Zero Net Energy Buildings: How California's Local Jurisdictions Can Lead the Way

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Prepared for the San Diego Regional Energy Partnership
By the Center for Sustainable Energy

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This report was prepared for the San Diego Regional Energy Partnership by the Center for Sustainable Energy. The San Diego Regional Energy Partnership includes San Diego Gas & Electric, City of San Diego, County of San Diego, City of Chula Vista, San Diego Association of Governments and Port of San Diego.

Abbreviations and Acronyms

CAHP	California Advanced Homes Program
CALGreen	California Green Building Standards Code
CAP	Climate Action Plan
CIAG	Compliance Improvement Advisory Group
CPUC	California Public Utilities Commission
CSI	California Solar Initiative
DOE	U.S. Department of Energy
EEBR	Energy Efficiency Business Rebates
Energy Commission	California Energy Commission
GHG	greenhouse gas
HVAC	heating, ventilation, air conditioning
IOUs	investor-owned utilities
kWh	kilowatt-hour
LEED	Leadership in Energy and Environmental Design Program
NSHP	New Solar Homes Partnership
PACE	Property Assessed Clean Energy (financing)
PEV	plug-in electric vehicle
PG&E	Pacific Gas and Electric
POUs	publicly owned utilities
PV	(solar) photovoltaic
SBD	Savings By Design
SCE	Southern California Edison
SDG&E	San Diego Gas & Electric
SGIP	Self-Generation Incentive Program
Title 24, Part 6	California's Building Energy Efficiency Standards
Title 24, Part 11	California Green Building Standards Code
TDV	time dependent valuation
TOU	time of use (pricing)
ZNE	Zero Net Energy

INTRODUCTION

Residential and commercial buildings are responsible for approximately 40 percent of total U.S. energy consumption[1] and carbon dioxide emissions.[2] There is growing recognition that existing buildings and new construction present a huge opportunity to make significant greenhouse gas emissions reductions and reduce energy burdens on families, businesses and public agencies. At the same time, energy efficiency and renewable energy are becoming more affordable and available. As a result, the concept of zero net energy (ZNE) has emerged as a realistic goal pursued by policy makers.

There are various definitions of a ZNE building. A broadly used definition is a building that produces as much energy as it consumes over the course of a year. However, the California Energy Commission (Energy Commission) and California Public Utilities Commission (CPUC) have proposed using the term "Zero-Net-Energy Code Building" along with the following definition:

> *A Zero-Net-Energy Code Building is one where the net 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 metric. A zero-net-energy code building meets an energy use intensity value designated in the Building Energy Efficiency Standards by building type and climate zone that reflect best practices for highly efficient buildings.*[3]

The State of California first outlined ZNE goals in the 2007 Energy Efficiency Strategic Plan[4] and has since expanded them. These goals include:

1. All new residential construction will be ZNE by 2020[5]

[1] U.S. Energy Information Administration
[2] Buildings Energy Data Book, U.S. Department of Energy
[3] 2013 Integrated Energy Policy Report
[4] Energy Efficiency Strategic Plan
[5] CPUC Decision 07-10-032

2. All new and 50 percent of existing state-owned public buildings will be ZNE by 2025[6]
3. All new commercial buildings will be ZNE by 2030[7]
4. 50 percent of existing commercial buildings will be retrofit to Zero Net Energy buildings by 2030 through achievement of deep levels of energy efficiency and clean distributed generation[8]

In addition to these state goals, local governments in the San Diego region have expressed an interest in pursuing ZNE in the municipal building sector.

The challenge in meeting these goals is not one of technical feasibility. Indeed, a 2012 report prepared for Pacific Gas and Electric (PG&E), on behalf of the other major California investor-owned utilities (IOUs), concluded:

> *There are a few challenging building types, and the dependency of ZNE on solar energy will make many sites impractical. But overall, this research suggests that a wide portion of California's new construction can move to Zero Net Energy by 2020 for homes and by 2030 for commercial buildings. Moreover, with only a few exceptions, most of the technologies modeled in this study are available and being utilized today, demonstrating the applicability of this analysis to today's new construction market.*[9]

State building codes and appliance standards are the principal regulatory mechanisms for achieving ZNE in new construction and major renovations in California. But local governments, working in collaboration with the state and industry stakeholders, will also play a key role in achieving these ambitious goals. This report is intended to help guide these efforts for local governments in the San Diego region.

[6] Executive Order B-18-12
[7] CPUC Decision 07-10-032
[8] Zero Net Energy Action Plan: Commercial Building Sector 2010-2012
[9] The Technical Feasibility of Zero Net Energy Buildings in California, Pacific Gas and Electric Company

CALIFORNIA POLICIES AND PROGRAMS

Building and appliance codes and standards are the primary mechanism for achieving ZNE in new construction and major renovations. In addition, the state has developed several action plans and other programs to incentivize and support the market in achieving ZNE goals.

Building and Appliance Codes & Standards

Building Energy Efficiency Standards (Title 24, Part 6)

The principal means of achieving the state's ZNE goals is through the Building Energy Efficiency Standards (Title 24, Part 6).[10] These standards dictate the energy efficiency requirements for new construction as well as additions and alterations for residential and nonresidential buildings. The standards are updated approximately every three years by the Energy Commission and require increasingly stringent levels of energy efficiency.

The most recent 2013 standards went into effect on July 1, 2014. Compared to the previous 2008 standards, the updated code requires new homes to be 25 percent more energy efficient and new commercial buildings to be 30 percent more energy efficient. In addition, the 2013 standards require "solar-ready roofs" for residential and nonresidential buildings to accommodate future installations of solar photovoltaic panels.

In 2014, the Energy Commission began holding workshops and requesting comments for the development of the 2016 standards. By 2020, the standards will require ZNE for all new homes built in the California; by 2030, all new commercial buildings will be required to be ZNE. Ostensibly, this means that the standards will require buildings to be constructed in a more efficient manner to reduce

[10] Building Energy Efficiency Standards, Building Energy Efficiency Program, California Energy Commission

energy consumption until efficiency is no longer cost-effective and require that any remaining energy load be offset by adequate sources of renewable energy.

Local jurisdictions have the option to enact "reach codes" that are stricter than the state's energy code; these are discussed in further detail in the following chapter on local policies.

California Green Building Standards Code (Title 24, Part 11)

The California Green Building Standards Code (Title 24, Part 11, also known as "CALGreen")[11] was the first state-mandated green building code in the nation. The 2013 CALGreen code is not an isolated code and must be used in conjunction with other parts of Title 24 to achieve code compliance and ensure minimum standards for public health and safety. CALGreen was adopted to address the five divisions of building construction: (1) planning and design, (2) energy efficiency, (3) water efficiency and conservation, (4) material conservation and resource efficiency and (5) environmental quality.

CALGreen provisions are for newly constructed buildings as well as additions and alterations to existing buildings that increase the building's conditioned area, interior volume or size. CALGreen establishes mandatory minimum green building standards; the energy-related standard defers to Title 24, Part 6 with an additional requirement for ENERGY STAR compliant bath fans. CALGreen also contains voluntary "tiers" that go beyond the minimum requirements. These tiers may be adopted by a city or county consistent with adoption of local amendments for other building standards. Tier 1 for energy is equivalent to 15 percent more efficient than Title 24, Part 6, while Tier 2 is 30 percent more efficient. CALGreen addresses other voluntary energy-related measures including cool roofs and plug-in electric vehicle (PEV) charging.

Appliance Efficiency Regulations (Title 20)

In 2009, appliances, electronics and lighting were responsible for 44 percent of energy use in California homes.[12] Some devices, such as washing machines and refrigerators, are regulated at the federal level by the Department of Energy. Others, such as DVD players and pool pumps are subject to California's Title 20.[13] Like the state's building codes, Title 20 appliance efficiency regulations are updated periodically. As Title 20 continues to raise efficiency requirements, the per-appliance plug load incorporated into ZNE calculations will decrease (although the average number of appliances and electronics per household may increase).

[11] CALGreen Code, California Buildings Standard Commission
[12] Household Energy Use in California, U.S. Energy Information Administration
[13] Appliance Standards Awareness Project

New Residential Zero Net Energy Action Plan 2014-2020

The New Residential Zero Net Energy Action Plan 2014-2020[14] (Action Plan) was developed as a collaborative effort by the Energy Commission and CPUC. The Action Plan highlights the following key goals as important to achieving the ultimate 2020 residential ZNE 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.
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.
3. **Technical Tools**: Ensure availability, effectiveness and efficiency of technical tools for designing, modeling, constructing and monitoring ZNE buildings.
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.
5. **Future Infrastructure**: Drive future grid infrastructure and technological improvements to support state distributed generation goals and a ZNE building future.
6. **Alignment**: Align the development and implementation of regulations, policies, plans, incentives and codes related to ZNE buildings.

The Action Plan identifies six key benchmarks to measure progress toward these goals:

1. By 2020, all new homes are ZNE code or ZNE-ready homes (single family and low-rise multifamily).
2. By early 2016, utility new construction activities will include fully subscribed ZNE Builder Early Adopter Programs that address incentives, training, market adoption, demonstration projects, etc.
3. An updated California residential building rating and/or labeling system (updated HERS[15] or equivalent) is in place by 2016.
4. Achieve a 5-10 percent decrease in the cost of implementing ZNE on production homes by 2017.
5. By 2017, a nationally recognized appraisal standard, accepted by underwriters and funders for ZNE homes, is in place and utilized in California.
6. An adequate pool of trained and educated professionals in design, engineering and construction to support ZNE demand in California is in place by 2018.

The Action Plan also highlights specific strategies to achieve the six key goals. These strategies include an Early Adopter Program to provide incentives and technical assistance to builders and

[14] Draft ZNE Action Plan 10/15, California ZNE Homes

[15] Home Energy Rating System, the current residential rating system supported by the Energy Commission that rates home on a scale of 0-250 (lower indicates more energy efficient).

demonstration projects to help expand capacity for builders, reduce startup costs and develop best practices.

While the Energy Commission, CPUC and IOUs will take the lead on ZNE efforts, the Action Plan makes clear that it will take a collaborative effort among all stakeholders to achieve ZNE goals. The Action Plan identifies "highly engaged local government support [for] ZNE" beginning in 2015 and "local government reach code adoption and support" beginning in 2016 as critical to achieving the 2020 ZNE goals. It is also noted that local governments can play a role in facilitating demonstration projects.

Zero Net Energy Action Plan: Commercial Building Sector 2010-2012

This Action Plan,[16] last updated in June 2011, was developed by stakeholders and includes several strategies to achieve ZNE goals for new and existing commercial buildings. Strategies related to new construction are:

- **Strategy 1-1**: Establish a long-term progressive path of higher minimum codes and standards for all new buildings by 2030.
- **Strategy 1-2**: Expand Titles 20 and 24 to address all significant energy end uses.
- **Strategy 1-3**: Establish a "path to zero" campaign to create demand for high-efficiency buildings.
- **Strategy 1-4**: Develop innovative financial tools for ZNE and ultralow energy buildings.
- **Strategy 1-5**: Create additional investment incentives and leverage other funding.
- **Strategy 1-6**: Develop a multipronged approach to advance the practice of integrated design.

Strategies related to existing buildings are:

- **Strategy 2-1**: Lead by example – state/local governments and major corporations commit to achieve energy efficiency targets.
- **Strategy 2-2**: Lower the threshold for applying codes to existing buildings.
- **Strategy 2-3**: Ensure compliance with minimum Title 24 codes and standards for building renovations and expansion.
- **Strategy 2-4**: Establish mandatory energy and carbon labeling and benchmarks.
- **Strategy 2-5**: Develop tools and strategies to use information and behavioral strategies, commissioning and training to reduce energy consumption in commercial buildings.
- **Strategy 2-6**: Develop effective financial tools for energy-efficient improvements to existing buildings.
- **Strategy 2-7**: Develop business models and supplier infrastructure to deliver integrated and comprehensive "one-stop" energy management solutions.

[16] Zero Net Energy Action Plan: Commercial Building Sector 2010-2012

- **Strategy 2-8**: Improve utilization of plug load technologies within the commercial sector.

Codes & Standards Action Plan 2012-2015

The Codes & Standards Action Plan[17] is structured around the two categories of state codes impacting ZNE: building standards and appliance standards. Strategies related to building standards are:

- **Strategy 1**: Develop progressive initiatives through the advancement of Building Energy Efficiency Standards, both mandatory and reach standards, to enable market transformation and support high-performance building design and operation in residential and nonresidential sectors.
- **Strategy 2**: Develop and enhance the electronic infrastructure and supporting tools to enable the advancement of Building Energy Efficiency Standards and compliance improvement.
- **Strategy 3**: Enhance education and training initiatives for improving compliance with both mandatory and reach Building Energy Efficiency Standards.
- **Strategy 4**: Expand the coordination and outreach initiatives among regulatory and nonregulatory agencies and other key market actors to facilitate improvement in compliance with the Building Energy Efficiency Standards.
- **Strategy 5**: Support efforts toward standards compliance improvement and enforcement at the local level for the Building Energy Efficiency Standards, both mandatory and reach standards.

Strategies related to appliance standards are:

- **Strategy 1**: Develop progressive initiatives to enable market transformation toward highly efficient appliances.
- **Strategy 2**: Expand the coordination of appliance efficiency initiatives among regulatory and nongovernmental agencies, associations and industry leads to facilitate the development and adoption of high-performance and efficient appliances.
- **Strategy 3**: Enable higher compliance with appliance standards and more effective enforcement actions.

Statewide Codes & Standards Program

The Statewide Codes & Standards Program[18] is intended to achieve maximum energy savings across all major groups and sectors in California. Collectively, the investor-owned utilities (IOUs) have a $28 million budget for 2013-2014 to pursue the following subprograms:

[17] Codes & Standards Action Plan 2012-2015

- **Building Codes Advocacy:** Seeks to improve Title 24, Part 6 as well as national building codes that impact California building codes.
- **Appliance Standards Advocacy:** Seeks to improve Title 20 and federal appliance regulations.
- **Compliance Improvement:** Works to improve compliance with increasingly advanced energy efficiency codes.
- **Reach Codes:** Provides technical support to local governments that wish to adopt ordinances that exceed Title 24, Part 6 by performing cost-effectiveness studies, drafting model ordinance templates and assisting with the application process required for Energy Commission approval.
- **Planning and Coordination:** Works with the Energy Commission, CPUC, Emerging Technologies, Workforce Education and Training, rebate and other voluntary programs to conduct strategic planning in support of state ZNE goals.

Nonresidential Building Energy Use Disclosure Program (AB 1103)

The Nonresidential Building Energy Use Disclosure Program (AB 1103) mandates benchmarking for existing nonresidential buildings. A building's energy use score, generated by inputting building data and 12 months of energy consumption data into the EPA's ENERGY STAR Portfolio Manager, must be disclosed upon financing, leasing or sale. This law took effect on January 1, 2014, for buildings with total gross floor area measuring more than 10,000 square feet and on July 1, 2014, for buildings with total gross floor area over 5,000 square feet. However, in response to stakeholder concerns about their ability to comply, the Energy Commission has proposed to change the compliance date for buildings between 5,000 and 10,000 square feet to July 1, 2016.[19] Benchmarking will make energy use in existing buildings more visible to buyers, sellers, lenders and other stakeholders.

California Clean Energy Jobs Act (Prop 39)

Approved in the 2012 general election, the California Clean Energy Jobs Act (Prop. 39) allocates up to $550 million per year for energy efficiency and renewable energy projects in schools. For fiscal year 2013-2014, $381 million was allocated for local educational agencies — including county offices of education, school districts and charter schools — and $47 million was allocated to community college districts.[20]

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[18] Statewide Codes & Standards Program
[19] CEC Notice of Emergency Rulemaking Action: Amendment to Nonresidential Building Energy Use Disclosure Program Compliance Schedule, August 11, 2014
[20] Proposition 39: California Clean Energy Jobs Act – 2013 Program Implementation Guidelines

Incentive Programs

There are several incentive programs in California for energy efficiency and renewable energy. Some of these programs are administered at the state level; others are coordinated at the state level but administered separately within the jurisdiction of each IOU. These programs include:

- **California Advanced Homes Program (CAHP)**: CAHP is an IOU-led program that provides incentives to builders to construct single-family and multifamily dwellings that are more efficient than required by Title 24, Part 6. The program relies on energy modeling to generate a HERS II whole-house rating. A HERS score of 100 indicates that a home is designed to meet the Title 24 standards; lower scores indicate more energy-efficient homes. Under CAHP, a home with a HERS score of 84 qualifies for a $300 incentive. The new home qualifies for an additional $100 for each point lower down to a score of 75 and $200 for each point lower thereafter.[21]
- **New Solar Homes Partnership (NSHP)**: Administered by the Energy Commission in coordination with the CPUC, NSHP provides financial incentives and other support for installing eligible solar energy systems on new residential buildings that receive electricity from PG&E, SCE, SDG&E and Bear Valley Electric Service. NSHP's goal is to create a self-sustaining market for solar homes where builders incorporate high levels of energy efficiency and high-performing solar energy systems. Current incentives are $0.75/watt for complying with Title 24, Part 6; $1.00/watt if the builder reaches Tier I; and $1.50/watt if the builder reaches Tier II of the code.[22]
- **California Solar Initiative (CSI)**: CSI provides rebates for solar installations on existing or new commercial, agricultural, government and nonprofit buildings, as well as existing homes.[23] Rebates are available to customers of PG&E, SCE and SDG&E. Rebates are based on the expected performance or actual performance of the solar array, including such factors as installation angle, tilt, shade and location.[24]
- **California Solar Initiative – Thermal**: The CSI-Thermal Program[25] offers rebates to single-family, multifamily and commercial customers installing natural gas-, electric- and propane-displacing solar water heating systems in PG&E, SCE, SoCal Gas and SDG&E territories. Rebates are based on how much energy the solar water heating system is expected to displace in one year. Commercial and multifamily properties can receive rebates for solar thermal systems for process heat, solar cooling, space heating and combination systems. In addition, the program provides rebates for swimming pool solar heating systems at commercial, multifamily, government, nonprofit or institutional properties.

[21] The California Advanced Homes Partnership
[22] The New Solar Homes Partnership
[23] CSI funding for existing homes has been exhausted in SDG&E territory; California does not have a ZNE goal related to existing homes.
[24] California Solar Initiative
[25] California Solar Initiative Thermal Program

- **Self-Generation Incentive Program (SGIP)**: The CPUC's SGIP[26] provides incentives to support existing, new and emerging distributed energy resources. The SGIP provides rebates for qualifying distributed energy systems — including wind turbines, waste-heat-to-power technologies, pressure reduction turbines, internal combustion engines, microturbines, gas turbines, fuel cells and advanced energy storage systems — installed on the customer's side of the utility meter. Incentives range from $1.13/watt for wind turbines to $1.83/watt for fuel cells.
- **Savings By Design**: Administered by the IOUs, Savings By Design (SBD)[27] encourages high-performance, nonresidential building design and construction through:
    - Owner Incentives: Available for projects estimated to exceed Title 24 by at least 10 percent on a whole-building performance basis. Owner incentives range from $0.10 - $0.30 per annualized kWh savings, with a step increase to $0.40 per annualized kWh savings for projects that exceed Title 24, Part 6 by 40 percent and $1.00 per annualized therm savings as the design becomes more efficient.
    - Design Team Incentives: Incentives are available for new buildings that exceed a minimum energy efficiency threshold (generally 10 percent better than Title 24, Part 6). Incentives range from $0.033 - $0.13 per annualized kWh savings with a maximum of $50,000 per project.
    - Design Assistance and Resources: Design assistance and consulting is offered at no charge to the building owner or the design team.
- **Direct Install:** The Direct Install program provides eligible small and mid-sized businesses with energy-saving upgrades at low or no cost. Energy-efficient equipment upgrades may include lighting; heating, ventilation and air conditioning (HVAC); or refrigeration.[28]
- **Commercial Calculated Incentives**: This program provides customized incentives for energy efficiency retrofit projects. Incentive amounts are based on the energy savings and permanent peak demand reduction above and beyond baseline energy performance, which include state-mandated codes, federal-mandated codes or industry-accepted performance standards.[29]
- **Commercial Deemed Incentives**: This program provides fixed rebate amounts for the installation of energy-saving upgrades that have been identified through standard utility energy efficiency audits. Eligible upgrades may include lighting, air conditioning equipment, food service equipment, refrigeration, high-efficiency water heating or plug load.[30]

[26] Self-Generation Incentive Program
[27] Savings By Design Program
[28] CPUC Fact Sheet: Statewide Commercial Program (2013-2014); Direct Savings with Direct Install, SDG&E
[29] CPUC Fact Sheet: Statewide Commercial Program (2013-2014); Save energy, earn incentives, SDG&E
[30] CPUC Fact Sheet: Statewide Commercial Program (2013-2014); Earn Rebates on Your Improvements, SDG&E

Table 1. Energy Efficiency and Renewable Energy Incentive Programs Applicable to New Residential, New Commercial and Existing Commercial Buildings in California			
Incentive Program	**Sector**		
	New Residential	**New Commercial**	**Existing Commercial**
California Advanced Homes Program	x		
New Solar Homes Partnership	x		
California Solar Initiative		x	x
CSI-Thermal	x	x	x
Self-Generation Incentive Program	x	x	x
Savings By Design		x	
Direct Install			x
Commercial Calculated Incentives			x
Commercial Deemed Incentives			x

Financing Programs

On-Bill Financing

On-Bill Financing offers nonresidential utility customers zero percent interest financing for qualifying energy-efficient business improvements. Loans are repaid through fixed monthly installments on customers' utility bills.[31]

Energy Efficiency Financing Pilot Programs

In September 2013, the CPUC authorized several energy efficiency financing pilot programs for IOU customers. The purpose of the pilot programs is test the effectiveness of on-bill repayment mechanisms and to use credit enhancements to provide better loan terms to customers. Relevant to ZNE goals in the existing commercial sector are the three pilots for small businesses and one for medium/large businesses.[32] The pilots, administered by the California Alternative Energy and Advanced Transportation Authority (CAEATFA) are expected to launch in 2015.

[31] CPUC Fact Sheet: Statewide Financing Program (2013-2014); On-Bill Financing, SDG&E
[32] Energy Efficiency Financing Pilot Programs, California Alternative Energy and Advanced Transportation Financing Authority

LOCAL POLICIES AND PROGRAMS

Local governments in the San Diego region have enacted a variety of policies to encourage and/or require energy efficiency and renewable energy. Many have completed Climate Action Plans (CAPs) and Energy Roadmaps (see Table 2, page 16). All have authorized Property Assessed Clean Energy (PACE) programs to help homeowners and businesses finance clean energy projects; most have launched active PACE programs. Several jurisdictions have Green Building Programs that encourage environmental practices and certifications that may include energy efficiency or renewable energy measures. As a result, a strong foundation has been built upon which to create a policy framework specifically addressing ZNE.

What is PACE?

PACE allows property owners to finance energy efficiency, renewable energy or water efficiency projects with little or no up-front costs; the loan is paid back through voluntary assessments on property tax bills. PACE is authorized under the statutory framework of either AB 811 (an amendment to the Improvement Act of 1911) or SB 555 (an amendment to the Mello-Roos Act of 1982), both of which allow for the creation of special tax districts.

However, few local governments in the San Diego region have enacted policies specifically targeting energy performance for new buildings beyond minimum Title 24, Part 6 standards. Only Chula Vista passed a reach code to require energy efficiency standards above the 2008 standards. As of publication of this report, no San Diego-area jurisdiction has passed a reach code above the 2013 standards.

Similar to the San Diego region, many local governments throughout California and the rest of the nation are developing CAPs and/or sustainable energy policies. For example, the Energy Commission approved 45 California cities to implement local ordinances[33] (reach codes) exceeding the 2008 Building Energy Efficiency Standards. With the onset of the 2013 standards, these reach codes are now obsolete. Four cities have been approved for local

[33] Local Ordinances Exceeding the 2008 Building Energy Efficiency Standards, California Energy Commission

ordinances exceeding the 2013 standards: Los Angeles, Glendale, Lancaster and the City and County of San Francisco (see Table 3, page 16-17).[34] A few jurisdictions in California have developed specific ZNE goals and strategies, yet the City of Lancaster is the only local government in California that has a comprehensive ZNE goal and program.

Several local governments have adopted ordinances requiring more stringent energy requirements than those set by Title 24, Part 6. Others have or are in the process of adopting code measures that are not directly energy-related, but pave the way for future energy features, such as rooftop solar PV or PEV charging. Adoption of reach codes will help build the market and prepare builders and property owners for future, more stringent versions of Title 24, Part 6.

Therefore, while the concept of ZNE is just beginning to become a part of city planning and policymaking, there is a real opportunity for San Diego-area jurisdictions to take the lead on developing a ZNE policy framework.

Table 2. San Diego-Area Jurisdictions with Energy Roadmaps, Climate Action Plans and PACE Programs*

Jurisdiction	Energy Roadmap	Climate Action Plan	PACE Programs (Active or Coming Soon)
City of Carlsbad	Pilot, 2006	Drafted, 2014	Residential, Commercial
City of Chula Vista	Completed, 2012	Adopted, 2000	Residential, Commercial
City of Coronado	Completed, 2012	Status unknown	Residential, Commercial
City of Del Mar	Completed, 2013	Draft in progress	Residential, Commercial
City of El Cajon	Completed, 2013	Status unknown	Residential, Commercial
City of Encinitas	Completed, 2011	Adopted, 2011	Residential, Commercial
City of Escondido	Completed, 2012	Adopted, 2013	Residential, Commercial
City of Imperial Beach	Completed, 2011	Status unknown	Residential, Commercial
City of La Mesa	Completed, 2013	Planned	Residential, Commercial
City of Lemon Grove	Draft in progress	Status unknown	Residential, Commercial
City of National City	Completed, 2012	Adopted, 2011	Residential, Commercial
City of Oceanside	Completed, 2012	Status unknown	Residential, Commercial
City of Poway	Pilot, 2009	Status unknown	Residential, Commercial
City of San Diego	--	Adopted, 2005 Drafted Update, 2014	Residential, Commercial
County of San Diego	Strategic Energy Plan: 2013-2015	Adopted, 2012	Residential, Commercial
City of San Marcos	Completed, 2011	Drafted, 2013	Residential, Commercial
City of Santee	Completed, 2011	Planned for 2014-15	Residential, Commercial
City of Solana Beach	Pilot, 2009	Status unknown	Residential, Commercial
City of Vista	Completed, 2012	Drafted, 2012	Residential, Commercial

** Links to PACE programs can be found at www.energycenter.org/pace (some jurisdictions have multiple PACE programs for each sector).*

[34] Local Ordinances Exceeding the 2013 Building Energy Efficiency Standards, California Energy Commission

Implementing a Reach Code

Prior to enforcing a reach code, local jurisdictions are required by the Energy Commission to make a determination that the local energy ordinance is cost effective (i.e., that the incremental cost of achieving the measure is recouped through savings over the lifetime of the measure) and at least as stringent as the state energy standards. Currently, cost-effectiveness studies for cool roof standards and "percent better" standards are being performed through the IOU Statewide Codes & Standards Program. The local ordinance must be adopted using the local public ordinance adoption process allowing for public review and comment. Local ordinances that exceed Title 24, Part 6 must be approved by the Energy Commission to be legally enforceable.

Such ordinances take many forms. Some require new buildings to be designed to use 10-20 percent less energy than allowed by the standards. This variation is typically referred to as a "reach code." Another example is a cool roof ordinance, requiring buildings to be constructed with roofing materials that meet minimum standards for solar reflectance and thermal emittance. Because both types of ordinances trigger aspects of Title 24, Part 6, jurisdictions that adopt them are required to follow the Energy Commission approval process outlined above.

Other local ordinances address building features that do not directly address the Title 24, Part 6 standards and can be enforced without commission approval. Examples include requiring new buildings to be prewired for rooftop solar PV, preplumbed for solar thermal and prepared for installation of breaker panels that can support solar PV and electric vehicle charging stations.

Table 3. Local Ordinances Exceeding 2013 Building Energy Efficiency Standards (Title 24, Part 6)

Jurisdiction	Date Approved by Energy Commission	Summary of Ordinance	Cost-effectiveness determination
City of Lancaster	Dec 11, 2013	Requires builders to provide solar energy systems for new homes and those homes, on average, shall produce at least 1 kWh of energy.	The benefit-cost ratio comparing levelized bill savings and levelized cost of solar is greater than one for all climate zones.[35]
City and County of San Francisco	May 14, 2014	Requires GreenPoint Rated for new low-rise residential projects, including minimum 10 percent less energy consumption than allowed by Title 24, Part 6.	Lifecycle benefit-cost ratio for group of performance-based efficiency measures is greater than one and therefore cost-effective.[36]

[35] Letter from City of Lancaster to California Energy Commission RE: Local ordinance for implementation of solar PV systems, October 23, 2013

[36] Letter from City and County of San Francisco to California Energy Commission RE: Transmittal of San Francisco Building Code Amendment, November 19, 2013

City of Glendale	July 22, 2014	Requires the installation of a radiant roof barrier in the concealed attic space of all new residential construction.	Average payback period for the cost of installing the radiant barrier is approximately 14 years.[37]
City of Los Angeles	Aug 27, 2014	Establishes and mandates minimum thermal emittance and solar reflectance values for roofing materials in residential buildings.	Higher roof reflectance correlates with greater energy savings with little to no additional labor cost and in some instances cost savings associated with choosing a low-slope cool roof.[38]

San Diego Region Examples

Following is a description of select energy policies and programs enacted by local governments in the San Diego region (listed in order of population) that support ZNE buildings.

City of San Diego

Sustainable Building Policy

The City of San Diego's commitment to become increasingly efficient with resources, including energy, water and materials associated with construction projects, began in 1997 with Council Policy 900-14 "Green Building Policy" which has been updated several times, most recently in 2010. The purpose of the Sustainable Building Policy is "to reassert the city's commitment to green and sustainable building practices and applies to new construction or major renovations that the city owns, occupies or leases."[39]

The policy includes the following standards relating to energy:

- City-owned, occupied or leased new construction and major renovation projects shall meet the requirements for LEED® Silver level certification.
- City-owned, occupied or leased new construction and major renovation projects shall use 15 percent less total building energy consumption than the minimally code-compliant building as modeled following Title 24, Part 6 requirements.[40]
- City-owned new construction and major renovation projects shall provide a minimum of 15 percent of total building energy from on-site self-generation using proven renewable energy technologies when site conditions and configuration allow for reasonable payback.

[37] Letter from City of Glendale to California Energy Commission RE: Cover Letter, November 23, 2013
[38] Documents submitted to the CEC for Approval of Ordinance
[39] City of San Diego Sustainable Building Policy No. 900-14
[40] This requirement is being revised for the 2013 standards.

The Sustainable Building Policy[41] also expedites permitting processes for residential and commercial projects that meet certain sustainability requirements. The policy is updated approximately every three years to comply with the updated Title 24, Part 6 standards and to stay on the path toward ZNE for new construction.

Property Assessed Clean Energy (PACE)

The City of San Diego initially approved PACE for commercial properties and residential properties with no mortgage liens in October 2012. After the state established a Loss Reserve Program to address the Federal Housing Financing Authority's concerns about PACE liens taking first position over mortgages, the city council approved PACE for residential properties with mortgage liens in April 2014.[42]

The city is working with three PACE providers to administer the residential and commercial programs. Nearly 300 residential projects totaling $7.4 million have been approved — with several hundred more applications in the queue — since PACE became available in the city. Sixty-four commercial projects have applied for PACE financing.[43]

Every San Diego-area jurisdiction has authorized one or more PACE programs. The majority are active now, with some anticipated to come online within the next few months. See Table 2, page 15.

County of San Diego

Green Building Incentive Program

The County of San Diego's Green Building Incentive Program,[44] established in 1997 and expanded over time, was initially designed to promote the use of resource-efficient construction materials, water conservation and energy efficiency in new and remodeled residential and commercial buildings.

For qualifying projects that comply with natural resources conservation, water conservation or energy conservation requirements, the county will reduce building permit and plan check fees by 7.5 percent and grant expedited plan checks, saving approximately 7–10 days on the project timeline. Examples of qualifying energy conservation measures include residential projects that exceed Title 24, Part 6 standards by 15 percent and commercial projects that exceed the standards by 25 percent. Approximately five percent of new residential projects have participated since 2003.[45]

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[41] City of San Diego Sustainable Building Policy
[42] Council President Todd Gloria Press Release: City Council Helps San Diego Homeowners Go Green, April 8, 2014
[43] Correspondence with Anita Pyle, Supervising Analyst/Project Manager, City of San Diego, Environmental Services Department on September 3, 2014
[44] The Green Building Program, County of San Diego
[45] Correspondence with Vince Nicoletti, Chief, Building Division, County of San Diego on August 20, 2014

Other Streamlined Permitting

In addition to the Green Building Incentive Program, the county offers free, online permitting for several project types, including rooftop solar PV and solar thermal, air conditioning replacements and repair and domestic hot water heater replacements that do not alter existing electrical systems.[46] Online permitting presents a significant benefit for both the permit applicant, who can secure multiple permits during one website visit, and the county's building department staff, who can address projects when time permits rather than dedicating time to sometimes lengthy counter visits.

Proposed Code Modifications for Solar and Electric Vehicle Charging

Based on direction from the board of supervisors to develop building code modifications that promote sustainable construction projects, county staff are drafting amendments to the county building code that will apply to new residential single-family developments. Staff will present the following draft building code amendments to the board in winter 2014-15 for consideration:

1. Installation of a 200-amp electrical panel to support installation of solar PV and/or plug-in electric vehicle (PEV) charging
2. Installation of labeled electrical conduit from the utility meter to the attic to support installation of rooftop solar PV
3. Installation of labeled electrical conduit from the utility meter to the garage to support installation of PEV charging station(s)
4. Reservation of 250 square feet of south-facing roof surface free from penetrations to enable installation of rooftop solar PV

These code modifications do not directly address Title 24, Part 6 requirements and, as such, are not considered "reach codes." Therefore, they are not required to be submitted to the Energy Commission for approval.

City of Chula Vista

Reach Code

Chula Vista is the only municipal government in the San Diego region that had adopted a reach code requiring higher levels of energy efficiency than the 2008 Title 24, Part 6 Standards. Enacted in 2010, the reach code included the following mandates:

- New residential and nonresidential projects in the coastal Climate Zone 7 were required to be 15 percent more energy efficient than the 2008 standards.

[46] Homeowner's and Business Owner's Relief Act, County of San Diego

- New low-rise residential projects (three stories or less) in inland Climate Zone 10 were required to be at least 20 percent more energy efficient than the 2008 standards.
- New nonresidential, high-rise residential or hotel/motel projects that fall within Climate Zone 10 were required to be at least 15 percent more efficient than the 2008 standards.
- In both climate zones, exemptions from the reach code were allowed for low-rise residential additions, remodels or alterations less than or equal to 1,000 square feet and for nonresidential, high-rise residential or hotel/motel additions, remodels or alterations less than or equal to 10,000 square feet.

The reach code was developed as part of the city's Climate Action Plan, which was developed through an extensive community stakeholder engagement process. Developers had expressed concern about the extra costs associated with complying with the reach code, arguing that they were unable to raise the sales price on a home simply because it is more energy efficient. The city helped overcome some of this opposition by promoting utility rebate programs such as Savings By Design and the California Advanced Homes Program; the city found that few developers were aware of these programs that could help reduce the costs of achieving higher levels of energy efficiency.

The city also was required to submit a cost-effectiveness study to the Energy Commission for approval before enacting the reach code. The study demonstrated that the measures used to exceed Title 24, Part 6 would pay for themselves via energy cost savings within the measures' lifetimes.

Chula Vista's reach code was no longer applicable on July 1, 2014, with the Energy Commission's release of the 2013 Building Energy Efficiency Standards. Adoption of a new reach code will require a new cost-effectiveness study and approval by the commission.

Cool Roof Standard

In 2012, the City of Chula Vista adopted an ordinance requiring the installation of Tier 2 cool roofs on all new low-rise residential buildings in Climate Zone 10.[47] CALGreen establishes two voluntary tiers for cool roof standards that minimize solar heat gain and reduce air conditioning loads. As with the reach code, Chula Vista performed a cost-effectiveness study that was approved by the Energy Commission; the study showed Tier 2 to be more cost-effective than Tier 1 in Climate Zone 10.

The Cool Roof Standard became inactive upon the release of the 2013 Title 24 standards. The Statewide Codes & Standards Program recently conducted a new cost-effectiveness study for cool roof standards in all climate zones across the state, and Chula Vista is considering adoption of an updated cool roof ordinance based on the results of that study.

Solar-Ready Ordinances

In 2009, Chula Vista adopted mandatory installation guidelines for solar-ready new construction including the following provisions:

[47] Letter to CEC: Application for Locally Adopted Energy Standards by the City of Chula Vista, January 12, 2012

- All new residential units are required to include plumbing specifically designed to allow the later installation of a system that utilizes solar energy as the primary means of heating domestic potable water.
- All new residential units are required to include electrical conduit specifically designed to allow the later installation of a photovoltaic system that utilizes solar energy as a means to provide electricity.

Home Upgrade, Carbon Downgrade Energy Retrofit Incentive

Chula Vista's Energy Retrofit Incentive (ERI) program provided financial incentives for energy efficiency retrofits to existing homes. Administered from May 2011 through July 2012, the ERI program matched the rebates provided by San Diego Gas & Electric's Energy Upgrade California (now known as Energy Upgrade California® Home Upgrade) program. Although the existing residential sector is not part of the state's ZNE goals, the results of the ERI program demonstrate the power of a matching incentive. While the City of Chula Vista represents only seven percent of San Diego County's single-family housing stock, it was home to 37 percent of total Energy Upgrade California single-family projects across SDG&E territory for that time.[48]

Sustainability Center

Chula Vista's Sustainability Center encourages and supports energy-efficient new construction and redevelopment. The Sustainability Center includes:

- A website with information on state building standards, local ordinances and incentive programs. It also includes links to online tools and resources.
- A Sustainability Desk, located at the Development Services Permit Counter, which offers personal assistance to property owners and builders concerning energy efficiency, water efficiency, renewable energy and codes and standards.
- Workshops for both city staff and the broader building community on Title 24, Part 6 and Title 24, Part 11.[49]

City of Encinitas

Green Building Incentive Program

The City of Encinitas' Green Building Incentive Program[50] provides financial incentives, priority plan check and city council recognition for projects that register and achieve certification with GreenPoint Rated and/or LEED. Approved projects receive priority in the city's plan check process. Upon

[48] Home Upgrade, Carbon Downgrade Energy Retrofit Incentive Program Analysis, August 2013
[49] City of Chula Vista Planning and Building Department
[50] Encinitas Green Building Incentive Program

completion of the project and certification by Build it Green or LEED, the project will be eligible for reimbursement for the cost of including green building measures to achieve final certification up to a maximum of $2,000 per project. Additionally, certified projects will be recognized at a city council meeting.

Encinitas also has enacted an energy efficiency permit fee waiver program that includes the installation of solar systems and electric vehicle charging stations.

City of La Mesa

La Mesa Sustainable Building Task Force

In 2004, the La Mesa Sustainable Building Task Force was established to evaluate the feasibility of integrating sustainable building techniques into all new publicly and privately financed commercial, multifamily and residential buildings as well as major retrofits of these buildings types. The task force was composed of representatives from various fields within the building industry, nonprofit organizations and other stakeholders. It issued a report to the city council that included policy recommendations promoting reasonable sustainable building within the city. On January 10, 2006, the La Mesa City Council approved a Sustainable Building Policy based on task force recommendations.

Sustainable Building Policy

The La Mesa Sustainable Building Policy requires the city to evaluate incorporation of sustainable building principles and practices into the planning, design, construction, management, renovation, operations and decommissioning of all municipal facilities. All newly constructed and renovated city facilities must strive to meet a minimum LEED Silver rating and exceed current Title 24, Part 6 requirements. In addition, the city provides information and guidance to stakeholders on sustainable building and promotes LEED and other similar rating systems to the private sector. A City Council Commendation is awarded to developers and property owners whose projects incorporate the goals of the LEED or other similar rating systems.[51]

[51] La Mesa Sustainable Building Committee: Sustainable Building Policies

City of Solana Beach

Expedited Permit Processing and Permit Fee

Projects that include the Green Building Application for the green building program are given priority status for staff level project review, saving applicants between 30 and 40 percent of their overall permit processing time.

Public Recognition Incentives

The city keeps a copy of the GreenPoint Rated or LEED certificate on file and notes it electronically in the city's record for the property. Potential buyers or real estate agents can quickly find out if properties have green certifications on file through these property records. The property owner and/or builder/designer/architect may elect to receive any or all of the following recognition incentives:

- Certificate of Recognition at a city council meeting
- Listing on the city's website as a green building-certified project with a brief description of the project and green measures implemented
- Listing in the subsequent edition of the Shorelines newsletter as a green building-certified project with a brief description of the project and green measures implemented [52]

[52] City of Solana Beach Green Building Incentives

Green Building Policies and ZNE

Several jurisdictions in San Diego County and across the state have adopted policies requiring or incentivizing new construction projects to achieve some level of "green" design. The most common green building standards referenced in such policies are the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) certification or Build It Green's GreenPoint Rated (GPR) certification. These point-based certification programs address much more than energy efficiency and renewable energy and the level to which they support ZNE construction varies.

For example, GPR previously required projects to exceed Title 24, Part 6 by 15 percent as a mandatory measure. With the release of the 2013 Title 24 standards on July 1, 2014, projects are now required to exceed the code by 10 percent as an interim threshold while additional analyses are performed. GPR also provides points for voluntary measures including on-site renewable energy generation, preparation for future solar PV installation, blower door testing and more.

All LEED certification types (except LEED for Homes) require commercial building projects to adhere to building energy standards set by the American Society for Heating, Refrigeration and Air Conditioning Engineers (ASHRAE), specifically ASHRAE 90.1-2010. Based on an analysis performed on behalf of the Energy Commission, ASHRAE 90.1-2010 is, on average, 12 percent less stringent than 2013 Title 24, Part 6 for nonresidential buildings. Similar to GPR, however, LEED does provide points for voluntary measures including renewable energy generation, purchasing clean energy offsets, commissioning and retrocommissioning of commercial buildings and more.

So, while green building policies are mentioned in this report as examples of best practices supporting ZNE construction, only policies requiring GPR for homes present real movement toward ZNE due to the inclusion of a mandatory measure to exceed Title 24, Part 6 by 10 percent.

Other Examples

City of Lancaster

The City of Lancaster has a goal of becoming the first Zero Net Energy (ZNE) city in the world.[53,54] Their mayor, working with the city council, has developed a number of innovative policies and programs to achieve this goal.[55] A summary of Lancaster's efforts are described below.

[53] Mayor of Lancaster Interview with the Planning Report, January 24, 2014
[54] The concept of a "ZNE city" does not necessarily align precisely with the state's ZNE goals, which are measured at the project (building) level and are based on the *societal value* of energy produced and consumed.
[55] Alternative Energy Developments, City of Lancaster

Solar Ordinance

On March 26, 2013, the Lancaster City Council adopted an ordinance requiring single-family residential units built on or after January 1, 2014, to provide solar-generated power at a minimum average of 1 kW per home. The installation of solar PV systems is not required for all homes within a production subdivision; however, the builder shall meet the aggregate energy generation requirement within the subdivision. For example, a subdivision with 10 new homes would have a solar requirement of 10 kW that could be satisfied in any combination of ways, such as two houses with 5 kW of solar or five homes with 2 kW each.

The Energy Commission approved the City of Lancaster for this local ordinance exceeding the 2013 Building Energy Efficiency Standards.[56] The cost analysis requirement was fulfilled by including a report by Energy and Environmental Economics, Inc., titled "Cost-Effectiveness of Rooftop Photovoltaic Systems for Considerations in California's Building Energy Efficiency Standards." This report was originally written in 2013 for the Energy Commission in response to the requirements of Senate Bill 1. The report provides cost-effectiveness estimates for all of California including different climate zones and utility rate assumptions.

Streamlined Permitting

Lancaster reports relatively quick permitting processes in general. In the case of rooftop solar PV, it could take as little as 15 minutes over the counter.[57]

Solar Development on City Infrastructure

In 2009, the City of Lancaster issued $27 million in bonds to buy solar power from Solar City and then sell that power to two school districts at a below-market rate. The project eventually included 27 sites and was completed in 2011. The systems now offset nearly 90 percent of the school districts' energy consumption and save around $325,000 a year in energy costs.

The city has installed solar on five of its largest municipal facilities, including City Hall. The solar panels offset 98 percent of the power used in these facilities and save the city approximately $50,000 per year. While energy efficiency improvements were made concurrently with the solar installations, the Lancaster Power Authority reports that the solar systems could have been sized more precisely by prioritizing efficiency improvements first and observing the impact on energy consumption prior to installing PV.[58]

[56] Local Ordinances Exceeding the 2013 Building Energy Efficiency Standards, California Energy Commission
[57] Conversation with Heather Swan, Lancaster Power Authority, August 14, 2014
[58] Conversation with Heather Swan, Lancaster Power Authority, August 14, 2014

City and County of San Francisco

The City and County of San Francisco have implemented a comprehensive building performance program, including various mandates, incentives and resources.[59]

Mandates

- **New Construction and Major Renovations**: In 2010, San Francisco enacted a local ordinance (reach code) exceeding the 2008 Building Energy Efficiency Standards. The ordinance, referred to as the 2013 San Francisco Green Building Code,[60] was the result of recommendations from the Mayor's Task Force on Green Buildings. The code was recently updated for the new 2013 Building Efficiency Standards and was approved by the Energy Commission on May 14, 2014. Provisions include:
    - Permit applicants for major alterations to existing Group R (multifamily) occupancy homes must submit documentation to achieve a LEED® Gold rating or GreenPoint Rated (60 points) certification rating requirements.
    - For new commercial buildings, permit applicants must submit documentation to meet LEED Gold certification requirement.
    - For new commercial buildings, permit applicants must submit documentation verifying either acquisition of on-site renewable energy or purchase of green energy credits, or a 10 percent compliance margin over 2013 Title 24, Part 6.

- **Existing Buildings**: San Francisco implemented an Existing Commercial Buildings Energy Performance Ordinance in 2011 and a Residential Energy Conservation Ordinance in the late 1980s, which was amended in 2011. According to the San Francisco Department of the Environment, the intent is "to help the local market maximize energy efficiency in San Francisco by empowering owners, managers, operators and occupants with the key information to control utility costs and to know exactly how they will benefit by improving energy efficiency."[61]
    - Nonresidential buildings over 10,000 square feet must benchmark energy use every year, and buildings over 50,000 square feet must get an energy audit every five years.
    - The San Francisco Commercial Lighting Efficiency Ordinance requires that fluorescent lighting in nonresidential commercial buildings meet a specific energy efficiency and low-mercury standard.

[59] San Francisco Green Building Website
[60] Local Ordinances Exceeding the 2013 Building Energy Efficiency Standards, California Energy Commission
[61] Conversation with Mark Palmer, Senior Green Building Coordinator, San Francisco Department of the Environment, August 19, 2014

Incentives

- **New Construction and Major Renovations**: Commercial projects that commit to LEED Platinum certification, ZNE, PassivHaus or Living Building Challenge are eligible for priority permit processing through coordination with the Planning Department, Department of Building Inspection and Department of Public Works.
- **Existing Commercial Buildings**: SF Environment has teamed with PG&E to deliver energy efficiency services and incentives to qualifying commercial customers and multifamily building owners through San Francisco Energy Watch.

Resources

- **The Green Tenant Toolkit**: An online resource designed by building sector professionals in San Francisco to enable commercial landlords and tenants to engage with one another on implementing sustainable practices in office spaces.
- **Task Forces**: San Francisco has developed a model task force process for the last 13 years. The task forces described below have resulted in successful green building policy development and implementation and have prevented opposition from the private sector by making those stakeholders a part of the policy-making process.
    - **Municipal Green Building Task Force**: Advises SF Environment on matters of policy and reviews municipal projects in design and construction to ensure compliance with San Francisco Environment Code Chapter 7 (LEED Gold certification). The task force enables communication about green building issues across city departments and project teams and provides an educational forum to increase knowledge and share project-related successes and lessons learned. The task force met monthly for 13 years and has been an effective forum for collaboration between public officials and the private sector. The city's Environment Code established the task force and designates twelve city departments to be represented on the task force plus a member of the public. The twelve departments include:
        - San Francisco Department of Public Health
        - San Francisco International Airport
        - San Francisco, Public Utility Commission (not the CPUC)
        - Real Estate Division of San Francisco General Services Agency
        - San Francisco Department of Environment
        - San Francisco Municipal Transportation Agency
        - San Francisco Department of Recreation and Parks
        - San Francisco Department of Public Works
        - San Francisco Department of Building Inspection
        - San Francisco Public Library
        - Port of San Francisco
    - **Mayor's Task Force on Existing Commercial Buildings**: Recommends policies, actions and partnerships to meet local and state goals for greater energy efficiency in existing commercial buildings. Its recommendations informed San Francisco's

approach to use building performance data to accelerate energy efficiency improvements in the commercial sector, resulting in the Existing Commercial Buildings Energy Performance Ordinance. This task force is no longer active.

- **Mayor's Task Force on Green Buildings**: Established to recommend green building standards applicable to all new buildings and most major renovations. The task force was convened and concluded its work in 2007. Their recommendations directly informed the San Francisco Green Building Code.

RECOMMENDED ACTIONS FOR LOCAL GOVERNMENTS

While the policy landscape surrounding ZNE is still evolving, it is clear that local governments have an opportunity to take a leadership role. The successes and challenges experienced by local governments as they implement ZNE-related policies and programs will directly inform and steer the state as they craft future mandates, creating a set of requirements that have been tested in local markets and vetted by the industry. In addition, local jurisdictions that take the lead will have more opportunity to shape ZNE policies and programs to meet their needs and limitations and will better prepare their constituents to comply with the rapidly arriving state mandates.

Following are eight key recommendations for local jurisdictions, each with specific action steps and resources for implementation. These recommendations are also presented in an interactive online tool called the Zero Net Energy Roadmap.[62]

Recommended Action #1 **Officially adopt ZNE goals and publically promote those goals**	
Example Implementation Steps	A. Align ZNE goals with state goals and/or establish local specific goals. B. Integrate Zero Net Energy policy into Climate Action Plan and/or Energy Roadmap. C. Make direct connection between CAP GHG emission reduction goals and ZNE policies/strategies to enable quantification of savings. D. Encourage staff to explore innovative approaches to achieve ZNE goals.
Reference	The **City of Lancaster**, where the mayor has stated a goal to become the first ZNE city in the world. • See details on page 24 • Contact: Heather Swan, Lancaster Power Authority at hswan@cityoflancasterca.org or 661-723-6195

[62] The Roadmap will be available at www.energycenter.org/zne

Recommended Action #2 **Create a ZNE task force**	
Example Implementation Steps	A. Establish task force through public statute. B. Appoint staff to lead and coordinate efforts; establish deliverables and performance metrics for staff. C. Include all relevant public departments as well as key stakeholders in the private sector.
Reference	The **City and County of San Francisco**'s task forces to address building energy efficiency • See details on page 26 • Contact: Mark Palmer, Senior Green Building Coordinator, SF Dept. of the Environment at mark.palmer@sfgov.org or 415-355-3710

Recommended Action #3 **Enact "reach codes" – local ordinances exceeding 2013 Building Energy Efficiency Standards**	
Example Implementation Steps	A. Require new construction and major renovation projects to be more efficient than required by Title 24, Part 6. B. Require new construction projects to include solar PV systems of an average minimal size. C. Establish a cool roof standard that goes above minimum Title 24, Part 6 requirements.
References	The **City of Chula Vista**'s reach code exceeding the 2008 standards • See details on page 19 • Contact: Janice Kluth, Senior Project Coordinator, City of Chula Vista Development Services Department at jkluth@chulavistaca.gov or 619-691-5022 The **City of Lancaster**'s local ordinance exceeding the 2013 standards to require single-family residential units to provide solar-generated power at a minimum average of 1 kW per home. • See details on page 24 • Contact: Heather Swan, Lancaster Power Authority at hswan@cityoflancasterca.org or 661-723-6195

Recommended Action #4 **Transform existing public buildings into ZNE or near-ZNE facilities**	
Example Implementation Steps	A. Conduct an assessment of existing public stock or utilize data collected from Climate Action Plans and/or Energy Roadmap. B. Enact ZNE policies for municipal buildings or transform existing green building policies for municipal buildings into ZNE policies. C. Establish renovation projects to address energy efficiency, renewable energy and energy storage opportunities within existing public building stock. D. Prioritize energy efficiency measures before solar to avoid investing in over-sized solar systems. E. Explore power purchase agreements (PPAs) for renewable energy development projects.
References	The **City of La Mesa**'s Sustainable Building Policy • See details on page 22 • Contact: Gregory Humora, Director of Public Works/City Engineer, City of La Mesa at GHumora@ci.la-mesa.ca.us or 619-667-1146 The **City of San Diego**'s Sustainable Building Policy • See details on page 17 • Contact: Craig Fergusson, Senior Civil Engineer, City of San Diego at cfergusson@sandiego.gov or 858-627-3311 The **City of Lancaster** issued $27 million in bonds to buy solar power from Solar City and then sold the power to two school districts at a below-market rate • See details on page 24 • Contact: Heather Swan, Lancaster Power Authority at hswan@cityoflancasterca.org or 661-723-6195

Recommended Action #5 **Streamline permitting and interconnection for applicable technologies**	
Example Implementation Steps	A. Streamline permitting for Title 24, Part 6 and energy-related Title 24, Part 11 measures (e.g., cool roofs). B. Streamline permitting and interconnection for solar PV and solar thermal projects. C. Provide ongoing training for building department staff to improve understanding of increasingly complex codes and standards.
References	The **County of San Diego's** free, online permitting system for certain renewable energy and energy efficiency projects • See details on page 18 • Contact: Vince Nicoletti, Chief, Building Division, County of San Diego at vince.nicoletti@sdcounty.ca.gov or 858-694-3075 The **City of Solana Beach's** Expedited Permit Process for green buildings • See details on page 23 • Contact: Dan King, Environmental Programs Manager, City of Solana Beach at dking@cosb.org or 858-720-2477

Recommended Action #6 **Create, promote and/or enhance incentives for construction that exceeds Title 24, Part 6**	
Example Implementation Steps	A. Develop and implement an expedited or reduced-fee permitting process for qualifying projects (e.g. GreenPoint Rated homes or LEED certified commercial projects). B. Promote and/or match utility programs that provide rebates for projects that exceed Title 24, Part 6. C. Create public recognition program for projects that exceed Title 24, Part 6.
References	The **City of Encinitas'** Green Building Incentive Program that provides financial incentives, priority plan check and city council recognition for projects that achieve GreenPoint Rated and/or LEED certifications • See details on page 21 • Contact: Kerry Kusiak, Senior Planner, City of Encinitas Planning and Building Department at kkusiak@encinitasca.gov or 760-633-2719 The **City of Solana Beach's** public recognition program for projects that achieve GreenPoint Rated (residential) or LEED (commercial) certifications • See details on page 23 • Contact: Dan King, Environmental Programs Manager, City of Solana Beach at dking@cosb.org or 858-720-2477 The **City of Chula Vista**'s Home Upgrade, Carbon Downgrade Energy Retrofit Incentive program • See details on page 21 • Contact: Cory Downs, Conservation Specialist, City of Chula Vista at cdowns@chulavistaca.gov or 619-476-2442

Recommended Action #7 **Enact PACE program(s)**	
Example Implementation Steps	A. Determine best framework (SB 555 or AB 811) and PACE program design. B. Secure approval from city council. C. Select one or more PACE providers through RFP process.
Reference	All San Diego jurisdictions have enacted PACE, including the **City of San Diego**. • See details on page 18 • Contact: Anita Pyle, Supervising Analyst/Project Manager, Environmental Services Department, City of San Diego at apyle@sandiego.gov or 858-492-6004

Recommended Action #8 **Provide ZNE education and outreach to industry stakeholders**	
Example Implementation Steps	A. Train architects, designers, builders and contractors on strategies, technologies, incentives, financing and other resources that can be used to meet and exceed code; offer a curriculum that can be used to earn continuing education units (CEUs) for building departments. B. Train the real estate community (real estate agents, appraisers, inspectors, lenders, etc.) on ways to value ZNE homes in the real estate market.
Reference	The **City of Chula Vista**'s Sustainability Center • See details on page 21 • Contact: Janice Kluth, Senior Project Coordinator, City of Chula Vista Development Services Department at jkluth@chulavistaca.gov or 619-691-5022

ADDITIONAL CONSIDERATIONS

On-site Energy Storage

While the state's ZNE definition does not address energy storage directly, storage could be included in the calculation of the "value of the energy consumed by the building annually." For example, if an on-site battery system reduces energy consumption from the grid, the time-dependent value of that avoided consumption, as well as the potential value of stored energy discharged back onto the grid, could be considered in the annual net energy calculation for a specific building. Further, grid stabilization, operational efficiency and its inclusion in the utility Long Term Procurement Planning (LTPP) could also be assigned to energy storage value in the future.[63,64]

On-site energy storage systems provide grid stabilization and load leveling and could potentially provide backup power to utility customers in times of high demand. For commercial, industrial and municipal customers, energy storage can help mitigate demand charges and play a critical role in automated demand response programs. In addition, the CPUC, under direction of AB 2514,[65] has established an energy storage procurement target of 1,325 MW by 2020 (with installation complete by 2024) for SDG&E, SCE and PG&E. Of this goal, 200 MW is customer-sited storage.[66] Several demonstration projects across the country are working to test system cost-effectiveness and the capacity of storage to address grid management, and manufacturers are working to develop technologies that can scale much like solar PV did over the last decade.

While there is no doubt energy storage will play an important role in the ZNE future, little is documented about exactly what that role will be. Two key determinants in storage's fate as a solution

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[63] Eyer, J., and G. Corey. *Energy Storage for the Electricity Grid: Benefits and Market Potential Assessment Guide.* SAND2010-0815. Sandia National Laboratories, February 2010

[64] Williams, B. D. *Plug-In-Vehicle Battery Second Life: the Effect of Post-Vehicle, Distributed-Grid-Energy-Storage Value on Battery-Lease Payments*

[65] Assembly Bill No. 2514, Chapter 469

[66] CPUC Press Release: CPUC Sets Energy Storage Goals for Utilities, October 17, 2013

for ZNE are net energy metering (NEM) and utility rate design. NEM is a "special billing arrangement that provides credit to customers with solar PV systems for the full retail value of the electricity their system generates" over a year's time.[67] Proper utility retail pricing, such as time-variant and capacity-based charges, coupled with NEM can significantly increase the cost-effectiveness of storage systems by providing credit to electricity discharged and energy avoided from batteries during peak pricing periods.

As regulators grapple with finding the correct tariffs and rates for different customer classes, energy storage could prove vital to solar and utility planning. Because energy storage mitigates the ramping of utility power in the early mornings and late afternoons, utilities may decide to further incentivize customer-sited and utility-sited battery storage by shifting peak pricing toward evening hours. This is done because solar no longer produces electricity when the sun recedes and batteries can be strategically discharged to offset the increase in plug loads related to homeowners rising in the early morning and returning home from work and school in the evening.

While battery technologies are improving rapidly, local governments can get ahead of what will likely be lengthy and complicated discussions around safety, siting, permitting and other aspects common to new technologies. Local governments may want to consider partnering with fire departments to develop and implement fire codes and building codes that address specific storage safety concerns. In addition, local governments should consider requiring solar paired with storage for municipal facilities ahead of anticipated state mandate timelines.

Energy Storage at Escondido Schools

The Escondido Union High School District is working to install stationary battery storage systems at three sites. The district leveraged SGIP rebates and a utility savings sharing arrangement with Tesla Motors to eliminate up-front costs. By charging the 600kW/1200kWh and 800kW/1600kWh lithium ion batteries at night and using the stored energy during the day, annual electricity expenses will be reduced by approximately 15 percent and the savings will go toward education. The project, part of a comprehensive energy solution developed by Climatec, is anticipated to be installed by early 2015.[68]

"The Escondido Union High School District is excited to be one of the first districts in the state to utilize this energy saving technology; this opportunity will further our long-standing commitment toward reducing our impact on the environment while at the same time freeing up dollars to be better spent toward educating the youth in our community."

- Jon Petersen, President, EUHSD Board of Education

[67] Net Energy Metering in California, Go Solar California

[68] Correspondence with Michael Simonson, Assistant Superintendent of Business Services, Escondido Union High School District, Aug 28, 2014

Plug-in Electric Vehicle Charging

At the state level, energy consumed to charge plug-in electric vehicles (PEVs) — i.e., plug-in hybrid EVs and all-battery EVs — is considered a transportation sector use as opposed to a building sector use. Yet it is not clear whether PEV charging will fall *within* or *outside* the boundaries of the ZNE definition. The reality is, at this early stage in PEV adoption, charging is being addressed in multiple ways with varying consequences for ZNE implementation.

Separate metering

Separate metering means PEV electric load is measured and billed separately from the rest of the customer load using a dedicated revenue-grade meter. There are three distinct forms of separate metering:

- **Separate utility services**: PEV and building loads are measured and billed by distinct meters installed on separate utility service drops.
- **Dual-meter adapter**: PEV and building loads are measured and billed by distinct meters installed in parallel on a single utility service drop.
- **Submeter**: PEV and building loads are measured and billed by distinct meters installed in series on a single utility service drop, with the submeter installed between the customer's main meter and the electric vehicle supply equipment (EVSE) that measures PEV load as a subset of the total customer site/building load as determined by the primary utility meter.

Electric Vehicle Metering Pilot Programs

SDG&E and the CPUC are supporting a pilot program for electric vehicle drivers to meter their cars' electric usage separately from their home use via submeters. This program was scheduled to launch on September 1, 2014.

SDG&E has also proposed a pilot program for separate metering (via separate utility services) for PEV charging in workplaces and multifamily dwellings.

Separate metering places PEV charging *outside* the boundaries defined by the current ZNE definition. These methods allow utilities to track and manage PEV consumption separate from building consumption and to provide price signals that incentivize recharging at optimal times for the PEV owner, host site and/or the electric utility system. Additionally, separate metering can potentially facilitate PEV charging to operate in a manner that is most beneficial to support high-value grid services.

The drawback of this approach is that the installation of separate meters requires additional cost and may require host sites and building owners to navigate a complicated landscape in which the utility, local government and building owner responsibilities are not well-defined. These barriers may reduce the rate of PEV adoption.

Single metering

With single metering, PEV electric load is not measured separately and is counted as part of the total building load. The main advantage to single metering is that it avoids the cost and effort to install separate metering and/or separate utility service – eliminating a potential barrier to PEV adoption.

However, single metering places PEV electric load *inside* the boundaries of the current ZNE definition. This confounds two fundamentally different types of load: 1) load that represents consumption by buildings, which energy efficiency programs aim to reduce, and 2) load that represents both displacement of gasoline and increased operational efficiency of vehicles, which state transportation policies aggressively aim to increase. Without a means to distinguish "good" load from "bad" load, the effectiveness of incentives is reduced and barriers to adoption of both ZNE buildings and PEVs may increase. Furthermore, lack of separate metering eliminates the ability to access specific PEV charging rates and prevents tracking PEV energy consumption and greenhouse gas (GHG) emissions separately.

Impacts for local policy

The landscape for PEV charging technologies and methods is evolving rapidly and will continue to progress over the next several years. To address the barriers presented by single metering mentioned above, regulatory stakeholders may determine that PEV charging should be excluded from ZNE calculations.

To prepare for this approach, local governments may wish to reduce barriers to installation of separate and/or submeters for PEV charging. While meter installation is primarily a utility function, as opposed to a local government function, permitting for separate meters and the associated electrical work is part of what makes installation a time-consuming process. Barrier removal could include better defining and streamlining the permit process, considering potential exemptions for separate PEV charging meters and incentivizing installation of separate meters.

Financing

California is not likely to reach its ZNE goals without the presence of accessible, innovative financing options for customers who might otherwise not have sufficient capital to install energy efficiency or renewable energy measures.

As discussed in previous chapter, local governments can enhance the financing options available in their jurisdictions by authorizing PACE programs. Local governments also can conduct outreach to constituents about current available financing products and support new financing programs.

Find Local Financing Programs

Two online resources can help local governments and consumers identify financing programs in their area:

- Clean Energy Financing Programs Database
- Property Assessed Clean Energy (PACE) Map

Consumer Understanding of ZNE

The concept of ZNE, particularly how it is defined by the state of California, may not be well-understood by consumers. The media's most common explanation for a ZNE building is one that produces as much energy as it uses, over the course of the year. This could be expressed in rough terms through the following equation:

[Annual BTUs consumed] – [Annual BTUs produced] = 0

However, the CPUC and Energy Commission definition of ZNE is based on *modeled energy consumption* rather than actual consumption. In addition, it is based on the *value* (defined by time dependent valuation; see page 40) of the energy used, not a strict measurement of BTUs. The state definition of ZNE could be demonstrated as such:

[Value of modeled energy consumed] – [net modeled energy produced] = 0

Furthermore, as the market responds to price signals by shifting demand to less expensive times of day, the value of any given energy use (e.g., air conditioning) may change over time.

This discrepancy — combined with the even bigger potential misperception among less sophisticated energy consumers that ZNE means zero energy bills — could present a marketing challenge for ZNE

stakeholders. Property owners or tenants may be confused or disappointed when they discover their new ZNE buildings do not have zero energy bills or ZNE use. Furthermore, a building that met the ZNE definition in 2020 may not meet the ZNE definition in 2030, and the building's energy bills may grow over time as time-of-use pricing is adjusted to reflect changing demand profiles.

In its 2013 Integrated Energy Policy Report, the Energy Commission underscored the importance of improving consumer understanding of ZNE:

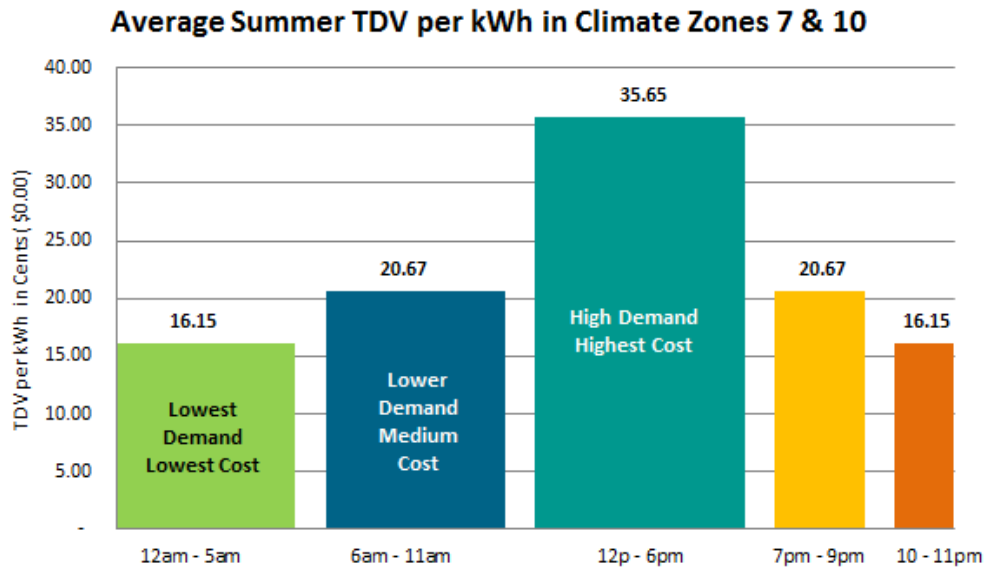
> *Public education is important so that people understand the estimated energy use for the ZNE Code Building is determined for the building design and that the actual energy use of the building will depend on how the building is operated. Public education should clarify the correct expectations for ZNE Code Buildings and should also illuminate the benefits of ZNE Code Buildings in achieving optimum energy performance, reduced criteria pollutants and reduced GHG emissions, as well as nonenergy benefits such as improved comfort and building functionality.*[69]

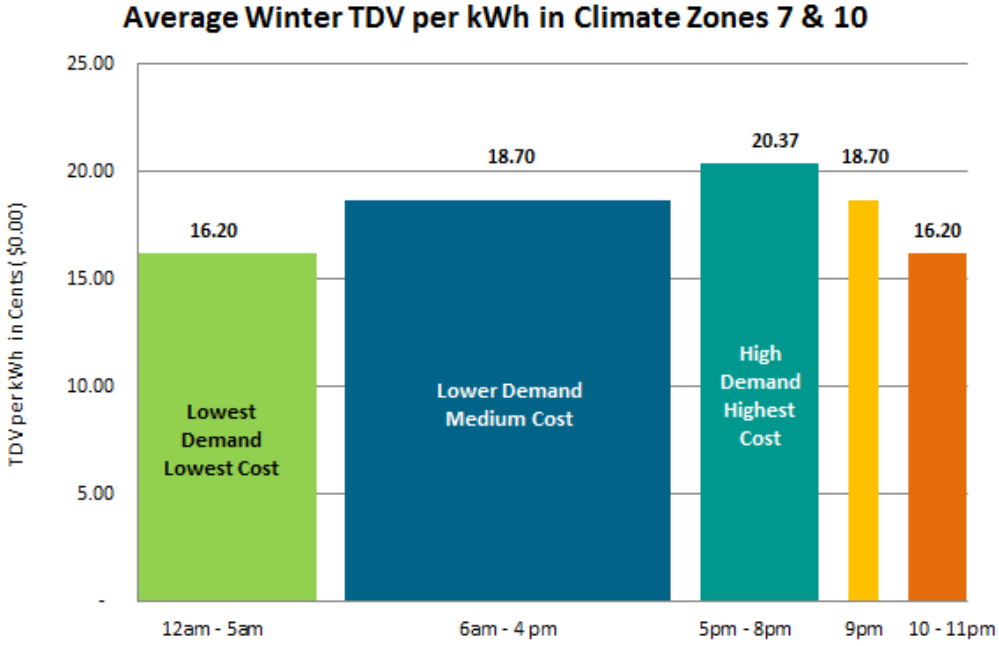
The New Buildings Institute has built a ZNE Communications Toolkit to help stakeholders align around consistent messaging. The toolkit outlines talking points emphasizing ingenuity, leadership, prosperity and economic development.[70] This toolkit was created before the latest definition of ZNE was proposed by the CPUC and Energy Commission. More market research is needed to clarify consumers' current perceptions of ZNE and to reconcile messaging efforts with the state's definition of ZNE.

[69] 2013 Integrated Energy Policy Report
[70] California ZNE Communications Toolkit, July 2013

Time Dependent Valuation

The Energy Commission captures value through time dependent valuation (TDV) that weights kilowatt-hours differently depending on the season, time of day and climate zone. For example, in 2014, a kWh used at midnight (regardless of the season) or in a temperate climate zone is valued less than a late-afternoon, summertime kWh in a hot climate zone.





Source for graphs: [Time Dependent Valuation (TDV) factors for the California Energy Commission's 2013 building standards]

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