CABEC

Residential Certified Energy Analyst (CEA)
Under the 2013 Energy Standards

CEA Competency 5

Sixth in a six-part series

California Association of Building Energy Consultants

Recorded & brought to you by..

Host: Gina Rodda
gina@gabelenergy.com (510) 428-0803 ext 204

GABEL ASSOCIATES, LLC
BUILDING ENERGY ANALYSIS & ENERGY CODE COMPLIANCE

California Statewide Codes & Standards

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This program is funded by California utility customers under the auspices of the California Public Utilities Commission and in support of the California Energy Commission.

Welcome

▶Welcome

- 5.1 Evaluate project for envelope recommendations
- 5.2 Evaluate project for HVAC and water heating recommendations
- 5.3 When HERS measures apply and the HERS registration process
- 5.4 Beyond code programs, incentives and tax credits
- Wrap Up

CEA Competency Four

- Pop-Up Resource!

Consider Recommendations for Improving Energy Performance and Comfort

Use the knowledge of the project design and climate zone to make recommendations for improving energy performance to meet or exceed code.

5

Energy Consulting

Interpreting energy performance results and making design recommendations

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5.1 Evaluate Project For Envelope

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5 Energy Consulting

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Competency 5.1

5.1 Evaluate the project using the energy model to make appropriate recommendations for improving the envelope design to meet or exceed code.

- Evaluate effectiveness of possible envelope measures based on climate zone and overall building design
- Identify areas of greatest envelope improvement based on the Total TDV energy budget and individual energy use components
- Assessing how best to meet or exceed code with envelope measures
- Improving comfort with envelope design

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5.1 Evaluate Project: Envelope

General Factors Affecting Envelope Design

- California climate zone
  - Magnitude of annual heating loads
  - Magnitude of annual cooling loads
  - Ratio of heating to cooling loads
- Overall building design
  - Total glazing percent (%)
  - Glazing orientations
  - General type(s) of windows, glass doors, skylights
- Areas, types of thermal mass

- Energy Code Ace: Training "Residential Standard Essentials for the Energy Consultant"
- 2013 Residential Manual

5.1 Evaluate Project: Envelope

Improvements Based on Energy Use Summary

- What are the Totals for Standard, Proposed and Compliance Margin?
- What are the relative values and compliance margins between different energy use components?

ENERGY USE SUMMARY				
04	05	06	07	08
Energy Use (kTDV/ft^2-yr)	Standard Design	Proposed Design	Compliance Margin	Percent Improvement
Space Heating	51.75	48.38	3.37	6.5%
Space Cooling	59.20	57.23	1.97	3.3%
IAQ Ventilation	0.00	0.00	0.00	0.0%
Water Heating	9.78	6.18	3.60	36.8%
Photovoltaic Offset	---	0.00	0.00	---
TOTAL	120.73	111.79	8.94	7.4%

- Energy Code Ace: Training "Residential Standard Essentials for the Energy Consultant"

5.1 Evaluate Project: Envelope

How Best to Improve Envelope Performance

- Evaluate best opportunities from Energy Use Summary and measures in the current energy model
  - Fenestration and shading
  - Opaque surface assemblies and insulation
  - Radiant barrier and cool roof
  - Reduced building leakage
- Test one or more envelope options at a time which are most likely to "move the dial"
- Consider incremental cost data in making recommendations

- Research products in market and keep up to speed on average prices in your area
- Play, play, play

5.1 Evaluate Project: Envelope

Improving Thermal Comfort

- Air sealing and reduced building leakage
- Mean radiant temperature affected by envelope design choices
  - Radiant barrier
  - Cool roof
  - Insulation levels
  - Glazing U-factor and SHGC
  - Thermal mass

- http://sustainabilityworkshop.autodesk.com/buildings/human-thermal-comfort
- http://repositories.lib.utexas.edu/bitstream/handle/2152/13980/1-Boduch_Fincher-Standards_of_Human_Comfort.pdf
- http://energydesignresources.com/media/1744/EDR_DesignBriefs_hiperformancenewhomes.pdf

Check Your Understanding

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Water Heating	9.78	6.18	3.60	36.8%
Photovoltaic Offset	---	0.00	0.00	---
TOTAL	120.73	111.79	8.94	7.4%

To improve the compliance margin for a Build It Green project in climate zone 12 (hot CZ), what would you suggest for the envelope?

a. Improve the U-factor of the fenestration
b. Improve the SHGC of the fenestration
c. Increase the insulation for all the floors
d. Increase the radiant barrier to really shiny

5.2 Evaluate Project For HVAC and Water Heating

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Competency 5.2

5.2 Evaluate the project using the energy model to make appropriate recommendations for improving the HVAC and water heating system design to meet or exceed code.

- Evaluate effectiveness of possible HVAC and water heating measures based on climate zone, building design and conditioned floor area per dwelling unit
- Identify areas of greatest HVAC and water heating improvement based on the Total TDV energy budget and individual energy use components
- Assessing how best to meet or exceed code with HVAC or water heating measures

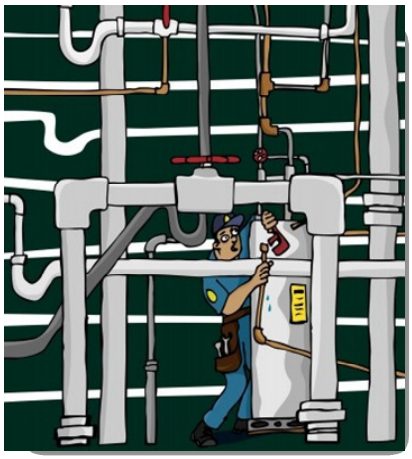
5.2 Evaluate HVAC/Water Heating

HVAC System Performance

- Review heating and cooling equipment type(s) and efficiencies in the current model considering the impact of climate zone and envelope design
  - Heating AFUE, HSPF or other
  - Cooling SEER, EER
  - Ducted or ductless
  - HERS measures
- Review the Energy Use Summary to identify where HVAC improvements will have the greatest impact
  - Primarily Space Heating
  - Primarily Space Cooling
  - Both Space Heating and Cooling

- Energy Code Ace: Training "Residential Standard Essentials for the Energy Consultant"
- Play, play, play

5.2 Evaluate HVAC/Water Heating



Water Heating System Performance

- Water heating options
  - Water heater type and efficiency
  - Distribution system
  - Solar hot water system
- Single Family vs. Multifamily measures
- Review the Energy Use Summary: Will better water heating system performance make a big difference in the Totals?
  - Based on dwelling size
  - Based on water heating system improvements (i.e., type, efficiency, distribution, solar)

- 2013 Residential Manual
- Play!

5.2 Evaluate HVAC/Water Heating

Improving HVAC and DHW Performance

- List potentially effective HVAC and DHW improvements given the climate zone, specific building design, initial system choices and a review of the Energy Use Summary
- Test one or more HVAC and/or water heating options to see the different energy impacts on meeting or exceeding code
- Consider incremental cost data in formulating recommendations

- Research
- And again…play

Check Your Understanding

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Energy Use (kTDV/ft^2-yr)	Standard Design	Proposed Design	Compliance Margin	Percent Improvement
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Water Heating	9.78	6.18	3.60	36.8%
Photovoltaic Offset	---	0.00	0.00	---
TOTAL	120.73	111.79	8.94	7.4%

To improve the compliance margin for a Build It Green project in climate zone 12 (hot CZ), what would you suggest?

a. Improve the AC efficiency
b. Use more HERS measures
c. Add a PV system ≥ 2 kWdc
d. All of the above

5.3 When HERS Measures Apply

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Competency 5.3

5.3 Identify HERS measures, when they apply and how to register the CF-1R form with a HERS provider.

- Mandatory HERS measures
- Performance approach HERS measures
- Registering a Certificate of Compliance (CF-1R) with a HERS provider
- Using a HERS rater for an E+A+A project to verify an existing condition

5.3 HERS Measures

HERS-verified Measure	Mandatory	Prescriptive	(if credit taken) Performance
Mechanical			
Duct sealing (maximum leakage)	X [A]		
Indoor air quality ventilation (based on ASHRAE Standard 62.2)	X		
Refrigerant charge or Installation of a charge indicator display		CZ 2, 8-15	CZ 1, 3-7, 16
Duct design (reduced surface area, high insulation, and duct location)			X
Ducts entirely in conditioned space			X
Low leakage ducts entirely in conditioned space			X
Ducts <12 feet outside conditioned space			X
Low leakage air handlers			X
Cooling coil air flow and air handler fan watt draw **AND/OR** Verified return duct design and air filter device	X		
High SEER			X
High EER			X
Photovoltaic (PV) system capacity to qualify for PV rebate via New Solar Home Partnership			X
Central fan integrated ventilation cooling systems		Optional [B]	
Zonal control			X
Evaporatively cooled condensers			X
Ice storage air conditioners			X
Plumbing			
Pipe insulation			X
Verified design (parallel piping, compact design, point of use)			X
Multi family recirculation loops			X
Envelope			
Quality insulation installation (QII)			X [C]
Building envelope sealing			X
HERS verified pre-existing conditions			X

[A] Unless it is a ductless system (e.g., ductless mini splits)

[B] A project may comply prescriptively by using either a central fan integrated ventilation cooling system.
+ If a central fan integrated cooling system is used, it requires HERS verification, and it must meet duct leakage, fan watt draw and airflow requirements
+ If a whole house fan is used, it does NOT require HERS verification.

[C] If QII is used for compliance credit, multiple inspections are required to confirm that QII standards are met.

Mandatory HERS Measures

- Duct sealing and verification, as applicable per Section 150.0(m)11
- Cooling forced air system airflow rate, fan watt draw, and determination of fan efficacy per Section 150.0(m)13
- IAQ whole building ventilation verification, as applicable per Section 150.0(o)1
  - New construction
  - Additions > 1,000 ft2

- Energy Code Ace: Webinar "Decoding HERS"

5.3 HERS Measures

Table RA2-1 – Summary of Measures Requiring Field Verification and Diagnostic Testing

Measure Title	Description	Procedure(s)
	Duct Measures	
Duct Sealing	Component Packages require that space conditioning ducts be sealed. If sealed and tested ducts are claimed for compliance, field verification and diagnostic testing is required to verify that approved duct system materials are utilized, and that duct leakage meets the specified criteria.	RA3.1.4.3
Supply Duct Location, Surface Area and R-value	Compliance credit can be taken for improved supply duct location, surface area and R-value. Field verification is required to verify that the duct system was installed according to the design, including location, size and length of ducts, duct insulation R-value and installation of buried ducts.[1] For buried ducts measures, Duct Sealing and High Quality Insulation Installation (QII) is required.	RA3.1.4.1
Verification of ducts located entirely in directly conditioned space, and Low Leakage Ducts in Conditioned Space	When the Standards specify use of the procedures in Section RA3.1.4.3.8 to determine if space conditioning system ducts are located entirely in directly conditioned space, the duct system location shall be verified by diagnostic testing. Compliance credit can be taken for verified duct systems with low air leakage to the outside when measured in accordance with Reference Residential Appendix Section RA3.1.4.3.8. Field Verification for ducts in conditioned space is required. Duct sealing is required.	RA3.1.4.3.8
Low Leakage Air-handling Units	Compliance credit can be taken for installation of a factory sealed air handling unit tested by the manufacturer and certified to the Commission to have met the requirements for a Low Leakage Air-Handling Unit. Field verification of the air handler's model number is required. Duct Sealing is required.	RA3.1.4.3.9
Verification of Return Duct Design	Verification to confirm that the return duct design conforms to the criteria given in TABLE 150.0-C or TABLE 150.0-D.	RA3.1.4.4
Verification of Air Filter Device Design	Verification to confirm that the air filter devices conform to the requirements given in Standards Section 150.0(m)12.	RA3.1.4.5
Verification of Prescriptive Bypass Duct Requirements	Verification to confirm zonally controlled systems comply with the bypass duct requirements in Section 150.1(c)13.	RA3.1.4.6
	Air Conditioning Measures	
Improved Refrigerant Charge	Component Packages require in some climate zones that air-cooled air conditioners and air-source heat pumps be diagnostically tested in the field to verify that the system has the correct refrigerant charge. For the performance method, the Proposed Design is modeled with less efficiency if diagnostic testing and field verification is not performed. The system must also meet the prerequisite minimum System Airflow requirement.	RA3.2 RA1.2
Installation of Charge Indicator Display	Component Packages specify that a Charge Indicator Display can be installed as an alternative to refrigerant charge testing. The existence of a Charge Indicator Display has the same calculated benefit as refrigerant charge testing. Field verification is required.	RA3.4.2
Verified System Airflow	When compliance requires verified system airflow greater than or equal to a specified criterion, field verification and diagnostic testing is required.	RA3.3
Air-handling Unit Fan Efficacy	When compliance requires verified fan efficacy (Watt/cfm) less than or equal to a specified criterion, field verification and diagnostic testing is required.	RA3.3
Verified Energy Efficiency Ratio (EER)	Compliance credit can be taken for increased EER by installation of specific air conditioner or heat pump models. Field verification is required.[2]	RA3.4.3 RA3.4.4.1
Verified Seasonal Energy Efficiency Ratio (SEER)	HERS Rater field verification of the SEER rating is required for some systems.	RA3.4.3 RA3.4.4.1
Maximum Rated Total Cooling Capacity	The calculations for determining Maximum Rated Total Cooling Capacity need not be field verified, but the prerequisites to taking the credit –Minimum Cooling Coil Airflow, duct sealing, and Verified EER/SEER – must be field verified and diagnostically tested.	RA3.1.4.3, RA3.3, RA3.4.3 RA3.4.4.1
Evaporatively Cooled Condensers	Compliance credit can be taken for installation of evaporatively cooled condensers. Field verification of duct leakage is required. Field verification of refrigerant charge is required. Field verification of EER is required.	RA3.1.4.3, RA3.2 RA3.4.3, RA3.4.4.1

HERS Measures in the Performance Method

- Consider all project-appropriate HERS measures beyond those initially specified
  - Envelope
  - HVAC system(s)
  - Water heating distribution system
- See Table RA2-1 Summary of Measures Requiring Field Verification and Diagnostic Testing in the 2013 Reference Appendices (Residential Appendix RA2)

- 2013 Referenced Appendices

5.3 HERS Measures

Must Register CF1R with a HERS Provider

- All residential projects with one or more HERS measures must have the CF1R form registered with a HERS provider
- Know how to accomplish the CF1R registration on a HERS provider web site
  - Documentation Author (energy consultant) must be registered with the HERS provider
  - Designer/Builder must also be registered and know how to sign off (approve) the CF1R
  - Design changes/revisions require registering the revised CF1R

- Use the training videos provided on the HERS provider site

5.3 HERS Measures

HERS Rater to Verify Existing Conditions

- 2013 Standards compliance option for Existing + Addition + Alteration performance calculations
  - To receive full energy compliance credit for Altered components which improve the previously existing condition
  - Building owner must have a HERS rater verify all existing conditions to be improved for credit prior to permit submittal
- Existing conditions to be verified are listed on the Certificate of Compliance CF1R form

- Develop a working relationship with a HERS II rater (if you are not already one yourself)

Check Your Understanding

Which of the following measures trigger HERS registration?

a. Replacing hot water heater
b. Adding new wall heater
c. Adding new windows
d. None of the above

5.4 Beyond Code

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5 Energy Consulting

Competency 5.4

5.4 Understand general features and requirements of local reach codes, utility incentive programs and low-income housing tax credits.

- Local energy and green building ordinances
- Residential utility incentive programs
- Green Point Rated and LEED for Homes
- CTCAC (low-income housing tax credit) and the California Utility Allowance Calculator
- CEC f-Chart for solar hot water systems

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5.4 Beyond Code

Local Energy and Green Building Ordinances

- Local ordinances with beyond Title 24 Part 6 requirements must be CEC approved to be legally enforceable
  - Check the CEC web site listing them: http://www.energy.ca.gov/title24/2013standards/ordinances/
- Additional mandatory measure(s) and/or performance requirements (e.g., 15% better than state code)
- Check for any specific triggers for new construction, additions and alterations

- CEC website
- Utility incentive programs

5.4 Beyond Code

Utility Incentives and Green Building Ratings

- Utility company incentive programs
  - Some specific measure-based requirements; and/or
  - Some performance-based requirements (e.g. % better than Title 24)
  - Some climate zone eligibility requirements
  - Single family vs. multifamily buildings
- Minimum energy performance requirement and additional energy credits (points) in green building rating programs
  - Green Point Rated, Build It Green
  - California LEED for Homes, USGBC and Davis Energy Group

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5.4 Beyond Code

California Low-Income Housing Tax Credit

- Beyond Title 24 energy performance an eligibility requirement for the state's low-income housing tax credit
  - Through the State Treasurer California Tax Credit Allocation Committee (CTCAC)
  - See current regulations at: http://www.treasurer.ca.gov/ctcac/programreg/regulations.asp
- Additional analysis required using the California Utility Allowance Calculator (CUAC) http://www.gosolarcalifornia.ca.gov/affordable/cuac/index.php

5.4 Beyond Code

CEC f-Chart for Annual Net Solar Fraction

- To calculate and document the Annual Net Solar Fraction (NSF) contribution of solar hot water systems, one may use the CEC's f-Chart software: http://www.energy.ca.gov/title24/swh_calculator/index.html
- Additional information on using CEC f-Chart is available at: http://www.gosolarcalifornia.ca.gov/solarwater/nshp/

Wrap Up

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▶ **Wrap Up**

Study resources

Traditional Classroom
[IN PERSON CLASS]
ENHANCED & NEW

Virtual Classroom
[ONLINE CLASS]
NEW

Decoding Talks
[ONLINE DISCUSSION]
ENHANCED & NEW

Self Studies
[ONLINE TRAINING]
NEW

Ace Training™

Ace Training Traditional Classroom™

Updated and additional courses on 2013 code - each targeting key measures and audiences. Check our calendar in the right sidebar for more information on scheduled classes.

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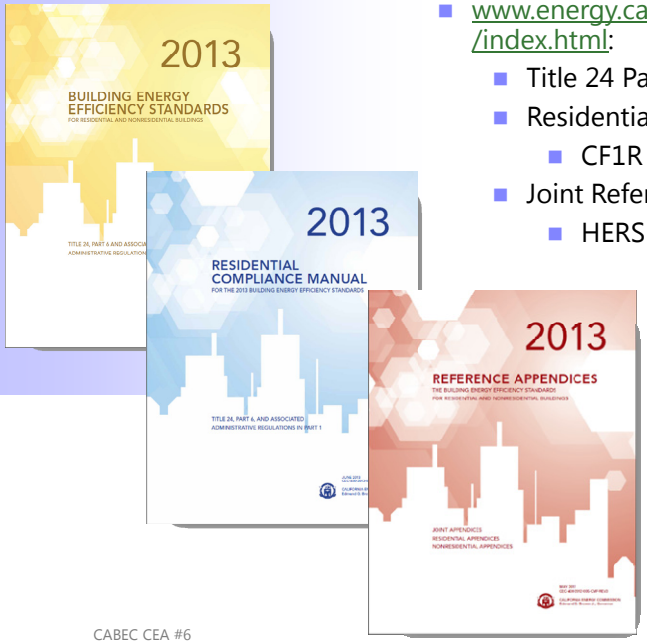
Study resources

CEC **www.energy.ca.gov**



- www.energy.ca.gov/title24/2013standards/index.html:
  - Title 24 Part 6 Standards
  - Residential Manual
    - CF1R and CF2R forms
  - Joint Reference Appendices
    - HERS procedures

Study resources

E+A+A Software

- CBECC-Res: www.bwilcox.com/BEES/BEES.html
- EnergyPro: www.energysoft.com

- Model everything you can get your hands on. The "sample" files provided are a good resource.

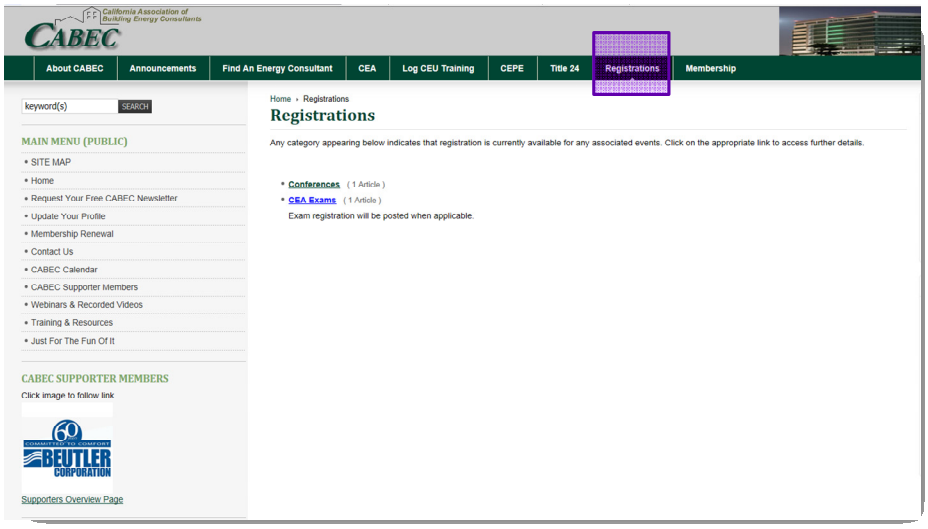
Take the Next Step

Be a recognized professional

- CEAs are recognized as technical experts who understand broader energy efficiency issues.
  - CEAs are committed to:
    - Provide quality service to clients
    - Conduct business in an ethical fashion
    - Meet ongoing educational requirements

Register for the CEA Exam

- www.cabec.org



Thank you

I want to personally thank the following for helping me make it through recording #6 ☺

- Kathryn Fortin of Fortech Solutions
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CEA Competencies