CABEC

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

CEA Competency 4

Fifth in a six-part series

California Association of Building Energy Consultants

Recorded & brought to you by..

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GABEL ASSOCIATES, LLC
BUILDING ENERGY ANALYSIS & ENERGY CODE COMPLIANCE

California Statewide Codes & Standards

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Welcome

Welcome

- 4.1 Create an accurate energy model
- 4.2 Analyze how the Standard Design sets the energy budget based on the Proposed building
- 4.3 Evaluate energy model results for reasonableness
- 4.4 Compare CF-1R to listed and input project data
- 4.5 Summarize applicable mandatory measures
- Wrap Up

CEA Competency Four

Model the Building with Approved Energy Compliance Software

Create an energy model of the building from all information gathered. Check to see if on-screen and report results are reasonable, and if not, correct the source of the error(s).

4

Troubleshooting Results

Creating an accurate energy model, and trouble-shooting when results do not make sense

- Pop-Up Resource!

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4.1 Accurate Energy Model

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Troubleshooting Results 4

- Welcome
- **▶4.1 Create an accurate energy model**
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Competency 4.1

4.1 Create an accurate energy model of a proposed project using the most current version of state-approved residential compliance software for E+A+A

- **This objective is covered by the energy modeling portion of the Residential CEA exam and includes:**
  - Understanding the input structures, hierarchies, menus and terminology of the approved compliance software version you are using
  - Creating an energy model from the building description data and area take-offs gathered
  - Knowing how to correct input errors to get the software to run the proposed building file

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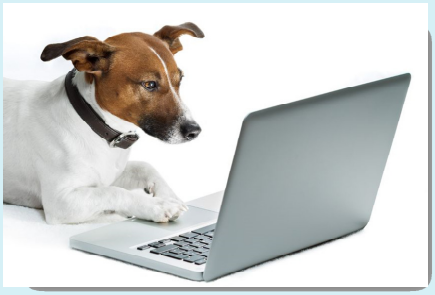
4.1 Accurate Energy Model

Modeling Inputs

- General building information
- Construction assemblies and thermal mass
- Fenestration and fixed shading
- HVAC system(s) and duct systems(s)
- Water heating system(s)
- Status of Inputs: New Construction vs. Existing + Addition + Alteration

- Energy Code Ace: Training "Residential Standard Essentials for the Energy Consultant"
- Energy Code Ace: Training "Residential Standard Essentials Modeling"
- User Manual of software

Check Your Understanding



How do you go about selecting which performance method works for you?

a. Create your own software to show compliance
b. Research modeling software available worldwide
c. Select from CEC approved software choices
d. Get the forms from CEC to show compliance

4.2 Standard Energy Budget

- Welcome
- 4.1 Create an accurate energy model

Troubleshooting Results
4

- **▶4.2 Analyze how the Standard Design sets the energy budget based on the Proposed building**
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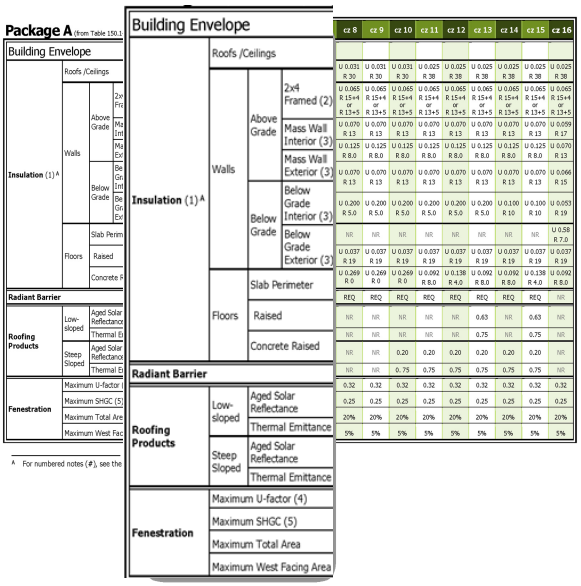
Competency 4.2

4.2 Analyze how the Standard Design sets the Title 24 Part 6 TDV energy budget based on the envelope, HVAC and water heating features in the Proposed building.

- Envelope features
- HVAC equipment and ducts
- Water heating systems
- Standard Design for New, Altered or Existing components and systems
  - With or without HERS verification of existing features to be improved for compliance credit

4.2 Standard Energy Budget

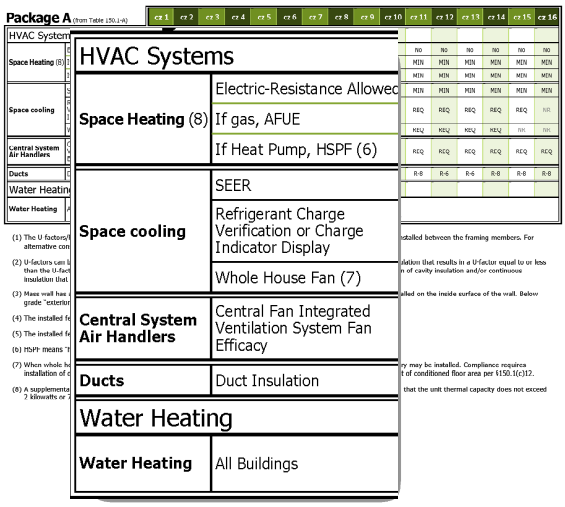


Envelope Standard Design

- Based on Prescriptive measures in Table 150.1-A Component Package A for new construction
  - Roof/ceiling U-factor, radiant barrier and cool roof
  - Exterior wall U-factor
  - Raised and slab floor U-factor
  - Fenestration area, U-factor, SHGC

- 2013 Residential Manual

cont.. 4.2 Standard Energy Budget



HVAC and Water Systems

- Space heating (gas vs. heat pump)
- Space cooling: SEER, refrigerant charge verification, whole house fan
- Central fan ventilation fan
- Duct insulation
- Water heater type, efficiency, distribution system

- 2013 Residential Manual

cont.. 4.2 Standard Energy Budget

Component Condition	Standard Design without HERS Verification	Standard Design WITH HERS Verification
Altered (at least 2 types of components)	Altered but *do not model* pre-altered existing condition (limited performance credit)	Altered and do model pre-altered existing condition (full performance credit)
Component type		
Opaque surfaces	*From 150.0 (a), (c), (d)*	Existing R-value
Roof	R-30, cool roof per Pkg A	existing R-value and roofing product
Framed Wall	R-13	existing R-value
Mass Wall	Proposed	existing R-value
Floor	R-19	existing R-value
Fenestration	U-factor = 0.40 / SHGC = 0.35	U-factor ≤0.40/SHGC ≤0.35 = existing
Area	same as existing bldg. (if > 20% of CFA)	same as existing bldg (if > 20% of CFA)
Window film	U-factor = 0.40 / SHGC = 0.35	existing = default values from Tables 110.6-A,B
HVAC	Pkg A	Existing efficiency
Duct sealing	HERS duct testing > 40 ft	HERS duct testing > 40 ft
Duct insulation	Pkg A	Existing R-values
Water heating	"Standard" with no solar credits	Existing efficiency
"All" other measures	Proposed	Existing efficiency levels

Baseline for Existing + Addition + Alteration

- Each Standard Design assumption is based on 2013 Residential ACM Manual
- For each altered component or system, potentially different baseline (compliance credit)
  - Compliance software uses an automatic baseline assumption if user selects "No HERS Verification of Existing Condition"
  - Full energy improvement credit available if user selects "With HERS Verification of Existing Condition"

- 2013 Residential ACM Manual Section 2.11.3 Tables 2-23 through 2-32
- 2013 Residential Manual

Check Your Understanding

Component Condition	Standard Design without HERS Verification	Standard Design WITH HERS Verification
Altered (at least 2 types of components)	Altered but *do not model* pre-altered existing condition (limited performance credit)	Altered and do model pre-altered existing condition (full performance credit)
Component type		
Opaque surfaces	*From 150.0 (a), (c), (d)*	Existing R-value
Roof	R-30, cool roof per Pkg A	existing R-value and roofing product
Framed Wall	R-13	existing R-value
Mass Wall	Proposed	existing R-value
Floor	R-19	existing R-value
Fenestration	U-factor = 0.40 / SHGC = 0.35	U-factor ≤0.40/SHGC ≤0.35 = existing
Area	same as existing bldg. (if > 20% of CFA)	same as existing bldg (if > 20% of CFA)
Window film	U-factor = 0.40 / SHGC = 0.35	existing = default values from Tables 110.6-A,B
HVAC	Pkg A	Existing efficiency
Duct sealing	HERS duct testing > 40 ft	HERS duct testing > 40 ft
Duct insulation	Pkg A	Existing R-values
Water heating	"Standard" with no solar credits	Existing efficiency
"All" other measures	Proposed	Existing efficiency levels

The client does not want to deal with HERS pre-existing verification. What will the performance calculation show as compliance credit for upgrading uninsulated walls to R-15 insulation?

a. A large compliance credit (comparing R-0 to R-15)

b. No compliance credit

c. A little compliance credit (comparing R-13 to R-15)

d. A little compliance credit (comparing R-11 to R-15)

4.3 Energy Model Results

Troubleshooting Results 4

- Welcome
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Competency 4.3

4.3 Evaluate the results of a building energy model to determine whether the results shown in reports and on screen are reasonable.

- Reasonable Annual TDV energy use / ft^2 for Standard and Proposed and compliance margin
- Distribution of TDV energy among energy use components for Standard and Proposed and compliance margin of each
- Load calculations if available

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4.3 Energy Model Results

Annual TDV Energy Use

- Based on your knowledge of the intended inputs, does the TOTAL TDV energy use (kBtu/ft^2-yr) appear reasonable?
  - Variables include climate zone, conditioned floor area, percent glazing, assembly U-factors, efficiencies of HVAC and water heating systems
  - Standard vs. Proposed credits and penalties
  - Total Compliance Margin

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"

cont... 4.3 Energy Model Results

Energy Use Components

- Does the distribution of energy use among different components (i.e. Space Heating vs. Space Cooling) appear reasonable?

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%
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Photovoltaic Offset	----	0.00	0.00	----
TOTAL	120.73	111.79	8.94	7.4%

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- Energy Code Ace: Training "Residential Standard Essentials Modeling"

cont...

4.3 Energy Model Results

Load Calculations, If Available

- Are heating and cooling design load calculations available as an option within the compliance software version you're using?
- If so, do the design loads look reasonable based on:
  - Outdoor design temperatures
  - Area of the zone(s)
  - Glazing types, areas and orientations
  - Roof, wall and floor insulation levels

- Play, play, play. Adjust the equipment size and type with your projects or with the "sample" files

Check Your Understanding

ENERGY USE SUMMARY				
04	05	06	07	08
Energy Use (kTDV/ft^2-yr)	Standard Design	Proposed Design	Compliance Margin	Percent Improvement
Space Heating	12.80	9.73	3.07	24.0%
Space Cooling	107.70	88.02	19.68	18.3%
IAQ Ventilation	1.31	1.31	0.00	0.0%
Water Heating	15.01	15.01	0.00	0.0%
Photovoltaic Offset	----	0.00	0.00	----
TOTAL	**136.82**	**114.07**	**22.75**	16.6%

You are modeling a brand new building with a 90% furnace, 15 SEER AC and gas tankless water heater, what energy component concerns you?

a. Space heating
b. Space cooling
c. IAQ Ventilation
d. Water heating

Sample CEA Exam Question

In March 2015 you complete an existing plus addition plus alteration analysis for a 650 ft2 addition to an existing 1,450 ft2 house in climate zone 3. The existing home was built in 1990 with what were then minimum prescriptive water heating and furnace efficiencies. The existing furnace system remains, but the original (existing) water heater is being replaced with a new standard 50 gallon storage gas water heater. For extra compliance credit, the homeowner has selected HERS verification of the existing water heater efficiency.

ENERGY USE SUMMARY

04	05	06	07	08
Energy Use (kTDV/ft²-yr)	Standard Design	Proposed Design	Compliance Margin	Percent Improvement
Space Heating	31.25	28.78	2.47	7.9%
Space Cooling	2.02	2.16	-0.14	-6.9%
IAQ Ventilation	1.12	1.12	0.00	0.0%
Water Heating	14.14	14.14	0.00	0.0%
Photovoltaic Offset	---	0.00	0.00	----
TOTAL	48.53	46.20	2.33	4.8%

Which statement best describes the results for the project shown above?

A. The water heating was modeled incorrectly; the results are not as expected.

B. The water heating was modeled correctly; the results are as expected.

C. It is not possible to know whether the water heating change is modeled correctly.

D. HERS verification of the existing water heater is not allowed.

4.4 Compare and Evaluate

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Troubleshooting Results

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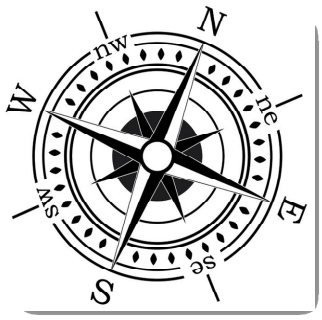
Competency 4.4

4.4 Compare and evaluate CF-1R Certificate of Compliance data vs. known and/or listed project data to identify modeling errors.

- General Building and Zone Information
- Required Special Features
- Opaque Surfaces, Attic and Construction Assemblies
- Windows (Fenestration), Overhangs and Fins
- HVAC and Duct Systems
- Water Heating Systems
- Project HERS Features
- Status: New, Altered or Existing

4.4 Compare and Evaluate



General Building Information

CERTIFICATE OF COMPLIANCE - RESIDENTIAL PERFORMANCE COMPLIANCE METHOD CF1R-PRF-01
Project Name: CEA Sample Calculation Date/Time: 21:03, Sun, Aug 10, 2014 Page 1 of 11
Calculation Description: Title 24 Analysis Input File Name:

GENERAL INFORMATION					
01	Project Name	CEA Objective 4.4 Example CF-1R			
02	Calculation Description	Title 24 Analysis			
03	Project Location	987 Mountain Boulevard			
04	CA City	Orinda	05	Standards Version	Compliance 2014
06	Zip code	94563	07	Compliance Manager Version	BEMCmpMgr 2013-2 (595c)
08	Climate Zone	CZ12	09	Software Version	EnergyPro 6.2
10	Building Type	Single Family	11	Front Orientation (deg/Cardinal)	191
12	Project Scope	Addition and/or Alteration	13	Number of Dwelling Units	1
14	Total Cond. Floor Area (FT2)	3154	15	Number of Zones	4
16	Slab Area (FT2)	0	17	Number of Stories	2
18	Addition Cond. Floor Area	807	19	Natural Gas Available	Yes
20	Addition Slab Area (FT2)	81	21	Glazing Percentage (%)	25.7%

GENERAL INFORMATION					
01	Project Name	CEA Objective 4.4 Example CF-1R			
02	Calculation Description	Title 24 Analysis			
03	Project Location	987 Mountain Boulevard			
04	CA City	Orinda	05	Standards Version	Compliance 2014
06	Zip code	94563	07	Compliance Manager Version	BEMCmpMgr 2013-2 (595c)
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Continued... 4.4 Compare and Evaluate

Zonal Information

ZONE INFORMATION

01	02	03	04	05	06	07
Zone Name	Zone Type	HVAC System Name	Zone Floor Area (ft^2)	Avg. Ceiling Height	Water Heating System 1	Water Heating System 2
Existing: Living and Base	Conditioned	Existing System1	1612	8.25946	DHW Sys 1	
Addition: Living	Conditioned	Existing System1	367	8.4	DHW Sys 1	
Existing: Bedrooms	Conditioned	New System2	735	8.3	DHW Sys 3	
Addition: Bedrooms	Conditioned	New System2	440	8.3	DHW Sys 3	

ZONE INFORMATION

01	02	03	04	05	06	07
Zone Name	Zone Type	HVAC System Name	Zone Floor Area (ft^2)	Avg. Ceiling Height	Water Heating System 1	Water Heating System 2
Existing: Living and Base	Conditioned	Existing System1	1612	8.25946	DHW Sys 1	
Addition: Living	Conditioned	Existing System1	367	8.4	DHW Sys 1	
Existing: Bedrooms	Conditioned	New System2	735	8.3	DHW Sys 3	
Addition: Bedrooms	Conditioned	New System2	440	8.3	DHW Sys 3	

Registration Number: | Registration Date/Time: | HERS Provider:
CA Building Energy Efficiency Standards - 2013 Residential Compliance | Report Version - CF1R-08012014-595c | Report Generated at 2014-08-10T21:10:35

Continued... 4.4 Compare and Evaluate

Required Special Features

REQUIRED SPECIAL FEATURES

The following are features that must be installed as condition for meeting the modeled energy performance for this computer analysis.

- Ducts with high level of insulation
- Non-standard roof reflectance
- Cathedral Ceiling
- Window overhangs and/or fins
- No cooling system included

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The following are features that must be installed as condition for meeting the modeled energy performance for this computer analysis.

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CA Building Energy Efficiency Standards - 2013 Residential Compliance | Report Version - CF1R-08012014-595c | Report Generated at 2014-08-10T21:10:35

Continued... 4.4 Compare and Evaluate

Opaque Surfaces

CERTIFICATE OF COMPLIANCE - RESIDENTIAL PERFORMANCE COMPLIANCE METHOD — CF1R-PRF-01

Project Name: CEA Sample — Calculation Date/Time: 21:03, Sun, Aug 10, 2014 — Page 3 of 11

Calculation Description: Title 24 Analysis — Input File Name:

OPAQUE SURFACES

01	02	03	04	05	06	07	08	09	10
Name	Zone	Construction	Azimuth	Orientation	Gross Area (ft²)	Window or Door Area (ft²)	Tilt(deg)	Status	Verified Existing Condition
Front: R-0 Wall (E)	Existing: Living and Base	R-0 Wall	191	Front	245	20	90	Existing	No
Left: R-0 Wall (E)	Existing: Living and Base	R-0 Wall	281	Left	239	56.9	90	Existing	No
Rear: R-0 Wall (E)	Existing: Living and Base	R-0 Wall	11	Back	236	20	90	Existing	No
Right: R-0 Wall (E)	Existing: Living and Base	R-0 Wall	101	Right	209		90	Existing	No
Front: R-0 Wall (E) 2	Existing: Living and Base	R-0 Wall	191	Front	293	46.69	90	Existing	No
Left: R-0 Wall (E) 2	Existing: Living and Base	R-0 Wall	281	Left	348	167.669	90	Existing	No
Rear: R-0 Wall (E) 2	Existing: Living and Base	R-0 Wall	11	Back	135	51.6925	90	Existing	No
Right: R-0 Wall (E) 2	Existing: Living and Base	R-0 Wall	101	Right	185		90	Existing	No
Roof Front (E): R-11 Att 2	Existing: Living and Base	R-38 Roof: Attic			598.9			Altered	N/A
Roof Front (E): Vaulted	Existing: Living and Base	R-19 Existing Roof			455			Existing	No
R-0 (E) Raised over Crawl	Existing: Living and Base	R-0 Existing Floor over C			578			Existing	No
Front: Wall (N)	Addition: Living	R-21 Wall	191	Front	80	39.9901	90	New	N/A
Left: Wall (N)	Addition: Living	R-21 Wall	281	Left	250	68.5045	90	New	N/A
Rear: Wall (N)	Addition: Living	R-21 Wall	11	Back	199	22.5	90	New	N/A
Right: Wall (N)	Addition: Living	R-21 Wall	101	Right	291	86.8066	90	New	N/A
(N) Raised Floor over Cra	Addition: Living	R-30 Floor over Crawl:			286			New	N/A
Front: R-0 Wall (E) 3	Existing: Bedrooms	R-0 Wall	191	Front	131	22.0947	90	Existing	No
Left: R-0 Wall (E) 3	Existing: Bedrooms	R-0 Wall	281	Left	60		90	Existing	No
Rear: R-0 Wall (E) 3	Existing: Bedrooms	R-0 Wall	11	Back	259	94.4967	90	Existing	No
Roof Front (E): R-11 2	Existing: Bedrooms	R-38 Roof: Attic			539.5			Altered	N/A
R-0 (E) Raised over Crawl 2	Existing: Bedrooms	R-0 Existing Floor over C			735			Existing	No
Front: Wall (N) 2	Addition: Bedrooms	R-21 Wall	191	Front	241	58.4	90	New	N/A
Left: Wall (N) 2	Addition: Bedrooms	R-21 Wall	281	Left	70	12	90	New	N/A
Rear: Wall (N) 2	Addition: Bedrooms	R-21 Wall	11	Back	167	34.1	90	New	N/A
Right: Wall (N) 2	Addition: Bedrooms	R-21 Wall	101	Right	288	16.9	90	New	N/A
(N) Raised Floor over Cra 2	Addition: Bedrooms	R-30 Floor over Crawl:			440			New	N/A

Registration Number: — Registration Date/Time: — HERS Provider:

CA Building Energy Efficiency Standards - 2013 Residential Compliance — Report Version - CF1R-08012014-595c — Report Generated at 2014-08-10T21:10:35

Continued... 4.4 Compare and Evaluate

Construction Assemblies

CERTIFICATE OF COMPLIANCE - RESIDENTIAL PERFORMANCE COMPLIANCE METHOD — CF1R-PRF-01

Project Name: CEA Sample — Calculation Date/Time: 21:03, Sun, Aug 10, 2014 — Page 7 of 11

Calculation Description: Title 24 Analysis — Input File Name:

OPAQUE SURFACE CONSTRUCTIONS

01	02	03	04	05
Construction Name	Surface Type	Framing	Total Cavity R-value	Assembly Layers
Attic Roof Cons	Attic Roofs	2x4 Top Chord of Roof Truss @ 24 in. O.C.	- no insulation -	• Roofing: Light Roof (Asphalt Shingle) • Above Deck Insulation - no insulation - • Roof Deck: Wood Siding/sheathing/decking • Cavity: - no insulation - • Inside Finish: - select inside finish -
R-0 Wall	Exterior Walls	2x4 @ 16 in. O.C.	- no insulation (vertical) -	• Inside Finish: Gypsum Board • Sheathing/Insulation: - no sheathing/insul. - • Cavity: - no insulation (vertical) - • Sheathing/Insulation: - no sheathing/insul. - • Exterior Finish: Wood Siding/sheathing/decking
R-19 Roof in Rafters	Cathedral Ceilings	2x6 @ 16 in. O.C.	R 19	• Roofing: Light Roof (Asphalt Shingle) • Above Deck Insulation - no insulation - • Roof Deck: Wood Siding/sheathing/decking • Cavity: R 19 • Inside Finish: Gypsum Board
R-0 Existing Floor over C	Floors Over Crawlspace	2x12 @ 16 in. O.C.	- no insulation -	• Floor Surface: Carpeted • Concrete Fill: - no concrete fill - • Floor Deck: Wood Siding/sheathing/decking • Cavity: - no insulation - • Sheathing/Insulation: - no sheathing/insul. - • Exterior Finish: - select finish -
Roof: Rafters	Cathedral Ceilings	2x12 @ 16 in. O.C.	R 38	• Roofing: Light Roof (Asphalt Shingle) • Above Deck Insulation - no insulation - • Roof Deck: Wood Siding/sheathing/decking • Cavity: R 38 • Inside Finish: Gypsum Board
R-38 Roof: Attic	Ceilings (below attic)	2x4 @ 16 in. O.C.	R 38	• Attic Floor: - no attic floor - • Cavity: R 38 • Sheathing/Insulation - no sheathing/insul. - • Inside Finish: Gypsum Board
R-38 Roof: Attic1	Cathedral Ceilings	2x4 @ 16 in. O.C.	R 38	• Roofing: Light Roof (Asphalt Shingle) • Above Deck Insulation - no insulation - • Roof Deck: Wood Siding/sheathing/decking • Cavity: R 38 • Inside Finish: Gypsum Board
R-19 Existing Roof	Ceilings (below attic)	2x4 @ 16 in. O.C.	R 19	• Attic Floor: - no attic floor - • Cavity: R 19 • Sheathing/Insulation - no sheathing/insul. - • Inside Finish: Gypsum Board

Registration Number: — Registration Date/Time: — HERS Provider:

CA Building Energy Efficiency Standards - 2013 Residential Compliance — Report Version - CF1R-08012014-595c — Report Generated at 2014-08-10T21:10:35

Continued... 4.4 Compare and Evaluate

Windows

CERTIFICATE OF COMPLIANCE - RESIDENTIAL PERFORMANCE COMPLIANCE METHOD — CF1R-PRF-01
Project Name: CEA Sample — Calculation Date/Time: 21:03, Sun, Aug 10, 2014 — Page 5 of 11
Calculation Description: Title 24 Analysis — Input File Name:

WINDOWS

01	02	03	04	05	06	07	08	09	10	11
Name	Side of Building	Width(ft)	Height (ft)	Multiplier	Area (ft^2)	U factor	SHGC	Exterior Shading	Status	Verified Existing Condition
(A) Casement	Left: R-0 Wall (E)	----	----	1	16.9	0.27	0.21		Altered	N/A
(A) Sliding Door	Left: R-0 Wall (E)	----	----	1	40.0	0.30	0.18		Altered	N/A
(E) Dual Wood Clear: Five	Front: R-0 Wall (E) 2	7.0	6.7	1	46.7	0.55	0.67		Existing	No
(E) Dual Wood Clear: Five 2	Left: R-0 Wall (E) 2	7.0	6.7	1	46.7	0.55	0.67		Existing	No
(E) Dual Wood Clear: Door	Left: R-0 Wall (E) 2	7.8	6.7	1	51.7	0.53	0.65		Existing	No
(N) Sliding Doors	Left: R-0 Wall (E) 2	8.0	6.7	0.281	15.0	0.30	0.18		New	N/A
(A) Sliding Doors	Left: R-0 Wall (E) 2	8.0	6.7	0.718	38.3	0.30	0.18		Altered	N/A
(N) Awning	Left: R-0 Wall (E) 2	4.0	4.0	0.525	8.4	0.28	0.19		New	N/A
(A) Awning	Left: R-0 Wall (E) 2	4.0	4.0	0.475	7.6	0.28	0.19		Altered	N/A
(E) Dual Wood Clear: Door 2	Rear: R-0 Wall (E) 2	7.8	6.7	1	51.7	0.53	0.65		Existing	No
Skylight (N)	Roof Front (E): R-11 Attl			1	17.1	1.30	0.73		New	N/A
(N) Sliding Doors 2	Front: Wall (N)	6.0	6.3	1.063	40.0	0.30	0.18		New	N/A
(N) Sliding Doors 3	Left: Wall (N)	8.0	6.7	0.999	53.3	0.30	0.18		New	N/A
(N) Casement	Left: Wall (N)	3.0	4.3	1.016	13.2	0.27	0.21		New	N/A
(N) Fixed	Rear: Wall (N)	----	----	1	22.5	0.26	0.23		New	N/A
(N) Sliding Doors 4	Right: Wall (N)	8.0	6.7	0.999	53.3	0.30	0.18		New	N/A
(N) Fixed 2	Right: Wall (N)	----	----	1	12.0	0.26	0.23		New	N/A
(N) Casement 2	Right: Wall (N)	----	----	1	21.5	0.27	0.21		New	N/A
(A) Casement 2	Front: R-0 Wall (E) 3	2.0	4.0	1	8.0	0.27	0.21		Altered	N/A
(A) Fixed	Front: R-0 Wall (E) 3	3.7	4.0	1.001	14.7	0.26	0.23		Altered	N/A
(N) French Door	Rear: R-0 Wall (E) 3	2.7	6.7	2.993	53.3	0.31	0.16		New	N/A
(A) Fixed 2	Rear: R-0 Wall (E) 3	5.7	4.0	1.001	22.7	0.26	0.23		Altered	N/A
(A) Casements	Rear: R-0 Wall (E) 3	4.6	4.0	1.005	18.5	0.27	0.21		Altered	N/A
Skylight (N) 2	Roof Front (E): R-11			1	10.5	1.30	0.73		New	N/A
(N) Casements	Front: Wall (N) 2	----	----	1	36.0	0.27	0.21		New	N/A
(N) Fixed 3	Front: Wall (N) 2	----	----	1	22.4	0.26	0.23		New	N/A
(N) Casement 3	Left: Wall (N) 2	----	----	1	12.0	0.27	0.21		New	N/A
(N) Fixed 4	Rear: Wall (N) 2	----	----	1	11.8	0.26	0.23		New	N/A
(N) Awning 2	Rear: Wall (N) 2	----	----	1	11.8	0.28	0.19		New	N/A

Registration Number: — Registration Date/Time: — HERS Provider:
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Continued... 4.4 Compare and Evaluate

Overhangs and Side-fins

CERTIFICATE OF COMPLIANCE - RESIDENTIAL PERFORMANCE COMPLIANCE METHOD — CF1R-PRF-01
Project Name: CEA Sample — Calculation Date/Time: 21:03, Sun, Aug 10, 2014 — Page 6 of 11
Calculation Description: Title 24 Analysis — Input File Name:

(N) Casement 4	Rear: Wall (N) 2	----	----	1	10.5	0.27	0.21		New	N/A
(N) Fixed 5	Right: Wall (N) 2	----	----	1	16.9	0.26	0.23		New	N/A
Skylight (N) 3	Roof Front (N): Vaulted			1	4.9	1.30	0.73		New	N/A

DOORS

01	02	03	04	05	06
Name	Side of Building	Area (ft^2)	U-factor	Status	Verified Existing Condition
(E) Door	Front: R-0 Wall (E)	20.0	1.00	Existing	No
(E) Door 2	Rear: R-0 Wall (E)	20.0	1.00	Existing	No
(A) Doors	Front: R-0 Wall (E) 2	40.0	0.50	Altered	No

OVERHANGS AND FINS

01	02	03	04	05	06	07	08	09	10	11	12	13	14
	Overhang					Left Fin				Right Fin			
Window	Depth	Dist Up	Left Extent	Right Extent	Flap Ht.	Depth	Top Up	DistL	Bot Up	Depth	Top Up	Dist R	Bot Up
(E) Dual Wood Clear: Five	3.5	1	4	4	0	0	0	0	0	0	0	0	0
(E) Dual Wood Clear: Five 2	3.5	1	4	41	0	0	0	0	0	0	0	0	0
(E) Dual Wood Clear: Door	3.5	1	20.5	4	0	0	0	0	0	0	0	0	0
(N) Sliding Doors	3.5	1	4	4	0	0	0	0	0	0	0	0	0
(A) Sliding Doors	3.5	1	4	4	0	0	0	0	0	0	0	0	0
(N) Awning	3.5	1	4	4	0	0	0	0	0	0	0	0	0
(A) Awning	3.5	1	4	4	0	0	0	0	0	0	0	0	0
(E) Dual Wood Clear: Door 2	3.5	1	4	4	0	0	0	0	0	0	0	0	0
(N) Sliding Doors 2	3.5	1	4	4	0	0	0	0	0	0	0	0	0
(N) Sliding Doors 3	3.5	1	21.5	4	0	0	0	0	0	0	0	0	0
(N) Casement	3.5	1	10	14	0	0	0	0	0	0	0	0	0
(N) Sliding Doors 4	3.5	1	4	10	0	0	0	0	0	0	0	0	0
(A) Casement 2	3.5	1	4	4	0	0	0	0	0	0	0	0	0
(A) Fixed	3.5	1	4	4	0	0	0	0	0	0	0	0	0
(N) French Door	3.5	1	4	4	0	0	0	0	0	0	0	0	0
(A) Fixed 2	3.5	1	4	4	0	0	0	0	0	0	0	0	0
(A) Casements	3.5	1	4	4	0	0	0	0	0	0	0	0	0

Registration Number: — Registration Date/Time: — HERS Provider:
CA Building Energy Efficiency Standards - 2013 Residential Compliance — Report Version - CF1R-08012014-595c — Report Generated at 2014-08-10T21:10:35

Continued...

4.4 Compare and Evaluate

HVAC Systems

HVAC SYSTEMS

01	02	03		04		05	06	07	08	09
Name	System Type	Heating System Name	Heating System Ducted	Cooling System Name	Cooling System Ducted	Distribution System	Fan System	Floor Area Served	Status	Verified Existing Condition
Existing System1	Other Heating and Cooling System	Heating Component 1	Yes	Cooling Component 1	Yes	Air Distribution System 1	HVAC Fan 1	1979	Existing	No
New System2	Heat Pump Heating and Cooling System	Heat Pump System 2	Yes	Heat Pump System 2	Yes	Air Distribution System 2	HVAC Fan 2	1175	New	No

HVAC SYSTEMS

01	02	03		04		05	06	07	08	09
Name	System Type	Heating System Name	Heating System Ducted	Cooling System Name	Cooling System Ducted	Distribution System	Fan System	Floor Area Served	Status	Verified Existing Condition
Existing System1	Other Heating and Cooling System	Heating Component 1	Yes	Cooling Component 1	Yes	Air Distribution System 1	HVAC Fan 1	1979	Existing	No
New System2	Heat Pump Heating and Cooling System	Heat Pump System 2	Yes	Heat Pump System 2	Yes	Air Distribution System 2	HVAC Fan 2	1175	New	No

Continued...

4.4 Compare and Evaluate

Duct Systems

CERTIFICATE OF COMPLIANCE - RESIDENTIAL PERFORMANCE COMPLIANCE METHOD CF1R-PRF-01
Project Name: CEA Sample Calculation Date/Time: 21:03, Sun, Aug 10, 2014 Page 10 of 11
Calculation Description: Title 24 Analysis Input File Name:

HVAC - DISTRIBUTION SYSTEMS

01	02	03	04	05	06	07	08	09	08
Name	Type	Duct Leakage	Insulation R-value	Supply Duct Location	Return Duct Location	Bypass Duct	Status	Verify Existing Condition	HERS Verification
Air Distribution System 2	Ducts located in a crawl space	Sealed and tested	8	Crawl Space	Crawl Space	None	New	No	Air Distribution System 2-hers-dist

HVAC - DISTRIBUTION SYSTEMS

01	02	03	04	05	06	07	08	09	08
Name	Type	Duct Leakage	Insulation R-value	Supply Duct Location	Return Duct Location	Bypass Duct	Status	Verify Existing Condition	HERS Verification
Air Distribution System 2	Ducts located in a crawl space	Sealed and tested	8	Crawl Space	Crawl Space	None	New	No	Air Distribution System 2-hers-dist

Continued... 4.4 Compare and Evaluate

Water Heating Systems

WATER HEATING SYSTEMS

01	02	03	04	05	06
Name	Distribution Type	Number of Heaters	Solar Fraction (%)	Ststus	Verified Existing Condition
DHW Sys 1	Standard	1	Annual	Altered	No
DHW Sys 3	Standard	1	Annual	New	No

WATER HEATERS

01	02	03	04	05	06	07	08
Name	Heater Element Type	Tank Type	Tank Volume (gal)	Energy Factor or Efficiency	Input Rating	Tank Exterior Insulation R-value	Standby Loss (Fraction)
DHW Sys 1	Natural Gas	Small Instantaneous	0.5	0.91 EF	199900 Btu/hr	0	0
DHW Sys 3	Natural Gas	Small Instantaneous	0.5	0.91 EF	199900 Btu/hr	0	0

WATER HEATING SYSTEMS

01	02	03	04	05	06
Name	Distribution Type	Number of Heaters	Solar Fraction (%)	Ststus	Verified Existing Condition
DHW Sys 1	Standard	1	Annual	Altered	No
DHW Sys 3	Standard	1	Annual	New	No

WATER HEATERS

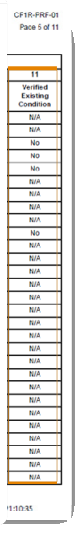
01	02	03	04	05	06	07	08
Name	Heater Element Type	Tank Type	Tank Volume (gal)	Energy Factor or Efficiency	Input Rating	Tank Exterior Insulation R-value	Standby Loss (Fraction)
DHW Sys 1	Natural Gas	Small Instantaneous	0.5	0.91 EF	199900 Btu/hr	0	0
DHW Sys 3	Natural Gas	Small Instantaneous	0.5	0.91 EF	199900 Btu/hr	0	0

Registration Number: CA Building Energy Efficiency Standards - 2013 Residential Compliance
Registration Date/Time: Report Version - CF1R-08012014-595c
HERS Provider: Report Generated at 2014-08-10T21:10:35

Continued... 4.4 Compare and Evaluate

Project HERS Features

11
Verified Existing Condition
N/A
N/A
No
No
No
N/A
N/A
N/A
N/A



Continued... 4.4 Compare and Evaluate

Status of Component or System

Status
Altered
Altered
Existing
Existing
Existing
New
Altered
New
Altered
Existing

Check Your Understanding

Roof: Rafters	Cathedral Ceilings	2x12 @ 16 in. O.C.	R 38	• Roofing: Light Roof (Asphalt Shingle) • Above Deck Insulation - no insulation - • Roof Deck: Wood Siding/sheathing/decking • Cavity: R 38 • Inside Finish: Gypsum Board

Why does this picture NOT represent the assembly modeled in the CF1R?

a. This is not a rafter roof assembly

b. No insulation needed above the roof deck

c. This does not meet QII standards

d. This is not in the right climate zone

4.5 Mandatory Measures

Troubleshooting Results
4

- Welcome
- 4.1 Create an accurate energy model
- 4.2 Analyze how the Standard Design sets the energy budget based on the Proposed building
- 4.3 Evaluate energy model results for reasonableness
- 4.4 Compare CF-1R to listed and input project data
- **▶4.5 Summarize applicable mandatory measures**
- Wrap Up

Competency 4.5

4.5 Understand all mandatory measures applicable to the proposed project.

- Envelope: opaque surfaces and glazing
- Mechanical and water heating systems
- Indoor and outdoor lighting

4.5 Mandatory Measures

Envelope Mandatory Measures

- New construction vs. altered components
- Roofs/ceilings
- Exterior walls
- Raised floors
- Slab-on-grade floors
- Windows and skylights

- 2013 Residential Manual
- CF2R forms which includes language on the mandatory measures

cont... 4.5 Mandatory Measures

HVAC and Water Heating System Measures

- Minimum HVAC equipment efficiencies
  - Based on HVAC equipment type and capacity
- Duct sealing and HERS testing requirements
  - Minimum airflow
- Minimum water heater equipment efficiencies
  - Based on type and capacity

- 2013 Energy Standards
- Energy Code Ace webinar: "Decoding HERS"

cont... 4.5 Mandatory Measures

Lighting Mandatory Measures

- Indoor luminaires, controls, other requirements for:
  - Kitchens
  - Inside cabinets
  - Bathrooms
  - Garages, laundry and utility rooms
  - Other spaces (e.g., living, dining and bedrooms)
- Outdoor lighting
  - Single family requirements
  - Low-rise multifamily requirements

- 2013 Energy Standards and CF2R form
- Energy Code Ace factsheet: Residential Lighting

Wrap Up

CABEC

Troubleshooting Results
4

- Welcome
- 4.1 Create an accurate energy model
- 4.2 Analyze how the Standard Design sets the energy budget based on the Proposed building
- 4.3 Evaluate energy model results for reasonableness
- 4.4 Compare CF-1R to listed and input project data
- 4.5 Summarize applicable mandatory measures

▶**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™

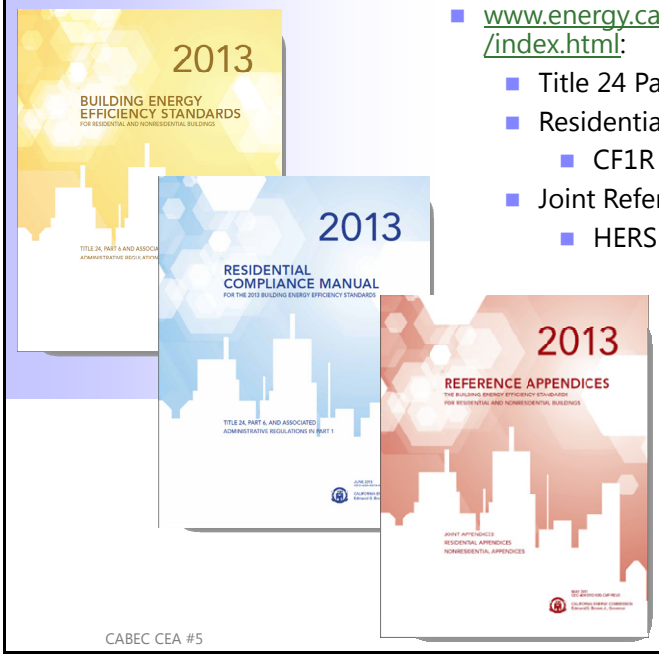
Ace Training Traditional Classroom™

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.

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.

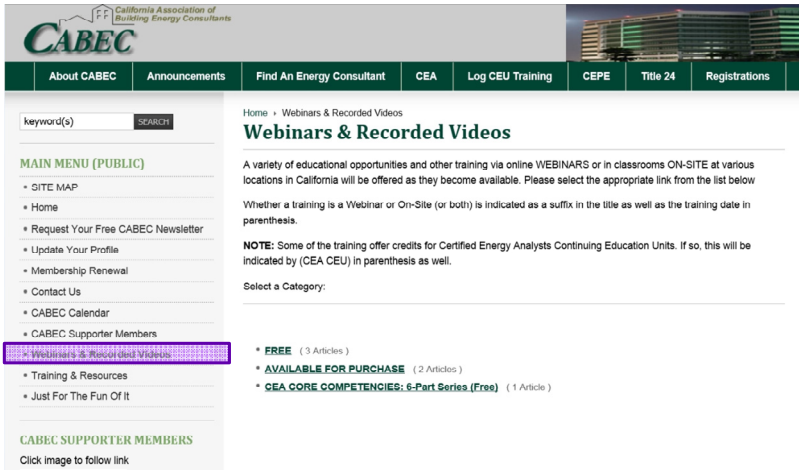
What's Next…

5 Interpreting energy performance results and making design recommendations

CABEC CEA Presentations

Where can I find them?

- www.cabec.org
- You can find the recordings and handouts (in PDF format) on the CABEC website under "Webinars & Recorded Videos".



Sample CEA Exam Question

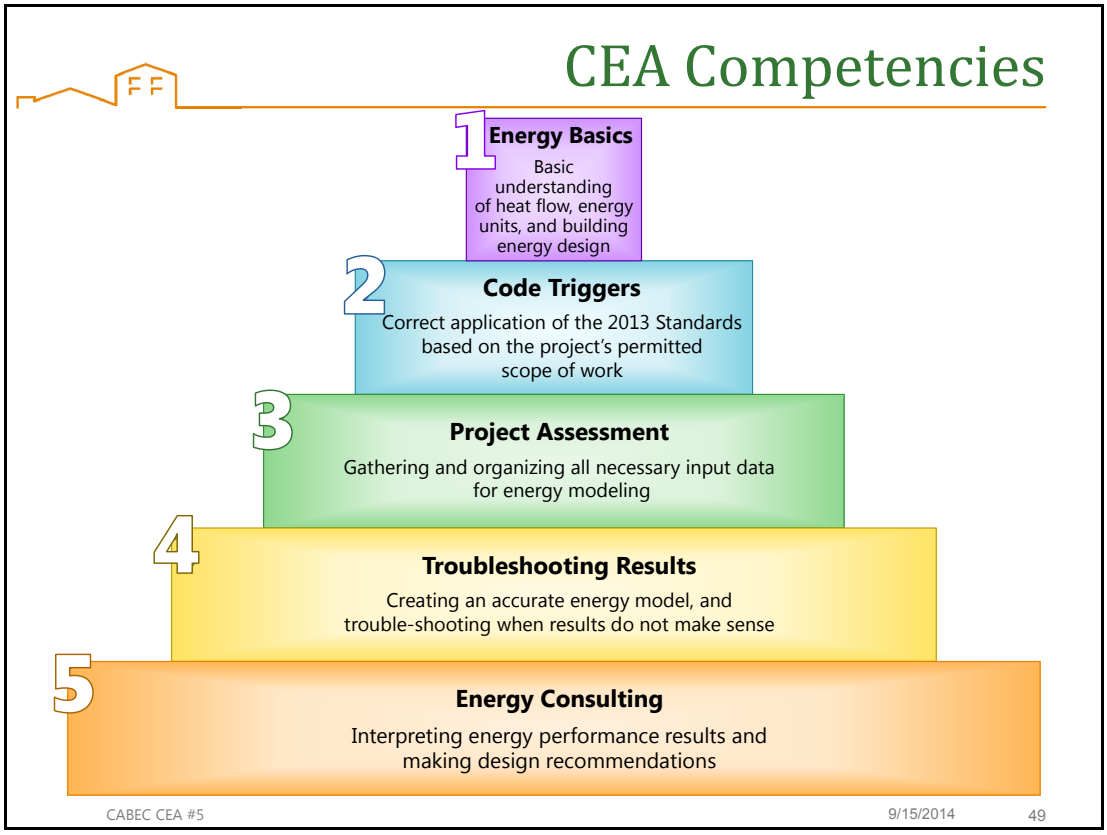
In March 2015 you complete an existing plus addition plus alteration analysis for a 650 ft2 addition to an existing 1,450 ft2 house in climate zone 3. The existing home was built in 1990 with what were then minimum prescriptive water heating and furnace efficiencies. The existing furnace system remains, but the original (existing) water heater is being replaced with a new standard 50 gallon storage gas water heater. For extra compliance credit, the homeowner has selected HERS verification of the existing water heater efficiency.

ENERGY USE SUMMARY

04	05	06	07	08
Energy Use (kTDV/ft^2-yr)	Standard Design	Proposed Design	Compliance Margin	Percent Improvement
Space Heating	31.25	28.78	2.47	7.9%
Space Cooling	2.02	2.16	-0.14	-6.9%
IAQ Ventilation	1.12	1.12	0.00	0.0%
Water Heating	14.14	14.14	0.00	0.0%
Photovoltaic Offset	----	0.00	0.00	----
TOTAL	48.53	46.20	2.33	4.8%

Which statement best describes the results for the project shown above?

A. The water heating was modeled incorrectly; the results are not as expected.
B. The water heating was modeled correctly; the results are as expected.
C. It is not possible to know whether the water heating change is modeled correctly.
D. HERS verification of the existing water heater is not allowed.


CEA Competencies
1
Energy Basics
Basic understanding of heat flow, energy units, and building energy design
2
Code Triggers
Correct application of the 2013 Standards based on the project's permitted scope of work
3
Project Assessment
Gathering and organizing all necessary input data for energy modeling
4
Troubleshooting Results
Creating an accurate energy model, and trouble-shooting when results do not make sense
5
Energy Consulting
Interpreting energy performance results and making design recommendations
CABEC CEA #5
9/15/2014
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