Residential EnergyPro Handbook



About the EnergyPro Handbook

This handbook is designed to be a resource for participating contractors in the Clean Energy Sacramento program who are modeling home upgrades using EnergyPro. This guide will present the basics of completing an energy simulation model in EnergyPro, communicate modeling-related program requirements, and describe how to properly submit EnergyPro data outputs to the program.

The EnergyPro Handbook is organized to mimic the structure of the EnergyPro building tree. Additional notes are included to highlight software features and tips, as well as program policies to keep in mind while you are building and editing your energy simulation model.

The technical team at Bevilacqua-Knight, Inc. (BKi) developed this handbook based on the EnergyPro modeling requirements of the Clean Energy Sacramento program, provided to them by the Ygrene team. Any EnergyPro questions or issues that contractor participants confront during the initial months of the Clean Energy Sacramento program should be emailed to Support@energysoft.com for direct program support.

Orange text in the handbook indicates either an external website link or a link to the referenced section within the EnergyPro Handbook. Click this text to access the referenced content. You can also click any item in the table of contents to jump to that section of the handbook.

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1. EnergyPro software information

a. How to obtain EnergyPro

EnergyPro is developed by EnergySoft, LLC, a Novato, California-based energy simulation software development company. To download EnergyPro, go to http://energysoft.com and click *EnergyPro* on the top navigation menu. Download the EnergyPro software by clicking *Download the EnergyPro Version 5.1*.

	Home EnergyPro EP News Dov	wnloads Firm Information Contact U
ENERGY Wor	d Class Building Energy Analysis Software	
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Nonresidenital Modules	Download the EnergyPro Version 5.1	ENERGYPRO
	Software available for download only.	ALAS
	NEW USERS ONLY	FI HARS
	Order EnergyPro online via PayPal	HHH

b. Ygrene EnergyPro module

For the Clean Energy Sacramento program, energy models must be performed using the Ygrene module which is available for no charge to participating contractors. The module must be requested from Ygrene, EnergySoft cannot supply the software directly. A license key will be emailed to you and will allow you to unlock the Ygrene module within EnergyPro.

c. Checking for updates

EnergyPro is updated periodically. Please check for software updates before performing calculations in EnergyPro and submitting your project. These updates are free and take only a few minutes to download to your computer. The final energy savings value will be based on model calculations performed by the most recent version of EnergyPro available on the day the project is approved.

To check for EnergyPro updates, go to *Help* in the menu bar and select *Check for Updates*.

2. EnergyPro process overview

a. Step 1: Model pre-upgrade conditions

Pre-upgrade conditions will need to be modeled in order to establish the existing energy use of the home.

The instructions provided in section 5 describe how to establish the pre-upgrade conditions of the home within the building tree of EnergyPro.

b. Step 2: Model proposed or final post-upgrade conditions

Post-upgrade conditions will need to be modeled in order to determine the proposed or final energy savings achieved by the upgrades.

If possible, simulate your proposed and final post-upgrade conditions using one EnergyPro model and incorporate your scope of work into the *Alternatives* tab of the *Ygrene* calculations. See the **Completing the Alternatives tab** section of this handbook for instructions on simulating proposed and actual post-upgrade conditions within one model.

See the **Two-model simulations** section of the handbook for specific conditions requiring a twomodel approach for estimating energy savings.

c. Step 3: Output reports and reporting energy data

After accurate pre-upgrade and proposed or final post-upgrade simulations of the home have been created, modeled energy use (in kWh and therms) will be submitted using the Ygrene energy report.

See the **EnergyPro reports and reporting energy data** section of the handbook for instructions on submitting the Ygrene energy report.

The data submitted should accurately reflect the actual pre-upgrade and post-upgrade conditions of the home. Any field verifications performed by the program will be based on the data provided in the EnergyPro file and Ygrene energy report.

3. Residential Project Eligibility

a. Single family homes

Single family residential properties in the City of Sacramento are eligible.

Manufactured homes that are constructed on site and bolted to a concrete foundation are eligible.

Mobile homes are ineligible.

A separate "guest home" or "mother-in-law" unit on the parcel is allowed in the program. It should be assessed and modeled as part of the detached single family home on the parcel, so long as the separate structure meets the requirements above. Any separate home must be part of the residential property that is assuming the APM.

b. Multi-family homes

2-4 unit buildings that are owned by a single entity including duplexes, triplexes, and quadplexes are part of this program.

Note: MF residential properties over 4 units are considered commercial. Any building over 4 units please refer to the Commercial Quick Start

All units in any building must be located in one single parcel.

- Additional rules/clarifications for duplexes, triplexes, and quadplexes:
 - a. All units in building must be owned by one entity
 - b. All units in building must participate in the upgrade
 - c. Projects will be reviewed only when all units are submitted
 - d. Surfaces adjacent to conditioned space cannot be modeled

c. Condos and townhomes

Condominiums are also eligible depending on ownership structure and HOA rules. In some cases multiplex residential is considered to be commercial property (over 4 units).

Buildings with two or more units in which each unit is individually owned may be eligible.

Additional rules/clarifications for condos, individual townhouses, and halfplexes:

- a. Not all units must participate in the upgrade
- b. Surfaces adjacent to conditioned space cannot be modeled

4. Create a new EnergyPro file – Home Rating Wizard

- 1. Launch the EnergyPro software.
- 2. Check for software updates by clicking to *Help* in the menu bar and selecting *Check for Updates*.
- 3. Click *File* in the menu bar and select *Home Rating Wizard* and follow the instructions provided by the wizard.

NOTE: The *Home Rating Wizard* is used to establish the basic parameters of the home being modeled. Note that the building wizard will not necessarily capture all of the relevant conditions needed to accurately model your existing home. Please ensure that all relevant fields have been incorporated into the building tree once completing the wizard. See the list of **Common Residential EnergyPro errors** to review specific areas that may require adjustments in the base building tree.

5. Create a new EnergyPro file – New Residential File

- 1. Launch the EnergyPro software.
- 2. Check for software updates by clicking to *Help* in the menu bar and selecting *Check for Updates*.
- 3. Click *File* in the menu bar and select *New*.
- 4. Configure the software to automatically check for program updates on a weekly basis by selecting *Configure Updates* from the *Tools* option in the menu bar, and selecting *Weekly*.

6. Building level: Whole house icon

EnergyPro tip: Expand the building tree

To view all elements in the building tree in the same view, click *View*, then select *Expand Tree*.

🔋 EnergyPro - [D08aCZ12_2010_	_0818*]
🔊 File Ed <mark>it View Tools Win</mark> s	dowHelp
🗄 🗋 🐔 🖄 🍃 📃 Expand Tree	📑 🛕 🌊 🔚 Calculate 🔹 🌏 Contents
Building	Building - D08aCZ12
D08aCZ12	Project Design Data Project Title Designer Lighting De

a. Project Design Data tab

1. Enter homeowner last name for *Building Name*.

Set Building Type to Existing.

Select the proper direction from the drop-down menu for *Front Orientation*.

a. Select the compass direction for the *Front* of the home (the side of the house that faces the street listed in the home address). This will ensure consistency across models and during field verifications. These compass directions will be converted to degrees during the calculation of the model (e.g., North = 0 degrees, East = 90 degrees, etc.).

In the *Location* section, click *Select* and choose the city in which the upgrade is performed.

NOTE: Some cities appear twice on this list, for example, "Sacramento AP" and "Sacramento CO." "AP" indicates that a location is an airport, while "CO" is associated with the city office. Select whichever location is closer to the home.

Building	Building - D08aCZ12
D08aCZ12	Project Design Data Project Title Designer Lighting Designer Mechanical Designer Utility Outdoor HERS
E-	General Location Building Name: D08aCZ12 Building Type: Existing State: California
- Front Wall	Job No: D08aCZ12
- y Window	Front Orientation: 0 City: Sacramento CO
□	Rotation: 0 User Defined Edit Select
Hight Wall	Number Of Dwelling Units: 1

b. Project Title tab

1. In the *Project* section, enter the homeowner name and installation address.

Building	Building - D08aCZ12
D08aCZ12 └── ⑦ DHW └── ● HVAC System	Project Design Data Project Title Designer Lighting Designer Mechanical Designer Utility Outdoor HERS
la Zone 1 La Zone 1	Name: PIP prescriptive home Address: 123 Main
i⊐–‱ Front Wall Window ₩ Door	City: anytown State: CA Zip Code:
Ģ—∭ Right Wall	Remarks:

c. Designer tab

1. Enter the name of the person building the model. Enter the contracting company's contact information.

Click Add to Contacts to save this contractor information for use in future models.

Project Design Data Project Title Designer Lighting Designer Mechanical Designer Utility Outdoor HERS DHW HVAC System Designer Select Contact Name: Select Contact Company: Company: CPBCA Add to Contacts Address: 1000 Brodway #410 City: Dakland Door State: CA Zip: 94607	Building	Building - D08aCZ12
Image: Sight Wall Telephone: 510.444.8707 x21 Fax: Image: Sight Wall Image: Sight Wall E-Mail: Image: Sight Wall Image: Sight Wall Image: Sight Wall Image: Sight Wall Image: Sight Wall Image: Sight Wall Image: Sight Wall Image: Sight Wall Image: Sight Wall Image: Sight Wall Image: Sight Wall Image: Sight Wall Image: Sight Wall	DHW HVAC System HVAC System Cone 1 Cone 1 Front Wall Window Boor Bight Wall	Designer Select Contact Name: Scott Fable Company: CPBCA Address: 1000 Brodway #410 City: Oakland State: CA Zip: 94607 Telephone: 510.444.8707 x21

d. Utility tab

The Utility tab is not used in the Clean Energy Sacramento program.

NOTE: Incentives in this program are based on modeled energy savings, rather than utility bill cost savings. Though you are asked to provide 12 months of past utility bill data to the program, you are not required to enter these data into EnergyPro.

e. HERS tab

 Enter the specifications and select the correct designations from the drop-down menus for all relevant appliances: *Inside Refrigerator*, *Garage Refrigerator* (or second refrigerator), *Dishwasher Energy Factor*, *Range* type, *Washer Location*, *Dryer Location*, *Dryer Type*, *Swimming Pool*, and *Spa*. NOTE: EnergyPro requests only the presence of a pool/spa, the designated heat source for the pool/spa, and whether the pool has a cover. You cannot specify the pump efficiency or heating schedule. If the home being upgraded has a pool or spa, this needs to be reflected in the EnergyPro model in order to accurately calculate the existing and final energy use in the home.

Building	Building - D0	8aCZ12							
008aCZ12	Project Design Data	Project Title	Designer	Lighting Design	er Mechar	nical Designer	Utility Outdoo	r HERS	
⊢ Ø HVAC System	Date of Rating:	7/25/2011		~	Indoor Lig	hting 🚺	∢ 0	of 0 🛛 🕨	₩ ♣ ×
- a Zone 1	Rater ID:				Quant	Туре	Locati	on	ro3
Zone 1 Front Wall Front Wall Door Fight Wall Fight Wall Fight Wall Fight Wall Fight Wall	Inside Refrigerator: Garage Refrigerator: Dishwasher: Range: Washer Location: Dryer Location:	0 k ¹ 0.46 C E Gas No Pilo In Condition	ed Space		Outdoor L	ighting	I I I	of 0	<u> 시 </u>
L 🗒 Window	Drver Type:	Electric			Quant	Туре	Locati	ion	Co
ÈSuite Left Wall └── 疑── Window 	Swimming Pool: Spa: Well Pump	None Gas heated Gas heated Solar or not Electric heat Electric heat	with no cov heated ed with cov	er					

To earn credit for upgrading an existing single-speed or two-speed pool pump to a variablespeed pool pump, indicate the pre-upgrade and post-upgrade pool pump conditions when submitting your project. *The electricity savings credits will be calculated independently, rather than in EnergyPro.*

Any fixtures that will be replaced with high efficacy (e.g., pin-based, low wattage) fixtures as part of the upgrade scope of work should be entered here. Under *Indoor Lighting* and *Outdoor Lighting*, enter the number of fixtures to be replaced by clicking on the yellow "+" and entering the lighting specifications.

NOTE: Only lighting that will be replaced with high efficacy (e.g., pin-based low wattage) fixtures should be entered in this location. EnergyPro calculates a default base lighting load based on total home area and number and types of rooms, so only the lighting being replaced should be incorporated into the model. Savings associated with screw-in CFLs cannot be reflected in the energy models for this program.

Building	Building - D0	8aCZ12				
DOMACET IF	Project Design Data	Project Title Designer Lig	hting Desi	gner Mechanical Designer U	Itility Outdoor HERS	
HVAC System	Date of Rating	6/24/2011	×	Indeer Lighting	Location	Control
Zone 1 Zone 1 From Wall Window Door Right Wall L Window Reau Vall L Window Left Wall L Window	Rater ID: Inside Refrigerator Gerage Refrigerator Distribution Range Washer Location Diser Type Sosteming Pool Spe	700 Kwhvlyr 0 Kwhvlyr 0.46 # Energy Factor Gas No Plat In Conditioned Space In Conditioned Space Electric None None	2 2 2 3 3			Control

7. Plant level: DHW icon

To add a domestic hot water (DHW) system to your EnergyPro model, right-click the whole house icon and select **Add Plant**.

Click the new **Undefined Plant** icon, and rename the DHW system in the **Name** field on the **Heating Hot Water** tab according to your naming preferences.

a. Heating Hot Water tab

The heating hot water tab is used when you have a house that has a designated boiler providing the heating hot water to the house, and a separate designated DHW providing hot water to the house.

b. Domestic Hot Water tab

1. In the Hot Water Boiler section, set *Type* to *Existing*.

Building	Plant - DHW
D08aCZ12	Heating Hot Water Chilled Water Hydronic Domestic Hot Water Renewables Exceptional DHW Boiler Type: Existing Pipe Length: 0 feet Existing Standard Gas 50 gal or Less Standard Gas Yipe Diameter: 0.5 inches
↓ ↓ ₩indow Door ⊖– ■ Right Wall	Multiplier: 1 Multi-Family Central System Monitored System

Click the magnifying glass icon to open the DHW system library.

a. Select the piece of equipment from the library that best matches the existing home equipment. It may be best to select a default DHW (listed as *Standard Gas 50 gal or less, Default Gas Prior to 1999, Default Tankless*, etc.).

- b. Click the yellow "+" to make a copy of the default equipment in the library. Rename the copy in the *Name* section (e.g., *Homeowner Last Name: Existing DHW*).
- c. Adjust the *Heating Type, Volume, Input,* and *Energy Factor* inputs to accurately reflect the existing equipment. Click OK.

NOTE: Any hot water heater with a 2 gallon tank or less is considered tankless.

NOTE: If you are unable to retrieve the actual equipment specifications from the equipment tags, reference the vintage tables provided through the program.

NOTE: For storage DHW heaters over 75,000 BTU, contractors must input the **Recovery Efficiency** and **Standby Loss** within the equipment specifications. Program defaults of 0.76Recovery Efficiency and 0.025 Standby Loss should be used if unable to determine the equipment specifications. The **Standby Loss** can be 0 only for tankless water heaters.



EnergyPro tip: Multiple DHW systems

1. Same fuel type, same specifications

If a home contains multiple DHW systems with identical fuel type and specifications, use the *Multiplier* function and set the model to the appropriate number of water heaters

2. Same fuel type, different specifications

When there are two or more DHW systems with the same fuel type and both are serving the entire home, enter the average *Energy Factor, Volume, Input*, and *Recovery Efficiency* for all systems. Set the system multiplier feature to reflect the number of systems.

Example: DHW #1 has an *Energy Factor* of 0.525 EF and DHW #2 has an *Energy Factor* of 0.575 EF. Enter an average *Energy Factor* of 0.55 EF and set the*Multiplier*totwosystems.



3. Different fuel types, or both tanked and tankless

When a home contains two or more DHW systems with different fuel types and/or a mixture of tanked and tankless heaters, they must be modeled such that each DHW has a dedicated zone it serves within the model, with accurate wall area, floor area, roof area, windows, bedrooms, and kitchens associated with each zone as found in the actual home.

If a home has multiple DHW systems but only one HVAC system, make a copy of the existing HVAC equipment so the base building tree shows two HVAC systems. The software calculates the heating/cooling load primarily based on volume of conditioned space associated with that system, and having a duplicate HVAC system to enable the correct DHW zones will not negatively impact the energy model. If you cannot determine the dedicated DHW zones or both systems serve the home in parallel, simply split the home area in half and dedicate 50% of the home area to each DHW.

a. Add a DHW system by right-clicking the whole house icon and selecting **Add Plant**. Add as many unique DHW systems as needed based on the instructions provided above.

- b. Click each newly added Undefined Plant icon from the step above, and on the Heating Hot Water tab rename each system using the Name field. For clarity, we recommend naming each DHW to indicate the system type and/or zone served within the home (e.g., "Tankless: Guest Bath").
- c. Under each DHW zone, enter the appropriate home assemblies and equipment as found in the actual home. Accurately **indicate wall area, floor area, roof area, windows, number of bedrooms and kitchens for** each zone; this information will determine the energy use load associated with each DHW.
- d. For homes with multiple DHW systems but only one HVAC system, you still need to enter an HVAC system for each DHW. These duplicate systems will be an identical copy of the original existing HVAC system. Right-click the *Plant level* and select *Add System*.

Building	Plant - Existing DHW
Undefined	Heating Hot Water Chilled Water Hydronic Domestic Hot Water Renewable
Electing HVAC	DHW Boler Combined Type: Ebiting Pipe Len Existing Boler Standard Gas 50 gwl or Less Pipe Dar
Existing DHW copy Existing HVAC copy Existing HVAC copy Zone 1 copy	Mutplier 1 0

- e. Within each duplicate **HVAC System**, select the same piece of equipment as identified in the original selection. Set all *Distribution tab* inputs (e.g., duct insulation, duct leakage, duct location) to match the original system.
- f. Set the *Thermostat* setting to *No Setback* in the *Residential* tab.
- g. In the *HERS Credits* tab, split the total existing infiltration among each *HVAC* zone. See the HERS Credits tab section below for information on how to correctly split this infiltration among multiple HVAC zones.

NOTE: If you are unable to determine individual DHW zones for multiple DHW systems in situation #3, divide the home evenly among each zone. For example, a home with two DHW zones would be split in half.

NOTE: If the existing home has a hydronic system and you are upgrading to a nonhydronic system, or vice versa, this system will need to be simulated using two EnergyPro models. See the **Two-model simulations** section of the handbook for instructions on how to model a hydronic system.

c. Renewables tab

NOTE: This section of the building tree is only for *existing* systems, and any newly installed systems will contribute to the modeled savings through the Alternatives tab inputs.

- 1. If there are *existing* solar DHW, solar thermal, or PV systems already incorporated into the building's operation, they must be entered in the *Renewables* tab to establish the baseline conditions for the home's energy consumption.
 - a. For *Solar Space Heating*, enter the percentage of space heating load that is met by the solar space heating system. See Chapter 5 of the state's Residential Manual for the guidelines to calculate annual solar performance.
 - b. For **Solar Domestic Hot Water**, enter the percentage of domestic hot water heating load that is met by the solar water heating system. See Chapter 5 of the state's Residential Manual for the guidelines to calculate annual solar performance.
 - c. For existing on-site electricity production, follow the instructions provided in the EnergyPro Help section.
 - i. Click *Help* from the menu bar, then select *Contents*.
 - ii. Select *Building Tree* in the left column, then select *Plant Element*.
 - iii. Click **Renewables Tab** at the top of the help page. Scroll down to the **Electricity Production** section and follow the instructions provided by EnergyPro.
 - NOTE: Download the CEC's PV calculator here: http://www.gosolarcalifornia.ca.gov/tools/nshpcalculator/download_calculat or.php



8. System level: HVAC icon

To add an HVAC system to your EnergyPro file, right-click the DHW icon and select Add System.

Click the new **Undefined System** icon, and rename the HVAC system in the **Name** field on the **General** tab according to your naming preferences.

a. General tab

1. In the *System Details* section, name the HVAC system.

Set System Type to Existing.

Building	System - HVAC System					
	General Distribution Residential HERS Credits MECH-2 System Details					
Zone 1	Name: HVAC System System Type: Existing Existing System: D05pmod_American Standard, Inc.					
Door ⊖– Right Wall ∟ 및 Window	Multiplier: 1.00					

Click the magnifying glass icon to open the HVAC system library.

- a. Select the piece of equipment from the library that best matches the existing home equipment. It may be best to choose a default unit (listed as *Standard FAU/AC*, *High Efficiency FAU/AC*, *Electric Baseboard*, etc.).
- b. Click the yellow "+" to make a copy of the default equipment in the library. Rename the copy in the *Name* section (e.g., *Homeowner Last Name: Existing HVAC*).
- c. Adjust the *System Type, Heating Type, Furnace Type, Total Output,* and *Efficiency* inputs to accurately reflect the existing equipment.

Nane	Type	Heat	Heat Eft	Cool	Cool Eff.	Heating Costing Control	ola Outdoox Air Fane	Evaporative Cooling Curves	-
Carrier 49HJD A.024576	PackagedE01	205.000	182% AFUE	261,000	10.BEER	Name: Carsie 404UE000	0-5/6	Protect Culo	
Carse 484.07A.024-5/6	Packaged WT	205,000	B2% AFLE	261,000	10.8EER	provenue	1920	There .	
Carler 494.074.029-5/6	PackagedDX	205,000	S2% AFUE	299,000	10.0 EER	System Type: Package	edQX 💌	C Electric Seguret	
Carlier 48HJD A.029-5/6	PackagedWVT	205,000	125 AFLIE	299,000	10.0 EER	Healing Col		O Holwayer [100 A	
Carier 494.000075/6	Packaged DK.	53,040	SZ% AFUE	77.300	11.0 EER	Heating Type Gim I	Fumeoe 💌	CONTRACTOR CONTRACTOR	
Carrier 48HJD0075/6 H	PackagedWVT	59.040	78% AFUE	77,300	8.5EER	Funsce Type Cerrin	kel 🔫	Fielwol Cols	
Carler 49HJ0009-5/6	Packaged 001	102,500	102% AFUE	92,900	11.0 EER	Col Comot	thand I living	None	
Care 484.0008-5/6 vi .	PackagedWVT	102,500	82% AFUE	52,900	11.0EER	1.1		O Electic Deka T	
Carter 40HJD009-5/6	Packaged DK	102,500	B25 AFUE	106,200	11.6-EER	TotalOutput: 1 Electrical	100000 Bhaffe	O Hat Water	
Carler 484,0009-5/6 m	Packaged W7	102.500	82% AFUE	106,200	11.6 EER	Poleg:		Desetioard Neel	
Carrier 40HJD012-5/6	PackagedDX	147,600	121: AFUE	121,900	11.0 £ER	Supply Terror 1	116 年	None	
Carles 494,0012-5/6 4	Packaged W/T	147,600	82% AFUE	121,900	11.0EER	Efficiency 0.75	B AFLIE	C Elected	
Catier 40HJD014-5/6	Packaged D01	183.680	82% AFLE	146,800	96EER	1		O Hot Water	
Carter 48HJD014-5/6 M	Packaged W/T	183.680	S2% AFUE	145.800	9,6658				
Carier 48HJE /M020-5/6	Packaged DM	296,000	B1% TE	214,000	10.8 EER				
Carer 404.8./M024-6/6	Packaged DM	296.000	81% TE	251.000	10.8 EER			1	
Cartin 494.8./M028-5/6	PackagedEX	296,000	81% TE	299,000	TODEER			100	
Carner 40HUE0075/6	Packaged(0X	93,150	INTARUE	77.300	11.0 EER				
Cashing attail \$5,0077. IS AS as	Part and Mill	00 150	ate an e	77.300	10.0255			1	

d. On the *Cooling* tab of the equipment selection window, adjust the *Output, Sensible*, *SEER*, and *EER* inputs to accurately reflect the existing equipment. Click OK.

NOTE: If the home has no cooling system, enter 0 BTU/hr for the **Output** and **Sensible** fields.

NOTE: If you are unable to retrieve the actual equipment specifications from the equipment tags, reference the vintage tables provided through the program.

Name	Type	Heat	HearEn.	Cod	eL • CostEV		Instea Coolor.	Controls Debdoor for	Farm - Evaporative Cooling Curves		÷
Carler 40HilD /L024-5/6	Packaged DK	205.000	and the second second second	and the second second	10.6 669		Cooling Col	Constant Constant of	Condense:		C
Carles 48HJD /L024 5/6	Packaged WT	205,000		a month of the set	TOBEER	111	1000	In the second second second		-	
Carler 48HJD /L029-5/6	Fackaged DX	205.000			10.0 EER	11	Eail Control:	Contain Lenge	Condenset Type Air Cooled	1	E
Carso 48HUD/L028-5/8	Packaged WT	205.000			10.0 EER		Output	68000 Btu/te	for Storage A/C INTERTITUTO	1.24	-
Cariel 48k/D007-5/5	Packaget DVC		82% AFUE		TLOEER		Sensible:	48000 Bhu/ty	Evap PC Ett		
Carner 48HJD007-5/6 w	Fackaged W1	10000	785 AFLE	contraction of	85EER	111	Supply Temp	55 FF	Evan Pump Motor		
Canter 48HJD 008-5/6	Packaged DK	102,500	82% AFUE	92.900	TLOEER	111	Efficiency	EER.	Design Power	10	
Carler 40HUD000-5/6 w	Fackaged Wf	102,500	RIT AFLE	92 900	11.0 EER	111	E Fan Heat Inc	charlest as Dudrest			
Carsie: 48HJD0095/6	Packaged DK	102.500	62% AFUE	106,200	11.6 EEP		C) i mirina in	adaptin control		-	
Carson 40HUD 009-5/6 w.	Packaged W1	102,500	BIT AFLE	106.200	11.6 EEA		Enders and of the	Di Pasalina			
Carie: 48HJD012-6/6	Packaged DX	147,600	82% AFUE	121.900	11.9 EER		C Energy Effice	MIGRAPH THE PARTY			
Carrier 40HUD 012-5/6 w.	Package6 VV1	147,600	B25 AFLE	121,900	11.0.669				-		
Carse 48HJD014-5/6	Packaged DX	183,680	82% AFUE	146,800	SEEER		C Cump/Condit	Posee III KW			

EnergyPro tip: Multiple identical HVAC systems

If there is more than one existing HVAC System *and they have identical specifications,* you can set the *Multiplier* to the number of identical systems in the home. This is recommended in lieu of entering multiple HVAC systems icons in the model.

See the **Two-model simulations** section of the handbook for instructions on how to model multiple post-upgrade HVAC systems with varying specifications.

NOTE: If the existing home has a hydronic system and you are upgrading to a nonhydronic system, this system will need to be simulated using two EnergyPro models. See the **Two-model simulations** section of the handbook for instructions on how to model a hydronic system.

b. Distribution tab

1. Set Distribution Type to Existing.

Indicate correct *Heating Distribution* and *Cooling Distributions* types.

Building	System - HVAC System
1008aCZ12	General Distribution Residential HERS Credits MECH-2
- DHW - O HVAC System	Distribution Type: Existing
È≪ Zone 1 È≪ Zone 1	Heating Distribution: Ducted O Duct Leakage not Verified
🛓 🔤 Front Wall	Cooling Distribution: Ducted 🔽 🖸 Sealed Ducts with Leakage Verified
Window	Duct Location: 🛛 Attic, Ceiling Ins, vented 👽 💿 Low Leakage AHU or HERS II Leakage Verified 🛛 28 📚 🗶
	Duct Insulation: 0 R-value O Ducts in Conditioned Space with Leakage Verified
Right Wall	CFM25 0 cfm

Select the correct *Duct Location* from the drop-down menu. The model assumes all duct runs in the house are in this location.

Enter the existing *Duct Insulation* R-value.

NOTE: See the **Completing the Alternatives tab: HVAC Distribution** section for how to model buried ducts.

Click the *Low Leakage AHU or HERS II Leakage Verified* radio button and enter the percent measured total duct leakage. This should be based on the duct pressurization results in CFM25 and the measured air flow of the system.

NOTE: The Clean Energy Sacramento program requires the reported duct leakage percent to be measured total duct leakage. The duct leakage percent should be based on the values you collect for measured system airflow and measured total duct leakage

Building	System - HVAC System
108aCZ12	General Distribution Residential HERS Credits MECH-2
E− Ø DHW E− Ø HVAC System	Distribution Type: Existing
ia⊣≪ Zone 1 ia⊣√ Zone 1	Heating Distribution: Ducted ODuct Leakage not Verified
- Front Wall	Cooling Distribution: Ducted 🔍 🔿 Sealed Ducts with Leakage Verified
↓ Window	Duct Location: 🛛 Attic, Ceiling Ins, vented 🚽 💿 Low Leakage AHU or HERS II Leakage Verified 🛛 28 📚 🖇
Door	Duct Insulation: 0 R-value Oucts in Conditioned Space with Leakage Verified
Bight Wall	CFM25 Cfm

Program policy: Ducts with asbestos

Clean Energy Sacramento will not require a duct blaster test on ducts with asbestos. If you elect to hire a qualified asbestos abatement contractor, this portion of the work will be covered within the project cost. If you replace the ducts, then you should indicate this in the notes field of the job report. If you do nothing to the ducts in the job, just note that you did not test the ducts because of the presence of asbestos.

If you cannot test the duct work because of asbestos, the pre-upgrade leakage in the EnergyPro model should be derived from the Title 24 default listed in the vintage table: 28% for homes built before 2001, and 22% for homes built in 2001 or later.

The fraction on the vintage table refers to the fraction of supply and return flow that stays within the system. If the table indicates .86, for example, then .14 of each run is lost due to If the supply and report runs lose 14% each, the total loss is 28% of total flow.

c. Residential tab

In the **Residential Features** section, confirm that the **Thermostat** is set to **Setback** on the dropdown menu.

Program policy: Select Setback for Thermostat setting

This is required for all projects due to required defaults to offset varying homeowner behavioral characteristics. This requirement will be implemented by the energy model reviewer if the file is not submitted with **Setback** selected.

Building	System - HVAC System
1008aCZ12 	General Distribution Residential HERS Credits MECH-2
HVAC System	Thermostat: Setback
È→ ♥ Zone 1 ┝→ ₩ Front Wall ↓ ₩ Window ↓ ₩ Door	Hydronic Space Heating: None
G-SSS Right Wall └──∰ Window Rear Wall └──∰ Window Window	Supply: 0 cfm Power: 0 watts Exhaust: 0 cfm Leave inputs at zero to use the default ventilation values.

d. HERS Credits tab

1. Enter the blower door test in the *HERS Credits* tab. In the *Building Envelope* section, set the *Building Leakage Testing* drop-down menu to *Airflow*.

Set the *Building Leakage Type* to *Existing*.

Building	System - HVAC System
108aCZ12	General Distribution Residential HERS Credits MECH-2
DHW DHW DHW Zone 1 DHW Zone 1 DHW Zone 1 DHW Door	HVAC Measures Verified Refrigerant Charge or Charge Indicator Display Verified Air Conditioner EER Verified Cooling Coil Airflow Verified Fan Energy Verified Cooling Size
Èsan Right Wall ↓ L Window ⊖-san Wall ↓ L Window ⊖-san Left Wall ↓ L Window	Maximum Capacity: 90332 Btu/hr Maximum Power: 9,033 watt Proposed Capacity: 68000 Btu/hr Proposed Power: 8,000 watt Puilding Envelope Quality Insulation Installation
Raised Floor	Building Leakage Airflow 🗸
	Building Leakage Type: Existing Specific Leakage Area CFM50 Existing Tested Value: 8.2 ft/10,000-ft ⊉800 cfm New Tested Value: 4.9 ft/10,000-ft 0 cfm

EnergyPro tip: SLA to CFM50

If you are able to obtain air infiltration only as specific leakage area (SLA), you must convert that SLA measurement to CFM50 for the EnergyPro inputs.

SLA = 3.819 x (CFM50/CFA)

Where:

CFM50 = the measured airflow in cubic feet per minute at 50 pascals with air distribution registers unsealed

CFA = conditioned floor area (ft²)

EnergyPro tip: Building leakage split between two or more HVAC systems

- If a home contains multiple identical HVAC systems, use the *multiplier* function and indicate appropriate number of systems in the home. In the *HERS Credits* tab of the HVAC system in the building tree, enter the total CFM50 for the entire home. On the *Alternatives* tab, the building leakage (in CFM50) should reflect the post-upgrade building leakage for the entire home.
- 2. If home has multiple HVAC zones, the existing building leakage for the total home should be split among each HVAC zone based on the proportion of conditioned floor area each system serves. The total post-upgrade CFM50 should be divided by the number of zones and then entered into the *Alternatives* tab.
- Click the first *HVAC* icon in the existing building tree and go to the *HERS Credits* tab.
- 4. Set *Building Leakage Testing* to *Airflow* and *Building Leakage Type* to *Existing*.
- 5. Calculate what percent of the home's total conditioned floor area is part of that HVAC zone.
- 6. Multiply that percent by the home's total existing building leakage (in CFM50), and enter the result in the *CFM50* field.
- 7. Repeat the above steps for each HVAC zone. The sum of the building leakage for all zones should equal the home's total building infiltration.

Example: zone 1 = 400 ft², zone 2 = 600 ft²; total building leakage = 2,000 CFM50

- a. Zone 1 represents 40% of the total home area (400 ft²/1000 ft²). Therefore, the infiltration entered under the HVAC System 1 should equal 40% of the total infiltration, or 800 CFM50.
- b. Zone 2 represents 60% of the total home area (600 ft²/1000 ft²). Therefore, the infiltration entered under the HVAC System 2 should equal 60% of the total infiltration, or 1200 CFM50.

NOTE: Divide the air infiltration values using the same technique for three or more HVAC systems.

9. Zone level: Multiple rooms icon

To add an multiple-room zone level to your EnergyPro, right-click the HVAC icon and select **Add Zone**.

Click the *Undefined Zone* icon, and rename the zone in the *Name* field on the *General* tab according to your naming preferences.

a. General tab

1. If you are modeling a multi-level home with more than one floor, you will need to verify that the *Floor Number* input is indicated correctly. First floor should be set to 1, second floor set to 2, etc.

Building	Zone - Zone 1
D08aCZ12	General Lighting Mechanical Schedules
DHW HVAC Sustem Zone 1 Cone 1 Front Wall Windd Bight Wall Windd Cone Right Wall Cone Right Wall Cone Right Wall Cone Right Wall Cone Rear Wall Cone Cone Rear Wall Cone Cone Cone Cone Cone Cone Cone Cone	DW 90.1 Ltg Occupancy: Building Area Dormitory Floor Number: 1 DW Floor Number: DW 0 Vertical Multiplier: 1.00 \$ Horizontal Multiplier: 1.00 \$ North, East, South West DW Display Perimeter: 0 feet

10. Room level: Single room icon

To add a single-room zone level to your EnergyPro, right-click the multiple-room zone icon and select **Add** *Room*.

Click the **Undefined Room** icon, and rename the zone in the **Name** field on the **General** tab according to your naming preferences.

a. General tab

1. Enter the **Area** for this HVAC zone of the house. If it is a single zone home, then this area should reflect the total conditioned space area. If the home has multiple HVAC zones, this area should represent only the conditioned space associated with this zone.

Enter the *Ceiling Height*. Ceiling height is typically 8 feet, but this number should be verified for all floors or zones in the model.

Set Type to Existing.

Enter the *Year Built*. This value can be adjusted for each zone if there is an addition that was constructed after the original house was built.

Indoor temperature settings are an important aspect of the model and can impact the total savings. The modeling for this program is not currently calibrated to the actual homeowner utility bills, so there is a need to standardize the homeowner behavior across all models to maintain consistency for all incentives. The required temperature defaults are:

a. Winter Indoor Temp set to 70 degrees

b. Summer Indoor Temp set to 78 degrees

Building	Room	i - Zone	1				
1008aCZ12	General	Infiltration	Occupant	Receptacle/Process	Domestic Hot Water	Exhaust Fan	Lighting
DHW	Nan		Za	one 1 1824_ft [≈]		1	24
Cone 1	l Tun	ng Height: ::	E	8 feet	¥	21	
P−www Right W	Yea	Built: er Indoor Te	2	77 📚 70 ºF			
k in k in the sear Wa	~ 1	mer Indoor T	emp:	78 ºF			

- b. Occupant tab
 - 1. Enter the *Number of Kitchens* and *Number of Bedrooms* for that zone. EnergyPro enters a default of 1 Kitchen and 3 Bedrooms for each zone, so room quantities need to be entered manually if the home has different numbers of rooms. If a zone has no bedrooms or kitchens, enter 0 for the number of rooms.

Building	Room - Zone 1
108aCZ12	General Infiltration Occupant Receptacle/Process Domestic Hot Water Exhaust Fan Lighting
DHW - O HVAC System - C Zone 1 - C Zone	Nonresidential Occupant Density: 333.33 ft*/occ Occupant Sensible: 245 Btu/hr-occ Occupant Latent: 155 Btu/hr-occ Ventilation: 0
G-Sight Wall C-Sight Wall C-Sight Wall C-Sight Wall C-Sight Wall C-Sight Wall C-Sight Wall C-Sight Wall	Residential Number of Kitchens: 1.00 \$ Number of Bedrooms: 3.00 \$

NOTE: These room totals must be entered correctly. EnergyPro incorporates these room totals into the energy base load calculation.

11. Assembly level: Slab, raised floor, exterior walls, roof

a. Slab-on-Grade

1. If the home has a slab foundation, right-click the room level icon, place the mouse over *Add*, and select *Slab-on-Grade* from the list of assemblies. Click the slab-on-grade icon.

- 2. Enter the *Area* of the slab.
- 3. Set *Surface Type* to *Existing*.
- 4. Enter the linear perimeter of the slab for *Ext. Perimeter*.

Building	Slab On Grade - Slab-on-Grade
Building D08aCZ12 DHW HVAC System DHW Dore 1 Front Wall Window Door Right Wall Window	Slab On Grade - Slab-on-Grade General Thermal Mass Name: Slab-on-Grade Area: 1830 ft ^a Surface Type: Existing Existing Assembly: Slab On Grade Ext. Perimeter: D feet
Rear Wall	

b. Raised Floor

- 1. If the home has a raised floor, right-click the room level icon, place the mouse over *Add*, and select *Raised Floor* from the list of assemblies. Click the raised floor icon.
- 2. Enter the *Area* of the raised floor.
- 3. Set Surface Type to Existing.

Building	Floor - Raised Floor
Building D08aCZ12 DHW HVAC System DHW Dore 1 Front Wall Window Door Right Wall Window Door Rear Wall Window Door Rear Wall Window Rear Wall Window Door Rear Wall Window Rear Wall Window	Floor - Raised Floor General Thermal Mass Name: Raised Floor Area: 0 ft ^a Surface Type: Existing Existing Assembly: Uninsulated Raised Slab Floor

- 4. Click the magnifying glass icon to open the floor assembly library.
 - a. Select the default floor assembly from the library based on the age of the existing home. Select the correct floor designation (*Default Floor Crawlspace* or *Default Floor No Crawlspace*).

EUC_SMUD_BellBros_Groves_Pre_2						
17 of 17 🕨 🕅 🕂	$\mathbf{X} \mid \mathbf{z}$	• •	Ex	port 👻 🏹 I	import 👻	▼
Name	Туре	R-Valu	U-Fac	Const.	JA4	Component Description
R-0 Floor Crawlspace	Floor	10.3	0.097	Wood Fr	4.4	Name: R-19 Floor Crawlspace
R-0 Floor No Crawlspace	Floor	4.2	0.238	Wood Fr	4.4	Type: Floor
R-11 Floor Crawlspace	Floor	20.4	0.049	Wood Fr	4.4	Construction: Wood Framed w/Crawl Space
R-11 Floor No Crawlspace	Floor	14.1	0.071	Wood Fr	4.4	Description: 16" OC, 2x8
R-13 Floor Crawlspace	Floor	21.7	0.046	Wood Fr	4.4	Insulation: R-19 JA-4 4.4.1-A4
R-13 Floor No Crawlspace	Floor	15.6	0.064	Wood Fr	4.4	CRRC-1 Certified Roofing
R-19 Floor No Crawlspace	Floor	20.8	0.048	Wood Fr	4.4	Roofing Type: Lightweight (< 5 #/sf)
R-22 Floor Crawlspace	Floor	29.4	0.034	Wood Fr	4.4	Aged Solar Reflectance: 0.3 Thermal Emittance: 0.7
R-22 Floor No Crawlspace	Floor	22.7	0.044	Wood Fr	4.4	
R-30 Floor Crawlspace	Floor	35.7	0.028	Wood Fr	4.4	Attic Radiant Barrier: None
R-30 Floor No Crawlspace	Floor	29.4	0.034	Wood Fr	4.4	
Uninsulated Raised Slab Floor	Floor	3.7	0.269	Concrete	4.4	1/150 Attic Vent Percentage of Vents High:
Default Floor Crawlspace Prior to 1991	Floor	10.3	0.097	Wood Fr	4.4	Added Interior Insulation Added Exterior Insulation
Default Floor Crawlspace 1992-Present	Floor	21.7	0.046	Wood Fr	4.4	Framing: None 🗸 Framing: None 🔨
Default Floor No Crawlspace Prior to 1991	Floor	4.2	0.238	Wood Fr	4.4	
Default Floor No Crawlepage 1992 Present	Floor	15.0	0.064	Wood Fr	4.4	Insulation: 0 R-value Insulation: 0 R-value

NOTE: A raised floor must be at least 18" above grade to be modeled as a raised floor with a crawlspace. Select a floor assembly with no crawlspace from the assembly library if the raised floor is not at least 18" above grade.

NOTE: Floor area over garages or cantilevered floor area exposed to the outside should be included in the model. Enter these assemblies within the correct zone in the building tree and name the assemblies accordingly (e.g., "Over garage," "Over carport," or "Cantilevered bedroom") to distinguish this floor area from the actual home foundation. Use the following default assemblies from the assembly library for these types of floors:

- Floor over garage: R-0 Floor With Crawlspace
- Floor over carport: R-0 Floor No Crawlspace
- Cantilevered room floor: R-0 Floor with Crawlspace

or	Const. Type	JA4	Component Description	
97	Wood Framed	4.4.1	Name: R-13 Floor No Crawlspace	ОК
38	Wood Framed	4.4.2	Type: Floor	
49	Wood Framed	4.4.1	Construction: Wood Framed w/o Crawl Space	Cancel
71	Wood Framed	4.4.2	Description: 16" OC, 2x6	
46	Wood Framed	4.4.1	Insulation: R-13 JA-4 4.4.2-A3	
64	Wood Framed	4.4.2	CRRC-1 Certified Roofing	
48	Wood Framed	4.4.2	Roofing Type:	
34	Wood Framed	4.4.1	Aged Solar Reflectance: 0,3 Thermal Emittance: 0,75	
44	Wood Framed	4.4.2		
28	Wood Framed	4.4.1	TKONG Y	
34	Wood Framed	4.4.2	Airspace between Roofing & Roof Deck	
69	Concrete Rais	4.4.6	1/150 Attic Vent Percentage of Vents High:	
97	Wood Framed	4.4.1	Added Interior Insulation Added Exterior Insulation	-
46	Wood Framed	4.4.1	Framing: None V Framing: None V Heat Capacity: 0.0 Btu/ft%.#F	
38	Wood Framed	4.4.2		
64	Wood Framed	4.4.2		
37	Wood Framed	4.4.1	Thickness: inches Thickness: inches	
37	Wood Framed	4.4.1-		

c. Exterior Wall

- 1. Right-click the room level icon, place the mouse over *Add*, and select *Exterior Wall* from the list of assemblies. Click the exterior wall icon.
- 2. Enter the *Area* of the exterior wall.
- 3. Set *Surface Type* to *Existing*.
- 4. Set *Orientation* to match the compass direction the wall faces.

NOTE: Wall orientation is not updated automatically if building orientation is changed. Update each individual wall's orientation manually if the building orientation is changed.

5. *Tilt* should be set to 90 if the wall is vertical.

Building	Wall - Front Wall
D08aCZ12 	General Thermal Mass Name: Front Wall Area: 365 ft ^a Surface Type: Existing Existing Assembly: 10.1 copy of Default Wall 1992 (a) × Orientation: 0 Tilt: 90

- 6. Click the magnifying glass icon to open the wall assembly library.
 - a. Select the default wall assembly from the library that best matches the age of the existing home. If you are using default assemblies, skip instructions b. through d. below.
 - b. If the wall insulation has water damage, compaction of loose fill, or other deterioration, the BPI Analyst may choose to de-rate the existing condition in the home. To enter a de-rated assembly, select the assembly from the library that best matches the existing home conditions.

NOTE: If you choose to de-rate the existing insulation, you will need to submit proper documentation (photos and calculations) supporting your assessment. These de-rated R-values need to pass verification, otherwise the review team will default to the vintage table values. BPI requires physical inspection of one full wall bay to de-rate insulation, and the contractor will need to show evidence of this.

- c. Click the yellow "+" to make a copy of that assembly in the library. Rename the copy in the *Name* field.
- d. Adjust the assembly to accurately reflect the existing assembly by adding additional R-value in the *Added Interior Insulation* section in the *Insulation* field.

EnergyPro tip: Custom R-value assemblies

To create a custom R-value assembly, select the pre-generated assembly closest in value to the actual R-value, and add the difference in R-value to either the **Added Interior Insulation** or **Added Exterior Insulation** fields, depending on the insulation assembly. For example, for an existing R-25 attic, copy the existing R-19 attic assembly and enter "6" in the *Added Interior Insulation* field.

NOTE: For homes with varying construction assemblies for walls, roofs, or floors, each assembly type should be accurately reflected in the base building tree. For example, if the first floor of a home has masonry walls, while the second floor of the same home has wood-framed R-11 walls, the energy model should include separate assemblies for each wall type.

U ^{ilding}		Wall	Eropt	wall			
D08aCZ12_2010_081	8	_					
1 of 25		⊕ ×		Export 🝷	🕤 Import 👻	•	
Name	Туре	R-Value	U-Factor	Const. Type	JA4 🔼	Component Description	
R-13 Wall w/1" EPS	Wall	13.8	0.072	Wood Framed	4.3.1	Name: Default Wall 1992 to Present	
R-15 Wall w/1" EPS	Wall	14.5	0.069	Wood Framed	4.3.1	Type: Wall	
R-0 Wall Metal Stud	Wall	2.2	0.458	Metal Framed	4.3.3	Construction: Wood Framed	
R-11 Wall Metal Stud	Wall	4.1	0.244	Metal Framed	4.3.3	Description: 16" DC. 2x4	Í
R-13 Wall Metal Stud	Wall	4.6	0.217	Metal Framed	4.3.3	Insulation: R-13 JA-4 4.3.1-A3	
R-15 Wall Metal Stud	Wall	4.7	0.211	Metal Framed	4.3.3	CRRC-1 Certified Rooting	100000
R-19 Wall Metal Stud	Wall	5.5	0.183	Metal Framed	4.3.3	Roofing Type: Lightweight (< 5 #/sf)	
R-21 Wall Metal Stud	Wall	5.6	0.178	Metal Framed	4.3.3	Aged Solar Reflectance: 0,3 Thermal Emittance: 0,75	
6'' Concrete Wall	Wall	1.2	0.820	Solid Unit Ma	4.3.6		
6" Concrete Wall w/R-13	Wall	11.6	0.086	Solid Unit Ma	4.3.6	Attic Radiant Barrier: None Airspace between Roofing & Roof Deck	
8" CMU Wall	Wall	1.4	0.690	Hollow Unit M	4.3.5		
Spandrel Panel	Wall	16.7	0.060	Spandrel Pan	4.3.8 🔳	1/150 Attic Vent Percentage of Vents High:	
6'' SIP Wall	Wall	18.5	0.054	Structurally In	4.3.2	Added Interior Insulation Added Exterior Insulation	ertie
Default Wall Prior to 1978	Wall	2.8	0.356	Wood Framed	4.3.1	Framing: None 🗸 Framing: None 🗸 Heat	Ca
Default Wall 1978 to 1991	Wall	9.1	0.110	Wood Framed	4.3.1	Insulation: 0 R-value Insulation: 0 R-value U-Fac	ctor
Default Wall 1992 to Pres	Wall	9.8	0.102	Wood Framed	4.3.1		
R-19 Floor Crawlspac	Wall	12.5	0.080	Wood Framed	4.3.1	Thickness: 0 inches Thickness: 0 inches R-Val	ue:

NOTE: The insulation level indicated should reflect the insulation level listed in the *Component Description* section, rather than the total assembly R-value listed in the *Properties* section.

EnergyPro tip: Modeling garage walls adjacent to conditioned space

Garage walls should be modeled only if they serve as a barrier between conditioned and unconditioned space. For example, if a wall separates the living room from an unconditioned garage, model that wall as an exterior wall, name it "Garage wall," and set the **Orientation** to **O** or **North** to simulate no solar heat gain. Only conditioned space should be included in the total area listed in EnergyPro.

d. Roof

- 1. Right-click the room level icon, place the mouse over *Add*, and select *Roof* from the list of assemblies. Click the roof icon.
 - a. Enter the *Area* of the roof. The *Area* is the area of the roof's footprint.

NOTE: If a home contains two different roof assembly types (e.g., an attic and a cathedral roof in the same home), both roof types must be added to the model. If only one of the two roof types is being upgraded, see the **Partial upgrades: New vs. existing** section for instructions on how to model this upgrade. If both roof types are being upgraded with different R-value insulation see the **Two-model simulations** section for instructions on how to model this upgrade.

b. Set *Surface Type* to *Existing*.

- c. Set *Orientation* to match the compass direction the largest sloped surface area of the roof faces. If the roof is flat, leave *Orientation* as *0* or *North*.
- d. *Tilt* should be set between 0 and 59 degrees relative to horizontal.

EnergyPro tip: Calculating roof pitch

Use the following formula to convert a roof pitch to degrees:

Angle = Arctan (rise / run)

You can use an online calculator to determine the arctan of a value (e.g., http://www.rapidtables.com/calc/math/Arctan_Calculator.htm)

For example, for a roof with 4 inches rise per 12 inches run:

Angle = Arctan (4 / 12)

Angle = Arctan (0.33)

Angle = 18.43 degrees

Building	Roof - Roof
₹0008aCZ12 =	General Thermal Mass
HVAC System	Name: Roof Area: 1830.3 ft ²
습~~~ Zone 1 뉴— 등 Front Wall	Surface Type: Existing
Window	Existing Assembly: 14 copy of R-11 Roof Attic
la⊐ Right Wall └─ ∭ Window	Orientation: 0
a–ssa Rear Wall └── ∰ Window	Tilt: 0 Replacing > 50% of Roof Surface (or > 2,000 sqft Nonres or >1,000 sqft Res)
G−sss Left Wall	
- Raised Floor	
Roof	

- 2. Click the magnifying glass icon to open the roof assembly library.
 - a. Select the roof assembly from the library that best matches the existing home conditions. It may be best to select a default assembly based on the home age. If you are using default assemblies, skip instructions b. through d. below.
 - b. If the roof insulation has water damage, is unevenly distributed, or is otherwise deteriorated, the BPI Analyst may choose to de-rate the existing condition in the home. To enter a de-rated assembly, select the assembly from the library that best matches the existing home conditions.

NOTE: If you choose to de-rate the existing insulation, you will need to submit proper documentation (photos and calculations) supporting your assessment. These de-rated R-values need to pass verification, otherwise the review team will default to the vintage table values. BPI requires physical inspection of one full wall bay to de-rate insulation, and the contractor will need to show evidence of this.

- c. Click the yellow "+" to make a copy of that assembly in the library. Rename the copy in the *Name* field.
- d. Adjust the assembly to accurately reflect the existing assembly by adding additional R-value in the *Added Interior Insulation* section in the *Insulation* field. The total assembly R-value indicated should be the sum of the *Insulation* and *Added Interior Insulation* in the *Component Description* section of the assembly library.

uilding	F	Roof - Roof								
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Name	Туре	R-Value	U-Factor	Const. Type	JA4	^	Component De			
R-0 Roof Attic	Roof	3.3	0.305	Wood Frame	4.2.1		Name:	R-13 Roof Attic		
R-0 Roof Cathedral	Roof	3.4	0.297	Wood Frame	4.2.2		Туре:	Roof		
R-11 Roof Attic	Roof	13.2	0.076	Wood Frame	4.2.1		Construction:	Wood Framed Attic		
R-11 Roof Cathedral	Roof	11.9	0.084	Wood Frame	4.2.2		Description:	24" OC		
R-13 Roof Attic	Roof	14.7	0.068	Wood Frame	4.2.1		Insulation:	R-13 JA-4 4.2.1-A15		
B-13 Boof Cathedral	Boof	14.5	P30.0	Wood Frame	422			20 10 C		

NOTE: The insulation level indicated should reflect the insulation level listed in the *Component Description* section, rather than the total assembly R-value listed in the *Properties* section.

EnergyPro tip: Cool roofs

To model a cool roof:

- 1. Click the roof icon in the building tree, and click the magnifying glass to open the roof assembly library.
- 2. Select the appropriate assembly type based on the roof framing and insulation.
- 3. Check the *CRRC-1 Certified Roofing* checkbox.
- 4. Select the *Roofing Type* from the drop-down menu.
- 5. Enter the *CRRC-certified Aged Solar Reflectance* and *Thermal Emittance* values.

NOTE: If you model includes an existing or upgraded cool roof, include the manufacturer's specifications sheet that provides these values with your job submission.

12. Room features level: Windows, doors, skylights

a. Windows

- 1. Right-click the appropriate exterior wall icon and click *Add Window*. Click the window icon.
 - a. Enter the *Area* of the window.
 - b. Set *Surface Type* to *Existing*.

Building	Window - Window	
D08aCZ12	General Exterior Shading	
DHW HVAC System DHW Zone 1 DHW Zone 1 Front Wall Door Door Door Door	Name: Window Area: 68 Surface Type: Existing Existing Fenestration: Double Metal Clear	

- 2. Click the magnifying glass icon to open the window assembly library.
 - a. Select the assembly from the library that best matches the existing home conditions. (We recommend using the generic *Single Metal Clear* or *Double Non-Metal Tinted* type options.) If there is an exact match, click OK and move to the next step.
 - b. If the selected assembly does not exactly match the home conditions, click the yellow "+" to make a copy of that assembly in the library. Rename the copy in the *Name* field.
 - c. Adjust the assembly to match the information provided and to accurately reflect the existing assembly.
 - i. Set *Product* Type to *Manufactured*.
 - ii. If specifications can be pulled from product or literature, enter the specific *U-Factor* and *SHGC*.
 - iii. Select the correct *Fenestration Type*.
 - iv. Select the correct *Frame Type*.

NOTE: French doors or other glass doors over 50% glass area should be entered into EnergyPro as a window. Add a window to the wall assembly, and for *Fenestration Type* select *Door*.

uilding	Wind	ow - Wir	ndow						
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Name	U-Factor	Source	SHGC	Source	>	Name:	Single Metal Clear		
Andersen Permashield	0.340	NFRC	0.330	NFRC		Product Type:	Site-Built 🗸	Visible Transmitance:	0.99
Milgard Classic Low-E Vinyl	0.390	NFRC	0.370	NFRC		- U-Factor			
Sierra Pacific Windows & Doors	0.390	NFRC	0.370	NFRC		 Default 	1.19 Btu/hr-ft	 Default 	0.83
Velux Comfort (75) Lowe2/Arg	0.370	NFRC	0.290	NFRC		Center of Glass	0.65 Btu/hr-ft ^e -#F	Center of Glass	0
Velux Comfort+(74) Lowe2/Arg	0.390	NFRC	0.290	NFRC		-		Ŭ	
Milgard Dbl/Mtl Clr Low-E	0.770	NFRC	0.400	NFRC		O NFRC Labeled	1.28 Btu/hr-ft²-ºF	NFRC Labeled	0.8
Marvin Clad Casemaster Low E	0.390	NFRC	0.300	NFRC					
Deck House Glass	0.320	NFRC	0.320	NFRC		 Fenestration Propert Fenestration 	les		
Lindal Vinyl Low-E Argon windo	0.310	NFRC	0.370	NFRC		Type:	Window 🔽	Number of Panes: 1	\$
Interpane INE-177	0.460	NFRC	0.398	NFRC		Frame Type:	Metal 🗸	Tinted] Operat
Loewen Dbl/Wd Mtlclad Low-E	0.340	NFRC	0.280	NFRC		rianci i ype.	motar		1 - 2010
Double Non Metal Tinted	0.550	Default	0.550	Default		I		-1	-

EnergyPro tip: Partial window replacement

If you are replacing only some of the windows in the home, set the *Surface Type* to *New* for any window that will not be replaced.

b. Doors

- 1. Right-click the appropriate exterior wall icon and click *Add Door*. Click the door icon.
 - a. Enter the *Area* of the door.
 - b. Set *Surface Type* to *Existing*.

Building	Door - Door
D08aCZ12 DHW HVAC System Zone 1 Front Wall Window Bioht Wall	Name: Door Area: 20 ft ² Surface Type: Existing Existing Assembly: Wood Door

- 2. Click the magnifying glass icon to open the door assembly library.
 - a. Select the assembly from the library that best matches the existing home conditions. If there is an exact match, click OK and move to the next step.
 - b. If the selected assembly does not exactly match the home conditions, click the yellow "+" to make a copy of that assembly in the library. Rename the copy in the *Name* field.

c. Adjust the assembly to match the information provided and to accurately reflect the existing assembly.

c. Skylights

- 1. Right-click the appropriate roof icon and click *Add Skylight*. Click the skylight icon.
 - a. Enter the *Area* of the skylight.
 - b. Set *Surface Type* to *Existing*.
 - c. Select the correct *Skylight Type* from the drop-down menu.

Building	Skylight - Skylight									
D08aCZ12	General Exterior Shading Daylighting									
DHW HVAC System Zone 1 Front Wall Window Door Right Wall Window Rear Wall Window Left Wall Window Rear Wall Window Skylight	Name: Skylight Area: 6 Surface Type: Existing Existing Fenestration: Double Non Metal Clear Double Non Metal Clear X Skylight Type: Glass w/Curb									

- 2. Click the magnifying glass icon to open the skylight assembly library.
 - a. Select the assembly from the library that best matches the existing home conditions. (We recommend using the generic *Single Metal Clear* or *Double Non-Metal Tinted* type options.) If there is an exact match, click OK and move to the next step.
 - b. If the selected assembly does not exactly match the home conditions, click the yellow "+" to make a copy of that assembly in the library. Rename the copy in the *Name* field.
 - c. Adjust the assembly to match the information provided and to accurately reflect the existing assembly.
 - i. Set *Product* Type to *Manufactured*.
 - ii. If specifications can be pulled from product or literature, enter the specific *U-Factor* and *SHGC*.
 - iii. Select the correct *Fenestration Type*.
 - iv. Select the correct *Frame Type*.

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Name	U-Factor	Source	SHGC	Source	^	Name:	Double Non Metal	Tinted		
Milgard Classic Low-E Vinyl	1.190	Default	0.370	NFRC		Product Type:	Site-Built	~	Visible Transmitanc	e: 0.66
Sierra Pacific Windows & Doors	0.390	NFRC	0.370	NFRC		- U-Factor		_	SHGC	
Velux Comfort (75) Lowe2/Arg	0.370	NFRC	0.290	NFRC		 Default 	0.55 Btu/ł	nr-ft	 Default 	0.55
Velux Comfort+(74) Lowe2/Arg	0.390	NFRC	0.290	NFRC			0.05 04.44.621	or-	Center of Glass	
Milgard Dbl/Mtl Clr Low-E	0.770	NFRC	0.400	NFRC		-	0.65 Btu/hr-ft²-	= -	 Lenter of Glass 	0
Marvin Clad Casemaster Low E	0.390	NFRC	0.300	NFRC		NFRC Labeled	0.87 Btu/hr-ft²-	₽F	NFRC Labeled	0.7
Deck House Glass	0.320	NFRC	0.320	NFRC						
Lindal Vinyl Low-E Argon windo	0.310	NFRC	0.370	NFRC		- Fenestration Properti	es			
Interpane INE-177	0.460	NFRC	0.398	NFRC		Fenestration Type:	Window	*	Number of Panes:	2 🛟
Loewen Dbl/Wd Mtlclad Low-E	0.340	NFRC	0.280	NFRC		Frame Tuner	Non-Metal	~	✓ Tinted	Operable
Double Non Metal Tinted	0.550	Default	0.550	Default		Frame Type:	Non-Metal	×	• mod	
Single Non Metal Tinted	0.550	Default	0.550	Default					1	

13. Completing the Alternatives tab

Program policy: One model versus two models

If possible, simulate your proposed and final post-upgrade conditions using one EnergyPro model and incorporate your scope of work into the *Alternatives* tab of the *Ygrene* calculations. This standardizes the modeling techniques and estimated energy savings across the Clean Energy Sacramento program. Please see the **Two-model** *simulations* section of the handbook for specific conditions requiring a two-model approach to estimating the energy savings.

a. Accessing the Alternatives tab

Proposed and final upgrade measures should be indicated in the *Alternatives* tab of the *Ygrene* calculations section of EnergyPro.

1. Click the *Calculations* icon.

Check the Ygrene box and click the Ygrene item.

NOTE: Confirm that only the *Ygrene* box is checked and no other calculation modules are selected.

Click the *Options* tab. In the *Alternative Energy Measures* section, select *Run Measures Combined Together*.

Calculations	Res Performance						
Loads Res T24 Performance Res GreenPoint Rated Res CHEERS Res CaICERTS Res CaICERTS Res Performance NR T24 Performance NR T24 Performance NR T24 LEED	Options Alternatives Calibration Image: Contract of the second secon	Alternative Energy Measures No Alternative Energy Measure Runs Run Individual Measures Run Measures Combined Together Run Test Out Home with Final Measures Measure Financing					
NR 90.1 Performance NR Performance Building Libraries	Res Performance		Interest Rate	ears Financed: 30	\$		
Calculations	Calculation Test-In Home	Heating 30.66	Cooling 6.45	Int Lights 2.45	Ext Lights	0.37	Applianc
Reports							

NOTE: The *Measure Financing* section is not needed for the Clean Energy Sacramento program.

3. Click the *Alternatives* tab.

The energy-related upgrade measures included in your scope of work should be indicated in the *Alternatives* tab. The scope of work indicated needs to match items selected on the Alternatives tab.

Select only those measures associated with the specific upgrade you are modeling. Uncheck any upgrade measures not performed on this home.

alculations	Res Performance				
Loads	Options Atenatives Calibration				
Loads Ret T24 Performance Ret DirectPort Rated Ret CaEERS Ret CaEERS Ret CaEERTS Ret CBPCA File Ygene NR T24 Performance NR T24 Performance NR T24 LEED NR T24 LEED NR T24 Performance NR Performance NR Performance	Optimie Attenuitives Calibration Type of Usgrade Cost Rod' Insulation 80 Proor Insulation 90 Windows 90 System Fan Wattage Werfication 90 System Fan Wattage Werfication 90 Onereduction Upting 90 Coate Data 90 Coate Data 90 Operator Hot Water Header 90 Demetric Hot Water 90 Deler Dometic Hot Water 90				

b. Roof Insulation

1. Check the *Roof Insulation* box if a roof insulation upgrade is in the scope of work.

NOTE: If you are upgrading the roof to have two or more new R-values, this home will need to be simulated using two EnergyPro models. See the **Two-model simulations** section of the handbook for instructions on how to model a home with two or more upgraded post-upgrade roof assemblies.

- 2. Click the magnifying glass icon to open the roof assembly library.
 - a. Select the roof construction that matches the proposed or actual post-upgrade roof type.
 - b. Select a pre-generated roof assembly that matches the post-upgrade roof insulation level. This will be R-38 or greater.
 - c. If an attic radiant barrier was added, select the appropriate installation method from the pull down menu.
 - d. Click OK to return to the Alternatives tab.

EnergyPro tip: Cool roofs

To model a cool roof:

- 1. Click the roof icon in the building tree, and click the magnifying glass to open the roof assembly library.
- 2. Select the appropriate assembly type based on the roof framing and insulation.
- 3. Check the *CRRC-1 Certified Roofing* checkbox.
- 4. Select the *Roofing Type* from the drop-down menu.
- 5. Enter the CRRC-certified Aged Solar Reflectance and Thermal Emittance values.

NOTE: If you model includes an existing or upgraded cool roof, include the manufacturer's specifications sheet that provides these values with your job submission.

NOTE: Credit for adding a cool roof is available only if there is no radiant barrier installed. In the Ygrene module, the cooling benefit of a cool roof is assumed to be equal to that of a radiant barrier. Also, EnergyPro assumes no heating impact within the cool roof calculations despite potential increased winter heating loads (while there is some heating benefit assumed for a radiant barrier).

c. Wall Insulation

- 1. Check the *Wall Insulation* box if a wall insulation upgrade is in the scope of work.
- 2. Click the magnifying glass icon to open the wall assembly library.
 - a. Select the wall construction that matches the proposed or actual post-upgrade wall type.
- b. Select a pre-generated wall assembly that matches the post-upgrade wall insulation level. This will usually be R-11 or R-15.
- c. Click OK to return to the Alternatives tab.

d. Floor Insulation

- 1. Check the *Floor Insulation* box if a floor insulation upgrade is in the scope of work.
- 2. Click the magnifying glass icon to open the floor assembly library.
 - a. Select the floor construction that matches the proposed or actual post-upgrade floor type.

NOTE: A raised floor must be at least 18" above grade to be modeled as a raised floor with a crawlspace. Select a floor assembly with no crawlspace from the assembly library is the raised floor is not at least 18" above grade.

- b. Select a pre-generated floor assembly that matches the post-upgrade floor insulation level. This will usually be R-19 or R-22.
- c. Click OK to return to the Alternatives tab.

e. Windows

- 1. Check the *Window* box if a window upgrade is in the scope of work.
- 2. Click the magnifying glass icon to open the window assembly library.
 - a. Select the assembly from the library that best matches the proposed or actual postupgrade home conditions. (We recommend using the generic *Single Metal Clear* or *Double Non-Metal Tinted* type options.) If there is an exact match, click OK and move to the next step.
 - b. If the selected assembly does not exactly match the home conditions, click the yellow "+" to make a copy of that assembly in the library. Rename the copy in the *Name* field.
 - c. Adjust the assembly to match the information provided and to accurately reflect the existing assembly. (You may be required to submit documentation to support the post-upgrade window performance claims.)
 - i. Set *Product* Type to *Manufactured*.
 - ii. If specifications can be pulled from product or literature, enter the specific *U-Factor* and *SHGC*.
 - iii. Select the correct *Fenestration Type*.
 - iv. Select the correct *Frame Type*.
 - d. Click OK to return to the Alternatives tab.

NOTE: Provide manufacturer, model, SHGC and U-factor for all new high-performance windows.

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Name	U-Factor	Source	SHGC	Source		Name:	PPG Solexia	
PPG Solexia	1.190	Default	0.830	Default		Product Type:	Manufactured 🗸 🗸	Visible Transmitance: 0.996
PPG SOLARBAN 60 (3) Bro	0.564	COG	0.347	COG		- U-Factor		SHGC
PPG SOLARBAN 60 (3) Cari	0.564	COG	0.347	COG		 Default 	1.19 Btu/hr-ft²-₽F	Default 0.83
PPG SOLARBAN 60 (2) Clear	0.564	COG	0.407	COG		Ĩ.		
Viracon VE-1-2M	0.878	COG	0.407	COG		 Center of Glass 	0.29 Btu/hr-ft ^e -ºF	Center of Glass 0.49
Milgard 5220 SH Brz/Clr Vinyl	0.520	NFRC	0.490	NFRC	=	NFRC Labeled	0.57 Btu/hr-ft ^e -#F	NFRC Labeled 0.49
IWC 5300 Vinyl/Clear	0.510	NFRC	0.610	NFRC				
IWC 5300 Vinyl/Low-E	0.370	NFRC	0.320	NFRC		- Fenestration Propert	es	
IWC 6200 Alum/Clear	0.740	NFRC	0.700	NFRC		Fenestration Type:	Window 🗸	lumber of Panes: 1 😂
IWC 6200 Alum/Low-E	0.590	NFRC	0.450	NFRC		Frank Trees	Metal	Tinted Dperab
Andersen Permashield	0.340	NFRC	0.330	NFRC		Frame Type:	Metal	
Milgard Classic Low-E Vinyl	1.190	Default	0.370	NFRC				1

f. HVAC System

- 1. Check the *HVAC System* box if an HVAC system upgrade is in the scope of work.
- 2. Click the magnifying glass icon to open the HVAC system library.
 - a. Select the piece of equipment from the library that best matches the proposed or actual post-upgrade equipment. It may be best to choose a default unit (listed as *Standard FAU/AC*, *High Efficiency FAU/AC*, *Electric Baseboard*, etc.).

NOTE: If the existing home has a non-hydronic system and you are upgrading to a hydronic system, this system will need to be simulated using two EnergyPro models. See the **Two-model** simulations section of the handbook for instructions on how to model a hydronic system.

- b. Click the yellow "+" to make a copy of the default equipment in the library. Rename the copy in the *Name* section (e.g., *Homeowner Last Name: New HVAC*).
- c. Adjust the *System Type, Heating Type, Furnace Type, Total Output*, and *Efficiency* inputs to match the information provided to accurately reflect the post-upgrade equipment.

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Name	Туре	Heat	Heat Eff.	Cool	Cool Eff.	^	Heating C	ooling	Controls Outdoor Air	Fans	Evaporative
Carrier 58MVB60-14 CNP	Split DX	57,000	94% AFUE	28,100	13.0 SEER / 11		Name: Fu	rnace - A	VC		Preheat C
Carrier 58MVB60-14 CNP	Split DX	57,000	94% AFUE	33,600	13.0 SEER / 11			-			None
Carrier 58MVB80-14 CN	Split DX	75,000	94% AFUE	23,700	13.0 SEER / 11		System Ty	pe: Spi	lit DX	*	O Elect
Carrier 58MVB80-14 CN	Split DX	75,000	94% AFUE	28,100	13.0 SEER / 11		Heating	Coil			O Hot V
Carrier 58MVB80-14 CN	Split DX	75,000	94% AFUE	16,900	13.0 SEER / 11		Heating	Туре:	Gas Furnace 🛛 👻		
Carrier 58MVB80-14 CN	Split DX	75,000	94% AFUE	33,600	13.0 SEER / 11		Furnace	Туре:	Central 🗸		Reheat C
Carrier 58MVB80-20 CN	Split DX	75,000	94% AFUE	23,700	14.0 SEER / 11		Coil Cont	trol:	Constant Temp 🔍		None
Carrier 58MVB80-20 CN	Split DX	75,000	94% AFUE	28,100	13.0 SEER / 11			I			O Elec
Carrier 58MVB80-20 CN	Split DX	75,000	94% AFUE	33,600	13.0 SEER / 11		Total Ou Electrica		0 Btu/hr		O Hot V
Carrier 58MVB80-20 CN	Split DX	75,000	94% AFUE	46,300	13.0 SEER / 11		Power:	' [0 kW		Baseboard
Carrier 58MVB80-20 CN	Split DX	75,000	94% AFUE	55,100	13.0 SEER / 11		Supply T	emp:	105 F		💿 None
Carrier48HJD/L020-5/6	Packaged VVT	205,000	82% AFUE	214,000	10.8 EER		Efficienc	v: [0.78 AFUE		O Elect
Carrier48HJE/M020-5/6	Packaged VVT	296,000	81% TE	214,000	10.8 EER			· .			🔵 Hot '
Carrier48HJE/M024-5/6	Packaged VVT	296,000	81% TE	261,000	10.8 EER						
Carrier48HJE/M028-5/6	Packaged WT	296,000	81% TE	299,000	10.0 EER						
Furnace - A/C	Split DX	0	78% AFUE	1	13.0 SEER / 10						

- d. On the *Cooling* tab of the equipment selection window, adjust the *Output, Sensible, SEER*, and *EER* inputs to match the information provided and to accurately reflect the post-upgrade equipment.
- e. Click OK to return to the Alternatives tab.

NOTE: If the home has no cooling system, enter 0 BTU/hr for the *Output* and *Sensible* fields.

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Name	Туре	Heat	Heat Eff.	Cool	Cool Eff.	^	Heating Cooling	Controls Outdoor Air	Fans 🗍 Evaporative Co
Carrier 48HJM0043 w/	Packaged WT	50,000	80% AFUE	37,800	13.0 SEER / 10		Cooling Coil		Condenser
Carrier 48HJM0045/6	Packaged DX	50,000	80% AFUE	37,800	13.0 SEER / 11		Coil Control:	Constant Temp 🔽	Condenser Type:
Carrier 48HJM0045/6	Packaged VVT	50,000	80% AFUE	37,800	13.0 SEER / 10		Output:	36000 Btu/hr	Ice Storage A/C:
Carrier 48HJM0053	Packaged DX	74,000	81% AFUE	48,400	13.0 SEER / 11				-
Carrier 48HJM0055/6	Packaged DX	74,000	81% AFUE	48,400	13.0 SEER / 11		Sensible:	26100 Btu/hr	Evap PC Eff:
Carrier 48HJM0055/6	Packaged WT	74,000	81% AFUE	48,400	13.0 SEER / 10		Supply Temp:	60 F	CEvap Pump Motor
Carrier 48HJN0043	Packaged DX	74,000	81% AFUE	37,800	13.0 SEER / 11		Efficiency:	14 SEER	Design Power:
Carrier 48HJN0043 w/	Packaged WT	74,000	81% AFUE	37,800	13.0 SEER / 10		🗖 Fan Heat Ing	luded in Output	
Carrier 48HJN0045/6	Packaged DX	74,000	81% AFUE	37,800	13.0 SEER / 11				
Carrier 48HJN0045/6 w	Packaged WT	74,000	81% AFUE	37,800	13.0 SEER / 10		⊂ Performance at A	PI Conditions	
Carrier 48HJN0053	Packaged DX	101,000	81% AFUE	48,400	13.0 SEER / 11		 Performance at A Energy Efficie 		
Carrier 48HJN0055/6	Packaged DX	101,000	81% AFUE	48,400	13.0 SEER / 11				
Carrier 48HJN0055/6 w	Packaged WT	101,000	81% AFUE	48,400	13.0 SEER / 10		Comp/Cond F	'ower 0 kW	
Carrier 48HJN0063	Packaged DX	101,000	81% AFUE	62,500	13.0 SEER / 11			leat Pump Side Louvers	
Carrier 48HJN0063 w/	Packaged W/T	101.000	81% AFUF	62 500	13.0 SEEB / 10		HOOM A/C & P	reach ump side Louvers	

NOTE: If the post-upgrade home has a different number of HVAC systems from the pre-upgrade home, or if the multiple new systems have different equipment specifications from each other, you will need to calculate energy savings using two energy models. Please see the **Two-model** simulations section of the handbook for more information.

EnergyPro tip: Partial system upgrades

When replacing only a portion of the existing HVAC system, the specifications for the remaining equipment must be re-entered in the Alternatives tab. For example, when only replacing the AC equipment, the existing furnace specifications must also be entered within the Alternatives tab.

g. HVAC Distribution

Check the **HVAC Distribution** box if the duct location was altered within the home, or if the ducts were buried as part of the work scope. If neither of these situations occurred, use the **HVAC Duct Leakage** and **HVAC Duct Insulation** inputs on the **Alternatives** tab to report upgraded duct conditions and skip the HVAC Distribution input.

1. To model an altered duct location, set the *Duct Location* drop-down menu to reflect the updated location.

Enter any upgraded Duct Insulation or Low Leakage AHU or HERS II Leakage Verified values for the post-upgrade system.

To model buried ducts in an upgraded home:

- a. In the Alternatives tab, check the HVAC Distribution box.
- b. In the *Duct Insulation*, indicate the *R-value* of the immediate duct wrap.
- c. Click the *Low Leakage AHU or HERS II Leakage Verified* radio button and enter the percent measured total duct leakage. This should be based on the duct pressurization results in CFM25 and the measured air flow of the system.
- d. NOTE: The Clean Energy Sacramento program requires the reported duct leakage percent to be measured total duct leakage. The duct leakage percent will be based on the values you collect for measured system airflow and measured total duct leakage.
- e. Check the *Measured Duct Surface* checkbox and click "..."
- f. Enter the duct location for each major duct run within the home. For buried ducts, the *Duct Location* should be either *Attic (Buried)* or *Attic (Deep Buried)* based on the installed depth. (Deep buried ducts are buried 3.5" or more under the attic insulation.) Contact your Program Administrator for information on buried versus deep buried ducts.
- g. Enter the *Diameter, Length*, and *Insulation* value for all major duct runs in the home, including those not located in the attic (indicate correct location in the *Location* drop-down menu). You can consolidate runs of identical locations, diameters, and insulation values. If there are more than five major duct runs, average together any runs with similar R-value or duct diameter in similar home.

- h. Select attic Insulation Type.
- i. For *Insulation Amount*, enter in the *R-value* of the home's post-upgrade attic insulation.
- j. Click OK to exit the Measured Duct Information window.
- k. When using *HVAC Distribution*, do not also use *HVAC Duct Leakage* or *HVAC Duct Insulation* in the *Alternatives* tab. *HVAC Distribution* already addresses post-upgrade duct leakage and duct insulation, so *HVAC Duct Leakage* and *HVAC Duct Insulation* are redundant to *HVAC Distribution*.

NOTE: For "Duct Insulation R-value," enter only the direct duct insulation R-value; do not use the effective R-value found in Table 3-50 of the Residential ACM Manual. The direct duct insulation R-value will typically will be R-6 or R-8.

NOTE: The Clean Energy Sacramento program requires the reported duct leakage percent to be measured total duct leakage. The duct leakage percent should be based on the values you collect for measured system airflow and measured total duct leakage.

h. HVAC Duct Leakage

1. Check the *HVAC Duct Leakage* box if an HVAC duct leakage upgrade is in the scope of work.

Enter the proposed or actual post-upgrade total duct leakage percent.

NOTE: You do not need to enter the leakage in CFM25 if you entered the percent leakage value.

NOTE: The Clean Energy Sacramento program accepts reported duct leakage as measured total leakage, nominal leakage, or measured total leakage to outside. However, any duct leakage calculation methods will need to be consistent for both pre-retrofit and post-retrofit submissions.

NOTE: For homes with multiple HVAC systems for which only one duct system was upgraded, enter the upgraded duct system test-out values and ensure the non-altered system is set as "New."

i. HVAC Duct Insulation

1. Check the *HVAC Insulation* box if an HVAC duct insulation upgrade is in the scope of work.

Enter the proposed or actual post-upgrade duct insulation level.

NOTE: Duct insulation indicated for this assembly should reflect only the immediate material R-value, and not the effective R-value of the entire assembly. Buried ducts should be modeled in the *HVAC Distribution* item of the Alternatives tab, as described in the HVAC Distribution section.

j. HERS Refrigerant Charge Verification

- 1. Check the *Refrigerant Charge Verification* box if you have submitted a completed CF-4R-MECH-22 or CF-4R-MECH-25 for the project.
 - a. Scope must have included: HVAC system completely or partially replaced (furnace, evap/cooling coil, air handler and condenser) with new or existing ductwork.

k. HERS System Airflow Verification

1. Check the *System Airflow Verification* box if you have submitted a completed CF-4R-MECH-22 for the project. a. Scope must have included: HVAC system completely replaced (furnace, evap/cooling coil, air handler and condenser) with completely new ductwork.

I. HERS System Fan Wattage Verification

- 1. Check the *System Fan Wattage Verification* box if you have submitted a completed CF-4R-MECH-22 for the project.
 - a. HVAC system completely replaced (furnace, evap/cooling coil, and condenser) along with completely new ductwork

m. Building Leakage

1. Check the *Building Leakage* box if air sealing is in the scope of work.

Check Tested CFM50 Airflow in the Upgraded Building Leakage box.

Enter the improved post-upgrade air infiltration in CFM50.

NOTE: For homes with multiple HVAC zones, the total post-upgrade building leakage (in CFM50) should be divided by the number of zones in the home and entered into the *Alternatives* tab. EnergyPro will apply this improved CFM50 to each HVAC zone in the building tree. For example, for a home with three HVAC systems and an upgraded building leakage of 1200 CFM50, you would enter a building leakage of 400 CFM50 in the *Alternatives* tab.

n. Appliances

Non-permanent appliance upgrades are not supported by the Clean Energy Sacramento program. Contact your local utility provider for information on appliance upgrade incentives.

o. Indoor Lighting

1. Check the *Indoor Lighting* box if an indoor lighting upgrade is in the scope of work.

Set Fixture Type to High Efficacy.

Set Control to On/Off Switch, Dimmer, or Sensor.

NOTE: Only lighting that will be replaced with high efficacy (e.g., pin-based low wattage) fixtures is eligible in the Clean Energy Sacramento program. Savings associated with screw-in CFLs cannot be reflected in the energy models for this program.

NOTE: Only the lighting entered in the *HERS* tab of the building tree will be affected by a modeled upgrade in the *Alternatives* tab.

p. Outdoor Lighting

1. Check the *Outdoor Lighting* box if an outdoor lighting upgrade is in the scope of work.

Set Fixture Type to High Efficacy.

Set Control to On/Off Switch, Dimmer, or Sensor.

NOTE: Only lighting that will be replaced with high efficacy (e.g., pin-based low wattage) fixtures is eligible in the Clean Energy Sacramento program. Savings associated with screw-in CFLs cannot be reflected in the energy models for this program.

NOTE: Only the lighting entered in the *HERS* tab of the building tree will be affected by a modeled upgrade in the *Alternatives* tab.

q. Domestic Hot Water Heater

1. Check the *Domestic Hot Water Heater* box if a DHW upgrade is in the scope of work.

Click the magnifying glass icon to open the DHW system library.

- a. Select the piece of equipment from the library that best matches the post-upgrade home equipment. It may be best to select a default DHW as a starting condition (listed as *Standard Gas 50 gal or less, Default Gas Prior to 1999, Default Tankless*, etc.) and then use the following steps to reflect the upgraded equipment specifications.
- b. Click the yellow "+" to make a copy of the default equipment in the library. Rename the copy in the *Name* section (e.g., *Homeowner Last Name: Existing DHW*).
- c. Adjust the *Heating Type, Volume, Input,* and *Energy Factor* inputs to match the information provided and to accurately reflect the existing equipment. Click OK.

NOTE: For storage DHW heaters over 75,000 BTU, contractors must input the **Recovery Efficiency** and **Standby Loss** within the equipment specifications. Program defaults of 0.76Recovery Efficiency and 0.025 Standby Loss should be used if unable to determine the equipment specifications. The **Standby Loss** can be 0 only for tankless water heaters.

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ptions Alternatives Calibration					
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Name	Volume I	nput	Energy Factor	Name:	Standard Gas 50 gal or Less
Standard Gas 50 gal or Less	50.0	40,000	0.58	Туре:	Gas Fired 🗸
nneelli 41-n40	40.0	40,000	0.62		
Rheem 41VRP50PT	50.0	40,000	0.65	Volume:	50 gallons
A O Smith ELJF-6	6.0	5,120	0.92	Input:	40000 Btu/hr
A O Smith ELJF-10	10.0	5,120	0.95	Energy Factor:	0.575
A O Smith ELJF-15	15.0	5,120	0.91	-	
A O Smith ELJF-20	19.0	15,358	0.91	Recovery Efficiency:	0.78
A O Smith PEC-30	30.0	15,358	0.93	Standby Loss:	0
A O Smith PEC-66	66.0	15,358	0.84	Pilot Loss:	0 Btu/hr
A O Smith PEC-80	80.0	15,358	0.86	External Insulation:	0 R-value
A O Smith PEC-120	119.0	15,358	0.83	External mstilation.	
Laars JVH050ND(I/L)	0.0	200,000	0.53		
Laars JVH075LD(1/L)	0.0	75,000	0.00		

d. Click OK to return to the Alternatives tab.

NOTE: If the post-upgrade home has a different number of DHW systems from the pre-upgrade home, or if the multiple new systems have different equipment specifications from each other,

you will need to calculate energy savings using two energy models. Please see the **Two-model** simulations section of the handbook for more information.

NOTE: If the home has a combined hydronic system, you will need to calculate energy savings using two energy models. Please see the **Two-model simulations** section of the handbook for more information.

r. DHW Distribution

1. Check the *DHW Distribution* box if accessible hot water pipes have been insulated as part of the work scope.

Select the appropriate pipe designation from the drop-down menu according to the pipe upgrade performed.

s. Solar Domestic Hot Water

1. Check the **Solar Domestic Hot Water** box if a solar how water system has been installed or if upgrades have been made to an existing solar hot water system that has increased the percent of hot water energy provided by the solar system.

Enter the percent of domestic hot water heating load that is met by the solar water heating system. See **chapter 5 of the California Residential Compliance Manual** for guidelines for the use of an approved program (e.g., f-Chart) to calculate annual solar performance.

t. Renewables

Renewable energy installations are accepted by the Clean Energy Sacramento program.

- 1. Check the *Renewables* box if renewable energy generation system is in the scope of work.
- 2. In the Renewable Energy section, set Annual Production, Annual Cost Savings, DC Rating, and Annual TDV Energy to the system design specifications.

NOTE: The Clean Energy Sacramento program will require a "stamped" system design sheet to verify the system capacity.

14. EnergyPro reports and reporting energy data

Program policy: Pre-upgrade home conditions locked into place when job is authorized to proceed

The existing home conditions reported to the program are "locked" into place once an upgrade is authorized to proceed.

Though the pre-upgrade home conditions are "locked," however, please note that the modeled pre-upgrade energy use may change between the pre-upgrade review and the final post-upgrade review if the EnergyPro software is updated during that time. The final approved energy savings will always be calculated using the most updated version of EnergyPro available the day the incentive is determined.

a. Generate Ygrene energy report

1. Click the Calculate button below the menu bar to refresh the energy calculations for your model.

EnergyPro - [D08aCZ12_2010_0	818*]
🔊 File Edit View Tools Window	v Help
: 🗋 🔏 🖄 🗃 🔒 🌡 🖻 🛍 🛸	A S Contents
Building	Building - D08aCz <mark>caculate</mark>
008aCZ12	Project Design Data Project Title Designer Lighting Designer Mechanical Designer Utility Outdoor HERS
É– <i>J</i> Ø DH₩	General
HVAC System	Building Name: D08aCZ12
	Building Type: Existing Country: UNITED STATES

EnergyPro tip: Check for updates

Please check for software updates before performing calculations in EnergyPro. The final energy savings value will be based on model calculations performed by the most recent version of EnergyPro available on the day the incentive is approved. To check for EnergyPro updates, go to *Help* in the menu bar and select *Check for Updates*.

2. Click the Report *Wizard* icon to specify the parameters of your report. The *Report Wizard* window will appear.

The *Report Wizard* icon is located below the top menu, between the *Print Preview* and *Calculate* buttons.

EnergyPro - [D08aCZ12_2010_0]	818*]
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Building	Building - Report Wizard 2
D08aCZ12	Project Design Data Project Title Designer Lighting Designer Mechanical Designer Utility Outdoor HERS
≟– Ø DHW ≟– ● HVAC System	General Location

Select **Ygrene** for the type of report. Click **Next**.

Report Wizard - Step 1	Welcome to the Report Wizard The Report Wizard will allow you to easily customize the content of your report to include exactly the forms you choose. Begin by choosing the type of report you would like. Residential California Code (Title 24) Performance GreenPoint Rated
En	 Performance Nonresidential California Code (Title 24) Prescriptive California Code (Title 24) Performance Performance LEED Title 24 Performance ASHRAE 90.1 Performance
	Other © Ygrene To continue, click Next. <back next=""> Cancel Help</back>

Select *Energy Usage Profile, Recommendations, Energy Savings Profile,* and *Project Summary* for the type of form. Click *Next*.

Forms Select forms to include in your report.			Į
 Energy Usage Profile Recommendations Energy Savings Profile Project Summary HVAC System Heating and Cooling Zone Load Summary Room Load Summary Room Heating Peak Loads Room Cooling Coil Loads Fom ECON-1 Energy Use and Cost Fom ECON-2 Energy Upgrade Re 	st Summary		
Press the Next button to continue			
	< Back	Next > C	ancel Help

NOTE: The Ygrene energy report is the minimum report needed to submit the energy savings calculations. You may choose to include additional forms to your report for your own needs or to display additional information to your customer.

Click *Print Preview* to create a PDF of the Ygrene energy report.



With Adobe Reader or Adobe Acrobat, go to *File* in the menu bar and select *Save As*. Save the file in a memorable location and include the company name, customer name, and today's date in the file name.

- b. Submit Ygrene report energy data
 - The energy use values required to properly report the savings are located at the bottom of the *Energy Savings Profile* page. The final program energy savings will be based on the Total Savings line item.



15. Two-model simulations

a. When to simulate upgrades using two models

Whenever possible, both pre-upgrade and post-upgrade home conditions should be simulated in a single EnergyPro model, using the *Alternatives* tab of the *Ygrene* calculation section to model improved conditions. Under some circumstances, however, the proposed or actual upgrades cannot be captured by the *Alternatives* tab, and building two models is necessary. In a two-model simulation, one of the two energy models should represent the pre-upgrade (existing) conditions, and the other model should represent the post-upgrade (improved) conditions based on the proposed or actual installed retrofit measures.

- 1. For the pre-upgrade conditions model, construct the existing home conditions within the building tree.
 - a. Do not populate upgrades in the *Alternatives* tab, and do not check the *Ygrene* box in the *Calculations* section of the model.
 - b. Save the pre-upgrade file in a memorable location and indicate in the file name that the model reflects existing conditions.

For the post-upgrade conditions model, use the pre-upgrade model as a starting point.

- a. Open the pre-upgrade model. In the EnergyPro menu bar, select *File* and *Save As* to create a copy of the pre-upgrade model.
- b. Save the new post-upgrade file in a memorable location and indicate in the file name that the model reflects improved conditions.

In the post-upgrade conditions model, construct the proposed or actual improved home conditions within the building tree.

a. Do not populate upgrades in the *Alternatives* tab, and do not check the *Ygrene* box in the *Calculations* section of the model.

The circumstances listed below are the only instances in which a two-model approach may be used to estimate savings in the Clean Energy Sacramento program.

b. Two-system homes

A two-model simulation is required when modeling a home with multiple DHW and/or HVAC systems. Below are the multiple-system conditions necessitating a two-model approach. This type of upgrade requires a two-model approach because, if you are converting from a two-system home to a one-system home, any HVAC or DHW system upgrades indicated in the *Alternatives* tab will be applied to both of the pre-upgrade systems, and the post-upgrade simulation will continue to model the existence of two systems. Additionally, if you are converting from a one-system home to a two-system home, the *Alternatives* tab doesn't accommodate more than one new HVAC or DHW system.

Below are the system upgrade conditions necessitating a two-model approach.

Pre-upgrade conditions	Post-upgrade conditions
Single DHW heater	Two or more DHW heaters
Two or more DHW heaters	Single DHW heater
Two or more DHW heaters	Two or more new DHW heaters with different fuel types
Two or more DHW heaters	Two or more DHW heaters involving tankless and storage equipment
Single HVAC system	Two or more HVAC systems
Two or more HVAC systems	Single HVAC system
Non-hydronic heating system	Hydronic or combined-hydronic system
Ducted system	Ductless system
Ductless system	Ducted system

c. Multi-type assembly upgrade

A two-model simulation is required when modeling an assembly that has been upgraded to two or more types of new assemblies. This type of upgrade requires a two-model approach because any upgrades indicated in the *Alternatives* tab will be applied equally to every relevant assembly in the model, and the *Alternatives* tab doesn't accommodate multiple types of upgrades to the same assembly.

Below are the multi-type assembly upgrade conditions necessitating a two-model approach.

Assembly type	Post-upgrade conditions
Roof assemblies	More than one insulation level (attic + cathedral, attic + knee wall) or assembly type
Wall assemblies	Upgraded to more than one insulation level or assembly type
Floor assemblies	Upgraded to more than one insulation level or assembly type
Windows	Upgraded with more than one window type

d. Hydronic systems

A two-model simulation is required when an HVAC system is replaced with a hydronic system, or when a hydronic system is replaced with an HVAC system. A hydronic setup in EnergyPro requires a linking of systems within the base building tree, and the Alternatives Tab is not capable of associating a new hydronic system in this manner, or disassociating a link that was made in the base building.

To model a *combined* hydronic space and water heating system:

1. Click the DHW icon in the building tree.

- a. In the *Domestic Hot Water* tab, select a DHW system with a water heater or boiler from the DHW library. Include all the standard water heating system attributes, including features of the distribution system.
- b. In the *Combined Hydronic Piping* section of the tab, enter the *Pipe Length* associated with the hydronic system that is in *unconditioned* space, the *Pipe Diameter*, and the *Insulation Thickness* on that pipe.

Click the HVAC system icon in the building tree.

- a. In the *General* tab, click the magnifying glass icon to open the HVAC system library. Create a new Split FAU-A/C system in the library and assign it a name. In the *Heating* tab, set *Heating Type* to *Hot Water* and *Total Output* to 0. Complete all other fields according to actual system conditions. EnergyPro automatically calculates the effective efficiency (AFUE or HSPF) from the water heater characteristics and pipe losses. Click OK to close the system library.
- b. In the *Distribution* tab, select the *Heating Distribution* type from the drop-down menu according to the actual system conditions. This could be *Radiant Floor* if the piping is embedded in the floor, *Baseboard* if the system uses perimeter hot water radiators, or ducted if the system uses fan coils.
- c. In the *Residential* tab in the *Residential Features* section, set *Hydronic Space Heating* to *DHW Boiler Provides Heat*.

To model a *dedicated* hydronic space and water heating system:

1. In the DHW icon element, in the *Heating Hot Water* tab, select a boiler from the boiler library and input a multiplier.

e. Home additions

Additions to an existing structure are allowed in the Clean Energy Sacramento and are subject to the same rebate structure and project guidelines as all other projects in the program. To model additions, use the following two-model approach:

1. **Existing model**: The existing model should represent the home as it exists during preupgrade conditions, without the additional square footage.

Improved model: The improved model should represent the home as it exists during postupgrade conditions, with the additional square footage included in the model and clearly labeled.

As in all two-model situations, the results from the existing and improved Ygrene energy reports will be both be used to determine the anticipated savings and rebate value.

uilding	Room - Addition
Undefined	General Infiltration Occupant Receptacle/Process Domestic Hot Water Exhaust Fan Lighting
New DHW New Heat Pump Zone 1 Room Front Wall Here Wall Here Wall Here Rear Wall Here Rear Wall	Name: Addition Area: 450 ft² Ceiling Height: 8 feet Type: New Year Built: 2012 🔄 Winter Indoor Temp: 70 °F Summer Indoor Temp: 78 °F
Addition Front Wall Front Front Front Wall Front Front Fr	Installed LPD: 0 W/ft² Installed LPD does NOT include Control Credits

f. Determining energy savings from Ygrene energy reports for two-model scenarios

In order to calculate the energy savings achieved by an upgrade simulated using the two-model approach, you will need to create two Ygrene energy reports and manually calculate the anticipated energy savings.

- 1. The energy use values required to properly report the savings are located on the *Energy Savings Profile* page.
- 2. Once these values are recorded for the existing and improved conditions, manually calculate the modeled savings for each fuel type and the modeled overall energy savings percentage.

16. Common EnergyPro errors

a. HVAC system: Input vs. Output

When entering the HVAC system specifications in EnergyPro, please enter the **Total Output** and not the system input. Please ensure the output listed is accurate based on the system input and efficiency (output = input x efficiency).

- 1. Click the HVAC system icon in the building tree.
 - a. In the *General* tab, click the magnifying glass icon to open the HVAC system library.
 - b. On the *Heating* tab of the system library, enter the *Total Output* in BTU/hr. Although this will not directly affect the model, it assists with the field verification process.

b. Lighting

Only pin-based, low wattage fixture upgrades can contribute to the whole house incentive in the Clean Energy Sacramento program. No other lighting replacements are eligible for the program. Do not enter any existing lighting into the model unless it is lighting that will be replaced with qualifying pin-based, low wattage fixtures.

- 1. To enter existing lighting that will be replaced with high-efficacy fixtures, click the whole house icon in the building tree.
 - a. In the HERS tab under the *Indoor Lighting* and *Outdoor Lighting* sections, enter the number of fixtures to be replaced by clicking on the yellow "+" and entering the lighting specifications.

To enter the upgraded lighting, go to the *Calculations* section of EnergyPro, select *Ygrene*, and go to the *Alternatives* tab.

- a. Check the *Indoor Lighting* and/or *Outdoor Lighting* boxes according to the proposed or completed scope of work.
- b. Set Fixture Type to High Efficacy.
- c. Set *Control* to *On/Off Switch*, *Dimmer*, or *Sensor*.

c. Two-story home

All two-story homes need to be modeled as two-story homes in EnergyPro, rather than as a single-story building with a 16-foot ceiling height. Individual floors need to be broken out within the model and assigned the appropriate ceiling height, total area, walls, and roof and/or foundation, if applicable. For example, the first floor of a simple "box" home should have the foundation modeled, while the second floor needs to have the roof included, and both should have all four exterior walls per floor.

- 1. For a one-system home, right-click the HVAC system icon in the building tree and select **Add Zone**.
 - a. Click the new zone in the building tree, and on the *General* tab rename it under *Zone Details*. We suggest "2nd Floor" or "Upstairs" to distinguish this floor within the model.
 - b. In the *General* tab, ensure that each zone in the model is designated with the correct *Floor Number*.
 - c. Create the appropriate exterior walls, windows, and roof/ floor assemblies for each zone.

Building	Wall - Rear Wall
D08aCZ12 DHW HVAC System HVAC System HVAC System Front Wall	General Thermal Mass Name: Rear Wall Area: 365 ft ^a Surface Type: Existing
Bear Wall	Existing Assembly: 10.1 copy of Default Wall 1992 📆 🗙 Drientation: 180
E-Sone 2	

d. Assembly R-values: Walls, floors, and roofs

Existing system

When selecting pre-upgrade home assemblies and their R-values, you are strongly encouraged to use any available software- generated defaults from the assembly library (e.g., *Default Wall Prior to 1978, R-11 Roof Attic*, or *Default Floor Crawlspace 1992-Present*). If a contractor chooses to downgrade an existing assembly, the contractor will need to provide supportive documentation (including photos of the existing condition and an explanation/equation demonstrating how the degraded R-value was determined) in order for the downgraded value to be accepted in the model.

If you do choose to downgrade an assembly, use the following steps to model that downgrade. This example uses downgraded attic insulation; however, this method is applicable to any existing wall or floor R-value downgrades.

For the existing roof, if the insulation has been downgraded based on field conditions, you can manually enter an R-value to correctly reflect the existing performance.

- 1. Example: An existing roof was initially deemed to have R-19 insulation, but a BPI analyst downgraded this to R-14 during the field inspection.
 - a. To represent this downgrade in EnergyPro, select the R-13 assembly already generated by EnergyPro. (NOTE: Select the next-closest R-value that is less than the existing performance level.)
 - b. Click the yellow "+" to make a copy of that assembly in the library. Rename the assembly with the intended new R-Value (e.g., *R-14 Roof Attic*).
 - c. In the *Added Interior Insulation* section add **1** to the *Insulation* field. This additional R-1 is added to the R-13 *Component Description* insulation, and EnergyPro will now assign the assembly an R-value of 14.

NOTE: The insulation level indicated should reflect the insulation level listed in the *Component Description* section, rather than the total assembly R-value listed in the *Properties* section.

Improved system

For the post-upgrade assemblies, software-generated options should be available in the assembly library for all potential R-value upgrades, so all improved conditions models should use these software-generated options.

e. Building leakage split between two or more HVAC systems

 If a home contains multiple identical HVAC systems, use the *multiplier* function and indicate appropriate number of systems in the home. In the *HERS Credits* tab of the HVAC system in the building tree, enter the total CFM50 for the entire home. On the *Alternatives* tab, the building leakage (in CFM50) should reflect the post-upgrade building leakage for the entire home.

If home has multiple HVAC zones, the existing building leakage for the total home should be split among each HVAC zone based on the proportion of conditioned floor area each system serves. The total post-upgrade CFM50 should be divided by the number of zones and then entered into the *Alternatives* tab.

Click the first *HVAC* icon in the existing building tree and go to the *HERS Credits* tab.

Set Building Leakage Testing to Airflow and Building Leakage Type to Existing.

Calculate what percent of the home's total conditioned floor area is part of that HVAC zone.

Multiply that percent by the home's total existing building leakage (in CFM50), and enter the result in the *CFM50* field.

Repeat the above steps for each HVAC zone. The sum of the building leakage for all zones should equal the home's total building infiltration.

Example: zone $1 = 400 \text{ ft}^2$, zone $2 = 600 \text{ ft}^2$; total building leakage = 2,000 CFM50

- a. Zone 1 represents 40% of the total home area (400 $ft^2/1000 ft^2$). Therefore, the infiltration entered under the HVAC System 1 should equal 40% of the total infiltration, or 800 CFM50.
- b. Zone 2 represents 60% of the total home area (600 ft²/1000 ft²). Therefore, the infiltration entered under the HVAC System 2 should equal 60% of the total infiltration, or 1200 CFM50.

NOTE: Divide the air infiltration values using the same technique for three or more HVAC systems.

f. Knee walls

Because knee walls are exposed to the same extreme conditions as attics, and they are connected to the conditioned space, all knee walls must be modeled as roof assemblies.

1. Right-click the room level icon in the building tree, place the mouse over *Add*, and select *Roof* from the list of assemblies. Click the roof icon.

- a. On the *General* tab, rename the new roof assembly to *Knee wall*, and add *North*, *South*, *East*, or *West* to the name to distinguish it from other knee wall assemblies within the model.
- b. Enter the correct *Area*, set *Orientation* to North, and set *Tilt* to 60 degrees.
- c. Depending on whether you are upgrading the knee wall insulation, set the assembly *Type* to *Existing* or *New*.
 - i. If you are upgrading only the attic insulation and not the knee wall insulation, set the knee wall assembly *Type* to *New* so that EnergyPro *will not* attribute the upgraded attic insulation on the *Alternatives* tab to the knee wall assembly.
 - ii. If you are upgrading only the knee wall insulation and not the attic insulation, set the knee wall assembly *Type* to *Existing* so that EnergyPro *will* attribute the upgraded attic insulation on the Alternatives tab to the knee wall assembly.

NOTE: If you are upgrading both the attic and knee wall insulation, this upgrade will need to be simulated with a two-model approach. See the **Two-model simulations** section of the handbook for more information.

- d. Choose the assembly with the appropriate pre-upgrade R-value from the roof assembly library.
- e. Within the knee wall assembly, set *Aged Solar Reflectance* to 1, and set *Thermal Emittance* to 0.75.

g. Seasonal temperature thermostat settings

Program policy dictates that the following occupant behavior settings be used in all models:

- 1. Click the room level icon in the building tree. In the *General* tab, the required temperature defaults are:
 - a. Winter Indoor Temp set to 70 degrees
 - b. Summer Indoor Temp set to 78 degrees
 - c. Click the HVAC system icon in the building tree. In the *Residential* tab, in the *Residential* Features section set the *Thermostat* to *Setback* on the drop-down menu. The final energy savings for every job will be calculated with this condition in place.

h. Buried ducts & multiple duct R-values

Check the **HVAC Distribution** box if the duct location was altered within the home, or if the ducts were buried as part of the work scope. If neither of these situations occurred, use the **HVAC Duct Leakage** and **HVAC Duct Insulation** inputs on the **Alternatives** tab to report upgraded duct conditions and skip the HVAC Distribution input.

1. To model an altered duct location, set the *Duct Location* drop-down menu to reflect the updated location.

Enter any upgraded Duct Insulation or Low Leakage AHU or HERS II Leakage Verified values for the post-upgrade system.

To model buried ducts in an upgraded home:

- a. In the Alternatives tab, check the HVAC Distribution box.
- b. In the *Duct Insulation*, indicate the *R-value* of the immediate duct wrap.
- c. Click the *Low Leakage AHU or HERS II Leakage Verified* radio button and enter the percent measured total duct leakage. This should be based on the duct pressurization results in CFM25 and the measured air flow of the system.
- d. NOTE: The Clean Energy Sacramento program requires the reported duct leakage percent to be measured total duct leakage. The duct leakage percent should be based on the values you collect for measured system airflow and measured total duct leakage.
- e. Check the *Measured Duct Surface* checkbox and click "..."
- f. Enter the duct location for each major duct run within the home. For buried ducts, the *Duct Location* should be either *Attic (Buried)* or *Attic (Deep Buried)* based on the installed depth. (Deep buried ducts are buried 3.5" or more under the attic insulation.) Contact your Program Administrator for information on buried versus deep buried ducts.
- g. Enter the *Diameter, Length*, and *Insulation* value for all major duct runs in the home, including those not located in the attic (indicate correct location in the *Location* drop-down menu). You can consolidate runs of identical locations, diameters, and insulation values. If there are more than five major duct runs, average together any runs with similar R-value or duct diameter in similar home.
- h. Select attic Insulation Type.
- i. For *Insulation Amount*, enter in the *R-value* of the home's post-upgrade attic insulation.
- j. Click OK to exit the Measured Duct Information window.
- k. When using HVAC Distribution, do not also use HVAC Duct Leakage or HVAC Duct Insulation in the Alternatives tab. HVAC Distribution already addresses post-upgrade duct leakage and duct insulation, so HVAC Duct Leakage and HVAC Duct Insulation are redundant to HVAC Distribution.

NOTE: For "Duct Insulation R-value," enter only the direct duct insulation R-value; do not use the effective R-value found in Table 3-50 of the Residential ACM Manual. The direct duct insulation R-value will typically will be R-6 or R-8.

NOTE: The Clean Energy Sacramento program requires the reported duct leakage percent to be measured total duct leakage, based on measured system airflow.

i. DHW input location

Be sure to enter the hot water heater specifications in the *Domestic Hot Water* tab of the DHW icon in the building tree, rather than in the *Heating Hot Water* tab.

j. Partial upgrades: New vs. existing

When performing a partial upgrade of one of the home's elements, it is possible to control which features EnergyPro associates with the upgrades indicated in the *Alternatives* tab.

- 1. By setting a specific assembly, system, or equipment *Type* to *New*, any upgrades to that assembly, system, or equipment indicated on the Alternatives *will not* be applied to that specific element in the building tree.
- 2. By setting a specific assembly, system, or equipment *Type* to *Existing*, any upgrades to that assembly, system, or equipment indicated on the Alternatives *will* be applied to that specific element in the building tree.
- EXAMPLE: If you are upgrading the wall insulation for all walls in the home except the rear wall, set the wall *Type* to *New* for the real wall, and *Existing* to all other walls. On the *Alternatives* tab, indicate the upgraded wall R-value and then click *Calculate* to run the simulation. Within that simulation, EnergyPro applies the new wall insulation R-value to all the walls designated as *Existing* and maintains the initial R-value of the rear wall, which was designated as *New*.

k. Pools and spas

EnergyPro requests only the presence of a pool/spa, the designated heat source for the pool/spa, and whether the pool has a cover. You cannot specify the pump efficiency or heating schedule. If the home being upgraded has a pool or spa, this needs to be reflected in the EnergyPro model in order to accurately calculate the existing and final energy use in the home.

To earn credit for upgrading an existing single-speed or two-speed pool pump to a variable-speed pool pump, indicate the pre-upgrade and post-upgrade pool pump conditions when submitting your project. *The electricity savings credits will be calculated independently, rather than in EnergyPro.*

I. Conditioned crawlspace

When modeling a conditioned crawlspace in EnergyPro, *do not* model the assembly as a **Raised Floor w/ Crawlspace**. The **Raised Floor w/ Crawlspace** assembly assumes the thermal barrier is at the raised floor, which is not true for conditioned crawlspaces. Instead, model the conditioned crawlspace as a slab-on-grade assembly to account for ground coupling (heat exchange between the ground and the crawlspace). If the crawlspace is conditioned, there is no thermal barrier at the raised floor, and the spaces on either side of the raised floor are now both conditioned and no heat transfer occurs between them. Because of this, the slab-on-grade should be modeled as uninsulated, regardless of the raised floor R-value.

When entering a slab-on-grade assembly that is representing a conditioned crawlspace, accurately name the assembly so the program administrators understand that this is a conditioned crawlspace. For example, you can name the assembly "SOG to represent conditioned crawlspace."

1. Right-click the *Room* icon in the building tree, add a *Slab-on-Grade*, and enter the correct area and assembly type. Although there is no slab, the exposed earth within the conditioned crawlspace will transfer heat similarly to a slab.

Enter the stem walls as independent, exterior wall assemblies with the appropriate wall assembly construction type (e.g., CMU, Concrete, Concrete w/ R-13), and enter accurate wall area, orientation, and other specifications. Label these walls so program administrators understand your intent, such as "Stem Wall: West".

Right-click the **Room** level icon and add four above-ground stem walls as **Exterior Walls**. Enter the correct area (ground up through the rim joist), orientation, assembly type, and other specifications for each above-ground stem wall.

NOTE: Existing conditioned crawlspaces can be modeled in the base building tree, but whenever modifying the crawlspace as part of the upgrade work scope, two models will be required.

m. Cool roofs and radiant barriers

1. To model a cool roof, click the roof icon in the building tree, and click the magnifying glass to open the roof assembly library.

Select the appropriate assembly type based on the roof framing and insulation.

Check the CRRC-1 Certified Roofing checkbox.

Select the *Roofing Type* from the drop-down menu.

Enter the CRRC-certified Aged Solar Reflectance and Thermal Emittance values.

Name	Тури	B.Value	U-Fector	Const. Type	UNK	Component Description	
R-0 Roat Apr: P	Red	4.0	0.251	Wood Formed	4.2.1	Name: R-38 Row Alex	OK .
R.Q. Roof Cathedral F	Rust	4.0	0.252	Wicod Frankel	4.2.2	Type Rod	
R-11 Rod Cathedral P	Real	11.9	0.084	Wood Formed	422	Construction World Preved Mic	Cancel
R-13 Reaf Atic /	Red	34,7	0.068	Wind Frend	4.2.5	Decryton 34"0C	
R-13 Roof Cethedrel	Rod	14.5	0.069	Word Frend	423	Instation R-30 JA4 421-821	
R-19 Rovel Agric /	Rod	20.8	0.048	Wood Frankel	42.5	V CRRC-1 Cethed Rooking	
R-19 Roof Cathedral	Root	19.6	0.051	Wood Framed	422-	Roofing Type: Lightweight (<5.4.14) *	
R-30 Roof Cathedral /	Rod	28.6	0.035	Wood Franed	422	Aged Solar Perfectance: 0.05 Themail Environ: 0.05	
					1.1		
R-3E Roof Cathedral P	Post	35.7	0.029	Wood Franed	422	Alto Radiert Batter Name •	
R-19 Metal Deck Roof F	Root	21.4	0.047	Span Deck or	425	Anguce between Roding & Rod Deck	
Default Roof Prior to 1978 F	Red	32.7	0.079	Wood Franed	42.5-	1/150 Atto Vert Percentage of Venta High 0 0	
Default Roof 1970 to Present F	Rauł	25.4	0.049	Wind Franed	421	Added Interior Insulation Added Ecenar Insulation Properties	
R-30 Revit Attic	Red	32.3	0.001	Wood Frankel	42.1	Ranning None + Ranning None + Heat Capacity 0.0 Burthill	
R-11 Roof Alle: P	Red	12.2	0.076	Wind Frend	425		
						FILLER CONTRACT CONTRACT	
						Thickness: U mittee Thickness: U mittee R-Value: 40.0 R-value	

NOTE: If you model includes an existing or upgraded cool roof, include the manufacturer's specifications sheet that provides these values with your job submission.

NOTE: Credit for adding a cool roof is available only if there is no radiant barrier installed. In the Ygrene module, the cooling benefit of a cool roof is assumed to be equal to that of a radiant barrier. Also, EnergyPro assumes no heating impact within the cool roof calculations despite potential increased winter heating loads (while there is some heating benefit assumed for a radiant barrier).

1. To add a radiant barrier, click the appropriate the roof icon and click the magnifying glass to open the roof assembly library.

Select the correct type of radiant barrier (*Continuous* or *Over Skip Sheathing*) in the *Attic Radiant Barrier* drop-down menu.

- a. *Continuous*: The radiant barrier creates a continuous thermal barrier.
- b. **Over Skip Sheathing**: The radiant barrier is installed over existing skip sheathing in a reroofing application.

High Root Also Hoot 4.0 0.251 Wood Proceed 4.2.1. How Proceed Also High Root Cathedral Hoot 113 0.084 Wood Proceed 4.2.2. Type Proof Hoot High Root Cathedral Hoot 113 0.084 Wood Proceed 4.2.2. Type Proof Construction Wood Proceed 4.2.2. Construction Wood Proceed Also Doord Hoot 113 0.084 Wood Proceed 4.2.2. Construction Wood Proceed Also Decurystance Also OC Hoot Hoot </th <th>Name</th> <th>Type</th> <th>HValue</th> <th>Ufactor.</th> <th>Const. Type</th> <th>344</th> <th>Component Description</th> <th>-</th>	Name	Type	HValue	Ufactor.	Const. Type	344	Component Description	-
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R.13 Field After Nod 14.7 0.088 Wood Framed. 4.2.1. R.13 Field Cathedral Nod 14.5 0.009 Wood Framed. 4.2.1. R.13 Field Cathedral Nod 19.6 0.051 Wood Framed. 4.2.2. R.19 Flood Cathedral Nod 19.6 0.051 Wood Framed. 4.2.2. R.19 Flood Cathedral Nod 20.6 0.035 Wood Framed. 4.2.2. R.00 Flood Cathedral Nod 20.6 0.035 Wood Framed. 4.2.2. R.00 Flood Cathedral Nod 20.6 0.035 Wood Framed. 4.2.2. R.00 Flood Cathedral Nod 20.6 0.035 Wood Framed. 4.2.3. R.00 Flood Cathedral Nod 20.6 Node Framed. 4.2.3. R.00 Flood Cathedral Node 20.6 Node Framed. 4.2.3. R.10 Hold Maid Deck Holf Rolf 21.4 0.047 Spart Deck or 4.2.6. Node Statem Wave Node Statem Hole Matter Noded Statem Hole Matter Node S	N-0 Roof Caliverinal	Plasf	4.0	0.252	Wood Framed	422	Type: Pool	
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	R-11 Red Atto:	Plant	13.2	0.076	Wood Frened.	42.1-		
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n. Garage walls common with conditioned space

Garage walls should be modeled only if they serve as a barrier between conditioned and unconditioned space. For example, if a wall separates the living room from an unconditioned garage, model that wall as an exterior wall, name it "Garage wall," and set the *Orientation* to "0" or "North" to simulate no solar heat gain. **Only conditioned space should be included in the total area listed in EnergyPro**.

o. Multiple DHW systems

1. Same fuel type, same specifications

If a home contains multiple DHW systems with identical fuel type and specifications, use the *Multiplier* function and set the model to the appropriate number of water heaters

Same fuel type, different specifications

When there are two or more DHW systems with the same fuel type and both are serving the entire home, enter the average *Energy Factor, Volume, Input*, and *Recovery* Efficiency for all systems. Set the system multiplier feature to reflect the number of systems.

Example: DHW #1 has an *Energy Factor* of 0.525 EF and DHW #2 has an *Energy Factor* of 0.575 EF. Enter an average *Energy Factor* of 0.55 EF and set the *Multiplier* to two systems.

Building	Plant - DHW			
Pated Home HVAC System HVAC System Kone 1 Kone 1	Heating Hot Water Chilled Water Hydronic Domestic Hot Water DHW Boiler Type: Existing Existing Boiler: Standard Gas 50 gal or Less () ×			
Window	Multiplier: 2			

2. Different fuel types, or both tanked and tankless

When a home contains two or more DHW systems with different fuel types and/or a mixture of tanked and tankless heaters, they must be modeled such that each DHW has a dedicated zone it serves within the model, with accurate wall area, floor area, roof area, windows, bedrooms, and kitchens associated with each zone as found in the actual home.

If a home has multiple DHW systems but only one HVAC system, make a copy of the existing HVAC equipment so the base building tree shows two HVAC systems. The software calculates the heating/cooling load primarily based on volume of conditioned space associated with that system, and having a duplicate HVAC system to enable the correct DHW zones will not negatively impact the energy model. If you cannot determine the dedicated DHW zones or both systems serve the home in parallel, simply split the home area in half and dedicate 50% of the home area to each DHW.

- a. Add a DHW system by right-clicking the whole house icon and selecting *Add Plant*. Add as many unique DHW systems as needed based on the instructions provided above.
- b. Click each newly added Undefined Plant icon from the step above, and on the Heating Hot Water tab rename each system using the Name field. For clarity, we recommend naming each DHW to indicate the system type and/or zone served within the home (e.g., "Tankless: Guest Bath").
- c. Under each DHW zone, enter the appropriate home assemblies and equipment as found in the actual home. Accurately **indicate wall area**, floor area, roof area, windows, **number of bedrooms and kitchens for** each zone; this information will determine the energy use load associated with each DHW.
- d. For homes with multiple DHW systems but only one HVAC system, you still need to enter an HVAC system for each DHW. These duplicate systems will be an identical copy of the original existing HVAC system. Right-click the *Plant level* and select *Add System*.
- e. Within each duplicate **HVAC System**, select the same piece of equipment as identified in the original selection. Set all *Distribution tab* inputs (e.g., duct insulation, duct leakage, duct location) to match the original system.
- f. Set the *Thermostat* setting to *No Setback* in the *Residential* tab.
- g. In the *HERS Credits* tab, split the total existing infiltration among each *HVAC* zone. See the HERS Credits tab section below for information on how to correctly split this infiltration among multiple HVAC zones.

NOTE: If you are unable to determine individual DHW zones for multiple DHW systems in situation #3, divide the home evenly among each zone. For example, a home with two DHW zones would be split in half.

p. Evaporative Coolers

When modeling an evaporative cooler, the HVAC system should be created similarly to any other HVAC system. Go to the HVAC equipment library, then select or create the appropriate equipment based on the equipment specifications. Once within the individual piece of equipment, select *Evap Cooler* for the *System Type*. This will allow you to enter the appropriate heating specifications, but will cancel out the cooling input and attribute fan usage only for cooling days in the model.

q. Wall Heaters

To designate a heater as a wall unit, follow the instructions in the **System level: HVAC icon** section of the handbook.

- 1. Click the HVAC icon in the building tree.
- 2. In the *General* tab, click the magnifying glass icon to open the HVAC system library.
 - a. Select the piece of equipment from the library that best matches the existing home equipment. It may be best to choose a default unit (listed as *Standard FAU/AC*, *High Efficiency FAU/AC*, *Electric Baseboard*, etc.).
 - b. Click the yellow "+" to make a copy of the default equipment in the library. Rename the copy in the *Name* section (e.g., *Homeowner Last Name: Existing Wall Unit*).
 - c. Set the **System Type** to **Room PTAC**, and set the **Heating Type** to **Gas Furnace**, **Electric Res**, **Heat Pump**, **Hot Water**, etc., according to the building conditions.
 - d. Set *Furnace Type* to *Fan Wall* or *Gravity Wall* if appropriate for the System Type selected. *Total Output* and *Efficiency* should match the information provided and accurately reflect the equipment.
 - e. On the *Cooling* tab of the equipment selection window, adjust the *Output, Sensible*, *SEER*, and *EER* inputs, if appropriate for the System Type selected, to match the information provided and to accurately reflect the equipment. Click OK.

r. Multi-family units and condos

When modeling multi-family homes, condo units, or any unit with shared walls/floors, please remember to never include these shared assemblies if they are adjacent to conditioned space. Including these shared walls will force the model to attribute an additional heating/cooling load due to assumed solar heat gain, when the assembly is actually adjacent to a conditioned unit and has very little heat loss/gain.

Appendix

- a. Additional EnergyPro resources
 - Please contact support@energysoft.com with additional questions.
 - To access the EnergyPro help section, click *Help* in the software menu bar and select *Contents*. Select *Search* and type your desired key words in the *Search for* field.
 - To search for words and phrases within the EnergyPro Handbook, open the handbook in Adobe Reader and hold down the "ctrl" and "f" keys on your keyboard to open the search tool. Type your search word or phrase in the search field and hit "Enter" on your keyboard.

b. Utility Bill Calibration

- For the Clean Energy Sacramento program, EnergyPro data should not be calibrated, but sometimes this can be valuable information to provide to your client.
- For existing buildings, EnergyPro allows you to easily compare your simulation results to the building's actual energy usage. Each Calculation module contains a Calibration Tab that will create a graph of the monthly simulated and actual energy usage and cost (both electricity and natural gas). Use this graph to compare your simulation to the actual usage and to identify significant differences between them. This will allow you to adjust your simulation as required to closely mirror the actual building usage profile and more accurately estimate the savings based on actual usage.

c. Vintage tables

• Use the program provided vintage tables for default assembly and equipment values that cannot be determined through the field audit.