2016 Building Energy Efficiency Standards

Adoption Hearing

Presenters:

Mazi Shirakh, PE
Project Manager, Building Energy Efficiency Standards

Payam Bozorgchami, PE
Technical Lead, Building Envelope Measures

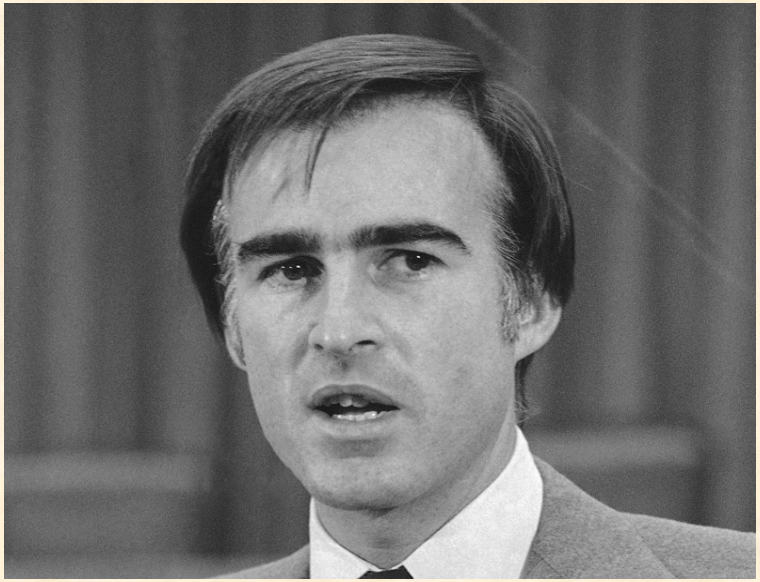
Peter Strait
Supervisor, Building Standards Unit

June 10, 2015

Authority & Process

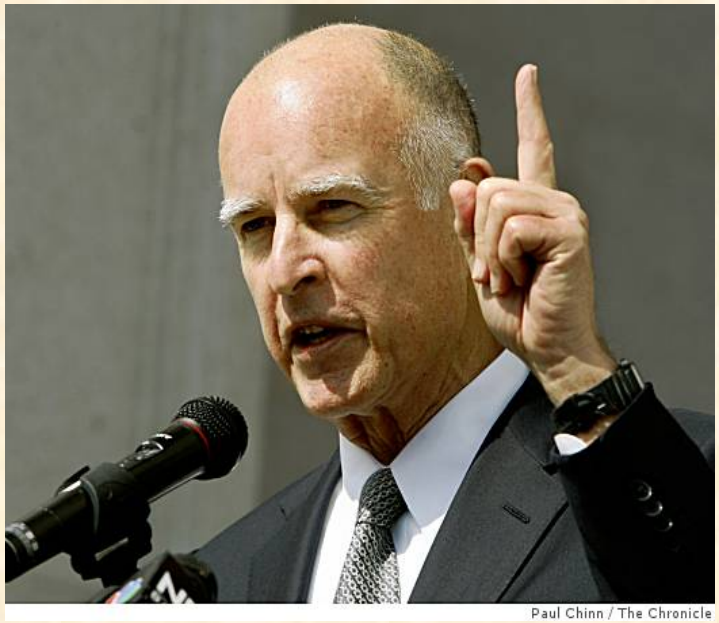
Public Resources Code (PRC 25402): Reduction of wasteful, uneconomic, inefficient or unnecessary consumption of energy

- (a)(1) Prescribe, by regulation, lighting, insulation climate control system, and other building design and construction standards that increase the efficiency in the use of energy and water…
- Warren Alquist Act Signed into law in 1974 by Governor Ronald Reagan and launched by Governor Jerry Brown in 1975



Policy Drivers For Building Standards

- Governor's "Clean Energy Jobs Plan"
- Governor Brown's ZNE goals – focused on ZNE building code requirement by 2020 for newly constructed residential buildings – get there in 3 code cycles (2013, 2016, 2019)
  - Zero Net Energy: Residential by 2020 and Nonresidential by 2030
  - CARB Climate Change Scoping Plan
  - California Long Term Energy Efficiency Strategic Plan

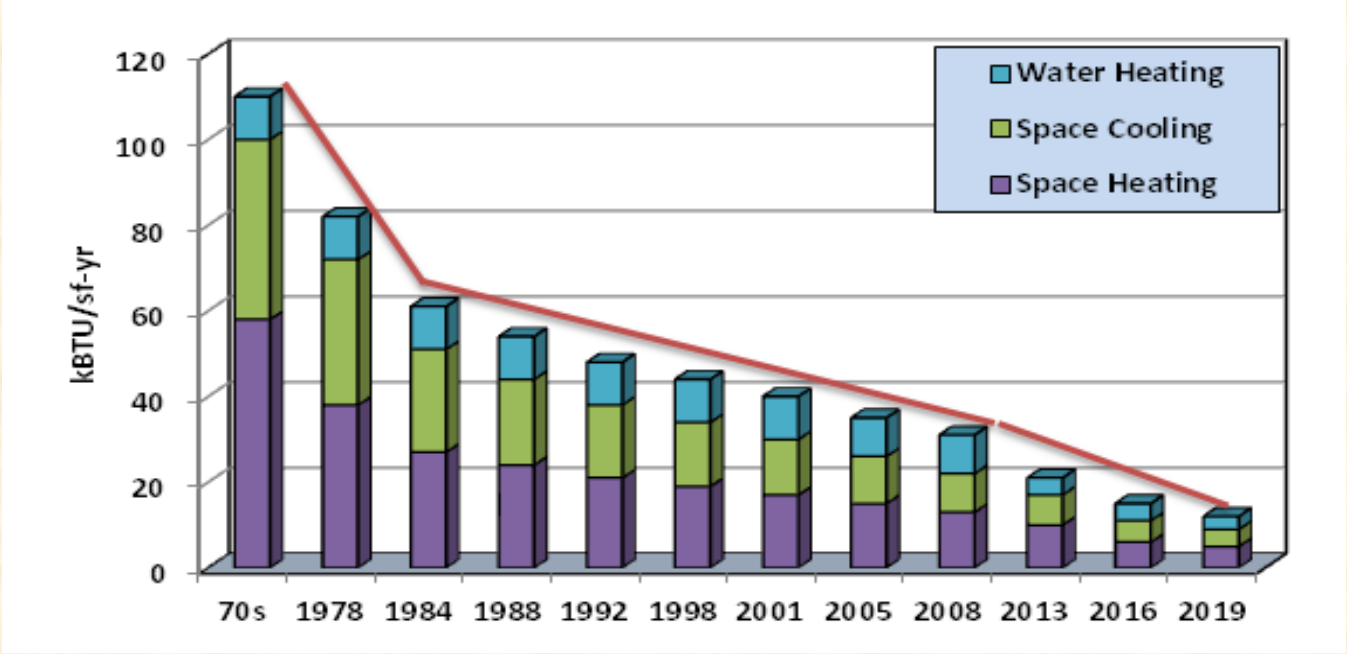


Paul Chinn / The Chronicle

Zero Net Energy Standards

- Achieve additional energy savings from building components regulated under Title-24 to reach ZNE goals
- Integrate onsite generation into building Standards to accomplish ZNE

Impacts of Building Standards on Home Energy Use



Title 24
2016
Standards

2016 Standards – Life Cycle Costing

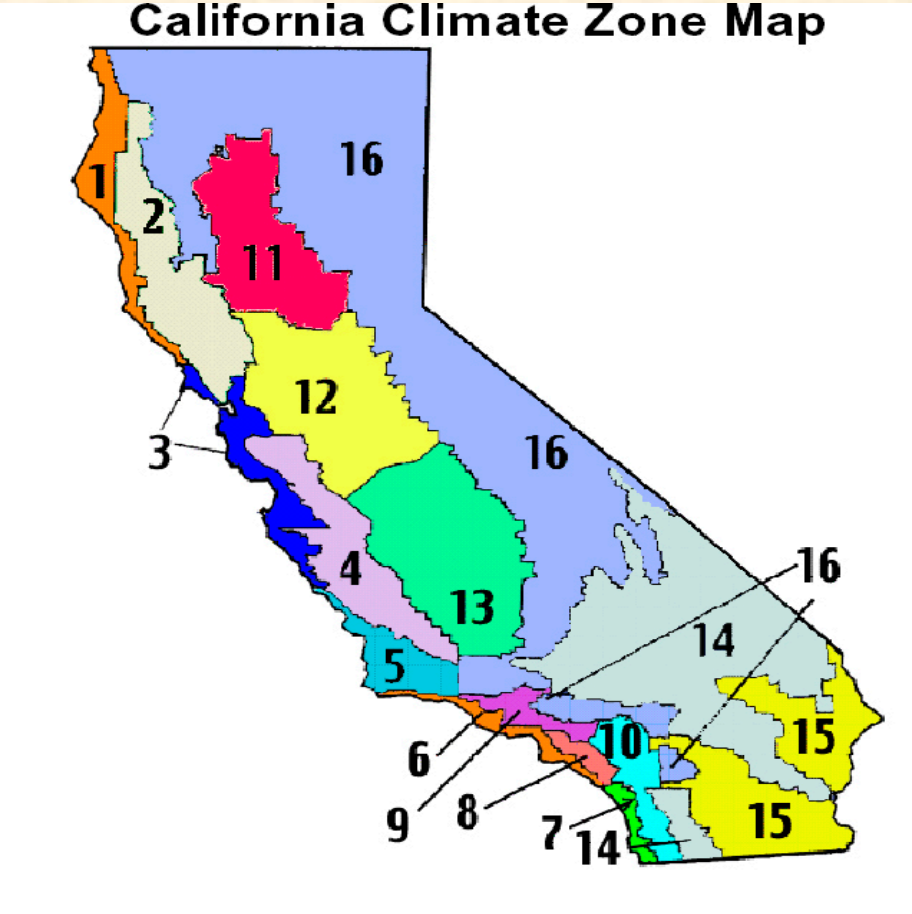
Standards measures must be cost effective

1. Using Life Cycle Costing Methodology (LCC)
   i. Discounted cash flows for costs and benefits
   ii. Accounts for maintenance costs/benefits
   iii. Appropriate discount rates and life of measures -
   30 years for residential measures, and 15 years for nonresidential measures

2. Time Dependent Valuation (TDV)
   i. Value of gas and electricity changes depending on the season and the time of day
   ii. 8,760 TDV multipliers for each hour of the year
   iii. Favors measures that save energy during high demand periods

Calif Standards for California Climates

- Focus on CA Climate Diversity
  - Standards set expectations for climate-specific designs
  - CA weather data captures statewide coincident peak demand climate conditions



Coastal - 1, 3, 5, 6, 7, 8

Inland - 2, 4, 9, 10

Central Valley - 11, 12, 13

Desert - 14, 15

Mountains -16

Title 24
2016
Standards

2016 Standards Energy Impact

- Getting to Residential ZNE by 2020:
  - Substantial improvement on remainder of loads that are regulated 28% savings on residential single family space heating/cooling, water heating and lighting (other loads not regulated) – similar savings for multi-family)
- For all buildings, estimated to avoid the need for 12 new 500 MW – combined cycle powerplants over the 30 year life of the Standards

2016 Standards Energy Impact Summary

Energy and Demand Savings

	Electric Savings, GWHs	Demand Reduction, MW	Gas Savings, Mtherms	GWH Savings Over 2013
Total Residential	345.0	115.0	31.0	28%
Total Nonresidential	192.0	80.0	(0.9)	5%
Total 2016 Standards	537.0	195.0	30.1	

March Towards ZNE

Design Rating – Based on 2006 IECC

Residential Single Family Statewide Weighted Prototype Rating				
	2013	2016	Savings	Percent
Weighted Statewide	72.30	60.06	12.23	16.9%

The unregulated portion of the DR does not include savings from the plug load reductions resulting from appliances and other system improvements in the house

2016 Standards Highlights

- 2016 is the second of three updates to move closer to our Zero Net Energy goals, with the 2019 update remaining
- Focused on getting home energy loads down so remaining can be met by PVs
- For nonresidential newly constructed buildings – keep current with ASHRAE 90.1 national consensus standards
- Make clean-up changes to clarify the Standards and resolve compliance concerns – major emphasis on nonresidential lighting alterations

Building Energy Efficiency Standards

- Benefits to California:
  - Improves Productivity (Lowers Energy Use per GDP)
  - Reduces the Need for Future Power Plants
    - Reduces air pollution
    - Reduces greenhouse gas emissions
    - Preserves land, water, and wildlife habitat
  - Improves Energy System Reliability
    - Reduces coincident statewide peak electricity demand
  - Creates Green Jobs
    - Quality construction, proper equipment installation, field verification
    - Spurs technology innovation and market adoption

Benefits of the 2016 Standards Update

After 30 years of construction,
California will annually save energy
equivalent to:

3.1 Million EVs
driven for 40 miles
each day

2.2 Million Homes

12 Power Plants

Title 24
2016
Standards

Cost of Residential Measures

- Statewide costs of $2,700, total life cycle cost savings of $7,400 for a net savings of $4,700 for a residential building over the 30 year life of the building
- Statewide levelized life cycle costs of $11 and savings of $31 for a "typical" residential unit per month
  - Benefits to the Consumer
    - Reduced Energy Bills
    - Comfort, Indoor Air Quality
    - Reduced Construction Defects
    - Increased Property Value

Title 24
2016
Standards

2016 Standards Update Schedule

Pre-Rulemaking	
April 4, 2014	First CBIA/CEC Standards Forum
Jan - May 2014	IOU CASE Stakeholder Meetings
Apr – Aug 2014	CEC Staff Public Workshops
November 2014	Draft 2016 Standards Workshop
November 2014	Second CBIA/CEC Standards Forum
Rulemaking	
January 2015	Release 45-day Language
March 2015	45-day Language Hearing
May 2015	Release 15-Day Language
June 2015	Proposed Adoption at Business Meeting
January 1, 2017	Effective Date of the Standards

2016 Standards Update Process

Pre-Rulemaking

IOU Stakeholder Meetings – Jan – May 2014 to present measures to public

Staff Workshops – April – August 2014

1. Held by staff at the Energy Commission
2. Open to the public
3. Generally one workshop per measure, sometimes two
4. Invited diverse group of stakeholders
5. Seek public comment on measures

2016 Standards Update Process

Rulemaking :

Presided Over By The Lead Commissioner

- 45-day language release – January 2015
- 45-day language hearing – March 2015
- 15-day language release – May 2015

Proposed Adoption Business Meeting –Energy Commission – June 2015

2016 Residential Standards Vision

Collaboration - 2016 Standards Built Upon the Past Experience

1. ZNE goal requires consideration of measures that represent a significant change in construction practice
2. The most significant measures needed to improve the integrity of the building envelope are High Performance Attics (HPA) and High Performance Walls (HPW)
3. Staff recognized at the beginning of the standards development process that accomplishing HPA and HPW would be very challenging and require close collaboration with industry stakeholders at all levels (builders, manufacturers, and suppliers) to achieve.

2016 Residential Standards Vision

The 2016 Standards Approach:

1. Not focused on specific measures: instead, staff defined performance targets, such as U-factors, needed to meet the ZNE goals
2. Invited builders, manufacturers, and suppliers to partner with staff to come up with solutions that meet equivalent performance
3. CBIA hosted forums in April and November of 2014 to communicate the ZNE vision and engage industry in creating new solutions – allowing the free market to settle on the most promising solutions
4. Worked with the CPUC and IOUs to provide incentives, education, and outreach supporting the transition of the building industry to the new practices needed for these solutions in advance of the effective date

The result was a cooperative and innovative collaboration between staff, builders, manufacturers, and utilities. The industry as a whole rose to the challenge with multiple solutions for both HPAs and HPWs.

2016 Standards Range of Options

High Performance Attics (HPA) performance defined by:

Roof deck insulation equivalent to R-13 insulation below deck and R-38 ceiling insulation. Insulation choices may include spray foam, batt, or blown-in, and SIP panels.

However, the builder has many other options, all meeting the HPA performance:

1. R-6 continuous insulation with radiant barrier
2. Hybrid roofing systems combining insulation and higher roof reflectance
3. Ducts in conditioned space (DCS)
4. Ducts in sealed or unvented attics
5. Or other solutions suggested by the industry

2016 Standards Range of Options

2016 Standards Range of Options

High Performance Walls (HPW) – Performance Defined By:

R19 cavity + R5 Continuous Insulation – U-Factor (Approx 0.051)

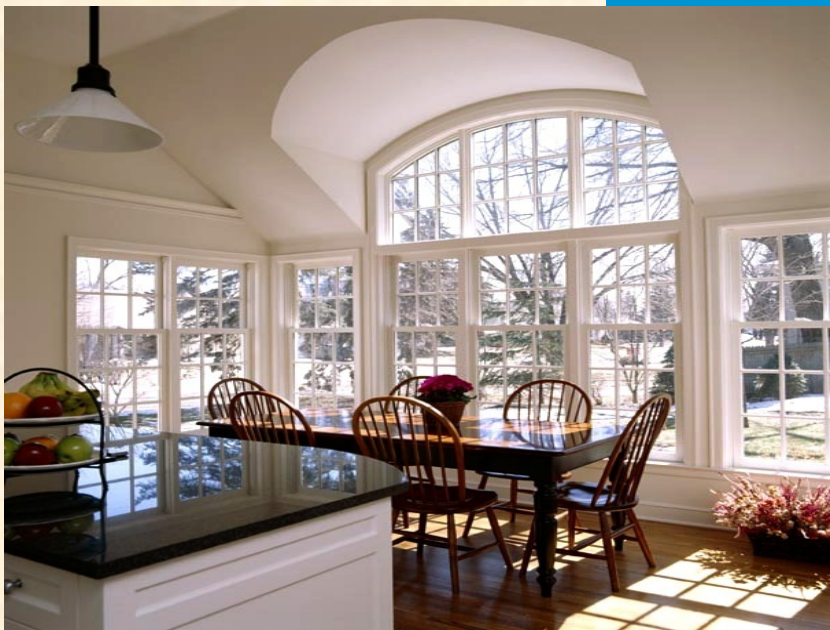
However, the builder has many other options, all meeting the HPA performance:

1. 2x4 @ 16" OC, R15 + R-8 CI (0.051)
2. 2x6 @ 24" OC, R19 + R-5 CI (0.049)
3. 2x6 @ 24" OC R21 + R-4 CI (0.048)
4. Staggered studs with batt insulation or spray foam
5. Structurally Insulated Panels (SIPs)
6. Or other solutions suggested by the industry

2016 Standards Range of Options

Or choose a compliance option to comply with the 2016 Standards:

- A limited, flexible photovoltaic compliance option proportional to the HPA and HPW, usable under the performance approach for other building measures
- Other compliance options, include among others, high performance windows and high EER air conditioning systems
- Compliance options will be approved as part of the ACM Reference Manuals update process in late in 2015; workshop planned for this summer



2016 Standards Other Measures

Instantaneous (Tankless)Water Heaters

- Basis of prescriptive and performance approach – set on federal IWH performance, currently at Energy Factor of 0.82
- For tanks less than 55 gallons, allow prescriptive alternative for standard storage water heaters in combination with:
  - Quality Insulation Installation (QII), with either
    - Compact pipe distribution design, or
    - Insulating all half inch and larger hot water pipes
  - For tanks above 55 gallons, no QII is required, only combine with compact distribution or pipe insulation
- Use the performance path for additional options, such as electric heat pump water heaters

2016 Standards Other Measures

High Efficacy Lighting

1. All high efficacy lighting in kitchens & throughout the house, and pair all lighting that complies with Joint Appendix 8 (JA8) with controls
2. All recessed downlights in ceilings must be high efficacy
3. Allow luminaires with screw base sockets as high efficacy if the socket is populated with a high quality, JA8 compliant lamp at the time of inspection; exception for downlights
4. LED sources must meet JA8 specs, including requirements for CRI, CCT, start time, dimming, flicker, lamp life, and other attributes

HPA & HPW Code Readiness Initiative

- **Collaboration** among the Energy Commission, CPUC, Utilities, and CBIA
- **Builders Support -** Support CBIA builders in preparing for 2016 Code change in building practice for High Performance Attics and High Performance Walls
- **Design Assistance** – Utilities provide financial support to builder teams to integrate HPA/HPW into builder plans and construction process
  - Architects, structural engineers, superintendents, installers, contractors, suppliers, marketing – "value engineering"
- **In-field Training of Trades –** Utilities provide financial support and direct training in conjunction with suppliers on measures chosen by builders to implement HPA/HPW
- **Targeted Incentives –** Utilities provide package of incentives to bring down the cost of HPA/HPW measures
- **Collaborative Campaign –** Work in consort with encourage builder participation and satisfaction

An EPIC Contribution

Commission's EPIC Program is funding Workforce Development to Help the Building Industry Transition to High Performance Attics and Walls

- On-the-job training for constructing high performance attics and walls for new homes constructed in a manner consistent with proposals for the 2016 building energy efficiency standards
- Complement design assistance and training programs provided by utilities

Without a skilled labor force trained in proper installation of these advanced energy efficiency measures, builders might forego these advancements, resulting in the savings and benefits being lost.

2016 Standards Nonresidential Measures

Nonresidential Measures Mostly to Stay In-line With ASHRAE National Standards:

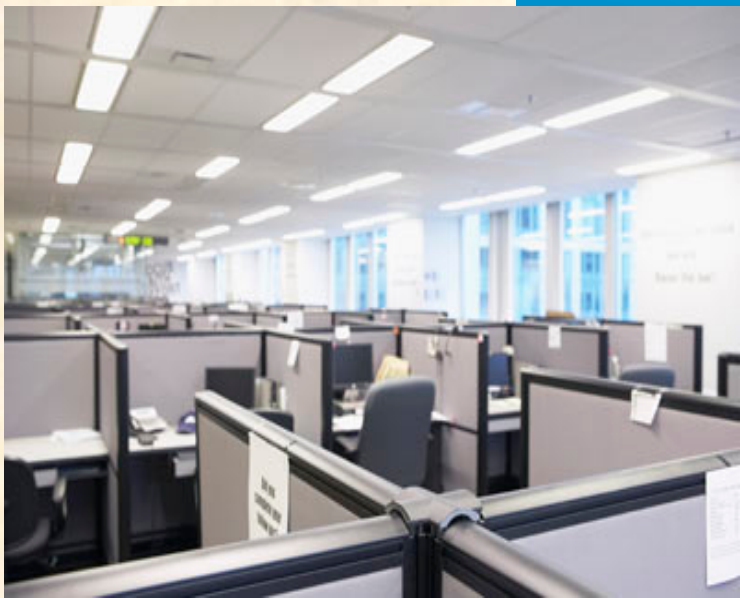
1. **Equipment Efficiencies**
2. **Envelope U-factors**
3. **Indoor Lighting**
4. **Outdoor Lighting**
5. **Elevators and Escalators**
6. **Windows and Doors HVAC Lockout Sensors**

2016 Standards Nonresidential Measures

Simplification of Lighting Alterations in Existing Buildings –

- Simplified the language, tailored requirements to project size
- For small projects, provided relief from complex control requirements in exchange for more power reduction for replaced or modified luminaires
- Comparable energy savings to the 2013 Standards lighting retrofit language (38 GWH/yr above the 2013 Standards)

Proposed Modeling Rules for Thermally Driven Cooling – Use the sun or waste heat to help cool buildings; will be considered as part of the ACM Reference Manual update process in late in 2015.



Clarifying Changes to the Regulations

In response to public comments on the 2013 standards and the proposed 2016 update, the language for the following topics has been simplified and clarified:

- Signature authority
- Acceptance Test Technician Certification Provider (ATTCP) requirements
- Energy Management Control Systems (EMCS)
- Nonresidential insulation
- Commissioning
- Nonresidential lighting controls
- Nonresidential electrical power distribution systems
- Computer rooms and data centers
- Residential HVAC requirements
- ASTM test references
- U-factor tables
- Occupant Controlled Smart Thermostats (OCST)
- Alternative Calculation Method (ACM) Approval Manual

In addition, numerous smaller edits have been made throughout the regulations to enhance clarity, consistency, and readability.

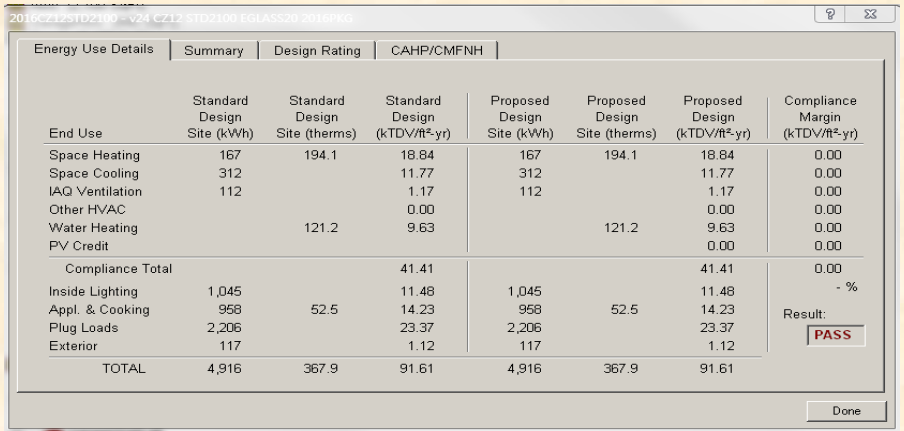
2016 Standards Compliance Tools

The 2016 Standards rollout will be on time. The 2013 Standards tools included two major initiatives:

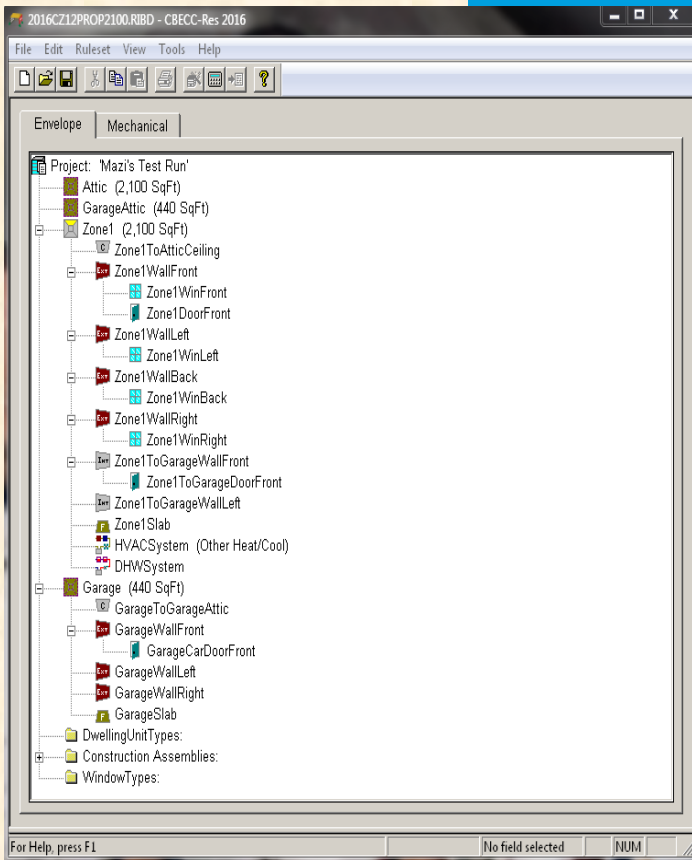
- Revisions to residential and nonresidential computer simulation tools, and
- Expansion of data registries for residential compliance documents

The 2016 Standards tools are already being developed

- Because the software and data registries underwent major revisions with the 2013 Standards, the 2016 updates are simpler
- Staff is already updating the software tools, and the compliance manuals and documents
- These tools will be available by January 2016, one year ahead of January 2017 effective date



End Use	Standard Design Site (kWh)	Standard Design Site (therms)	Standard Design (kTDV/ft²-yr)	Proposed Design Site (kWh)	Proposed Design Site (therms)	Proposed Design (kTDV/ft²-yr)	Compliance Margin (kTDV/ft²-yr)
Space Heating	167	194.1	18.84	167	194.1	18.84	0.00
Space Cooling	312		11.77	312		11.77	0.00
IAQ Ventilation	112		1.17	112		1.17	0.00
Other HVAC			0.00			0.00	0.00
Water Heating		121.2	9.63		121.2	9.63	0.00
PV Credit						0.00	0.00
Compliance Total			41.41			41.41	0.00
Inside Lighting	1,045		11.48	1,045		11.48	- %
Appl. & Cooking	958	52.5	14.23	958	52.5	14.23	Result:
Plug Loads	2,206		23.37	2,206		23.37	PASS
Exterior	117		1.12	117		1.12	
TOTAL	4,916	367.9	91.61	4,916	367.9	91.61	



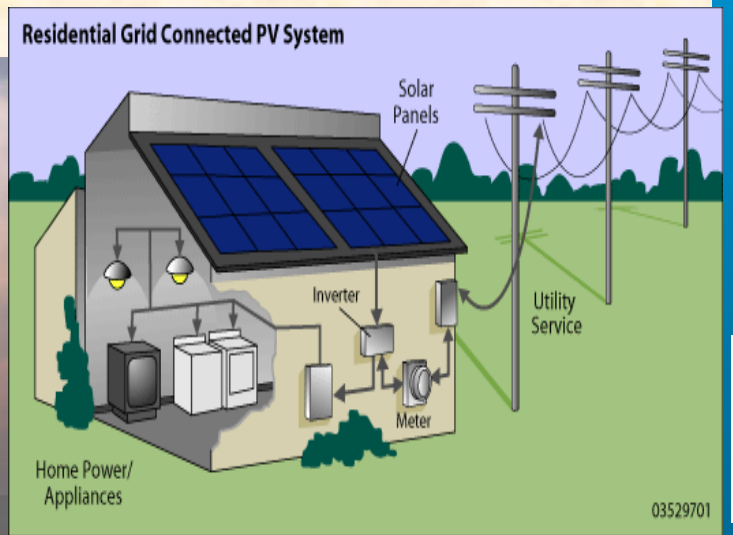
2016 Residential Standards ZNE Vision

With adoption of the measures included in the 2016 Standards, we will have energy efficiency requirements nearing what is needed to achieve residential ZNE.

The Future - 2019 Standards and ZNE

Although the 2016 Standards approaches getting to the necessary level of energy efficiency, much remains to be done to achieve ZNE

1. Consider a few additional prescriptive measures such as Quality Insulation Installation (QII) and others to be determined
2. Consider additional measures for extreme CZs, such as CZ15
3. Evaluate options for homes that are not able to reach ZNE, such as exceptions for particularly difficult situations, and consideration of community solar
4. Harmonize renewables, such as PV, with Grid – addressing potential for smart inverters and batteries, and incorporating upcoming CPUC decisions related to grid impacts



Title 24 2016 Standards

Special Thanks to the Team!

This accomplishment would not have been possible without the incredible effort and dedication shown by everyone on our Standards development team!

Requested Commission Action

Staff hereby requests Commission adoption of:

- **The Negative Declaration for the 2016 update to the Building Energy Efficiency Standards, and**
- **The proposed 2016 update to the Building Energy Efficiency Standards in California Code of Regulations, Title 24, Part 6, associated administrative regulations in Part 1, the Reference Appendices, and the Alternative Calculation Method Approval Manual.**


Questions?