

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

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By the Center for Sustainable Energy



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More information is available at www.energycenter.org/zne.

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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



CALIFORNIA'S ZERO NET ENERGY GOALS

Residential and commercial buildings are responsible for approximately 40 percent of total U.S. energy consumption¹ and carbon dioxide emissions.² Existing building retrofits and energy-efficient new construction present a huge opportunity to reduce greenhouse gas emissions and energy burdens on families, businesses and public agencies. At the same time, energy efficiency and renewable energy technologies are becoming more affordable and available. As a result, the concept of zero net energy (ZNE) buildings has emerged as a goal pursued by policy makers in California and beyond.

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) uses 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 Plan⁴ and has since expanded them. These goals include:

1. All new residential construction will be ZNE by 2020⁵

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](#)

2. All new and 50 percent of existing state-owned public buildings will be ZNE by 2025⁶
3. All new⁷ and 50 percent of existing⁸ commercial buildings will be ZNE by 2030

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

Yet despite the technical feasibility, the reality is that the market has a long way to go before meeting the state's ZNE goals. A 2015 study performed on behalf of California IOUs identified barriers to achieving the 2020 residential ZNE goal based on current market characteristics.

Despite this vibrant activity among the emerging ZNE-type market, the study also found various indicators that the market is not currently poised to achieve a ZNE homes 2020 aspirational goal, including a lack of consumer demand, a lack of qualified building professionals, early adopters' misperceptions about the ZNE concept, questions regarding the cost effectiveness of ZNE-type homes, and various barriers (real and perceived) to adoption of ZNE-type homes... Results indicate, however, that current efforts are insufficient to reach the goal of all ZNE residential new construction by 2020. To achieve this goal, the PAs, CPUC, CEC, and others will need to expand activities, significantly increase financial incentives, design assistance and workforce education efforts, and take risks with new programs and policies.¹⁰

State building codes and appliance standards are the principal regulatory mechanisms for achieving ZNE in new construction and major renovations in California. But, as the 2015 study indicates, the market likely will not be ready to comply with these evolving codes and standards without a variety of other programs and policies. Thus, local governments, working in collaboration with the state and industry stakeholders, will play a key role in preparing the market meet the state's ambitious ZNE goals. This report is intended to help guide these efforts for local governments in the San Diego region.

⁵ [CPUC Decision 07-10-032](#)

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, PG&E, December 2012](#)

¹⁰ [Residential ZNE Market Characterization, PG&E, February 27, 2015](#)



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).¹¹ 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 many new 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

¹¹ [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”)¹² 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.¹³ 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 20.¹⁴ Like the state’s building codes, Title 20 appliance efficiency regulations are updated periodically.

¹² [CALGreen Code, California Buildings Standard Commission](#)

¹³ [Household Energy Use in California, U.S. Energy Information Administration](#)

¹⁴ [Appliance Standards Awareness Project](#)

ZNE Action Plans

New Residential Zero Net Energy Action Plan 2014-2020

The New Residential Zero Net Energy Action Plan 2014-2020¹⁵ (Action Plan) was developed as a collaborative effort by the Energy Commission and CPUC. The Action Plan highlights six key benchmarks to measure progress toward the 2020 residential ZNE goal.

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 HERS¹⁶ 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.

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,¹⁷ 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 include expanding Title 20 and 24 to address all significant energy end uses, establishing a “path to zero” campaign to create demand for high-efficiency buildings, and developing innovative financial tools for ZNE buildings. Strategies related to existing buildings include state and local government commitment to energy efficiency, ensuring code compliance, establishing mandatory energy labeling and benchmarks, and developing business models to deliver comprehensive “one-stop” energy management solutions.

¹⁵ [Draft ZNE Action Plan 10/15, California ZNE Homes](#)

¹⁶ 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).

¹⁷ [Zero Net Energy Action Plan: Commercial Building Sector 2010-2012](#)

Codes & Standards Action Plan 2012-2015

The Codes & Standards Action Plan¹⁸ is structured around the two categories of state codes impacting ZNE: building standards and appliance standards. Strategies related to building standards include advancing mandatory and reach Building Energy Efficiency Standards, developing the electronic infrastructure to improve code compliance, and enhancing education and training initiatives to improve compliance.

Statewide Codes & Standards Program

The Statewide Codes & Standards Program¹⁹ is intended to achieve maximum energy savings across all major groups and sectors in California. Collectively, the investor-owned utilities (IOUs) had a \$28 million budget for 2013-2014 to pursue the following subprograms.

- **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)

Benchmarking makes energy use in existing buildings visible to buyers, sellers, lenders and other stakeholders. This information – and its public disclosure – can be a powerful motivator for improving energy efficiency. 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,

¹⁸ [Codes & Standards Action Plan 2012-2015](#)

¹⁹ [Statewide Codes & Standards Program](#)

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 changed the compliance date for buildings between 5,000 and 10,000 square feet to July 1, 2016.²⁰

In its recent Existing Buildings Energy Efficiency Action Plan released in March 2015, the Energy Commission proposed an expansion of energy benchmarking and disclosure that would require all buildings with more than 50,000 square feet to report energy data using ENERGY STAR Portfolio at least every two years.²¹ This data would be reported at a set time each year and become public after the second benchmarking cycle. The Energy Commission is in program development and anticipates phasing in these requirements over the next three to four years.

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.²²

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 6.²³
- **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.²⁴

²⁰ [CEC Notice of Emergency Rulemaking Action: Amendment to Nonresidential Building Energy Use Disclosure Program Compliance Schedule, August 11, 2014](#)

²¹ [Existing Buildings Energy Efficiency Action Plan, California Energy Commission, March 2015](#)

²² [Proposition 39: California Clean Energy Jobs Act – 2013 Program Implementation Guidelines](#)

²³ [The California Advanced Homes Partnership](#)

²⁴ [The New Solar Homes Partnership](#)

- **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.²⁵ Rebates are available to customers of PG&E, SCE and SDG&E.²⁶
- **California Solar Initiative – Thermal:** The CSI-Thermal Program²⁷ offers rebates to single-family, multifamily and commercial customers installing natural gas displacing solar water heating systems in PG&E, SoCal Gas and SDG&E territories.
- **Self-Generation Incentive Program (SGIP):** The CPUC's SGIP²⁸ 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.
- **Savings By Design:** Administered by the IOUs, Savings By Design (SBD)²⁹ encourages high-performance, nonresidential building design and construction through incentives (for both owners and design teams) and no-cost design consulting.
- **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.³⁰
- **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.³¹
- **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.³²

²⁵ CSI funding for existing homes has been exhausted in SDG&E territory; California does not have a ZNE goal related to existing homes.

²⁶ [California Solar Initiative](#)

²⁷ [California Solar Initiative Thermal Program](#)

²⁸ [Self-Generation Incentive Program](#)

²⁹ [Savings By Design Program](#)

³⁰ [CPUC Fact Sheet: Statewide Commercial Program \(2013-2014\); Direct Savings with Direct Install, SDG&E](#)

³¹ [CPUC Fact Sheet: Statewide Commercial Program \(2013-2014\); Save energy, earn incentives, SDG&E](#)

³² [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.³³

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.³⁴ The pilots, administered by the California Alternative Energy and Advanced Transportation Authority (CAEATFA) are expected to launch in late 2015 and will continue for at least 24 months, allowing for changes to the design based on feedback and evaluation results.

³³ [CPUC Fact Sheet: Statewide Financing Program \(2013-2014\); On-Bill Financing, SDG&E](#)

³⁴ [Energy Efficiency Financing Pilot Programs, California Alternative Energy and Advanced Transportation Financing Authority](#)



ZNE ROADMAP FOR LOCAL GOVERNMENTS

While the concept of ZNE is just beginning to become part of city planning and policymaking, a strong foundation exists upon which to build a ZNE policy framework. Local governments in the San Diego region have enacted a variety of policies that encourage and/or require energy efficiency and renewable energy. Many have completed climate action plans (CAPs) and energy roadmaps (see table below). All have launched property assessed clean energy (PACE) programs to help homeowners and businesses finance clean energy projects. Several jurisdictions have created green building programs that encourage environmental practices and certifications that may include energy efficiency or renewable energy measures.

Table 2. San Diego-Area Jurisdictions' Energy Roadmaps and Climate Action Plans		
Jurisdiction	Energy Roadmap	Climate Action Plan
City of Carlsbad	Pilot, 2006; Updated, 2014	Drafted, 2014
City of Chula Vista	Completed, 2012	Adopted, 2000; Updated, 2008 & 2011
City of Coronado	Completed, 2012	--
City of Del Mar	Completed, 2013	Draft in progress
City of El Cajon	Completed, 2013	--
City of Encinitas	Completed, 2011	Adopted, 2011
City of Escondido	Completed, 2012	Adopted, 2013
City of Imperial Beach	Completed, 2011	--
City of La Mesa	Completed, 2013	Planned
City of Lemon Grove	Completed, 2014	--
City of National City	Completed, 2012	Adopted, 2011
City of Oceanside	Completed, 2012	--
City of Poway	Pilot, 2009	--
City of San Diego	--	Adopted, 2005; Drafted Update, 2015
County of San Diego	Strategic Energy Plan: 2013-2015	Adopted, 2012
City of San Marcos	Completed, 2011	Drafted, 2013
City of Santee	Completed, 2011	Planned for 2014-15
City of Solana Beach	Pilot, 2009	In progress
City of Vista	Completed, 2012	Adopted, 2013

Similarly, many local governments beyond the San Diego region are developing CAPs and sustainable energy policies. For example, the Energy Commission approved local ordinances (reach codes) exceeding the 2008 Building Energy Efficiency Standards for 45 California cities.³⁵ While these reach codes are now obsolete with the onset of the 2013 standards, five cities have obtained approval for local ordinances exceeding the 2013 standards: Los Angeles, Glendale, Lancaster, San Francisco and Pasadena (see Table 3, page 19).³⁶ Adopting reach codes helps build the market and prepare builders and property owners for future, more stringent versions of Title 24, Part 6.

A few jurisdictions in California have developed ZNE-specific goals and strategies. Others have an opportunity to learn from these early examples or adapt their pre-existing energy efficiency or renewable energy policies into ZNE-specific policies.

The successes and challenges experienced by local governments as they implement ZNE-related policies and programs will directly inform and steer state officials 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 greater opportunity to shape ZNE policies and programs to meet their needs and limitations and, in turn, better prepare their constituents to comply with the rapidly arriving state mandates.

Following are nine policy recommendations for local governments, each with a list of resources to assist with implementation. Examples of jurisdictions that have enacted these policies are also discussed, with an emphasis on the San Diego region.

1. Officially adopt ZNE goals

The first step to moving the market toward ZNE is to officially establish a ZNE goal for the jurisdiction. A ZNE goal can help frame a variety of energy efficiency and renewable energy goals that may already be on the books. It's also important to incorporate ZNE goals into CAPs or energy roadmaps.

Example implementation steps

1. Engage stakeholders to build support for ZNE goal (see recommendation #2 on page 16).
2. Align ZNE goal with state goals and/or establish local specific goals.
3. Integrate ZNE policy into climate action plan and/or energy roadmap.
4. Make direct connection between CAP GHG emission reduction goals and ZNE policies/strategies to enable quantification of savings.
5. Encourage staff to explore innovative approaches to achieve ZNE goals.

³⁵ [Local Ordinances Exceeding the 2008 Building Energy Efficiency Standards, California Energy Commission](#)

³⁶ [Local Ordinances Exceeding the 2013 Building Energy Efficiency Standards, California Energy Commission](#)

Lancaster

In 2011, the City of Lancaster set a goal to become the first net-zero energy city, which it defined as producing or procuring more electricity within city limits from renewable sources than is consumed.³⁷ The goal has two phases: first to reach 215 megawatts (MW) of renewable power capacity, then 530 MW. The driving force behind the goal was the vision of Mayor R. Rex Parris and the city council and their passion for cost-effective climate change solutions. City leaders initially focused on solar programs and have since evolved into a more holistic look at energy, including efficiency and storage.

By the end of 2014, the city was 54% of the way to achieving its phase one goal, with 117 MW of solar production operational or under construction. The city's suite of policies and programs supporting the ZNE goal has brought financial benefits to taxpayers, schools and individual families. Following are some of these initiatives.

"Net-zero is possible, net-zero is cost-effective and net-zero is necessary to maintain the wellness of our planet."

– [Mayor R. Rex Parris](#)

- **Solar on municipal facilities and school sites:** Ninety-seven percent of Lancaster's municipal buildings and all 25 school sites have solar, an accomplishment facilitated by a public/private partnership between the city and solar developer SolarCity. Solar shade structures on five municipal sites save the city an average of \$50,000 per year in energy costs and during construction provided approximately 100 jobs. The solar panels installed on the schools saved nearly \$421,000 in electricity costs in the first year of operation.
- **Utility-scale solar:** Solar developers also have installed utility-scale solar systems, with 77 MW operational and another 250 MW in the planning process. The city estimates these private developments have created more than a thousand local jobs.
- **Partnership with KB Home:** The city has worked with homebuilder KB Home to bring net-zero energy homes to the area. KB Home's Double ZeroHouse 2.0, unveiled in 2014, is highly water and energy efficient and estimated to reduce annual utility expenses by \$4,452 per household. In addition, KB Home has built more than 200 homes with solar installations in Lancaster.
- **Streamlined permitting for solar PV:** Lancaster simplified its permitting, interconnection and inspection process for installing solar. Residential solar permits are issued over the counter in just one visit. (See recommendation #5 on page 22.)
- **Local ordinance requiring solar on new homes:** In January 2014, the city began requiring new single-family homes to provide solar-generated power at a minimum average of 1 kilowatt per home. (See recommendation #3 on page 18.)
- **PACE financing:** The city has authorized three providers to offer property assessed clean energy (PACE) financing for residential energy efficiency, water efficiency and renewable energy projects. (See recommendation #8 on page 27.)

³⁷ It should be noted that a ZNE city, as defined by Lancaster, is different from a city made up of ZNE buildings as defined by the Energy Commission.

- **Better Built Home Program:** This voluntary program offers builders incentives for incorporating energy- and water-efficient features. Incentives include a 25% discount on city-imposed impact fees, a waiver for backyard landscaping requirements and the use of recycled water for dust control at no charge. The estimated value of these incentives is \$9,000-\$12,000 per home. (See recommendation #7 on page 26.)
- **Single-Family Affordable Solar Housing (SASH):** In August 2014, the city council approved the ratepayer-funded SASH program that provides rebates for solar installations on qualified low-income homes. The program also provides local students with hands-on installation experience, building the local workforce.
- **Community choice aggregation:** In May 2014, the Lancaster City Council officially established a community choice aggregation (CCA program) through local ordinance No. 997 and an associated implementation plan – the culmination of more than two years of groundwork. Under the CCA, electricity customers within city limits will have the option to procure power from an alternative provider. (The electricity would continue to be delivered via Southern California Edison’s distribution grid.) The CCA launched for municipal customers in May 2015 and will be available to commercial, industrial and residential customers in October 2015.
- **Energy storage and electric vehicle charging project:** The city has partnered with Green Charge Networks to install an energy storage system and electric vehicle charging station at the Lancaster Museum of Art and History. The project is funded by a grant from the Energy Commission and is estimated to cut demand charges by \$3,200 in the first year.
- **Street light buy-back and retrofit:** The city is working with Southern California Edison to buy back its street lights and retrofit them to LEDs.

The community, which is largely politically conservative and centered on the agriculture and aerospace industries, has been generally supportive of the city’s ZNE efforts. The initiatives have led to cost savings and jobs for constituents; many were developed with the input of builders and developers.

Lancaster officials recognize that an opportunity for improvement would have been to incorporate energy efficiency strategies from the onset. Lancaster focused much of its early attention on solar without considering the loading order. The result has been overproduction at some facilities and potential missed opportunities for a more cost-effective approach.

The most important lesson from Lancaster’s example is the importance of strong internal leadership. The mayor and city council were willing to take calculated risks and try creative solutions, and it is paying off in cost savings, job creation and huge advancements in the production of clean, renewable energy.

For more information

- [Case study: Lancaster's ZNE Goal](#)
- Heather Swan, Lancaster Power Authority at hswan@cityoflancasterca.org or 661-723-6195

2. Create a ZNE task force

A task force can help build consensus among internal and external stakeholders and work through barriers before they derail a new initiative. It is important to specify objectives and performance metrics from the onset. Although no jurisdiction has established a ZNE-specific task force, some have successfully used task forces to address various sustainable building objectives. This model can be adapted to focus on ZNE buildings.

Example implementation steps

1. Establish task force through public statute.
2. Include all relevant public departments as well as key stakeholders from the private sector.
3. Appoint staff to lead and coordinate efforts.
4. Establish deliverables and performance metrics for staff.

City of La Mesa

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.³⁸

City and County of San Francisco

The City and County of San Francisco has used task forces to develop and implement green building policies and have prevented opposition from the private sector by bringing those stakeholders into the process.

³⁸ [La Mesa Sustainable Building Committee: Sustainable Building Policies](#)

- **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 designated 12 city departments to be represented on the task force plus a member of the public. The 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.³⁹

For more information

- Gregory Humora, Director of Public Works/City Engineer, City of La Mesa at ghumora@ci.la-mesa.ca.us or 619-667-1146
- Mark Palmer, Senior Green Building Coordinator, San Francisco Department of the Environment at mark.palmer@sfgov.org or 415-355-3710

³⁹ [San Francisco Green Building Website](#)

3. Enact “reach codes” or local ordinances exceeding Title 24, Part 6

Title 24, Part 6 is updated approximately every three years with increasingly stringent energy efficiency requirements. Many local jurisdictions enact local ordinances that go beyond the state code. Some require new buildings to be designed to use 10-20 percent less energy than allowed by the standards. This 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.

Prior to enforcing these types of reach codes, 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 performed through the IOU Statewide Codes & Standards Program. Local ordinances that exceed Title 24, Part 6 must be approved by the Energy Commission to be legally enforceable.

Other local ordinances require building features that do not directly address the Title 24, Part 6 standards and that are enforceable without commission approval. Examples include requiring new buildings be pre-wired for rooftop solar PV or electric vehicle charging systems or pre-plumbed for solar water heating systems.

Example implementation steps

1. Engage stakeholders to identify desired local ordinance(s) that go beyond Title 24, Part 6 requirements.
2. If required, conduct cost-effectiveness study or tap into cost-effectiveness study conducted by Statewide Codes and Standards Program.
3. Identify local, state and utility incentives that would help developers offset additional cost of complying with local ordinance, if any. Use this information and cost-effectiveness study to help build support among stakeholders.
4. Complete local public ordinance adoption process, including public review and comment period.
5. If required, secure approval from Energy Commission.

The following table shows jurisdictions that have received approval from the Energy Commission for local ordinances exceeding the 2013 version of Title 24, Part 6.

Table 3. Local Ordinances Exceeding 2013 Building Energy Efficiency Standards (Title 24, Part 6)			
Jurisdiction	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. ⁴⁰
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.	Life cycle benefit-cost ratio for group of performance-based efficiency measures is greater than one and therefore cost-effective. ⁴¹
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. ⁴²
City of Los Angeles	Aug 27, 2014	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. ⁴³
City of Pasadena	Nov 17, 2014	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. ⁴⁴

Other jurisdictions have implemented ZNE-related local ordinances that do not directly address Title 24, Part 6 requirements and thus do not require Energy Commission approval.

City of Chula Vista

Since 2009, Chula Vista has required new residential construction be plumbed for solar water heating systems and include electrical conduit for solar PV systems.

⁴⁰ [Letter from City of Lancaster to California Energy Commission RE: Local ordinance for implementation of solar PV systems, October 23, 2013](#)

⁴¹ [Letter from City and County of San Francisco to California Energy Commission RE: Transmittal of San Francisco Building Code Amendment, November 19, 2013](#)

⁴² [Letter from City of Glendale to California Energy Commission RE: Cover Letter, November 23, 2013](#)

⁴³ [Documents submitted to the California Energy Commission for Approval of Ordinance](#)

⁴⁴ [Climate Zone 9 Energy Cost-Effectiveness Study for Cool Roofs, June 13, 2014](#)

County of San Diego

In July 2015, the County of San Diego will begin implementing an ordinance that requires new single-family homes to include conduit and space in the electrical panel for circuit breakers for future solar PV and electric vehicle charging systems.⁴⁵

For more information

- [Local Ordinances Exceeding the 2013 Building Energy Efficiency Standards](#)
- Heather Swan, Lancaster Power Authority at hswan@cityoflancasterca.org or 661-723-6195
- Janice Kluth, Senior Project Coordinator, City of Chula Vista Development Services Department at jkluth@chulavistaca.gov or 619-691-5022
- Vince Nicoletti, Chief, Building Division, County of San Diego at vince.nicoletti@sdcounty.ca.gov or 858-694-3075

4. Transform municipal buildings into ZNE buildings

Leading by example is important to demonstrate a jurisdiction's commitment to ZNE and to demonstrate to local stakeholders ZNE's technical feasibility, cost-effectiveness and best practices.

Example implementation steps

1. Enact ZNE policies for municipal buildings or transform existing green policies for municipal buildings into ZNE policies.
2. Conduct benchmarking to generate and compare energy use scores among buildings. (This data may exist as part of climate action plan or energy roadmap activities.)
3. Conduct audits on high priority buildings to plan retrofit measures.
4. Explore power purchase agreements (PPAs) and other financing mechanisms for energy projects.
5. Continue benchmarking activities post-retrofit to assess results. Consider disclosing energy benchmarking results as part of larger energy use disclosure/energy efficiency awareness program.

County of Santa Barbara

The County of Santa Barbara's Zero Net Energy Facilities Resolution sets an interim target for 50% of new county-owned facilities beginning design after 2020 to be ZNE and requires that all new facilities and major renovations beginning design after 2025 will be ZNE.

⁴⁵ [San Diego County Ordinance No. 10380](#)

The county board of supervisors approved the ZNE resolution on March 4, 2014, and included it in its 2014 Sustainability Progress Report. Supervisors cited local jobs, public health, cost-effectiveness and leadership as motivators for expanding the county's sustainability initiatives. The resolution has not received dedicated funding yet, but is anticipated to be incorporated into the budgeting process in 2015. Solar installations proposed in the 2015 county budget would be among the first capital improvement projects in support of the ZNE resolution.

The resolution set a vision that is driving development of supporting policies and ordinances. The board recently enacted a policy to commission and retro-commission county buildings. The momentum for energy-efficient buildings and retrofits is growing, with a new commitment to incorporate both energy efficiency and renewable energy together into holistic projects. A key next step will be to bring even more agencies on board and to identify funding mechanisms for the suite of actions needed to reach zero net energy consumption.

City of San Diego

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" that 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."⁴⁶

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.⁴⁷
- 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.

The Sustainable Building Policy⁴⁸ 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.

⁴⁶ [City of San Diego Sustainable Building Policy No. 900-14](#)

⁴⁷ This requirement is being revised for the 2013 standards.

⁴⁸ [City of San Diego Sustainable Building Policy](#)

City of La Mesa

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.⁴⁹

For more information

- [Case Study: Santa Barbara County's ZNE Facilities Resolution](#)
- Roy Hapeman, General Services Energy Manager, Santa Barbara County at rhapema@countyofsb.org or 805-568-2628
- Craig Fergusson, Senior Civil Engineer, City of San Diego at cfergusson@sandiego.gov or 858-627-3311
- Gregory Humora, Director of Public Works/City Engineer, City of La Mesa at GHumora@ci.la-mesa.ca.us or 619-667-1146
- [Roadmap to Zero Net Energy Public Buildings](#) by Northeast Energy Efficiency Partnerships

5. Streamline permitting and interconnection for energy efficiency and renewable energy

Long, complicated permitting processes can be a significant barrier to the adoption of measures such as solar PV, solar water heating, cool roofs, HVAC upgrades and other energy efficiency measures. Similarly, complex interconnection procedures can add time and cost to solar PV projects. Local jurisdictions that streamline these processes (or if the jurisdiction does not run a municipal electric utility, work with the utility to streamline the interconnection process) can lower the costs of creating ZNE buildings and increase the likelihood of Title 24 compliance. California Assembly Bill 2188, enacted in 2014, requires local governments to adopt streamlined permitting processes for small rooftop solar PV installations by September 30, 2015. The law applies to systems no larger than 10 kW on single-family or duplex family dwellings.

⁴⁹ [La Mesa Sustainable Building Committee: Sustainable Building Policies](#)

Example implementation steps

1. Provide clear information on building department website. List permit requirements by project type. Minimize number of clicks needed to navigate from jurisdiction home page to permit application.
2. Offer online permitting, including applications in fillable PDF format with electronic signatures and payment and the ability for both the applicant and the building department to track progress online.
3. Provide checklists to help permit applicants complete forms correctly the first time and reduce the time building department staff members need to review applications.
4. Provide ongoing training for contractors, developers and building department staff to improve understanding of increasingly complex codes and standards, as well as local permitting processes. (See recommendation #9 on page 29.)

County of San Diego

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.⁵⁰ 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.

For more information

- Vince Nicoletti, Chief, Building Division, County of San Diego at vince.nicoletti@sdcounty.ca.gov or 858-694-3075
- [Solar Roadmap](#), online interactive tool by Optony
- [AB 2188](#)
- [California Solar Permitting Guidebook](#), 2014 report by Solar Permitting Working Group, Governor's Office of Planning and Research
- [Best Practices for Interconnection Processes](#) and [Best Practices for Interconnection Standards](#), 2013 reports for Southern California Rooftop Solar Challenge
- [Model Interconnection Procedures](#) by International Renewable Energy Council
- Tamara Gishri Perry, Senior Manager, Center for Sustainable Energy at tamara.perry@energycenter.org or 323-284-5667
- [Improving Residential HVAC Permit Compliance: Best Practices for Local Jurisdictions](#) by Center for Sustainable Energy
- Marissa Spata, Project Manager, Center for Sustainable Energy at marissa.spata@energycenter.org or 858-737-1584

⁵⁰ [Homeowner's and Business Owner's Relief Act, County of San Diego](#)

6. Establish benchmarking and disclosure policies

Benchmarking and disclosure of building energy and water use makes this information publicly available and has been shown to reduce energy consumption and help property owners save billions of dollars in utility costs. The U.S. EPA's ENERGY STAR program has found that buildings that benchmark energy use over three years reduce energy use by an average of seven percent.⁵¹ A study prepared for the MIT Energy Initiative Symposium found that utility expenditures per square foot are approximately two percent lower in buildings covered by benchmarking and disclosure laws.⁵²

Local governments in California are encouraged to pass their own local benchmarking and disclosure ordinances that align with the state's forthcoming benchmarking program (AB 1103). Local governments should harmonize their requirements with the Energy Commission, particularly by using ENERGY STAR Portfolio Manager as the primary reporting tool. However, local governments may choose to adopt tailored requirements, such as requiring that data be reported from buildings with less than 50,000 square feet.

Another way that local governments can lead by example is to benchmark and publicly report monthly energy and water use data for all municipal buildings in advance of the statewide benchmarking program. Benchmarking also helps local governments understand their building stock, which can help them improve energy and water efficiency programs and track progress toward ZNE goals. (See recommendation #4 on page 20.)

Example implementation steps

1. Review existing benchmarking ordinances to become familiar with best practices. The Institute for Market Transformation has tools to compare existing benchmarking and reporting regulations.
2. Determine the scope of buildings covered and engage stakeholders from these sectors to inform them of the benefits of a benchmarking policy, help them understand the process and requirements and work through their concerns.
3. Implement benchmarking and reporting requirements.
4. Provide ongoing stakeholder support via a help center.
5. Create case studies to show the benefits of energy management and analyze the data collected so that it can be used to inform CAPs, energy and water efficiency programs and ZNE implementation.

At least 17 local jurisdictions across the country have adopted benchmarking and reporting requirements.⁵³

⁵¹ [ENERGY STAR® Portfolio Manager: Benchmarking and Energy Savings](#)

⁵² [Palmer, K and Walls, M. 2014. *Can Benchmarking and Disclosure Laws Provide Incentives for Energy Efficiency Improvements in Commercial Buildings?*](#)

⁵³ [U.S. Benchmarking Map, Institute for Market Transformation](#)

District of Columbia

Washington, D.C., was the first jurisdiction to pass a benchmarking and public disclosure ordinance at the local level as part of the Clean and Affordable Energy Act of 2008.⁵⁴ The district's ordinance requires that all municipal buildings greater than or equal to 10,000 square feet and all multifamily and nonresidential buildings above 50,000 square feet benchmark and publicly disclose monthly energy and water use each year. The District Department of the Environment enforces the benchmarking ordinances and the penalty for noncompliance is up to \$100 per day. The district offers a benchmarking help center that provides trainings and answers stakeholder questions about the benchmarking and reporting process.

City and County of San Francisco

In 2011, San Francisco passed the Existing Commercial Buildings Energy Performance Ordinance that requires annual benchmarking, periodic energy audits and public reporting of benchmarking information for nonresidential buildings greater than 10,000 square feet. It was phased in over three years and started with buildings with more than 50,000 square feet.⁵⁵ The city also conducts benchmarking and discloses energy information for its municipal buildings.

For more information

- [ENERGY STAR: Learn about benchmarking](#)
- [Institute for Market Transformation](#)
- Marshall Duer-Balkind, Energy Administration, District Department of the Environment, Government of the District of Columbia at marshall.duer-balkind@dc.gov or 202-671-3042
- Barry Hooper, Green Building Program, San Francisco Department of the Environment at barry.hooper@sfgov.org or 415-355-3753

⁵⁴ [BuildingRating: District of Columbia's Clean & Affordable Energy Act](#)

⁵⁵ [BuildingRating: San Francisco's Existing Commercial Buildings Energy Performance Ordinance](#)

7. Incentivize construction that exceeds Title 24, Part 6

Incentives can take many different forms, including expedited permitting, public recognition programs and rebates.

County of San Diego

The County of San Diego's Green Building Incentive Program,⁵⁶ 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, water 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 2003.⁵⁷

City of Encinitas

The City of Encinitas' Green Building Incentive Program⁵⁸ 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 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 are 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 Solana Beach

Projects in Solana Beach that include a Green Building Application are given priority status for staff level project review, saving applicants 30-40 percent of permit processing time.

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 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.

⁵⁶ [The Green Building Program, County of San Diego](#)

⁵⁷ Correspondence with Vince Nicoletti, Chief, Building Division, County of San Diego on August 20, 2014

⁵⁸ [Encinitas Green Building Incentive Program](#)

- 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.⁵⁹

City and County of San Francisco

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.

City of Chula Vista

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 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.⁶⁰

For more information

- Kerry Kusiak, Senior Planner, City of Encinitas Planning and Building Department at kkusiak@encinitasca.gov or 760-633-2719
- Dan King, Environmental Programs Manager, City of Solana Beach at dking@cosb.org or 858-720-2477
- Cory Downs, Conservation Specialist, City of Chula Vista at cdowns@chulavistaca.gov or 619-476-2442

8. Enact PACE or other financing program(s) for commercial buildings

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

⁵⁹ [City of Solana Beach Green Building Incentives](#)

⁶⁰ Home Upgrade, Carbon Downgrade Energy Retrofit Incentive Program Analysis, August 2013

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.

Example implementation steps

1. Determine best framework (SB 555 or AB 811) and PACE program design.
2. Secure approval from city council.
3. Select one or more PACE providers through RFP process.

Every jurisdiction in the San Diego region and many more across the state have implemented both commercial and residential PACE programs. The City of San Diego is highlighted below.

City of San Diego

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 the PACE 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 2014.⁶¹ The city is working with three PACE providers to administer residential and commercial programs. More than 800 residential projects totaling \$19 million have been completed – with more than 1,100 additional projects in the works – since PACE became available in the city. These projects have led to an estimated 164 new local jobs and \$33.5 million in direct economic stimulus.⁶² Sixty-four commercial projects have applied for PACE financing.⁶³

For more information

- [Property Assessed Clean Energy \(PACE\) Programs in California](#), interactive map
- [Residential and Commercial Property Assessed Clean Energy \(PACE\) Financing in California](#), 2013 report by Center for Sustainable Energy and Energy Policy Initiatives Center
- [Figtree, commercial PACE provider](#)
- [Renewable Funding, commercial PACE provider](#)
- [Renovate America, commercial PACE provider](#)
- [Ygrene, commercial PACE provider](#)

⁶¹ [Council President Todd Gloria Press Release: City Council Helps San Diego Homeowners Go Green, April 8, 2014](#)

⁶² Correspondence with Donna Chralowicz, Environmental Services Department, City of San Diego on May 11, 2015

⁶³ Correspondence with Anita Pyle, Supervising Analyst/Project Manager, City of San Diego, Environmental Services Department, on September 3, 2014

9. Provide ZNE education and outreach to industry stakeholders

Building industry stakeholders – from building department staff to mom-and-pop contractors to large-scale developers – face a rapidly evolving policy, programmatic and technology landscape. Education and outreach efforts can help them comply with Title 24, Part 6 and local ordinances at a lower cost.

City of Chula Vista

Chula Vista’s Sustainable Communities Program provides resources to stakeholders such as architects, developers, contractors and building department staff to improve compliance with energy efficiency and green building codes and to promote construction of sustainable buildings. The program offers free workshops and resources such as permitting fact sheets for over-the-counter energy and water efficiency measures and application checklists. A unique innovation has been the city’s “Code Coach,” an expert who staffs a public-facing Sustainability Desk one day per week to provide guidance to permit applicants and building department staff on California’s Building Energy Efficiency Standards (Title 24, Part 6) and the Green Building Standards (Title 24, Part 11; CalGreen).

City staff have found the tools, training and Code Coach service particularly valuable because the latest version of Title 24, Part 6 is more complex than initially realized. The city has recognized that a well-trained building department increases compliance with the energy efficiency standards and helps move the entire community toward more sustainable development through ongoing education at the permit desk. Better-informed staff members are able to address applicant needs expeditiously and with fewer applicant return visits, helping to keep costs down.

The program is funded by California ratepayers via a local government partnership with San Diego Gas & Electric.

For more information

- [Case study: Chula Vista’s Sustainable Communities Program](#)
- Janice Kluth, Senior Project Coordinator, City of Chula Vista Development Services Department at jkluth@chulavistaca.gov or 619-691-5022
- [Zero Net Energy Communications Toolkit](#) by the New Buildings Institute
- [Case Studies of ZNE Verified and ZNE Emerging Projects](#), New Buildings Institute
- [Success Stories](#) by EnergyTrust of Oregon



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.^{64,65}

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 2514,⁶⁶ 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.⁶⁷ 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

⁶⁴ [Eyer, J., and G. Corey. *Energy Storage for the Electricity Grid: Benefits and Market Potential Assessment Guide*. SAND2010-0815. Sandia National Laboratories, February 2010](#)

⁶⁵ [Williams, B. D. *Plug-In-Vehicle Battery Second Life: the Effect of Post-Vehicle, Distributed-Grid-Energy-Storage Value on Battery-Lease Payments*](#)

⁶⁶ [Assembly Bill No. 2514, Chapter 469](#)

⁶⁷ [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.⁶⁸ 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

⁶⁸ [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 Program

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.

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:

$$[\text{Annual BTUs consumed}] - [\text{Annual BTUs produced}] = 0$$

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 35) of the energy used, not a strict measurement of BTUs. The state definition of ZNE could be demonstrated as such:

$$[\text{Value of modeled energy consumed}] - [\text{net modeled energy produced}] = 0$$

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

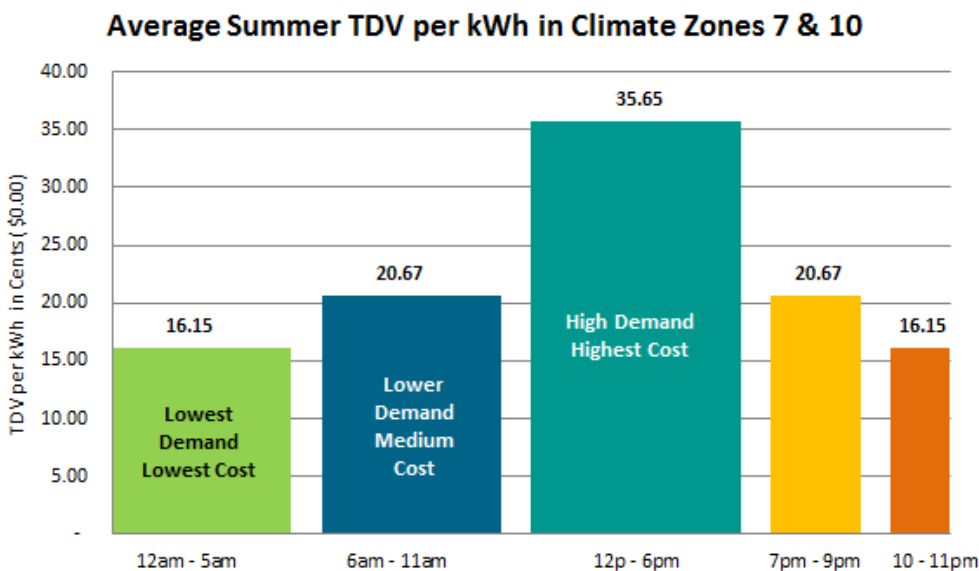
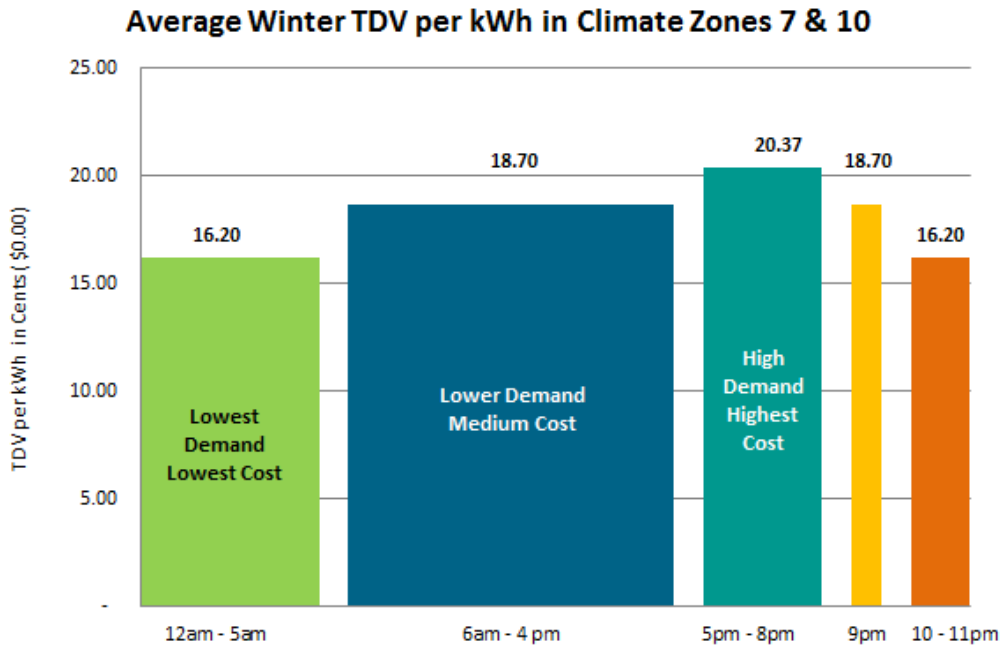
The New Buildings Institute has built a ZNE Communications Toolkit to help stakeholders align around consistent messaging. The toolkit outlines talking points emphasizing ingenuity, leadership, prosperity and economic development.⁷⁰

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](#)

