What More Can California Do to Achieve the 2020 Residential ZNE Goals? We Asked the Market

Stephanie Berkland, TRC
Marian Goebes, PhD TRC
Abhijeet Pande, TRC
Mersiha McClaren, PhD Research Into Action, Inc.
Ann V Edminster, Design AVEnues
Debra Little, Debra Little Sustainable Design
Rachel Allen, Pacific Gas & Electric Company
Carrie Brown, PhD Resource Refocus LLC
Anna LaRue, Resource Refocus LLC
Derek Jones, Navigant Consulting, Inc.

ABSTRACT

As California pursues the goal of zero net energy (ZNE) for all residential new construction by 2020, questions have arisen regarding the feasibility of this target. This paper presents findings and implications from a market characterization of ZNE homes in California through which various ZNE market actors (homeowners, builders, appraisers, and lenders) provided feedback on their respective drivers and barriers to ZNE. The study also estimated the market size and identified trends of "ZNE-type" (ZNE and near ZNE) home construction.

The study found vibrant early adopter activity: over 50 builders have constructed ZNE-type homes in over 130 California cities. Despite this progress, numerous indicators suggest the market is not currently poised to achieve the 2020 goal without further regulatory and market interventions. We will discuss key barriers determined from market actor interviews that stand between the target and market reality, including lack of consumer demand, lack of qualified building professionals, misperceptions about ZNE, and other challenges to market adoption. We will also explore the primary barrier – incremental cost – by comparing incremental cost estimates, acceptable price points reported by consumers, and the increased value of ZNE. The study concludes that California will need to significantly increase ZNE activities to achieve its 2020 goal. We will explore activities that California regulators and program administrators should pursue to encourage a ZNE market transformation, such as incentive strategies, design assistance and workforce education efforts, and taking risks with new ZNE-oriented programs and policies. Results will guide other states and jurisdictions contemplating ZNE goals.

Introduction

The California Public Utilities Commission (CPUC) established ZNE goals in their 2008 California Long Term Energy Efficiency Strategic Plan, and the California Energy Commission (CEC) established similar ZNE goals in their 2007 Integrated Energy Policy Report (IEPR) (CEC 2007). The goals seek ZNE for all new residential construction by 2020 and for all new commercial construction by 2030. Since then, several efforts have been undertaken in the state to march towards those goals – building energy standards updates, voluntary and incentive programs, training and outreach, stakeholder engagement and demonstrations. Studies conducted in 2012 by the California Investor Owned Utilities (IOU), particularly The Road to ZNE:

Mapping Pathways to ZNE Buildings in California (Heschong Mahone Group 2012) identified the need to accelerate the pace of the efforts in order to meet the ZNE targets. That study also identified a key gap in the state agencies' understanding of progress towards the ZNE goals – a systematic assessment of the ZNE residential new construction market.

Following the Road to ZNE study, the IOUs jointly funded a Residential ZNE Market Characterization (Pande 2015) study that characterized the residential ZNE-type new construction market by estimating the market sizes and exploring trends for ZNE-type homes; assessed residential rating systems and financing opportunities for ZNE-type homes; and assessed drivers, barriers, and opportunities to messaging, building, financing, and purchasing residential ZNE-type new construction. The study produced robust results across a broad range of ZNE issues. This paper focuses on a subset of results that we find applicable beyond California, such as market size, primary drivers and barriers, and a deep incremental cost analysis. Other results available in the full report include messaging, customer preferences, and local government policies.

Classifications and Methodology

Study Classifications

In general, the researchers viewed energy performance as a continuum, with code at the high end of a net energy use scale and ZNE at the low end. This study also classified homes as "ZNE-type" if energy modeling showed them to be any of the following:

- ZNE-ready: highly efficient (at least 40% more efficient than Title 24[1]) without distributed generation;
- Near ZNE: highly efficient (at least 40% more efficient than Title 24) with some distributed generation, generally solar photovoltaic (PV); OR modeled to use at least 80% less energy than a Code-Built home;
- ZNE: produce as much energy as they consume annually;
- In addition, this study classified an "Energy Efficient" home as one that is modeled as 15-39% above Title 24 – i.e., more efficient than a Code-built home, but not as efficient as a ZNE-type home.

Note that, in alignment with California state agency definitions (CEC 2013), this study did not classify homes that were minimal energy efficiency beyond Code-Built, but that had large enough PV to offset consumption, as ZNE. Figure 1 illustrates these classifications, albeit with some simplifications. For example, ZNE-ready homes could potentially have a lower net energy use than near ZNE homes. In addition, a study by the Net Zero Energy Coalition (NZEC) (NZEC 2015) indicates that builders have begun constructing net positive homes (as shown later in Table 3) with a negative net energy use.

[1] The efficiency requirements have increased with each iteration of Title 24, and we did not convert efficiency levels for the ZNE-type homes built under the different Title 24 versions. Most homes studied were built under Title 24-2008.

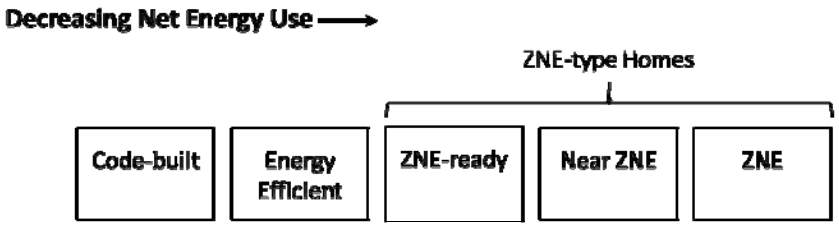

Figure 1. Home Energy Performance Classifications

Data Sources

To estimate the ZNE-type home market size and to develop market maps, we used several data sources[2]:

- Databases for the four IOUs' California Advanced Homes Programs (CAHP), which incentivize the homes built to exceed Title 24 efficiency levels by at least 15%;
- The California Energy Commission (CEC) database for the New Solar Homes Partnership (NSHP), which incentivizes solar PV for new construction;
- A Request for Information (RFI) – sent as an electronic survey – of ZNE practitioners, including builders, architects, energy consultants, utility staff, and others.

To collect market actor feedback, we interviewed or surveyed various ZNE market actors, as summarized in Table 1. Note that this study primarily collected feedback from market actors with experience with ZNE-type, rather than the broader new construction market. Because the number of ZNE-type homes is small, we also gathered feedback where necessary from market actors with high performance homes (a broader category that refers to a ZNE-type or Energy Efficient home), or homes with PV.

Table 1. Market Actor Data Collection Activities

Market Actor	Data Collection Activity
Builders of ZNE-type homes	19 interviews (16 builders – 8 custom and 8 production, and 3 industry experts)
Appraisers with high performance home	11 interviews
Lenders with high performance home experience	6 interviews
Building Officials with high performance home experience	1 discussion with 6 officials
Planners with high performance home experience	1 discussion with 4 planners, and 4 interviews (8 planners total)
ZNE-type Owners	43 interviews (27 production and 16 custom); 1 forum with 4 near ZNE owners (all production)
Energy Efficient Owners	112 surveys (109 production, 3 custom)
Market Actor	Data Collection Activity
Code-built Owners	1 forum with 10 owners (all production)
Utility Program Managers and CEC staff involved with ZNE efforts	Interviews with 9 program and 3 CEC Staff

[2] Data sources include: four IOUs' California Advanced Homes Programs (CAHP) built 2007 – 2014, California Energy Commission (CEC) database for the New Solar Homes Partnership (NSHP) built 2006 – 2014, Request for Information (RFI) for homes built through 2013.

Results

Market Size and Location

Using the study classifications, we found that approximately 1,124 ZNE-type homes had been constructed, the majority of which were near ZNE. Table 2 summarizes the difference in results of ZNE-type home market size estimates. We have also included market size estimates of ZNE-ready and near ZNE as homes using a minimum threshold of 30% more efficient than Title 24. As shown, this different classification increases the estimate by an order of magnitude, and includes a much higher fraction of ZNE-ready homes. Both classifications show only 16 ZNE homes.

Table 2. Estimated of ZNE-type Homes under Different Definitions of ZNE- Type

ZNE-type Home	ZNE-type ≥ 30% above Title 24	ZNE-type ≥ 40% above Title 24
ZNE-ready	6,490	164
Near ZNE	4,040	944
ZNE	16	16
Total ZNE-type homes	10,546	1,124

Figure 2**Error! Reference source not found.** shows the number of ZNE-type homes relative to California single-family permits. As shown, ZNE-type homes have comprised approximately 0.2-0.4% of the overall market, although the estimate for 2014 (based primarily on 2014 Quarters 1 and 2) was approximately 1%. This indicates that ZNE-type construction is still in the innovator stage of market adoption.

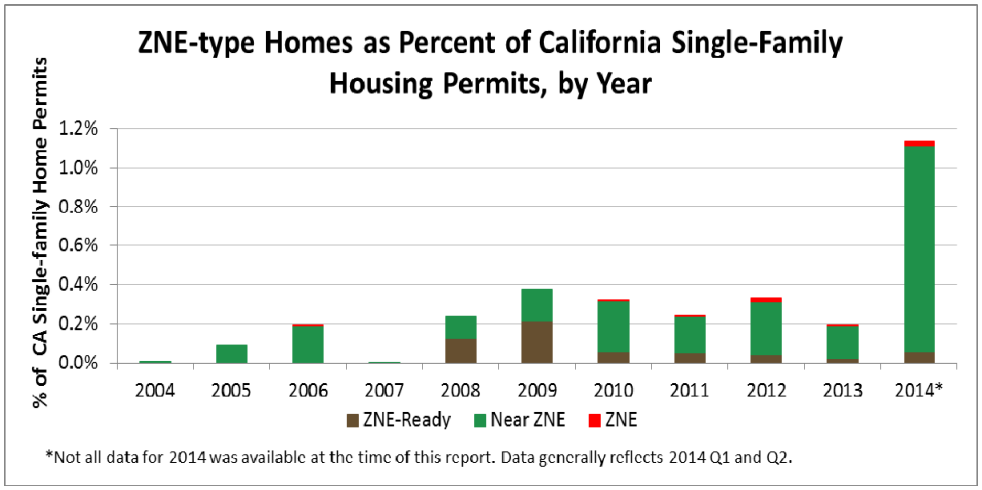

Figure 2. Number of ZNE-type Homes Relative to the Total Single-family Housing Market

The study found ZNE-type homes across California: Over 50 builders had constructed ZNE-type homes in over 130 California cities. Compared to the number of housing permits in each county, the Sacramento area has a particularly high number of ZNE-type homes; this may reflect early ZNE-type home program efforts in this area by Sacramento Municipal Utility District (SMUD) and Pacific Gas and Electric Company (PG&E), and it may indicate peer

pressure among builders in this area to construct ZNE-type homes. The Sonoma / Napa area also has a high number of ZNE-type homes compared to total housing permits.

Comparison to Net Zero Energy Coalition (NZEC) findings

Since this study was conducted, the Net Zero Energy Coalition (NZEC) conducted an inventory of ZNE buildings in North America, including ZNE homes in California. This study found a total of 143 single family and 1,688 total units constructed that were net producer, Zero energy, Zero energy ready, or that met the U.S. DOE Thousand Home Challenge.

The difference in the findings came from differences in data sources, definitions – particularly for Zero energy and Zero Energy ready[3], and the timing of when each study was conducted. While the absolute numbers of ZNE-type homes differed between the IOU-funded study and the NZEC study, the overall findings were the same: The number of ZNE-type homes is relatively small compared to the overall residential new construction market, and the majority of these ZNE-type homes are ZNE ready.

Table 3. NZEC Estimate of the Number of ZNE-type Homes Constructed and Planned

Completed new construction units in CA				New construction units in design, planned, and under construction in CA:		
	# SF Units	# MF Units	Total Units	# SF Units	# MF Units	Total Units
Net Producer	31		31		92	92
DOE Thousand Home Challenge	1		1	4		4
Zero Energy	9	279	288	61	299	360
Zero Energy Ready	102	1266	1368	1150	1209	2359
Total	**143**	**1545**	**1688**	**1215**	**1600**	**2815**

In addition, the NZEC study also found that almost 2,815 residential units in the above categories were in design, planned, and under construction in California, the majority of which Zero Energy Ready (84%) and most of which were multifamily units (58%). NZEC did not frame the question with a specific start and end date. But, if these units in design, planned, or under construction were completed in 2016, compared with California construction estimates, they would represent approximately 1% of the single-family and 5% of the multi-family new construction market.

The NZEC results support our study's finding that single family ZNE-type homes are in the innovator stage, and the NZEC findings suggest that single family ZNE-type homes may remain in the innovator stage for the short-term. The NZEC findings also highlight the importance of the multifamily market (not included in our study). In addition, if all of the Zero

[3] NZEC definitions – Zero Energy: supplies 100% or more of the annual energy demand, and Zero Energy Ready: can supply 90% or more of the annual energy demand (or could, if/when RE is added or system capacity is increased); AND/OR energy use data are not available.

Energy Ready multifamily units that the NZEC study identified are constructed in 2016, the multifamily market would be at the beginning of the early adopter phase for Zero Energy Ready.

Drivers and Barriers

As part of our interviews and surveys with market actors, we asked about their drivers and barriers to ZNE. Figure 3 summarizes the top drivers of, and barriers to, different market actors for pursuing ZNE-type homes.

Figure 3. Drivers and Barriers to ZNE-type Homes for Different Market Actors

Market Actor	Primary Driver(s)	Primary Barrier(s)
Builders	Marketing differentiation, desire to innovate	Lack of consumer demand, incremental cost to build ZNE-type homes
Appraisers	Fulfillment of responsibilities and keeping up with market	Data availability
Lenders	Marketing differentiation*	Lack of consumer demand and additional resources for providing special financing
Building Officials	Fulfillment of responsibilities and keeping up with market	Additional resources, training needs (for builders and subcontractors)
Planners	Sustainability goals	Incremental cost to local builders for building ZNE-type homes, and challenges in meeting CEC incremental cost tests
Homebuyers	Energy savings, improved comfort, and improved indoor air quality (IAQ)	Incremental cost; misperceptions of ZNE, including expectations that misalign with policy*; availability of ZNE-type homes; and confusion over PV policies and procedures*

*Inferred by the researchers. All other drivers and barriers were reported directly by the market actor

Drivers

While the drivers varied by market actor, several types of actors in the supply side of the home market identified marketing differentiation is important, as well as keeping up with the market. For owners, energy savings and low energy bills were found to be key, followed by improved comfort and improved indoor air quality. Surprisingly, few owners mentioned sustainability as a driver in open-ended interview or survey questions, although several builders and utility program managers believed this would be a driver.

Barriers

The key barrier identified by most market actors was incremental cost. Feedback from builders and owners indicated a “chicken-and-egg” problem: Some owners of energy efficient and code built homes said they did not have the option to buy a ZNE-type home, but builders are wary of building a ZNE-type home because of concerns that consumers will not pay the incremental cost. However, we found that the gap between builders’ reported incremental cost, owners’ reported willingness to pay, and estimates of sales premiums (both from appraisers’ interviews and from literature that analyzed actual sales prices) may be relatively small. This is described in more detail in the next section, Incremental Cost.

After cost, barriers to ZNE included misperceptions about ZNE. In our homeowner interviews and surveys, we asked whether the owner had heard of the term "zero net energy, or ZNE". Of the 62 ZNE-type and Energy Efficient owners that had, owners most commonly described a ZNE home as one that produces as much energy as the home uses (i.e., a "site-based ZNE" interpretation: 38% of owners), followed by no energy bills (23%), followed by minimal energy use (11%), and off-the-grid (11%). Overall, 34% interpreted ZNE to mean either no energy bill or off-the-grid, both of which are interpretations that are misaligned with the CPUC and CEC definition of ZNE. In addition, the site-based definition provided by owners, which we interpreted to be based on *actual* home performance, conflict with the interpretation of ZNE by builders and policy-makers, who generally base their definitions on *modeled* home performance.

In addition, several market actors reported barriers related to a lack of ZNE-type sales volume or a lack of consumer demand for them. Appraisers reported that the lack of comparable home sales data ("comps") for ZNE-type homes, as well as other types of high performance homes, was a primary barrier to their ability for accurately assessing their value. The lack of consumer demand was also reported as a barrier by lenders, who noted that they would be more proactive about providing financing specific to ZNE-type or high performance homes if they could provide a larger volume of these loans, thereby reducing their incremental loan origination fees.

Homeowner Satisfaction and Purchasing Criteria

Related to drivers, this study collected information on home satisfaction from owners. Generally speaking, ZNE-type and Energy Efficient owners were very satisfied with their homes, and the energy performance and comfort of their homes contributed to their satisfaction. In contrast, Code-built owners were generally satisfied with their homes despite some frustration with high energy bills.

The homeowners' satisfaction findings align with this study's results of homeowners' purchasing criteria. In coded interview or survey questions, most owners of production homes identified location (38% of production ZNE-type or Energy efficient owners), price (29%), and home size (21%) as their most important criteria. Energy efficiency and PV were generally "nice to have" but of secondary importance –17% of production ZNE-type or Energy efficient owners identified energy efficiency, and 13% identified PV as most important, although 71% of these owners reported that energy efficiency and/or PV was a feature they considered. The study findings also highlighted the importance of ZNE-type homes being available in various locations. Most (74%) ZNE-type and just under half (49%) of Energy Efficient owners reported they would put a high priority on purchasing a ZNE-type home with their next home purchase if it were in the right location.

Incremental Cost

Because cost was identified as the primary barrier to ZNE, the study collected various data related to incremental cost and the market's willingness to pay for ZNE or ZNE-type home. As shown in Table 4, builders' and appraisers' incremental cost estimates for a ZNE-type home ranged from 5-15%, while the reported willingness to pay for a ZNE-type homeowner ranged from 5-10% for ZNE-type owners to 1-11% for Energy Efficient owner. This indicates an alignment in the lower range of the incremental cost.

Table 4: Market Actors' Estimates of Incremental Cost, and Willingness to Pay for a ZNE-type Home

Market Actor	Sample size	Type of Estimate	Estimate [a]
Builders	n=11 [b]	Incremental Cost for ZNE [c]	5-15%
ZNE-type home owners	n=32	Self- Reported Willingness to Pay for ZNE-type	5-10%
Energy efficient home owners	n=112	Self-Reported Willingness to Pay for ZNE-type	1-11% [d]
Appraisers	n=5 [e]	Incremental Sales Price for ZNE-type	5-15%

a Interviewed market actors provided a response in either a percentage or a dollar value. We converted the percentages to dollar values based on California Building Industry Association's (CBIA) median home sale price in California in 2014: $379,8004.

b Four custom, six production, and one custom and production builder.

c For interview time constraints, we did not ask builders to estimate the incremental cost to build a ZNE-type home.

d Energy efficient homeowners estimated incremental price (or an increase in sales price) of their energy efficient home compared to a code-compliant home.

e Many of the appraisers interviewed declined to estimate a percent increase for a ZNE-type home, reporting that they consider the value of the home comprehensively, and that they could not estimate the value for one particular aspect.

Literature also supports an increase in a sale price of a ZNE-type home. Davis Energy Group (2012) estimated that the incremental cost to achieve 40% reduction in thermal and lighting energy consumption was approximately $4,000 - $23,000, based on the median size of custom and production ZNE-type homes (2,049 and 2,902 square feet, respectively). BIRAenergy (2013) conducted cost analysis of the De Young ZNE home and estimated the incremental cost for the efficiency upgrades as $13,093, with an additional $5,500 for a fully pre-paid lease for a 6 kW PV system. Kok (2012) estimated that California homes with a green label sold for ±9% more than unlabeled homes. Lawrence Berkeley National Lab (LBNL) study (2015) found that U.S. homes with a solar PV system sold for approximately $4 per Watt more for a similar home, or approximately $15,000 for a typical PV system (LBNL 2015). These incremental prices were in a similar range as found in this study.

The key finding was that there appears to be an encouraging alignment in the lower end of the incremental cost range. In other words, the incremental cost gap may not be that wide, and may not exist at all for ZNE-type homes -- particularly for near ZNE homes (given this study's and other findings that homeowners value solar PV) – if they can be constructed for less than 10% of incremental cost.

Besides being asked how much they were willing to pay for their next home to be ZNE-type, owners of ZNE-type homes were asked how much (if any) they estimated their current home would sell for because of its ZNE-type features. Most ZNE-type owners expected their

[4] CBIA, median home sale price in California in 2014 was $379,800 in California, $91,200 for the lowest price area (Colusa / Glenn), and $806,500 for the highest price area (San Francisco / San Mateo / Redwood City). Downloaded August 27, 2014 from http://www.cbia.org/housing-statistics.html.

homes to sell for more, as shown in as shown in Figure 4 (i.e., most data points have a y-value > 0%). Even more encouragingly, most owners reported they were willing to pay more for their next home to be ZNE-type home, relative to their estimate of their current home's sales premium, as indicated in Figure 4 (i.e., the response trend line falls to the right of the line for which the perceived sales increase equals willingness to pay).[5] This indicates that, once homeowners experience a ZNE-type home, their willingness to pay for a similar home increases.

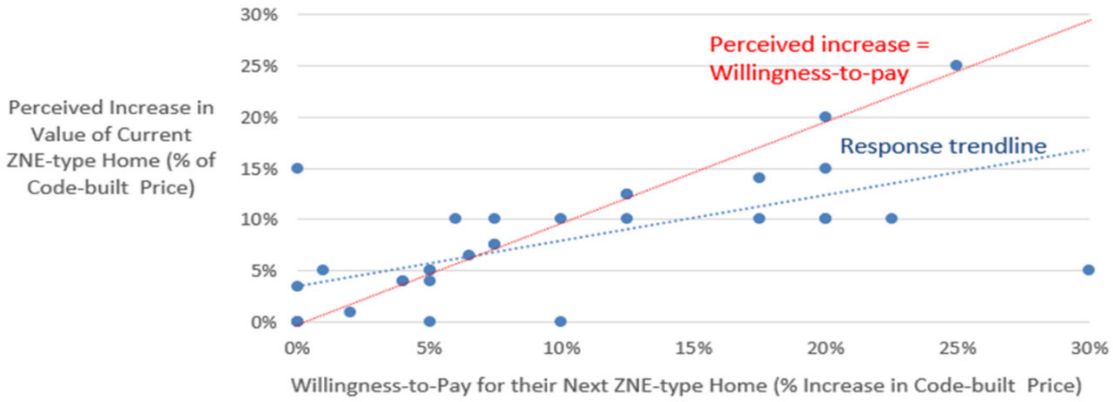

Figure 4. ZNE-type Owners' Expected Increase in Sales Price of Current Home vs. Willingness-to Pay for their Next Home to be ZNE-type (n=32)

The study also conducted an income analysis of ZNE-type homes to investigate trends in ZNE-type home adoption across income levels. While the study did not identify the income levels of the owners of ZNE-type homes (both to allow a comparison with a PV study and for owner privacy considerations), we identified the median income levels for the zip code where each ZNE-type home was located. Most ZNE-type homes were primarily in zip codes with income levels in the third quintile, followed by the fourth and second income quintiles. This generally aligns with a study that identified the location of homes with host-owned and third-party-owned PV (Navigant, 2014). Again, this an encouraging finding, because it indicates that ZNE-type homes are located in moderate income neighborhoods.

Epilogue: March Towards ZNE Goals Has Accelerated

Results of the study indicate that ZNE-type homes are in the innovator stage of market adoption. In addition, the diversity of builders and locations of ZNE-ready, near ZNE, and ZNE homes indicates that this type of construction is feasible under different contractor business models and in different climates. Furthermore, because California is at the beginning stage of this market transformation, this is likely the most difficult stage, when the required cost and effort are highest. There are various indicators that the market is not currently ready to embrace a ZNE mandate without continued and sustained efforts on behalf of the state regulatory entities, utilities and voluntary efforts. These indicators include a lack of consumer demand, a lack of qualified building professionals (contractors, subcontractors, real estate professionals, and others), early adopter misperceptions about the ZNE concept, questions regarding the cost

[5] Because the willingness-to-pay question was asked as a percentage, rather than an absolute dollar value, it should not matter if owners expect to buy a more or less expensive home with their next home purchase, compared to their current home.

effectiveness of ZNE, and various barriers to adoption of ZNE-type homes. In short, left purely to market forces, the residential new construction market is not likely to reach the goal of all new construction homes to be ZNE by 2020.

The good news is that the state regulatory agencies and utilities are not letting the market address these problems on their own. Partnering with key market actors, these entities have made substantial strides in supporting the market towards growth of ZNE construction. In this section of the paper, we summarize recent developments that point towards a more positive outcome for the achievement of ZNE goals.

The CEC and the Program Administrators (PAs, through their Codes and Standards programs) have helped move the market towards ZNE by continually increasing the energy efficiency requirements in new versions of Title 24 building energy efficiency standards. More importantly, the California Building Industry Association (CBIA), an umbrella association that represents the states' residential builders, has been an active partner in improving the Title 24 standards for the most recent 2016 update to Title 24 which take effect January 1, 2017. The 2016 Title 24 Standards have made a significant stride in improving the energy efficiency of residential new construction by addressing several key areas of inefficiency in current home construction practices. Four key standards changes include:

1. Requirements for HVAC ducts to either be in conditioned space or in an high-efficiency attic (insulation at or below roof deck in addition to ceiling)
2. High performance walls that requires some combination of increased insulation in the wall cavity and continuous wall insulation (e.g., rigid insulation)
3. High efficiency lighting requirement for all hardwired lighting in the home – projected to reduce lighting energy use in new construction homes by half compared to the 2013 code
4. High efficiency water heating through use of tankless water heating and improved distribution design that reduces water heating energy approximately 35% compared to the previous standard

These four measures, in addition to other updates to the Title 24 requirements are projected to reduce energy use by 28% compared to the 2013 standards[6]. Combined with the substantial energy efficiency achieved by the 2013 Title 24 standards[7], the energy code for California is poised to make all residential new construction ZNE-ready. The CEC and PAs are currently working on the 2019 Title 24 updates, in which the last remaining hurdles to achieving ZNE Code design are expected to be tackled through a combination of efficiency upgrades and requirements for renewables and energy storage.

[6] Based on California Energy Commission FAQ on 2016 Standards: http://energy.ca.gov/title24/2016standards/rulemaking/documents/2016_Building_Energy_Efficiency_Standards_FAQ.pdf

[7] Based on impact analysis for 2013 Title 24, http://energy.ca.gov/2013publications/CEC-400-2013-008/CEC-400-2013-008.pdf, homes built to the 2013 Title 24 standard use 36% less electricity, 40% less peak demand, and 7% less natural gas on average compared with homes built to 2008 Title 24. Similarly, based on impact analysis for 2008 Title 24, http://www.energy.ca.gov/title24/2008standards/rulemaking/documents/2007-11-07_IMPACT_ANALYSIS.PDF, homes built to 2008 Title 24 use 23% less electricity, 8% less peak demand, and 10% less natural gas compared with 2005 Title 24. Savings from the two standards are not directly additive, and 40% is likely an underestimate of total electricity and demand savings.

Having a standard that requires the efficiency levels described above is one thing. But it will be another challenge to actually get the market to meet those efficiency levels. Most California builders are not familiar with the construction techniques required to meet the four big efficiency measures required in the 2016 Title 24 code. As such, more hands-on training and education is necessary to prepare the market to meet the 2016 Title 24 Standards. With that in mind, the California IOUs have funded a "Code-Readiness" initiative that is working with builders across the state to change construction practices to meet the 2016 code. The initiative provides technical design assistance, construction inspections, manufacturer support, as well as performance monitoring. In addition, the CEC has funded a major effort (approximately $3M) through the Electric Program Investment Charge (EPIC) program to train all relevant building trades in California on construction techniques necessary to meet the code requirements. These efforts are still early in their implementation and need to be sustained, and their efforts must be monitored and adjusted as needed, in order to meet the state's code and ZNE goals.

Conclusions and Implications

The results presented here provide a classic "glass half-full" picture. On one hand, the efforts by state regulatory agencies and builders are on the path to ZNE and picking up steam. On the other hand, there is considerable work to be done to meet the 2020 goal, which will require significant market interventions. In addition, there is a need for increased monitoring to understand whether buildings constructed to be ZNE actually do perform as ZNE buildings, and to make program, policy, and modeling adjustments based on the results.

For California, the lessons are clear – current efforts are making an impact, but more is needed and soon. While most efforts have focused on the technical aspects of ZNE, less effort has been focused on addressing the non-technical aspects such as financing, customer engagement, generating demand for ZNE homes and having a clear elevator pitch for ZNE for the average homeowner. The study points to the fact that current ZNE homeowners and occupants do indeed like their homes and would be willing to buy more, and pay a premium, for such homes in the future. Such customer testimonials are critical in building demand for ZNE homes.

For the rest of the U.S., it makes sense to consider how California's unique situation has allowed the state to make such rapid strides in a relatively short amount of time. The progress to date has happened due to three major trends:

a. The regulatory agencies are committed and have made repeated and concerted efforts to push the ZNE agenda, notably, through stepping up the rate at which Title 24 energy efficiency requirements have been increased
b. The utilities have been a very active supporter and have put in significant resources – research, field demonstrations, trainings, code development and incentives – to move the market
c. Perhaps most important, the regulatory agencies and utilities are working in close collaboration with builders, manufacturers and other interested stakeholders.

These three factors together are important because any one by itself would not result in the kind of progress California has seen over the past five years. For states looking to increase

penetration of ZNE homes in their jurisdictions, collaborative engagement with industry as well as concerted policy efforts are key to achieving those goals. California has the resources to create new systems from scratch, and our unique code landscape of Title 24 often makes this necessary. For other states, whose code frameworks bear more similarity to one another, it may make sense to collaborate in the development of more broadly applicable policy and program templates.

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