



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

CEA Competency 3

Fourth 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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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.
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Welcome

► Welcome

- 3.1 Analyze project for HVAC system modeling data
- 3.2 Analyze project for water heating modeling data
- 3.3 Organize zone-by-zone area take-offs
- 3.4 Identify missing or inconsistent data
- Wrap Up



CEA Competency Three

Gather, Calculate and Organize All Information Needed for Energy Modeling



Review drawings, specifications and information provided by the designer or client; gather, calculate and record all pertinent data to input into the energy modeling software.

■ Pop-Up Resource!



CABEC Intake Checklist



Residential Intake Checklist

Project Title/Address: _____ CF: _____
 City/Building Department: _____ North Arrow? Y/N
 Project Assigned To: _____
 Report to be Delivered by: e-mail/mail/will call _____ # of copies: _____
 Date in: _____ Date Out: _____
 Client's Name: _____ New? Y/N HERS Reg.? Y/N
 Mailing Address: _____
 Phone: _____ e-mail address: _____
 Designer/Owner: _____
 Mailing Address: _____
 Phone: _____ e-mail address: _____

Existing (Built _____) / Alteration/Addition/New

Roof Insulation: _____ Construction (Framing type and insulation): _____
 Radiant Barrier? Y/N Cool Roof? Y/N

Wall Insulation: _____ Construction (Framing type and insulation cavity): _____

Raised Floor Ins: _____ Construction (Framing type and insulation cavity): _____

Slab Insulation/Depth: _____ Heated? Y/N

Windows/Doors: _____ Frame: _____ Manufacturer: _____
 Skylights? Y/N Frame: _____ Manufacturer: _____

Heating/Eff: _____ Fuel: Gas/Propane/Electric Output: _____
 Cooling/Eff: _____ Output: _____

Ducts: Supply/Return/Exhaust/Other Whole house fan? Y/N

HERS: _____ Performance HERS: _____
 DWH: _____ Solar? Y/N

PV? Y/N _____

- This resource was created for you by CABEC as a tool for project intake
- This can be found at www.cabec.org

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3.1 Analyze HVAC System Data



- Welcome

▶ **3.1 Analyze project for HVAC system modeling data**

- 3.2 Analyze project for water heating modeling data
- 3.3 Organize zone-by-zone area take-offs
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Objective 3.1

3.1

Analyze the proposed project to determine pertinent data regarding HVAC system(s) and zones including HERS measures to input into energy modeling software.

- HVAC system type(s) and duct location(s)
- Building zone(s) served by each system
- Equipment data from CEC directories and other acceptable sources
- Mechanical plans, symbols, and location of data

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3.1 HVAC & Ducts

HVAC system type(s) and duct location(s), existing, new and altered

- Types and number of mechanical systems
 - Manufacturer and model number
 - Efficiency and other ratings
 - Cooling installed
 - Combined or separate hydronic heating system
- Ducted or ductless system(s)
 - Duct R-value, location(s)
 - HERS verification



- 2013 Energy Standards
- 2013 Residential Compliance Manual: Chapter 4 (HVAC)

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continued..

3.1 HVAC & Ducts



Zone(s) Served by Each System, existing, new and altered

- What area(s) are served by each system?
 - Include directly and indirectly conditioned space
- Do duct locations differ?
- Are any systems ductless?
- Is Zonal Control credit available?

■ 2013 Residential Compliance Manual: Chapter 4 (HVAC)



continued..

3.1 HVAC & Ducts



Equipment Data from CEC Directories



- Using generic vs. equipment-specific values in modeling
- What equipment values must be obtained from the CEC directories?
- Are other equipment listings acceptable?
 - Manufacturer cut sheets?
- Equipment sizing contingent on load calculations

■ <http://www.energy.ca.gov/appliances>

■ <https://www.ahridirectory.org/ahridirectory/pages/vsmshp/defaultSearch.aspx>



continued..

3.1 HVAC & Ducts

	GMEC96 0302BNA	GMEC96 0402BNA	GMEC96 0003BNA	GMEC96 0803CNA	GMEC96 1004CNA	GMEC96 1205DNA
Heating Data						
High Fire Input*	30,000	40,000	60,000	80,000	100,000	120,000
High Fire Output*	28,800	38,400	57,600	76,800	96,000	115,200
Low-Fire Steady-State Input*	21,000	28,000	42,000	56,000	70,000	84,000
Low-Fire Steady-State Output*	20,160	26,880	40,320	53,760	67,200	80,640
A/FUE†	96	96	96	96	96	96
Temperature Rise Range (°F)	-	20 - 50	20 - 50	25 - 65	25 - 65	25 - 65
Vent Diameter*	2" - 3"	2" - 3"	2" - 3"	2" - 3"	2" - 3"	2" - 3"
No. of Burners	2	2	2	4	5	6
Circulator Blower						
Available AC @ 0.5" ESP	1.5 - 2	1.5 - 3	1.5 - 3	1.5 - 3	1.5 - 4	3 - 5
Size (D x W)	10" x 8"	10" x 8"	11" x 8"	11" x 8"	11" x 10"	11" x 11"
Horsepower @ 1075 RPM	¾	¾	¾	¾	1	1
Speed	5	5	5	5	5	5
Filter Size (W")						
Permanent	366	341	512	683	1,067	1,024
Disposable	183	171	256	341	533	512
Electrical Data						
Min. Circuit Ampacity*	8	8	8	8	13.3	13.3
Max. Overcurrent Device (amps)†	15	15	15	15	15	15
Shipping Weight (lbs)	111	112	115	118	140	154

Reading Mechanical Plans and Specs

- Understanding mechanical plans
 - Symbols
 - Notations
 - Schedules
- Researching manufacturer specifications for a selected line of equipment
 - Understanding equipment options and how they affect modeling assumptions

■ http://www.urbandesignlondon.com/wordpress/wp-content/uploads/drawing_workshop_lr_w1.pdf
 ■ <http://e-book.lib.sjtu.edu.cn/print%20reading/Dusek/Chapter%2012.pdf>



continued..

3.1 HVAC & Ducts



Existing + Addition + Alteration Calculations

- Correctly understand the scope of work
 - **Existing** HVAC system(s) and/or ducts to remain
 - **Altered** HVAC system(s) and/or ducts
 - **New** HVAC system(s) or ducts
- If using HERS Verification of Existing Conditions, get reliable information on what existing HVAC system attributes can be confirmed by a HERS Rater

■ Clear communication with the client. Make sure to get "worst case" and "best case" scenarios.



Check Your Understanding



A new 35,000 BTUH outdoor unit replaced in March of 2015, which of the following efficiency values are required at a minimum?

- a. 13 SEER and no EER
- b. 13 SEER and 11.0 EER
- c. 14 SEER and no EER
- d. 14 SEER and 12.2 EER

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Sample CEA Exam Question



You are asked to perform the energy compliance analysis on a new custom home that needs to exceed the Title 24 energy budget by 15 percent. The owner would like to use a custom-designed high efficiency split HVAC system and has provided you with the makes and model numbers for the condenser, furnace, and cooling coil. You have determined that you will need to take a HERS performance credit for high efficiency cooling equipment to exceed Title 24 by 15 percent.

In order to take a HERS performance credit for high efficiency cooling equipment, what additional information do you need and where should you look to find it?

- A. The SEER and EER rating of the tested system from the Air-Conditioning, Heating, and Refrigeration Institute (AHRI) directory
- B. The SEER and EER rating of the tested system from the California Energy Commission (Energy Commission) Appliance Database
- C. The SEER rating of the tested system from the Air-Conditioning, Heating, and Refrigeration Institute (AHRI) directory
- D. The SEER rating of the tested system from the California Energy Commission (Energy Commission) Appliance Database

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3.1 Analyze Water Heating System Data



- Welcome
- 3.1 Analyze project for HVAC system modeling data

3 Project Assessment

▶ 3.2 Analyze project for water heating modeling data

- 3.3 Organize zone-by-zone area take-offs
- 3.4 Identify missing or inconsistent data
- Wrap Up



Competency 3.2

3.2

Analyze the proposed project to determine pertinent data regarding water heating system(s) and zones to input into energy modeling software.

- Water heating system type(s)
- Building area(s) served by each DHW system
- Equipment data from CEC directories and other acceptable sources

3.2 Water Heater Systems



Detailed Data on Water Heating Systems, Existing, New and Altered

- Types and number of water heater systems?
 - Manufacturer and model number?
 - Efficiency and other ratings?
 - Combined hydronic system?
- Distribution system
 - Energy compliance credit or penalty?
 - HERS verification required?

■ 2013 Energy Standards

■ 2013 Residential Compliance Manual: Chapter 5 (Water heating)

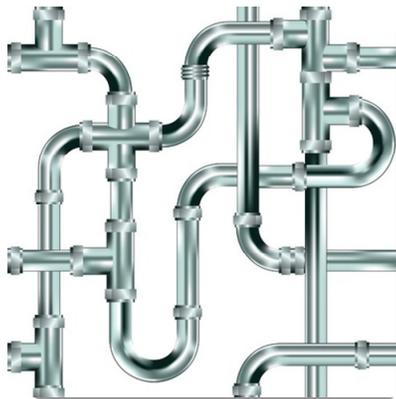
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continued 3.2 Water Heater Systems



Area(s) Served by Each Heater, Existing, New and Altered

- What area(s) are served by each DHW system?
 - Must be known and input correctly in all CEC-approved compliance software versions

■ 2013 Residential Compliance Manual: Chapter 5 (Water heating)

■ 2013 Residential Alternative Calculation Method (ACM) Manual

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continued 3.2 Water Heater Systems

MODEL NUMBER	SERIES	FIRST HOUR RATING GALLONS	ENERGY FACTOR (EF)	GALLON CAPACITY	BTU INPUT PER HOUR NATURAL*	RECOVERY 90°F RISE GALLONS PER HOUR	FOAM THICKNESS (INCHES)	DIMENSIONS IN INCHES						DRAFT HOOD OUTLET	APPROX. SHIPPING WEIGHT (LBS)
								A	B	C	D	E	F		
TALL MODELS															
GCF-40	100	67	.67	40	40,000	42	2	64-1/4	58-1/4	20	13	8	51-3/4	3 or 4	152
GCF-50	100	81	.67	50	40,000	42	2	63-1/2	57-1/4	22	13	8	50-1/4	3 or 4	167
SHORT MODEL															
GCL-40	100	67	.67	40	40,000	42	2	54	47-3/4	22	13	8	41	3 or 4	149
GCL-50	100	86	.67	50	40,000	42	2	55-3/4	49-1/2	24	13-1/4	8	42-1/2	3 or 4	175

Equipment Data from CEC Directories

- Using generic vs. equipment-specific values in modeling
- What water heater values must be obtained from the CEC directories?
- Are other equipment listings acceptable?
- Manufacturer cut sheets?

■ <http://www.energy.ca.gov/appliances>

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continued 3.2 Water Heater Systems



Existing + Addition + Alteration Calculations

- Correctly understand the scope of work
 - Existing DHW system(s)
 - Altered DHW system(s)
 - New DHW system(s)
- If using HERS Verification of Existing Conditions, get reliable information on what existing DHW system attributes can be confirmed by a HERS Rater

■ Clear communication with the client. Make sure to get "worst case" and "best case" scenarios.

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Check Your Understanding



You are preparing the compliance documentation for a house alteration and addition using the E+A+A performance approach. When must an altered water heater be HERS verified for pre-existing condition?

- a. When replacing with a tankless water heater
- b. When taking credit for improved efficiency**
- c. When adding a hot water recirculation pump
- d. All of the above

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3.3 Organize Take-Offs



- Welcome
- 3.1 Analyze project for HVAC system modeling data
- 3.2 Analyze project for water heating modeling data
- ▶ 3.3 Organize zone-by-zone area take-offs**
- 3.4 Identify missing or inconsistent data
- Wrap Up



Competency 3.3



3.3

Organize and perform zone-by-zone area take-offs in accordance with the scope, type and compliance approach for the project.

- Divide building into water heating and/or HVAC zones
- General data for building and each zone
- Calculate conditioned floor area for each zone per Title 24 rules
- Perform area take-offs for surfaces
- Perform area take-offs for all fenestration (with fixed shading as applicable)
- Include any special envelope modeling conditions
- Be clear on what is New, Altered or Existing

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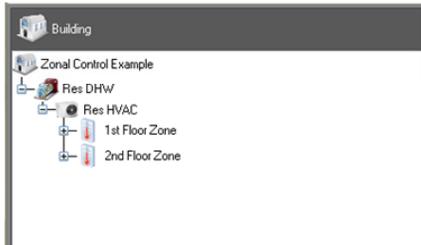
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3.3 Organize Take-Offs



Organizing Zone-By-Zone Data



- Use water heating and HVAC zones to organize input data per the modeling software version
 - Energy Pro uses an input "tree" structure
 - ▶ Water heater and/or boiler are defined as a "Plant" directly under the "Building" level
 - ▶ HVAC Systems are defined under DHW Plant
 - ▶ Zones are defined under HVAC Systems, and Rooms under Zones
 - CBECC-Res uses a different input structure and simply links each physical zone to a selected HVAC System and Water Heating System

- Energy Pro: User Manual
- CBECC-Res: User Manual

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continued..

3.3 Organize Take-Offs



General Building and Zone Data

- Project name and address, site location, "Front" orientation, building rotation from true north, climate zone, principal heating source
- General zone or room characteristics
 - Single family vs. multi-family
 - Ceiling Height
 - Floor Elevation
 - Floor to Floor Height
 - New, Altered or Existing

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

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continued..

3.3 Organize Take-Offs

Perform Area Take-offs

- Calculate conditioned floor area for each zone per Title 24 rules
- Perform opaque surface area take-offs
 - Roofs/ceilings, exterior walls, floors
 - Aggregate by assembly type, orientation
- Perform fenestration (glazing) area take-offs
 - Areas based on nominal sizes or rough openings (i.e., both glazing and frame)
 - Vertical glazing and skylights
 - NFRC ratings, operator type, fixed shading
 - Orientation
 - Include fixed shading as appropriate
- Any special envelope conditions to consider?
 - Unusual construction assemblies or materials
 - Unusual architectural geometry
- Keep track of New, Altered or Existing

- Energy Code Ace: Training "Standard Essentials: Residential Modeling"
- 2013 Residential Compliance Manual: Chapter 1 (Introduction) and Chapter 3 (Envelope)

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Check Your Understanding



When doing take-offs for windows, what inputs do you need to model in a performance calculation?

- a. Rough opening
- b. U-factor / SHGC
- c. Orientation
- d. All of the above

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3.4 Identify Missing/ Inconsistent Data

3 Project Assessment

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- 3.1 Analyze project for HVAC system modeling data
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- ▶ **3.4 Identify missing or inconsistent data**
- Wrap Up



Competency 3.4



3.4

Identify any relevant energy modeling data which may be missing or inconsistent.

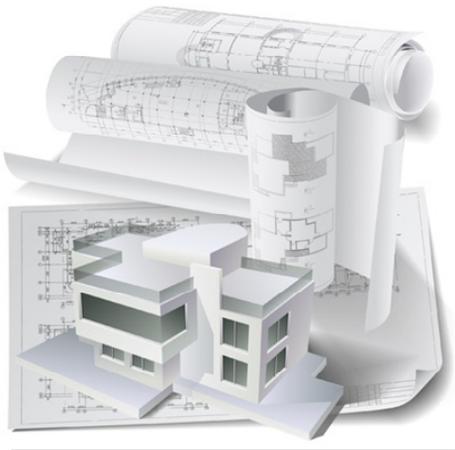
- Architectural drawings
- Envelope surfaces: roofs, walls and floors
- Fenestration: windows, glass doors and skylights
- Mechanical systems
- Water heating

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3.4 Identify Data



To-Scale Architectural Drawings

- Are additional sections or elevations needed to fill in missing information?
 - Raised floor vs. slab-on grade conditions
 - Above grade wall heights
 - Attic vs. cathedral ceilings
- Inconsistencies between plans and elevations?
 - Between elevations and window schedules?
- Are different construction assemblies and fenestration types clearly marked?

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

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

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Continued...

3.4 Identify Data



Roofs, Walls and Floors

- Insulation types and levels specified?
 - Cavity (batt, blown-in), continuous insulation?
 - Are proposed insulation R-values reasonable based on framing depth and common insulation types?
- Cool roof specified?
- Slab insulation details?
- In alterations: is it clear what surfaces are New, Altered or Existing?
- If Altered, are previous existing conditions known?

■ 2013 Residential Compliance Manual

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Continued...

3.4 Identify Data



Fenestration

- Is there a complete Window and Door schedule?
 - If not, are nominal glazing opening dimensions shown in plan, or are there elevations drawn to scale?
- Are drawings sufficient to accurately model overhangs and side fins?
- Are NFRC values available for the fenestration products selected?

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

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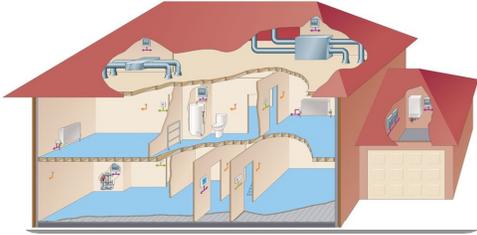
Continued...

3.4 Identify Data

HVAC and Water Heating Missing Data

■ Examples:

- Duct location(s) missing?
- HVAC equipment efficiencies approved by client not indicated?
- Electric resistance heaters not indicated in selected areas? Exempt under 2013 rules?
- Redundant HVAC systems not indicated?
- Water heater tank size missing?
- Proposed HVAC or water heating equipment not found in CEC Appliance Efficiency Database?



■ <http://www.energy.ca.gov/appliances>

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Check Your Understanding



When gathering information on a project, the client indicates the ducts will be in the attic and the drawings indicate all of the ceilings are cathedral type. What should be the next step?

- a. Model as "ducts in vented attic" since that is "worst case".
- b. Model the ducts in the crawlspace, if there is a crawlspace.
- c. Model the actual location once you verify with client.
- d. Model a ductless split system since then there are no ducts.



Wrap Up

3 Project Assessment

- Welcome
- 3.1 Analyze project for HVAC system modeling data
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▶ Wrap Up



Study resources

CABEC www.cabec.org

- Recorded webinars on 2013 Energy Standards
- Residential: Working With Your Clients HANDOUT

Home • Training & Resources • Energy Consultant Tools (Handouts & Checklists)

Energy Consultant Tools (Handouts & Checklists)

Tools, training and resources associated with 2013 Standards Title 24, Part 6.

Display # 10

- 1 **EnergyCodeAce Overview HANDOUT**
(PDF) Overview of the new tools, training, and resources developed by the California Statewide Codes & Standards Program.
- 2 **EnergyCodeAce (web site)**
A new tool developed by the California Statewide Codes & Standards Program to provide you with Tools, Training, and Resources to help you meet the requirements of Title 24, Part 6
- 3 **HERS Mandatory/Prescriptive/Performance HANDOUT**
PDF download
- 4 **Residential Energy Consultants: Working with your Clients HANDOUT**
PDF download
- 5 **Nonresidential Energy Consultants: Working with your Clients HANDOUT**
PDF download
- 6 **Residential Intake CHECKLIST**
PDF download
- 7 **Nonresidential Intake CHECKLIST**
PDF download

- [Energy Consultant Tools \(Handouts & Checklists\)](#) (7)
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Study resources

Energy Code Ace

www.energycodeace.com

- Training
- Resources



visit us at
www.EnergyCodeAce.com

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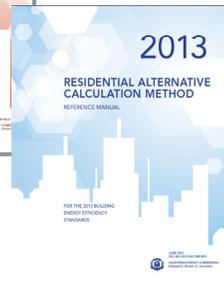
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Study resources

CEC www.energy.ca.gov

- www.energy.ca.gov/title24/2013standards/index.html: Title 24 Part 6 Standard; Residential Manual (and the forms); Joint Reference Appendices; Residential ACM Manual
- <http://www.energy.ca.gov/appliances>



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What's Next...



4

Creating an accurate energy model, and troubleshooting when results do not make sense



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".

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Webinars & Recorded Videos

A variety of educational opportunities and other trainings via online WEBINARS or in classrooms ON-SITE at various locations in California will be offered as they become available. Please select the appropriate link from the list below.

Whether a training is a Webinar or On-Site (or both) is indicated as a suffix in the title as well as the training date in parenthesis.

NOTE: Some of the trainings offer credits for Certified Energy Analysts Continuing Education Units. If so, this will be indicated by (CEA CEU) in parenthesis as well.

- 1 Residential & Nonresidential 2013 Advanced Title 24 Standards Videos, 3-part Series (CEUs available)
- 2 California Energy Commission's 2013 Residential & Nonresidential Energy Standards Overview and Webinars (Free) (CEUs available)
- 3 Title 24 Standards Changes Videos, Gina Rodda, presented in August 2013 (CEUs available)
- 4 Introduction to Title 24, the Basics Video, Jeff Pollock (Free)
- 5 Title 24 2013 Standards for Res and Nonres, Martyn Dodd, presented in Dec 2012 (CEUs available)
- 6 Self-Help How-To Videos & Educational Information (Free)



Sample CEA Exam Question



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CEA Competencies

