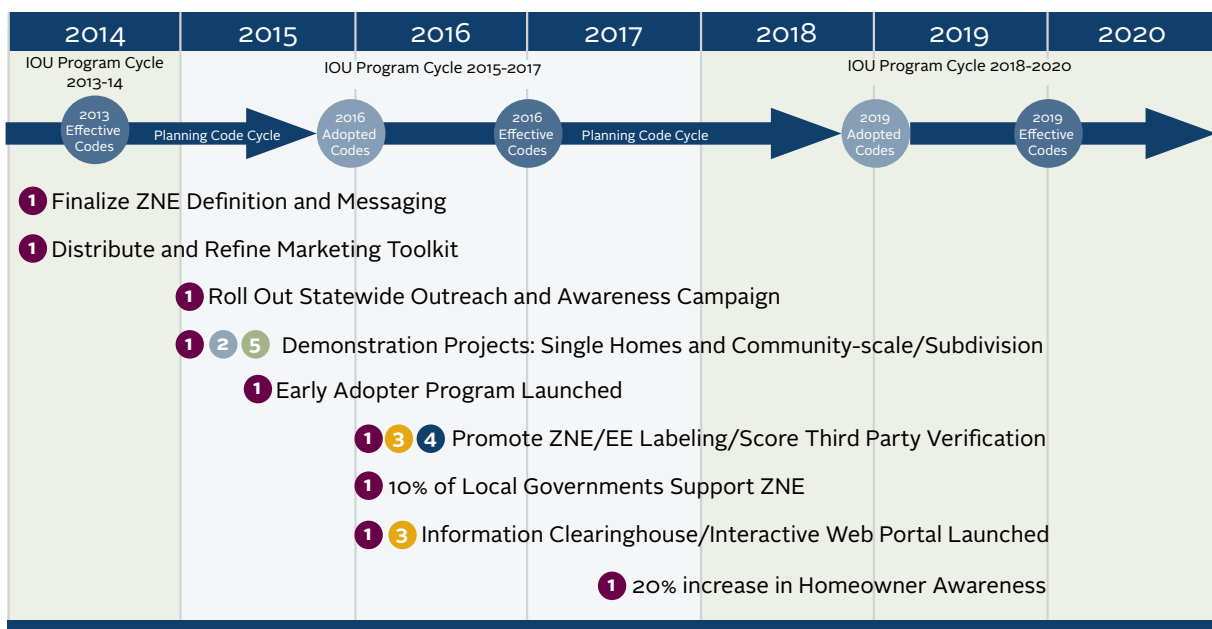
1 Goal 1. Demand and Awareness

Create deep awareness of the value and benefits of ZNE with homebuyers and builders to spur demand and drive broader industry involvement.

Goal Results

Builders and homeowners are inspired to voluntarily adopt ZNE through a market driven process starting in 2014 and increasing steadily until 2020.

Critical Path



Current Activities

- ✓ A ZNE Code Building definition was adopted in the 2013 Final IEPR Report.
- ✓ ZNE Marketing Toolkit: NBI is finalizing a ZNE Marketing Toolkit. Distribution to policy makers and market actors is on schedule for Q3 2014.
- ✓ PG&E is leading a Residential ZNE Market Characterization Study to be completed in 2014.
- ✓ Launch of preliminary planning website by CPUC in Q3 2013. www.CaliforniaZNEhomes.com

GREENPOINT RATED ZNE DESIGNATION

Beginning in January 2014, to coincide with the new California Codes, Build It Green will update its GreenPoint Rated New Building rating with a special "Zero Net Energy" designation. Two levels of ZNE are currently proposed:

- Near Zero at 80% offset of site energy use
- Net Zero 100% offset site energy use. To achieve 100% offset the home must be all electric.

The Title 24, Part 6 code must be met without use of PV in compliance software.

1 Goal 1. Demand and Awareness *Strategies*

Strategy	Metrics	Leads and Partners
1.1 Plan and launch comprehensive and targeted outreach and awareness building activities statewide and regionally 1.1.1 Agree upon a consistent, clear and simple layperson definition for ZNE to be used for messaging, promotion and education in conjunction with clarity in a technical “ZNE Code” definition 1.1.2 Develop clear, accurate and consistent sales and marketing tools for use by policy makers and all levels of the real estate, lending professionals, design, and construction industry	Funding is allocated for ZNE target awareness and outreach by first quarter of 2015 CPUC and Energy Commission adopt a ZNE Code definition by 2014 and market actors test messages for various levels of ZNE in 2015-2016 Expand messaging toolkit for residential and widely distribute to key market actors by early 2014	CPUC/Energy Commission/IOUs/Builders/Local Government CPUC/Energy Commission/market actors CPUC/NBI
1.2 Leverage community and civic leadership to build awareness and advocates for ZNE at the local, regional, and state level 1.2.1 Engage and educate Governor’s office and legislators about ZNE goals and benefits, potential barriers and need for state engagement	10% of local governments pass a resolution supporting ZNE goals by first quarter of 2016 Hold regular briefings with Governor’s office and interested legislators beginning in first quarter of 2015	SEEC, CBIA, local government, and other stakeholders ZNE stakeholders/ state and local agencies
★ 1.3 Integrate builder recognition program, promotions and marketing incentives into the Early Adopter Program 1.3.1 Ensure builders are consistently integrated into marketing efforts 1.3.2 Support Builder’s marketing efforts by providing them findings and research data regarding ZNE	Early Adopter Program includes incentives for marketing in 2015 and recognition program by end of 2015 Funding supports builder marketing efforts Provide Findings of the Market Characterization Study by early 2015 (or when complete)	IOUs/CPUC/builders IOU/CPUC/Builders IOU

Strategy	Metrics	Leads and Partners
★ 1.4 Promote the use of independent third party verification programs (labeling/score/certification) to help market, build awareness and promote ZNE homes	Adopt ZNE verification programs beginning in 2016 and ongoing	Voluntary building verification programs, Energy Commission, IOUs, builders, HERS whole house raters
1.5 Conduct baseline and regular awareness surveys and focus groups to ensure marketing efforts are targeted and achieve desired results	Establish baseline for homeowner awareness in 2015. Achieve 20% improvement in homeowner awareness by mid 2017 and additional 20% improvement in homeowner awareness by 2018	IOUs/CPUC
1.6 Explore instituting easy-to-understand, informational billing formats (online and mail) that help consumers understand their energy use and the difference between an energy cost and an utility or infrastructure cost to reduce confusion that ZNE does not mean zero bill	Proposals for new billing formats developed by 2017	ZNE stakeholders

ZNE Buildings Messaging Toolkit

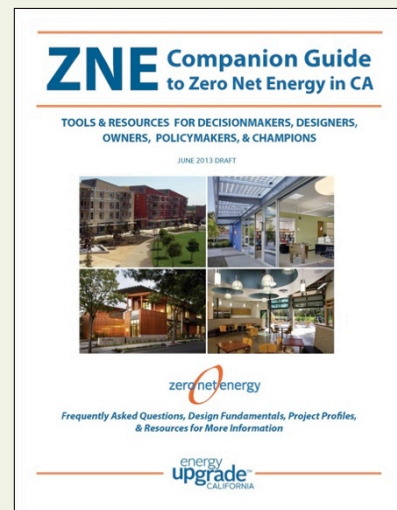
While supporting the CPUC's ZNE Commercial Building Action Plan, the New Buildings Institute (NBI) developed a suite of ZNE messaging materials. The materials were evaluated and tested for effectiveness in 2013. The target audience for these materials is commercial ZNE and policy makers, but the materials will be expanded to serve a larger audience including residential. The materials are designed to:

- Help address commonly asked questions
- Provide messages for consistent communications
- Support advocates in advancing the Path to Zero Campaign

Materials include:

- ZNE Messaging Platform
- ZNE Presentation Template
- ZNE Companion Guide
- ZNE FAQs for multiple audiences

The materials are available for download at <http://www.californiaznehomes.com>



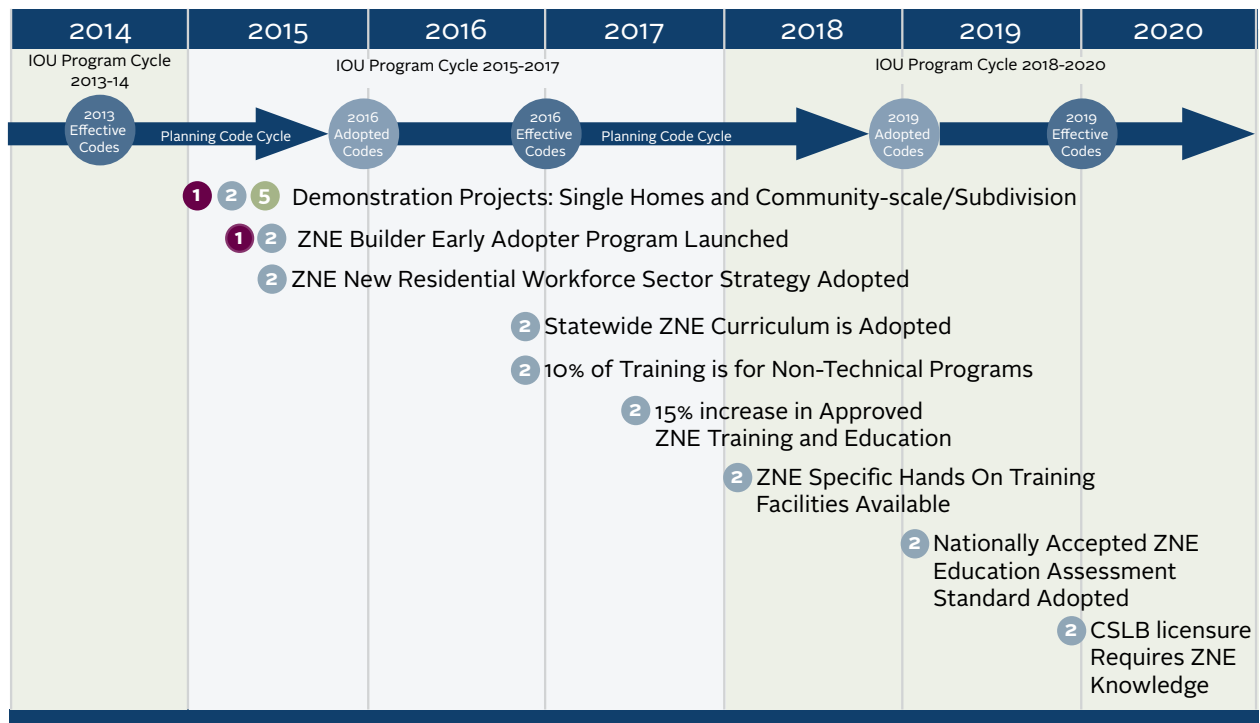
2 Goal 2. Technical Training and Education

Adopt a residential workforce sector strategy to increase participation in and improve the quality of education and training for industries related to planning, designing, constructing and developing ZNE homes.

Goal Result

Industry workforce and professionals (existing and entering) are equipped to create quality ZNE homes at a production scale starting in 2015 and increasing steadily to 2020.

Critical Path



Current Activities

- ✓ Pacific Gas & Electric (PG&E) has recently hired the Donald Vial Center for Employment in the Green Economy to complete a Workforce, Education, and Training (WE&T) study to help design a comprehensive approach to WE&T for energy efficiency in the utility portfolios. The project should be completed in late 2014.
- ✓ The Energy Commission and IOUs have updated Title 24, Part 6 Code Compliance training activities to train to 2013 Title 24, Part 6 levels and beyond
- ✓ IOUs are moving to improve coordination between New Construction, Codes and Standards, WE&T and Emerging Technologies programs to align them to achieve the ZNE 2020 goals.
- ✓ As part of their Residential and Commercial workforce sector strategies, the IOUs are developing priority occupations and technologies such as HVAC and lighting.
- ✓ Building America Task Force is currently evaluating higher education programs to assess existing and potential programs for high performance buildings.

2 Goal 2. Technical Training and Education *Strategies*

Strategy	Metrics	Leads and Partners
<p> 2.1 Develop new or coordinated curricula to support sector strategies and changing building codes, regulations, integrated design and business strategies and technologies for multiple audiences (i.e. architects, engineers, builders, inspectors)</p> <p>2.1.1 Mainstream home builders receive ZNE specific education and training to ensure quality and a robust industry</p> <p> 2.1.2 Building Inspectors/Plan Checkers, Home Real Estate Inspectors, Property Managers, HERS Raters and other relevant market actors receive ZNE specific training and education</p> <p>2.1.3 Develop standardized non-technical ZNE sales and general education training for multiple audiences to expand understanding of ZNE, green and high performing homes</p>	<p>A Statewide ZNE building curriculum is developed by the end of 2016; IOUs fully integrate ZNE training activities across programs</p> <p>CSLB licensure requirements demonstrate ZNE knowledge by 2020</p> <p>Renewal and new license/certification requirements demonstrate ZNE knowledge by 2020</p> <p>10% of all training and education dollars are spent on non-technical programs by 2017</p>	<p>IOU/CEC/CPUC/educational entities/CALBO/AIA</p> <p>CSLB/CPUC</p> <p>CEC/CalCERTS/CA Real Estate Inspection Assoc./CALBO/AIA</p> <p>IOUs/Third party providers</p>
<p> 2.2 Integrate training and education into the Early Adopter Program to build capabilities of medium and large builders</p> <p>2.2.1 Engage management of medium and large builders to participate in, commit to and support ZNE training for staff and subs</p> <p> 2.2.2 Encourage leading builders to partner with IOU Residential New Construction and Emerging Technologies Programs to trial and disseminate training on technologies and techniques anticipated to enter Title 24, Part 6 code</p>	<p>20 builders participate in IOU ZNE pilot and related training activities by mid-2015</p> <p>Top five production builders in five most populous regions participate in ZNE pilot training activities by 2015/2016</p> <p>Management commitment for Site Supervisor and Basic Management Training on ZNE buildings by two large builders, 20 medium firms, and 20 small firms by 2016</p> <p>Establish a minimum of five partnerships to pilot core and emerging ZNE technologies and techniques focused on supporting codes and standards in 2015</p>	<p>IOU/CPUC/CBIA/CBECC/training partners/HERS raters/CALBO/AIA</p> <p>CBIA/builders/AIA</p> <p>IOU Emerging technology, RNC and C&S programs, builders and researchers/CALBO/AIA</p>

Strategy	Metrics	Leads and Partners
★ 2.3 Create a Local Government (LG) Peer-to-Peer Early Adopter Program to provide support, training and assistance to Building Departments to effectively permit and inspect ZNE homes	RENS/LG 2015 Project Implementation plans (PIP) include technical support and training to local municipalities to support ZNE goals	Regional Energy Networks (REN)/Local Government/CALBO
2.4 Foster partnerships with education providers to expand opportunities, availability and dissemination of ZNE curriculum, education and training programs 2.4.1 Identify potential educational partners and foster mutually beneficial models for delivery of education and training programs 2.4.2 Motivate education providers to encourage and recruit new students to complete ZNE courses of study potentially leading to a formal certification program (technical, business, design et al) ★ 2.4.3 Develop hands on technical education and training facilities and demonstration projects that illustrate ZNE techniques, best practices and new technologies 2.4.4 Develop or expand training and certification courses for appraisers, real estate brokers and loan officers	Statewide ZNE curriculum is used by majority of education partners by 2018 Established partnerships with 10 to 20 third party education providers in 2016 Annual increase of 15% of those who complete approved education and training programs by 2017/18 ZNE specific training facilities are available in the five major regions in California by 2018 Representative trade organizations encourage ZNE training by 2016	WE&T, Trades, higher education, other 3rd party providers IOUs 3rd party education providers/Building America Teams IOU/3rd Party Providers Trade Organizations (i.e. CAR, NAA)
2.5 Align an existing or create a new evaluation and assessment process to monitor effectiveness of ZNE training and education programs (including IOU and other non-accredited third party training entities) 2.5.1 Encourage continuous improvement and creation of education and training programs to address evolving audience needs, best practices, new technologies, and new pedagogies	California establishes a nationally aligned education assessment standard and process for all relevant ZNE training programs by 2019	IOU WE&T, Trade Associations

Who do we need to train and educate?

To transform the market to support a robust ZNE housing market, a broad spectrum of individuals requires education and training, including online and hands on technical classes, 2-year certificate programs, and 4-year degree programs. The content of these programs will range from continuing education with specific technical elements and management to broader integrated business strategy and degrees for entering professionals. The following is a partial list of the key audiences that this Plan and Goal 2 addresses in the development of the Workforce Sector Strategy and other strategies identified above.

Trades (Builders, specialty contractors, technicians, site supervisors etc.)
Professionals (Architects, engineers, designers, land use planners)
Energy Consultants (HERS Raters)/CABEC members
Development (Developers, property owners and building firm CEOs and managers)
Property Management (Maintenance, facility managers, property managers)
Local Government (Building inspectors, QA/QC, code officials, plan checkers)
Real Estate Transaction (Real estate agents and brokers, appraisers, financial institutions, loan officers, loan underwriters)
Homeowners and tenants (for behavior and use of building/home)

IBEW/NECA Zero Net Energy Training Center – San Leandro, CA

Opened on May 30, 2013, the new training center will provide hands on training for ZNE technologies and techniques specifically for the electrical industry. The Zero Net Energy Center utilizes unique structures, environmental designs and technologies that dramatically lowers the building's energy consumption by 75 percent when compared to similar, traditional commercial structures. The ZNE Center's renewable energy systems – combining wind and solar PV generation – will produce enough energy to meet the energy consumed by the building. Energy produced equals energy consumed: a zero-net energy building.

www.znecenter.org



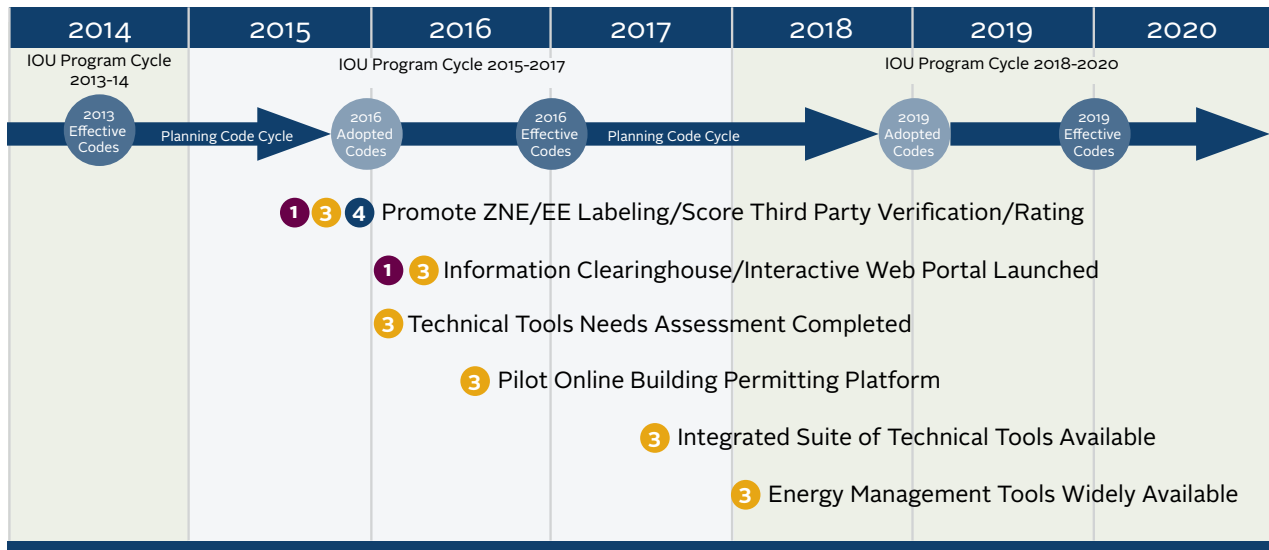
3 Goal 3. Technical Tools

Ensure availability, effectiveness, and efficiency of technical tools for designing, modeling, constructing, rating, and monitoring ZNE buildings.

Goal Result

By mid-2016, designers, builders and developers have access to an integrated suite of technical tools that facilitates their ability to bring ZNE homes to market successfully.

Critical Path



Current Activities

- ✓ SCE is leading the development of a ZNE Plug Load and MELs Study that will be completed in 2014.
- ✓ Energy Commission has developed a new code compliance simulation engine called the CBECC-Res³⁵ starting with the 2013 Standards. The engine will be the calculation basis for all code compliance software developed by third party vendors.
- ✓ The Energy Commission will be updating the California HERS rating system in connection with the AB 758 proceedings currently in progress.

³⁵ www.bwilcox.com/BEES/BEES.html

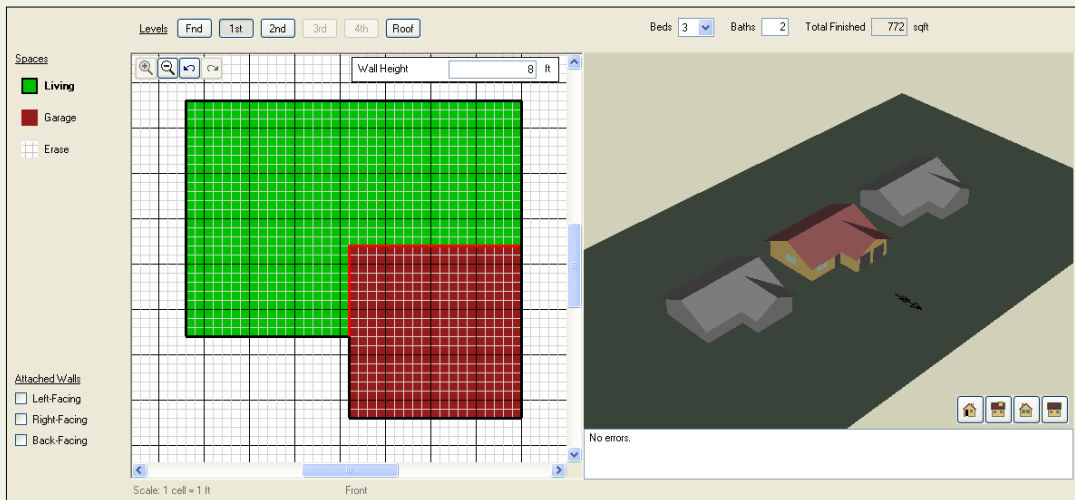
3 Goal 3. Technical Tools *Strategies*

Strategy	Metrics	Leads and Partners
3.1 Complete a needs assessment of existing software tools that identifies gaps, weaknesses and potential solutions to address ZNE needs 3.1.2 Conduct and integrate research on plug loads and MELS data that is California specific	Completed Technical Tools Needs Assessment by 2016 MELS research gaps are included in the needs assessment or separately addressed by 2015	IOU or Energy Commission study IOU, CalPlug
3.2 Develop ZNE modeling standards and criteria to enable consistent, market-driven development of integrated tools for ZNE residential projects 3.2.1 Ensure the software tools are user friendly and regularly updated 3.2.2 Encourage innovation in appliances, miscellaneous electric loads (MELS) and installation practices to improve efficiency and reduce renewable system requirements 3.2.3 Integrate data from emerging technologies research activities into ZNE tools development and evaluation approaches  3.2.4 Ensure that technical tools effectively support code compliance and are readily available to energy consultants and local jurisdictions	An integrated suite of ZNE tools are available to builders by 3rd quarter 2016 Software standards include user needs and update schedules Plug loads and MELS modeling are seamlessly integrated into software and calculations for ZNE homes Emerging Technologies groups develop systems to regularly incorporate new data and technologies into ZNE tools and evaluation approaches Code compliance software is integrated in all technical tools	Energy Commission/IOU ETP and C&S Programs /CalPlug Manufacturers, CalPlug ETCC/ IOU Emerging Technologies programs / EPIC research Energy Commission/IOU C&S/ Local Government
3.3 Support development of energy management tools to support end user feedback and monitoring of ZNE home performance 3.3.1 Research and create a standardized communications protocol for energy management tool(s) 3.3.2 Create companion tools designed for multifamily energy management	End user energy management tools are widely available and installed in new homes by 2018 Communication protocol standards are adopted by 2017 Communication protocol standards are adopted by 2017	Energy Commission/ private market / CPUC / IOUs / builders

Strategy	Metrics	Leads and Partners
3.4 Leverage industry knowledge and expertise by creating a collaborative web portal that acts as a clearinghouse of ZNE concepts, technologies, and best practices 3.4.1 Develop prototypical ZNE technology application guidelines and menus that illustrate multiple approaches to achieve ZNE	Fund, launch and utilize an online data sharing portal by 2016 ZNE technology application guidelines and menus are available to builders by 2015	CPUC/CEC CEC / IOUs/ CPUC/CBIA/ CalPlug
★ 3.5 Develop technical tools that support California ZNE home efficiency labeling/rating system(s)	Energy modeling standards and tools that support California ZNE building rating and labeling	CEC/Stakeholders/ RESNET
🚩 3.6 Pilot and develop efficient and effective online permitting platform for increasing code compliance	Online permitting is available in Early Adopter jurisdictions in mid-2016	Local Governments/RENS

BEopt Modeling Tool

The National Renewable Energy Laboratory (NREL) has developed a building optimization (BEopt) platform to evaluate residential building designs and identify cost-optimal energy efficiency packages at various levels of whole-house energy savings along the path to zero net energy. The tool allows builders and designers to evaluate the cost of various energy efficiency scenarios along with demand response and on-site solar generation, based on cost functions. The tool is available for free download at beopt.nrel.gov.



Screen shot of BEopt Tool. Source: beopt.nrel.gov

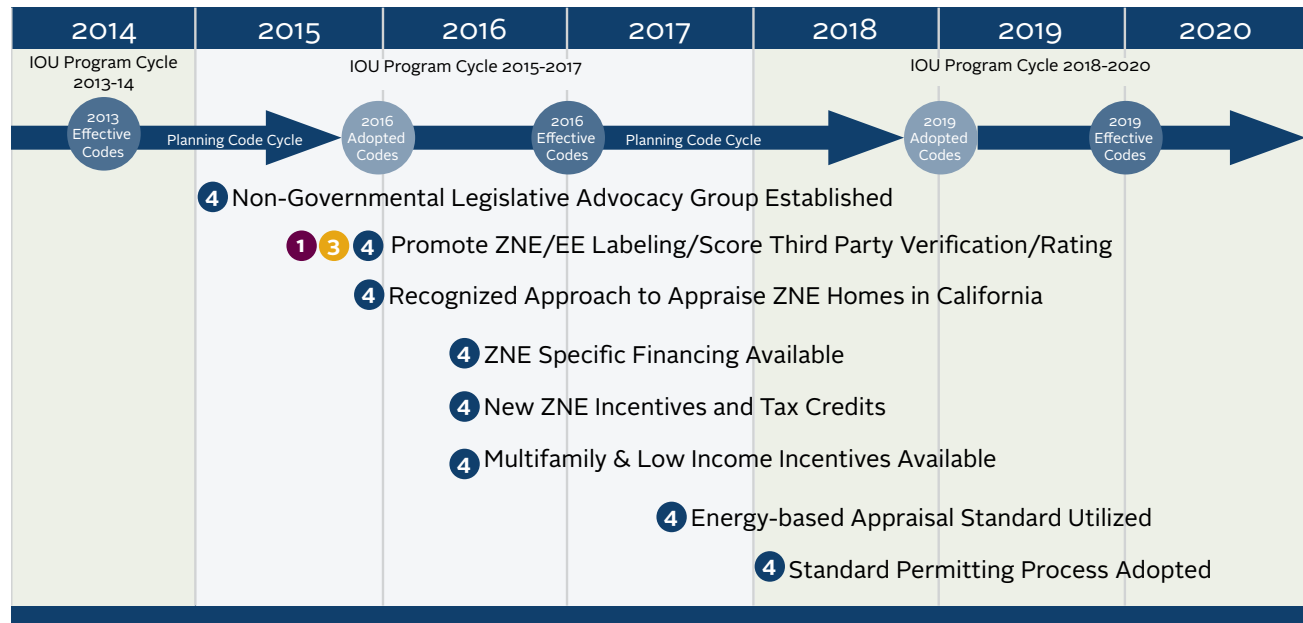
4 Goal 4. Financing, Affordability and Value of ZNE

Develop specific approaches and standards to quantify the value of ZNE homes, support a robust financing market and ensure that ZNE homes are affordable.

Goal Result

By 2017, create a systematic way to value ZNE homes to enable underwriters, appraisers and financial institutions to support financing and a strong and affordable ZNE housing market.

Critical Path



Current Activities

- ✓ SAVE Act: Proposed federal legislation that incorporates the value of utility costs in mortgage calculations
- ✓ CPUC adopted \$65 million in new, reduced cost energy efficiency financing pilots in Fall 2013
- ✓ Finance pilots supported by CPUC allow up to 30% non-energy efficiency (e.g. solar) lending with credit support
- ✓ Umpqua and other new home lenders promote use of energy efficient mortgages that support financing of advanced efficiency features and renewables
- ✓ New Solar Homes Partnership (NSHP) incentives for PV on new homes supporting 16% of new homes market including rooftop solar in 2013³⁶
- ✓ Widespread use of solar leasing options in the new home construction market and solar as a standard feature in several new home models
- ✓ Federal Solar Investment Tax Credit available to end of 2016 that offsets up to 30% cost of solar; declines to 10% in 2017.
- ✓ Range of existing IOU incentive programs, including development of an updated California Advanced Homes Program (CAHP) and ZNE technical assistance programs

³⁶ Matt Brost, SunPower, personal contact, CEC ZNE IEPR Workshop, July 17, 2013.

4 Goal 4. Financing, Affordability and Value of ZNE Strategies

Strategy	Metrics	Leads and Partners
4.1 Facilitate development of a national ZNE appraisal standard applicable in California <p>4.1.1 Develop a recommended approach to appraising ZNE and near-ZNE homes in California by working with key statewide and national organizations and stakeholders (potentially consider pilot appraisal program)</p> <p>4.1.2 Explore legislation in California that provides a multi-tier approach to appraising ZNE and near-ZNE homes</p> <p>4.1.3 Link with legislation (i.e. SAVE Act) to incorporate utility costs and value of energy efficient improvements into home valuations and mortgage calculations</p>	<p>California mortgage institutions accept energy-based appraisal standard by mid-2017</p> <p>Recognized path and steps to appraise ZNE homes in California that can influence a national standard by late-2015</p> <p>Established group of interested stakeholders engaging in formal legislative advocacy by 2015</p> <p>Established group of interested stakeholders engaging in formal legislative advocacy by 2015</p>	<p>Local Government/ Building Industry/ CAR/NAA/CBIA</p> <p>Local Government/ Building Industry/ CAR/NAA/ CBIA/IOUs/CPUC/ Energy Commission</p> <p>CBIA/LGC</p> <p>CBIA/LGC</p>
<p>★ 4.2 Establish and update statewide third party verification/rating program (label/score etc.) to quantify the value of ZNE and facilitate appraisals and lending</p> <p>★ 4.2.1 Utilize demonstration, pilot and early adopter programs to test and refine third party verification/rating program and quantify ZNE benefits and home resale value</p> <p>4.2.2 Evaluate ZNE home's ability to meet performance expectations and to provide inherent value to the marketplace</p>	<p>Third-party verification/rating programs are adopted for use for ZNE in 2015</p> <p>An increasing number of ZNE (or near ZNE) demonstration homes are developed and verified annually between 2014-2020</p> <p>Third party verification/rating programs are available to evaluate ZNE homes in 2015</p>	<p>CEC/ CPUC/Voluntary building verification programs</p> <p>IOUs/voluntary building verification programs/builders/ real estate industry</p> <p>CEC/Voluntary building verification programs / IOUs/builders</p>
<p>4.3 Leverage existing financing products (EE, PV etc.) and develop new ones to expand the financing options for ZNE homes (including multifamily and renters)</p> <p>4.3.1 Work with State, Federal, and financial institutions to identify innovative ways to finance ZNE improvements (i.e. offset tax incentives, credits for Prop. 13, direct to consumer tax credits)</p>	<p>ZNE specific financing products are widely available covering both energy efficiency and renewables by mid-2016</p> <p>New ZNE financial mechanisms and tax credits are available for homeowners and builders by 2016</p>	<p>Financial Institutions/builders/ solar installers</p> <p>Franchise Tax Board/ Legislature/local governments/builders/ ZNE stakeholders</p>



Strategy	Metrics	Leads and Partners
<p>4.3.2 Work closely with IOUs and the State to support and augment existing programs to provide robust incentives to the ZNE industry</p> <p>4.3.3 Identify and foster development of non-financial incentives to support integration of renewables and ZNE buildings (i.e. technical assistance, streamlined building permits, turnkey programs)</p>	<p>NSHP, RNC, CAHP and other similar ZNE incentives are available to and utilized by builders (ongoing)</p> <p>Supportive non-financial incentives are provided to production builders by 2018</p>	<p>IOU/Energy Commission/CPUC/builders/solar installers</p> <p>Local governments/IOU local government programs/builders/CA LBO</p>
<p>4.4 Continue and grow incentive program(s) that encourages builders and homeowners to develop high performing, ZNE and near-ZNE homes</p> <p>4.4.1 Implement moderate and low income ZNE incentive programs to inspire a range of housing types and market availability</p>	<p>IOU Residential New Construction incentive program is available for mainstream development of ZNE homes by mid-2016</p> <p>RNC program incentivizes ZNE moderate and low income housing developments, including multifamily, by mid-2016</p>	<p>IOUs/CPUC</p> <p>IOU/CPUC/affordable housing experts</p>
<p>4.5 Integrate financing incentives and non-financial tools (i.e. technical assistance, streamlined process) into Early Adopter Program</p>	<p>Secure 20 builder commitments to participate in ZNE early adopter pilot project by 2015</p> <p>Top 5 production builders in 5 regions participate in ZNE pilot program by early 2016</p>	<p>POU/IOU/CPUC/SMUD</p>

Zero Net Energy Home Tax Credits – A “Best Practice” for California to Monitor?

The Colorado Energy Saving Mortgage Program, signed into law on May 28, 2013, allows a homebuyer purchasing a new or renovated ZNE home (HERS 0 rating, RESNET scale) to be eligible for an \$8,000 reduction on the total cost of their home mortgage. A new or renovated home that has a HERS rating greater than HERS 0 but less than HERS 50 (50% energy reduction), will also receive a mortgage reduction incentive. Homebuyers benefit as well from lower monthly energy bills *[some fees will likely be charged for utility service separate from energy costs]*, which can be used to offset cost increase on a ZNE home. Colorado Senator Gail Schwartz noted that, “the program has great support from the construction and financial sectors.”

Assemblywoman Barbara Lipton introduced a ZNE Tax Credit Bill in the New York Assembly on May 17th, proposing up to \$10,000 in credits for ZNE homes purchases. New Mexico passed a similar Sustainability Tax Credit Bill earlier in 2013.

Source: Architecture 2030 E-News Special Bulletin June 13, 2013, and 2030 Palette (©2011 2030, Inc.) (www.2030palette.com)

Typical Home 2,200 square feet	ZNE Home 2,200 square feet
	
Cost = \$250,000	Cost = \$280,000 Mortgage Incentive = \$8,000
Down Payment (10%) = \$25,000 Mortgage Amount = \$225,000	Down Payment (10%) = \$27,200 Mortgage Amount = \$244,800
Monthly Payment \$1,074.18 \$154.00 energy bill	Monthly Payment \$1,168.71 \$0.00 energy bill
\$1,228.18 total cost/month	\$1,168.71 total cost/month

Source: Architecture 2030

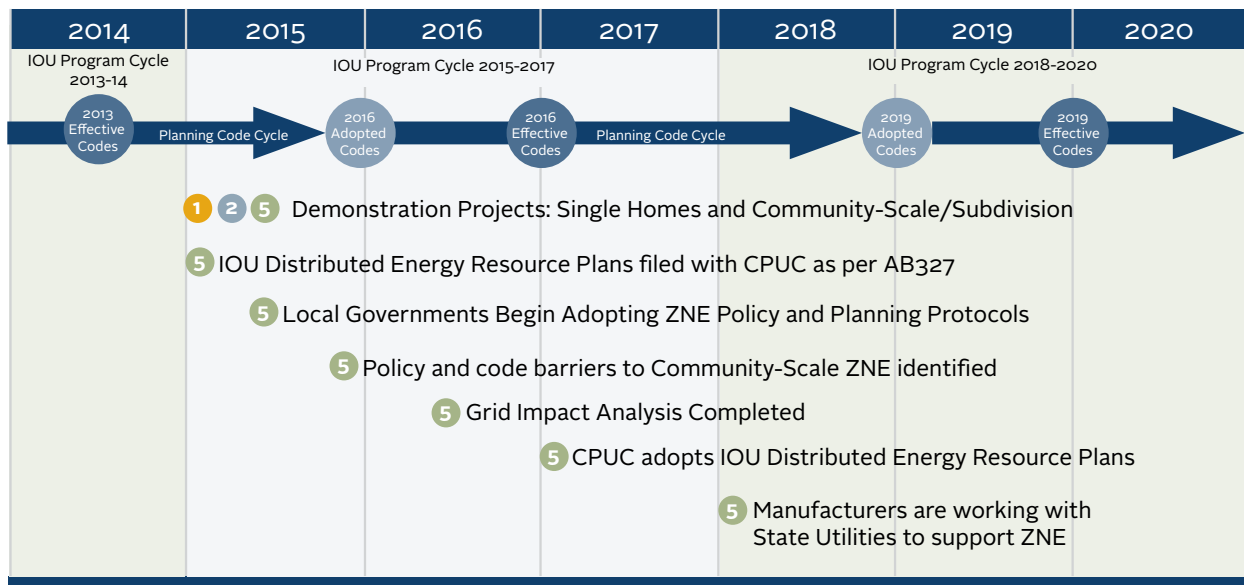
5 Goal 5. Future Infrastructure

Drive future grid infrastructure and technological improvements to support State distributed generation goals and a ZNE Building Future.

Goal Results

By 2017, investor owned utility distribution resource plans to evaluate locational benefits and costs of distribution resources (i.e., distributed renewable energy, energy efficiency, energy storage, electric vehicles and demand response technologies) are adopted, as directed in Assembly Bill 327. These plans support the goal that ZNE buildings connect and integrate with the grid effectively.

Critical Path

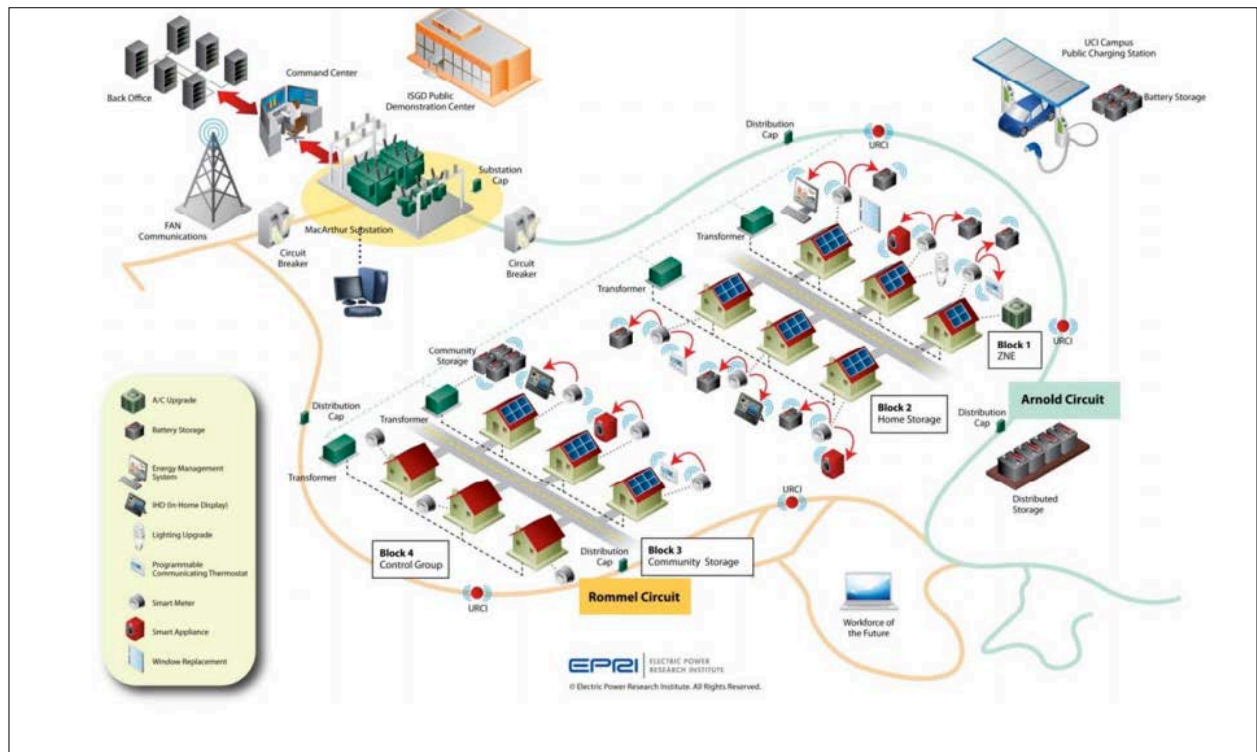


Current Activities

- ✓ California Solar Initiative (CSI) Research, Development, Demonstration and Deployment (RDD&D) grants targeting renewables grid interconnection and ZNE community demonstration projects
- ✓ Ongoing California Solar Initiative Measurement & Evaluation research projects such as biennial impact evaluations, biennial grid impact studies, cost effectiveness analyses, market transformation studies, and a statewide distributed generation integration study
- ✓ EPIC grants target renewables grid interconnection, ZNE communities research
- ✓ CPUC considering additional changes to "Rule 21," which contains rules governing renewables interconnection to the grid
- ✓ AB 327 preserves current Net Metering rules through 2016 (or until the net metering cap is reached), and thereafter gives the CPUC authority to establish new tariffs or charges to replace

current rules and meet new statutory goals, and requires the IOUs to submit a plan to support the deployment of distributed energy resources by 2015³⁷

- ✓ Comprehensive examination of IOU residential rate structures and other issues under CPUC Rulemaking 12-06-013³⁸
- ✓ SCE \$80 million DOE funded, Irvine Smart Grid Demonstration Pilot³⁹ is evaluating the interplay between solar, energy-smart homes and grid management (see graphic below)
- ✓ SDG&E's Borrego Springs pilot scale demonstration to prove effectiveness of microgrid to improve grid stability and maintain control in normal and outage conditions, funded by both DOE and the Energy Commission⁴⁰



Irvine Smart Grid Demonstration Pilot (ISGP). Source: Graphic SCE Presentation, 6/8/2012

³⁷ California AB327 (Perea), "Electricity: natural gas: rates: net energy metering: California Renewables Portfolio Standard Program."


³⁸ CPUC R.12-06-013, Order Instituting Rulemaking on Commission's Own Motion to Conduct a Comprehensive Examination of Investor Owned Electric Utilities' Residential Rate Structures, the Transition to Time Varying and Dynamic Rates, and Other Statutory Obligations.

³⁹ <http://www.greentechmedia.com/articles/read/southern-california-edisons-smart-grid-roadmap>, March 22, 2013.

⁴⁰ http://energy.gov/sites/prod/files/30_SDGE_Borrego_Springs_Microgrid.pdf

5 Goal 5. Future Infrastructure *Strategies*

Strategy	Metrics	Leads and Partners
5.1 Develop and adopt utility distribution resources plans per AB327 that evaluate locational benefits and costs of distribution resources (i.e., distributed renewable energy, energy efficiency, energy storage, electric vehicles and demand response technologies)	IOU proposals filed in 2015 address: standard tariffs and contracts; means to cost-effectively coordinate existing CPUC programs; identify additional utility spending necessary to integrate distributed resources; and, identify barriers to deployment, including but not limited to safety standards and operational reliability. CPUC adopts plans by 2017	IOUs/ CPUC
5.2 Research and build data on the impact of energy production and demand response related to ZNE buildings on electric grid and gas distribution systems' stability and effectiveness 5.2.1 Incorporate impacts of MELS, electric vehicles and other existing and emerging ZNE system technologies in research 5.2.2 Evaluate policy needs related to distributed storage 5.2.3 Assess existing micro-grid and community scale-ZNE projects 5.2.4 Update Grid Analysis annually and ensure ongoing coordination with other complimentary grid/distributed generation research efforts	As part of the AB327 IOU submission requirements, include the impact of ZNE in the plan for distributed energy resources by 2015 General Rate Cases and other ratepayer investment plans advance objectives set forth in AB327 distributed energy resources (DER) plans Grid Analysis impacts and recommendations are consistently incorporated into EPIC, CSI and IEPR planning	IOUs/CPUC CA research universities CEC/CPUC EPIC Program/CSI RD&D/National Lab/CAISO CEC/CPUC
★ 5.3 Develop pilot projects to study innovative and scalable approaches utilizing community-scale ZNE renewables and micro-grids 5.3.1 Ensure adequate funding sources for private sector pilots as well as EPIC, IOU ZNE or RNC, NSHP, CSI RDD&D and other new construction programs to support robust pilots and demonstration projects	Initiation of subdivision/ community-scale ZNE and micro-grid demonstration project(s) by 2016 to evaluate site, community-scale and demand-side approaches to achieving ZNE and potential impacts on the grid, cost structures, and market	IOUs/ CEC/ CPUC/CAISO

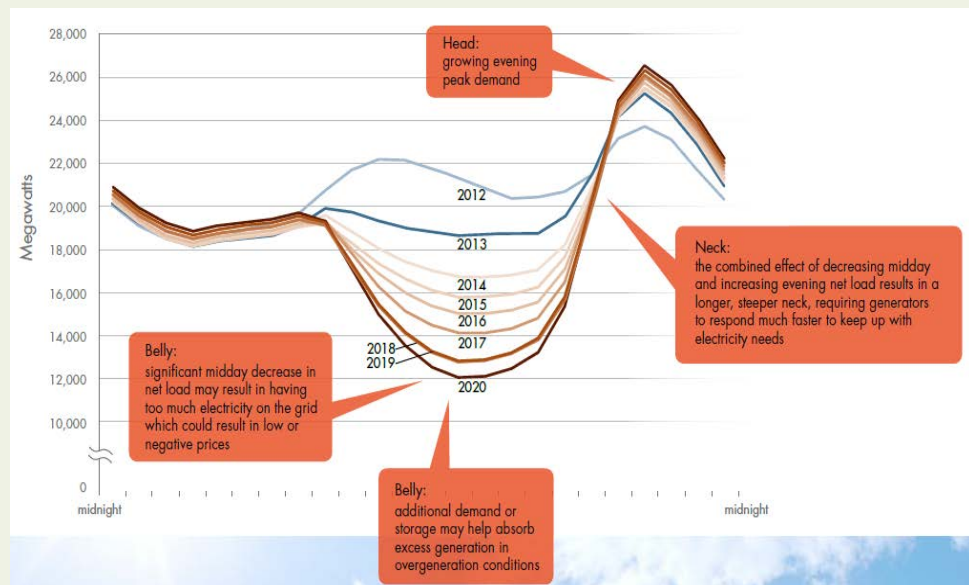
Strategy	Metrics	Leads and Partners
5.3.2 Monitor and evaluate the results of existing community-scale ZNE and micro-grid and future demonstration and pilots		
 5.4 Identify potential policy and code barriers to community-scale ZNE and develop strategy to garner state support 5.4.1 Work with local government planning, urban design, and zoning to ensure that multiple approaches to ZNE are allowed (i.e. site or community-scale)	Barriers identified by late-2015 Local governments adopt policies and planning protocols to support and encourage ZNE goals beginning by mid- 2015	ZNE stakeholders/IOU SEEC/Local Government
5.5 Work with the Emerging Technology Coordinating Council and manufacturers to influence equipment supply chains central to ZNE goals, including consumer electronics and other appliances.	Manufacturers are engaged with California utilities and agencies to develop cost effective products that support ZNE policies by 2018	ETCC/SMUD/CEC/IOUs/CPUC

CAISO Strategic Plan for the Grid Integration of Renewables

The California Independent System Operator (ISO) 2014-2016 Strategic Plan identifies its two top strategies as: 1) transition to renewable energy, demand response and energy efficiency; and 2) reliably managing the grid and maximizing flexibility in operations.

The graphic to the right illustrates the challenges these strategies address and the changing profile of California's electric system with increasing distributed and utility scale renewable generation.

www.caiso.com/Documents/Decision-2014-2016StrategicPlan-Sep2013.pdf



Source: CAISO 2014-2016 Strategic Plan, September 2013

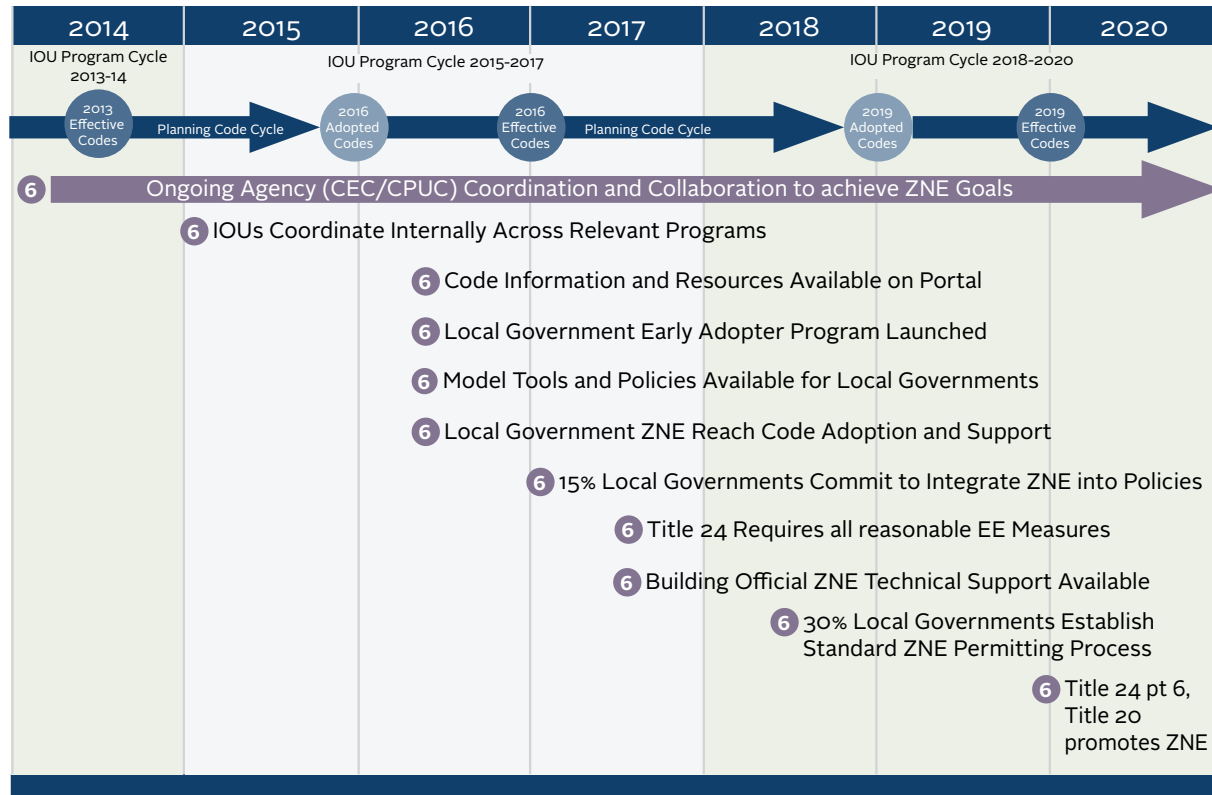
6 Goal 6. Alignment

Align the development and implementation of regulations, policies, plans, incentives and codes related to ZNE buildings.

Goal Results

By 2015, California has a consistent, integrated and clear ZNE policy framework (regulations, incentives and codes) due to continuous multi-agency coordination and collaboration efforts.




Critical Path



Current Activities

- ✓ Energy Commission development of AB 758 Action Plan outlining a comprehensive retrofit program for all existing residential and commercial buildings
- ✓ Integrated Energy Policy Report, defining ZNE Code Buildings (released January 2014)
- ✓ Energy Upgrade California Implementation and Brand Expansion
- ✓ Ongoing Energy Commission and CPUC Commissioner and management level coordination meetings

6 Goal 6. Alignment *Strategies*

Strategy	Metrics	Leads and Partners
6.1 Ensure ongoing Energy Commission/CPUC/IOU collaboration and that utility programs and incentives complement the development and enforcement of state building energy codes 6.1.1 Create forum for an enduring cross-cutting coordination effort for ongoing ZNE discussions 6.1.2 Engage relevant agencies to help share understanding of the goals for ZNE and how their agency fits into delivering on that goal 6.1.3 Align relevant utility programs to remove barriers and advance ZNE goals	Regular Energy Commission and CPUC management and Commissioner communications, beginning in 2014 Regular briefings, either in person or through other communication channels are made to partner agencies on a regular basis beginning in 2014 Internal IOU coordination across C&S, ET, DG, RNC and W&ET programs beginning in 2014	CEC/ CPUC/ IOUs/ POU/CAISO
6.2 Adopt statewide policies towards an achievable path to ZNE  6.2.1 Develop 2016 and 2019 Title 24, Part 6 Building Energy Efficiency Standards that move closer to ZNE  6.2.2 Align and continue Title 20 updates to improve appliance and equipment standards to support ZNE goals	Title 24, Part 6 building codes achieves ZNE residential buildings by 2020 Updated 2016 and 2019 Title 24, Part 6 Building Energy Efficiency Standards become effective in 2017 and 2020 respectively Title 20 efficiency standards adopted as planned by 2020 (see page 21 table)	CEC/ CPUC/IOUs/POUs/CASIO Local Governments/ CEC CEC/ ZNE stakeholders/IOUs
 6.3 Launch Local Government Early Adopter Program and support Local Governments to create statewide, streamlined, transparent and consistent process for policies, plans and procedures impacting ZNE development 6.3.1 Invite and support CALBO and local jurisdictions to develop consistent and transparent permitting standards, inspection procedures and approvals for use statewide	Early Adopter Program for Local Government is available in 2016 and 15% of Local Governments adopt a commitment to integrate ZNE into planning and regulations by mid-2016 30% of Local Governments establish a standard permitting process for ZNE buildings by mid-2018	RENS/SEEC/CEC/IOUs/ CPUC/CALBO RENS/Local Government/CALBO

Strategy	Metrics	Leads and Partners
<p>★ 6.3.2 Provide tools and model policies (climate action plans, reach codes, housing planning and municipal ZNE policies) to support local jurisdictions to adopt ZNE-related policies such as density bonuses, expedited permitting, etc.</p> <p>🏠 6.3.3 Encourage and assist Local Governments to establish consistent, cross-jurisdictional application of all building codes and compliance, including reach and green building codes, and distributed renewable generation permitting practices</p>	<p>Set of tools and model policies are made available to Local Governments by mid-2016</p> <p>Key agencies and local governments begin coordination towards this goal by mid-2016, building on and modifying model policies as needed</p>	<p>REN/Local Government</p> <p>RENs/SEEC?CEC/IOUs, CPUC/CALBO/others</p>
<p>🏠 6.4 Expand communication methods and timeliness regarding code cycle, milestones and expectations to allow the market to prepare for changes</p> <p>6.4.1 Provide technical support to building departments regarding existing and emerging energy efficiency technologies and renewables in new homes</p>	<p>Code information and resources are available on the statewide online portal by 2016</p> <p>ZNE related technical assistance is available to highly engaged** local governments by 2017 and more broadly by 2019</p>	<p>CEC/ IOUs/Local Governments</p> <p>IOU/REN/CEC/Local Governments/CPUC <i>** Refers to local governments with funded energy efficiency programs and/or active RENs</i></p>



Photo credit: dispatch.com

City of Lancaster, California is the First City to Require Solar

Beginning in 2014, the City of Lancaster will require all new residential construction projects to include solar power. The City's Mayor Rex Parris is interested in making Lancaster "the solar capital of the universe." The city council unanimously passed the ordinance as part of the City's zoning code Residential Zones Update in March 2013. The new code requires that new homes meet a minimum solar power requirement similar to how new homes must meet other requirements such as parking.

Lancaster has a population of 150,000 and in recent years built about 200 new homes annually. Mayor Parris's vision extends beyond homes. He is moving to make solar standard on all municipal buildings and schools in the city. More information on the City's website: www.cityoflanasterca.org



Photo Credit:
livinginurbansac.blogspot.com/2012_08_01_archive.html

CHAPTER 4. MULTIFAMILY

INTRODUCTION

This Action Plan focuses on single family and low-rise multifamily housing (3 stories or lower). The low-rise divide is a reflection of how the building energy standards address multifamily and attached housing under Title 24, Part 6. Due to a number of unique needs and attributes of the multifamily housing market, this chapter focuses on strategies particular to multifamily that are not covered in Chapter 3.

The low-rise multifamily sector presents both opportunities and challenges in achieving ZNE.

Approximately one-third of housing in California is estimated to be multifamily households. However, over the last decade, the proportion of multifamily housing has been increasing with new multifamily permits representing over 50% of all permits in 2012.⁴¹ This trend may slow down as single-family housing starts increase. However, multifamily starts are expected to remain a significant portion of new construction due to increasing demand, needs for higher building densities, and requirements for affordable housing.

Multiple types

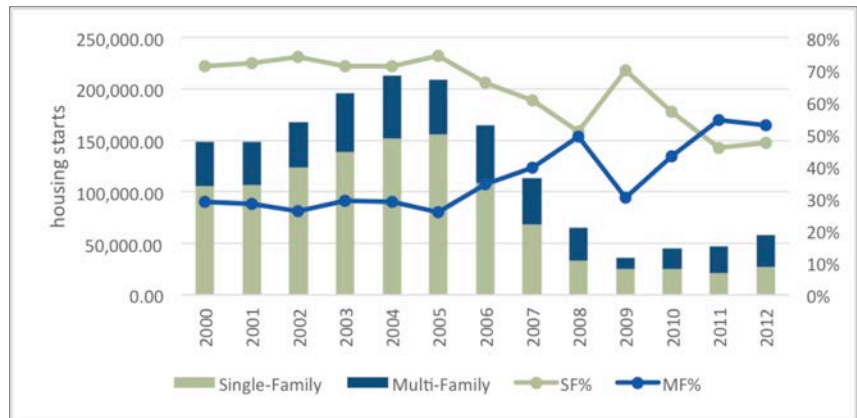
Multifamily housing has many sub-types that make it more challenging to address as a single sector with regard to new policies, building standards and ZNE programs. Multifamily includes some of the following common configurations:

Apartments, condominiums
Mixed-use
Special needs
Co-op housing

Garden-style attached units
Senior housing/Assisted living
Single room occupancy
Dormitories

Each type has different occupancy and is nuanced with energy use intensities that are specific to the type and cannot always be generalized in a single category of low-rise multifamily housing. In addition, over 50% of multifamily housing is located in high-density urban areas with smaller rooftops and smaller unit

Single-Family and Multifamily Housing Starts (# Households) in California



Source: California Department of Finance>California Construction Data
http://www.dof.ca.gov/html/fs_data/latestsecondata/FS_Construction.htm

⁴¹ Based on data from Dept. of Finance http://www.dof.ca.gov/html/fs_data/latestsecondata/FS_Construction.htm

sizes. This configuration can limit solar access and potential for on-site energy generation, as well as imply higher energy use intensity on a per-square-foot occupied area basis.

Affordable Housing

Policymakers and advocates call housing “affordable” when a household pays no more than 30% of its total income for housing costs (rent or mortgage payment and utilities). While similar in most other aspects to market rate housing, affordable housing financing mechanisms are different and the developers have more stringent requirements to get loans and make investments in high-energy performance buildings.

Multiple Market Actors

Another challenge to the multifamily market sector is the multitude of market actors associated with the process. Below is a partial list of parties that could be involved with the development of a new multifamily building:

- Decision Makers
 - Developers
 - Property Owners
 - Facility Managers/Property Managers
- Financiers/Funders - Multiple funding sources common in affordable housing
 - California Tax Credit Allocation Committee (CTCAC)
 - U.S. Department of Housing and Urban Development (HUD)
 - United States Department of Agriculture’s Rural Development Program
 - California State Treasurer’s Department
 - Local Government loans and grants
- Appraisers and Market Study Analysts
- Design and Inspection Teams
 - Mechanical, Electrical and Plumbing Engineers
 - Architects
 - Energy Consultants
 - HERS Raters - Consistent group serves both single and multifamily
- Occupants
 - Renters
 - Owners

Technical Feasibility

The per-square-foot energy usage in multifamily housing is much higher when compared to single-family homes, but total energy use is less per household and less per person. According to PG&E's 2012 study "The Technical Feasibility of Zero Energy Buildings in California," the low-rise multifamily sector can more readily technically achieve ZNE by 2020 as compared to high-rise. Some of the key measures that were used in the study to prove the technical feasibility of ZNE in low-rise multifamily include:

- high level of ceiling insulation (up to R 60);
- reduced building infiltration (1.8 SLA or 3.15 ACH);
- improved windows; cool roofs;
- high efficacy LED lighting and vacancy controls; reduced plug loads;
- ducts in conditioned space;
- high efficacy 2-speed AC; additional thermal mass;
- integrated ventilation cooling;
- rooftop solar; and
- condensing space and water heating with drain water heat recovery.

The majority of multifamily housing is located in the cooler coastal climate zones of California. This presents the opportunity to develop more ZNE projects due to the relatively mild climates and low energy use for heating and limited need for cooling.⁴²

Technical Feasibility Summary										TDV\$/ft ² (30 yr)	
Percent of 2020 New Build		15: Palm Springs			12: Sacramento			3: Oakland			
		Load:	Solar:	Net:	Load:	Solar:	Net:	Load:	Solar:	Net:	
Single Family Home	47%	12	-12	0	10	-10	0	8	-8	0	
Multi-family Low-rise	8.5%	20	-20	0	15	-15	0	14	-14	0	
Multi-family High-rise	3%	30	-11	19	23	-11	12	17	-12	5	

Source: "The Technical Feasibility of Zero Energy Buildings in California", 2012.

⁴² "Residential New Construction Program: Impact Evaluation, 2006-2008", KEMA, 2/8/2010, p. 4-21.

MULTIFAMILY POLICY CONTEXT

Financing Affordable Multifamily Housing

Multifamily housing plays an important role in providing affordable housing options to Californians. However, changes in Federal affordable housing policies and increases in market demand for transit-friendly, high density housing is reducing the availability of those units.

Availability of viable financing tools and resources will be critical to increase and maintain an appropriate level of affordable multifamily units.

An important aspect of energy use in multifamily is that the end users are tenants, who often pay the utility costs, but who are usually not the owners of the high energy use appliances installed in the home, such as refrigerators, washers, and dryers along with heating and cooling. Hence the providers of energy-efficient technologies (property owners) are usually disconnected from directly reaping the cash flow benefits derived from low utility costs. Financing mechanisms and rent regulations will need to consider this and provide the appropriate motivation to investors.

Lenders, appraisers, and financiers of affordable housing will need market comparison data along with utility cost data to appropriately value energy efficiency and on-site renewable generation. Market comparison studies and asset ratings that include energy use data associated with energy efficiency features and solar will allow for factoring in the higher rent potential of a property and positively impact the level of financing available.

A separate renter-targeted rating could serve as a mechanism to provide return on investment made by the landlords towards improved energy efficiency and onsite generation in the form of higher rents and less turnover. The renter-targeted rating based on reduced energy costs and higher comfort could attract renters and make the properties higher value rentals. It also has the potential for lowering renter turnover due to higher level of satisfaction, which in turn avoids operating costs for landlords associated with each turnover.

Federal Programs

The US Department of Housing and Urban Development (HUD) administers more than 20 programs that award loans and grants for the construction, acquisition, rehabilitation, and preservation of affordable



SOLARA is a community recognized by the California Energy Commission as the first Zero Energy New Home (ZENH). This groundbreaking, mixed-use development created 56 affordable apartments and a commercial office building on 2.5 acres in Poway, a suburban community 20 miles north of San Diego. SOLARA's 141 kilowatt, grid-tied photovoltaic (PV) system supplies power separately to each of the project's 56 energy-efficient apartment units, community center, and common areas.

Source: http://www.globalgreen.org/i/file/Green%20Urbanism/GGUSA_CaseStudy_SOLARA.pdf

rental and ownership housing, homeless shelters and transitional housing, public facilities and infrastructure, as well as the development of jobs for lower income workers. Federal Housing Administration (FHA) Programs provide insurance and underwriting on financial loans for low and moderate income multifamily housing.

Low Income Housing Tax Credit

The Low Income Housing Tax Credit (LIHTC) Program is an indirect Federal subsidy used to finance the development of affordable rental housing for low-income households.⁴³ The LIHTC Program, was created to provide the private market with an incentive to invest in affordable rental housing. Housing tax credits are awarded to developers of qualified projects. Developers then sell these credits to investors to raise capital (or equity) for their projects, which reduces the debt that the developer would otherwise have to borrow. Because the debt is lower, a tax credit property can in turn offer lower, more affordable rents. In California, the Tax Credit Allocation Committee (TCAC) allows for the use of the California Utility Allowance Calculator (CUAC)⁴⁴ to calculate project-specific utility allowances for low income housing projects that include high levels of energy efficiency (at least 15% above base code) and on-site solar generation. This allows developers to invest in energy efficiency and solar as well as earn tax credits to offset the initial costs. Additionally, it aligns the utility allowance in rent calculation due to potentially lowered utility bills for the low income residents.

Solar Incentives

The New Solar Homes Partnership (NSHP) is a part of the State's California Solar Initiative (CSI) Program, and has a separate goal and allocation for new affordable housing. NSHP provides incentives for both residential units and common areas, the latter receiving a base incentive. The 2014 incentives for units meeting 2013 Title 24, vary from \$1 per kW for units meeting 2013 Title 24 standards up to \$1.75/watt for units meeting and exceeding 2013 Title 24 energy standards by 30%. Since 2007, the program has reserved over 5 MW of solar in new affordable housing.⁴⁵

Building Energy Efficiency Standards

Low-rise multifamily building construction is covered by similar residential building standards as single-family residential. This approach creates some unintentional issues, such as misaligned standards related to hot water, HVAC, and common areas. This approach will need mitigation to serve the multifamily housing industry more cohesively and will require additional consideration as the State moves forward to its ZNE goals.

Utility Metering

Utility metering is another important aspect of multifamily housing that has direct implications for motivating owners and tenants to save energy, purchase energy-efficient equipment, and invest in other energy-saving tools.

The basic metering types associated with multifamily housing are:

- Individually-metered buildings. These are buildings in which each unit has its own meter. The utility company bills each unit separately.

⁴³ Housing and Urban Development, http://portal.hud.gov/hudportal/HUD?src=/program_offices/comm_planning/affordablehousing/training/web/lihtc

⁴⁴ California Solar Initiative, <http://www.gosolarcalifornia.org/affordable/cuac/index.php>

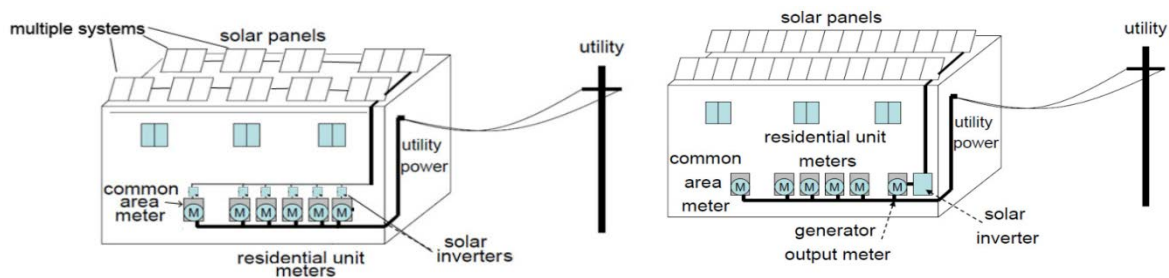
⁴⁵ New Solar Homes Partnership Guidebook, Seventh Edition (December 2013), <https://www.newsolarhomes.org/WebPages/Public/RebateLevelView.aspx>

- Master-metered buildings. These have one utility meter for an entire multi-unit building. The utility company bills the owner, and the owner then charges units, typically based on the square footage of the unit, not on actual use. Master-metering of newly constructed buildings has not been permitted by the CPUC since 1986, with limited exceptions.
- Sub-metered buildings. These are master-metered buildings in which the owner has installed sub-meters to individual units. The utility company bills the owner for the entire cost and the owner uses the sub-meters to allocate cost for each unit based on use. This mechanism is seen as a motivating factor for landlords or property owners to make investments in energy efficiency so that they can be allowed to sub-meter and recuperate some of their investments through the discount on master-meters. However, since 1986, master-metering and electric sub-metering has not been allowed in California new construction, with limited exceptions.
- Common area meters. These serve the spaces common to multiple tenants, for example, stairwells, lobby areas, common rooms, and other such spaces. The landlord or property owner pays the utility bill on this meter and allocates the cost as part of the rent and cost of operation.

Virtual Net Metering

Virtual Net Metering (VNM) is a mechanism that allows a solar-electric system to be metered individually, with the electricity produced in aggregate to be allocated by contract to individual housing units within a multifamily development (see image below).

Multifamily Net Metering System vs. Virtual Net Metering System



Source: www.cpuc.ca.gov

VNM has made it more cost-effective for multifamily housing developers to put larger building-wide arrays on rooftops and make virtual allocations to the individual unit meters rather than require individual PV systems. The larger systems have the additional benefit of being able to serve common areas such as stairwells, entry foyers, and other shared spaces.

For the Multifamily Affordable Solar Housing (MASH) program,⁴⁶ California started implementing VNM tariffs allowing tenants to receive the direct benefits of solar by reducing their monthly electric bills. According to the MASH Semi-Annual Progress Report, as of July 2013, a total of 6,265 tenant units are being served by VNM tariffs. VNM was originally only available for low income multifamily properties in California, but in April 2011, the CPUC approved the expansion of VNM to all multi-tenants and multi-metered properties. In July, the CPUC reported that, as of March 2013, there were 24 non-MASH projects (a total of 0.9 MW) that use the VNM tariff.⁴⁷

⁴⁶ MASH Program provides incentives for solar on existing affordable multifamily housing, while NSHP is for new construction.

⁴⁷ California Solar Energy Apartments: Virtual Net Metering Allows Energy Savings One Tenant at a Time, RenewableEnergyWorld.com

MULTIFAMILY STRATEGIES

The strategies listed in this section align with the Plan's overall goals and objectives and are specific to low-rise multifamily new construction. While many of the strategies identified in Chapter 3 also apply to multifamily buildings, the following strategies provide an additional layer of detail and specificity that are designed to support the low-rise multifamily market.

Goal 1. Demand and Awareness

Create deep awareness of the value and benefits of ZNE with tenants, property owners, and developers to spur demand and drive broader industry involvement.

Strategy	Metrics	Leads and Partners
MF 1.1 Provide awareness and outreach resources and tools for multifamily lenders, property owners and occupants	Materials that illustrate the objectives and benefits for ZNE in multifamily housing are available in 2015	IOU RNC MF Program/ Private sector/ZNE stakeholders

Goal 2. Technical Training and Education

Adopt a residential workforce sector strategy to increase participation in and improve the quality of education and training for industries related to planning, designing, constructing, and developing ZNE homes.

Strategy	Metrics	Leads and Partners
MF 2.1 Offer technical training to energy consultants, architects, and engineers to help them conceptualize and effectively design ZNE multifamily projects	Guidelines and model specifications for developers to assist and streamline MF projects are available for ZNE development in 2015	IOU/POU Multifamily Programs and WE&T/ CABEC/Community Colleges and other vocational training institutes
MF 2.2 Develop post-occupancy training programs for property managers and occupants to properly maintain and operate ZNE buildings	Multifamily ZNE-specific training modules (potentially online) are available for property managers and tenants by end of 2015	IOU/POU Multifamily programs and WE&T/Building Performance Institute/BOMA ⁴⁸

⁴⁸ Building Owners and Managers Association (BOMA) <http://www.boma.org/Pages/default.aspx>

Goal 3. Technical Tools

Ensure availability, effectiveness, and efficiency of technical tools for designing, modeling, constructing, and monitoring ZNE buildings.

Strategy	Metrics	Leads and Partners
MF 3.1 Evaluate technical gaps and weaknesses related to project asset evaluation tools	Life cycle costing approaches that enable operational benefits of energy efficiency and solar to be monetized in underwriting ZNE projects are available by 2022	IOU/POU RNC Multifamily Programs /HCD/CEC/DOE
MF 3.2 Develop tools to enable effective energy management in multifamily buildings	Utility data sharing protocols/data clearinghouse for dissemination of aggregate property level energy use data are developed by 2019 In-home feedback technologies for tenants, property management tools and best practices are developed by 2022	IOU/POU RNC Multifamily Programs/HCD/CEC/DOE

Goal 4. Financing, Affordability and Value of ZNE

Develop specific approaches and standards to quantify the value of ZNE homes, support a robust financing market, and ensure that ZNE homes are affordable.

Strategy	Metrics	Leads and Partners
MF 4.1 Develop feasible and flexible asset and operational valuation tool(s) specifically designed for multifamily properties	Asset and operational valuation tool for Multifamily properties is available by end of 2022	CEC/HUD
MF 4.2 Develop energy rating system specifically targeted to tenants/renters	Proposal for a rating system targeted to renters based on energy use and that enables return on investments made towards ZNE by landlords, is developed by 2022	DOE/CEC/HUD
MF 4.3. Develop guidelines and source data to support market rent determinations in ZNE projects	Guidelines that value ZNE for Market Comparability assessment practices are developed by 2022	CEC/HCD/HUD
MF 4.4 Develop new products or enhance existing offerings for financing Multifamily ZNE projects	Enhanced Multifamily ZNE financing and incentive products are available by 2019.	Private sector/IOUs/CEC/CPUC/HCD/HUD
MF 4.5 Continued support for utility allowance calculations through tax credit allocation for energy efficiency and solar on multifamily projects	Relevant agencies at state and national level align utility allowance calculations by 2019 and continue to support it through 2020 and beyond	CEC/HUD/TCAC

Goal 5. Future Infrastructure

Drive future grid infrastructure and technological improvements to support the State's distributed generation goals and a ZNE Building Future.

Strategy	Metrics	Leads and Partners
MF 5.1 Assess and evaluate potential impacts of multifamily and infill projects on the grid	Grid impact analysis of ZNE in future multifamily and infill projects is included in distributed energy resources plans developed by 2015 pursuant to AB327	IOUs/EPIC program/ CSI RD&D/ National labs/ CA research universities

Goal 6. Alignment

Align the development and implementation of regulations, policies, plans, incentives, and codes related to ZNE buildings.

Strategy	Metrics	Leads and Partners
MF 6.1 Assess multifamily building energy standards to address different requirements between low-rise and high-rise multifamily projects	<p>Develop separate compliance manual for multifamily building sector to clarify code requirements and make available to industry by 2022</p> <p>Review and propose revised approach to multifamily market sector for future Title 24, Part 6 building standards by 2022</p>	CEC/IOU C&S Program



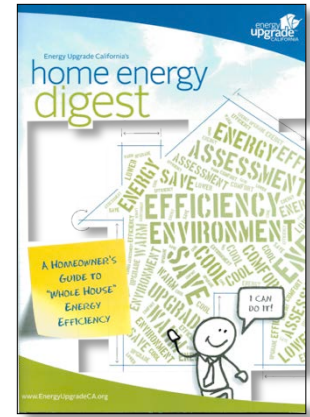
Photo Credit: KB Homes/new-homes-orange-county/whisler-ridge

CHAPTER 5. COORDINATING WITH OTHER ACTIVITIES

The New Residential ZNE Action Plan is designed as a focused and targeted effort. However, it is important to recognize the considerable work that is being done in the State of California surrounding energy efficiency, sustainability and green building and the potential impacts and opportunities for synergies. Below is a brief synopsis of some of the most relevant activities.

Energy Upgrade California

Starting in 2009 and initially funded by the America Recovery and Reinvestment Act (ARRA), “Energy Upgrade California” is in the process of transforming from primarily a whole-house residential energy efficiency program to the new State of California clean energy brand. As such, the brand and the marketing anticipated can help expand awareness and understanding of Zero Net Energy buildings. The brand strives to share the spectrum of activities that a person can do to be more energy efficient. This starts with behavior and includes simple appliance changeouts, weatherization, whole house retrofits and ultimately zero net energy.



Emerging Technologies

While it is widely accepted that the currently available technologies are adequate for ZNE residential buildings, emerging technologies create the cutting edge for higher energy conservation and more vertical construction. Emerging technologies such as innovative building materials like phase change insulation and heat or energy recovery ventilation (HRV / ERV) have the potential to further reduce energy loads and use and therefore reduce the size of generation required to get to ZNE. The IOUs' statewide Emerging Technologies Program identifies, tests and brings to market promising emerging technologies through demonstrations and scaled field placements and is an important enabler under the aegis of the Emerging Technologies Coordinating Council (ETCC).

Electric Vehicles

As plug in electric vehicles (EVs) gain more ground they will need to be addressed as a load in ZNE home energy use. EVs have the potential of adding an entire new category of load (transportation) not currently seen in residential energy use. Future options of EV charging may or may not end up coupled with home usage depending on market offerings. The potential to use EVs as a demand response and storage option is also a possibility depending on the business models that develop in response to the potential increase in the EV market.

Role of Plug Loads and Miscellaneous Energy Loads (MELs)

Plug loads are becoming an increasing proportion of overall energy use in homes as building energy efficiency standards, which control the building envelope and larger system loads, become increasingly stringent. Plug loads or miscellaneous electrical loads (MELS) as an end-use category are now 30-50% of home energy use. The appliance efficiency levels achieved, along with behavior patterns in using them, will impact the total contribution of these end uses to the ZNE equation. The Center for Plug Loads (CALPlug) at UC Irvine is a hub for all plug loads related research and activity in the state.

Behavior and Operation of ZNE

How a ZNE designed and constructed building is operated and how occupants behave will determine if the building actually achieves ZNE performance. The CPUC's Research and Technology Action Plan, launched in August 2013, has identified Integrated Building Design and Operation along with Market Intelligence and Behavior as two of the focus areas in need of more attention. A gap analysis and research needs identification will be undertaken as part of implementation of the Action Plan. While residential buildings are not the focus of this plan per se, there may be applicable outcomes.



KB Homes Energy Management System for ZNE
Photo Credit: Mindy Craig