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***.

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 two-model 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.

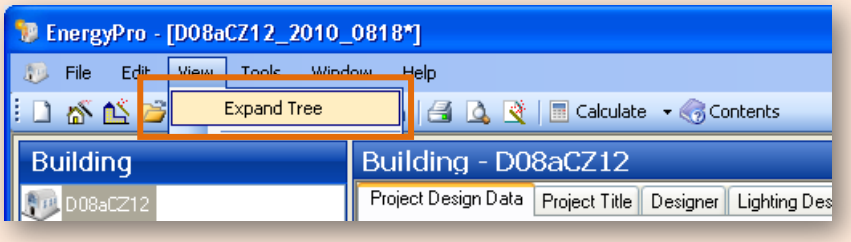
5. Create a new EnergyPro file – New Residential File

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***.



a. Project Design Data tab

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

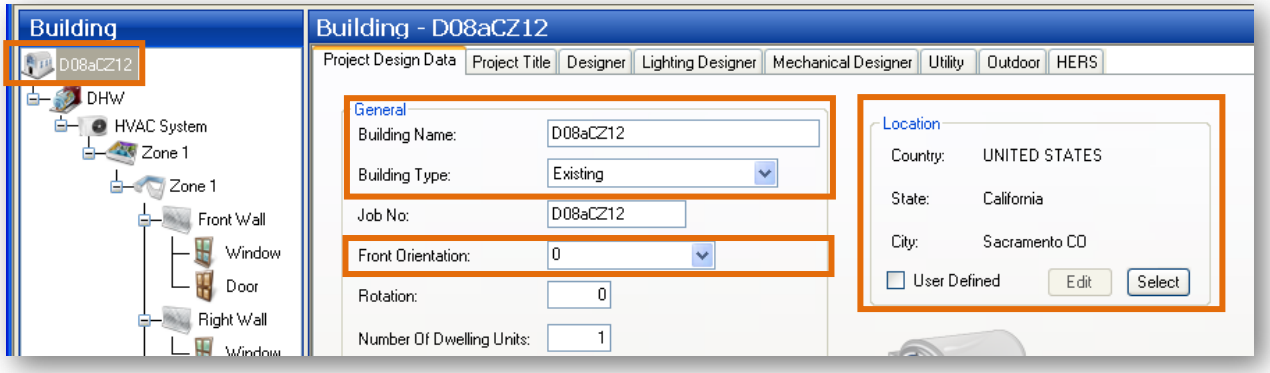
   Set ***Building Type*** to ***Existing***.

   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.).

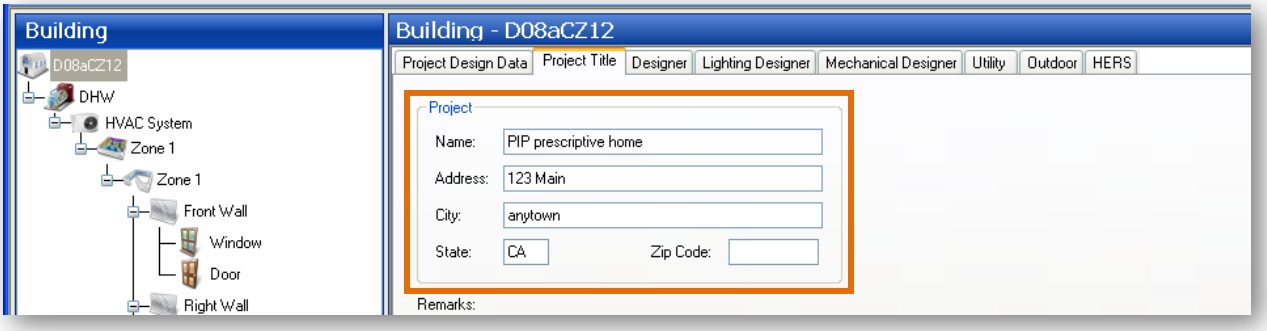
      In the ***Location*** section, click ***Select*** and choose the city in which the upgrade is performed.

      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.



b. Project Title tab

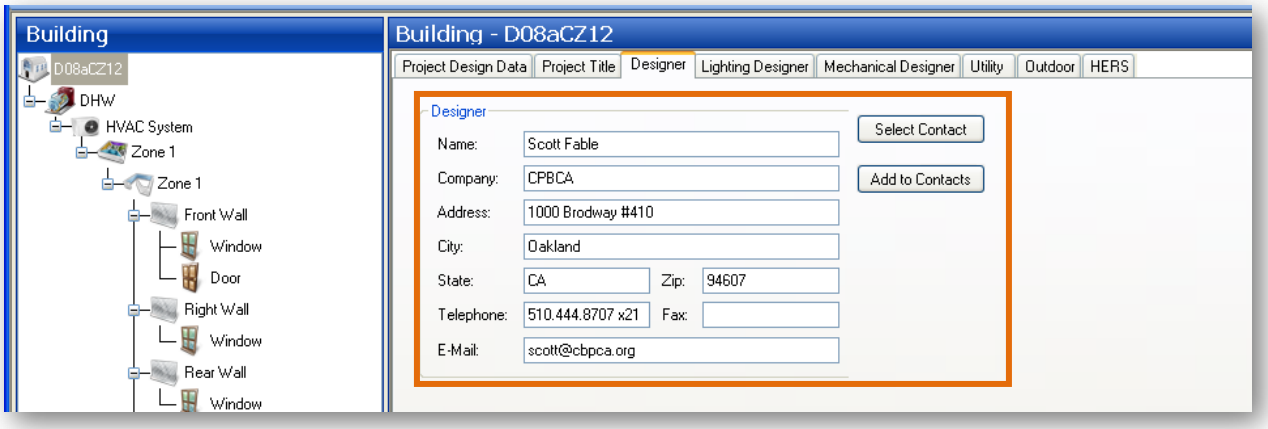
1. In the ***Project*** section, enter the homeowner name and installation address.



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.



d. Utility tab

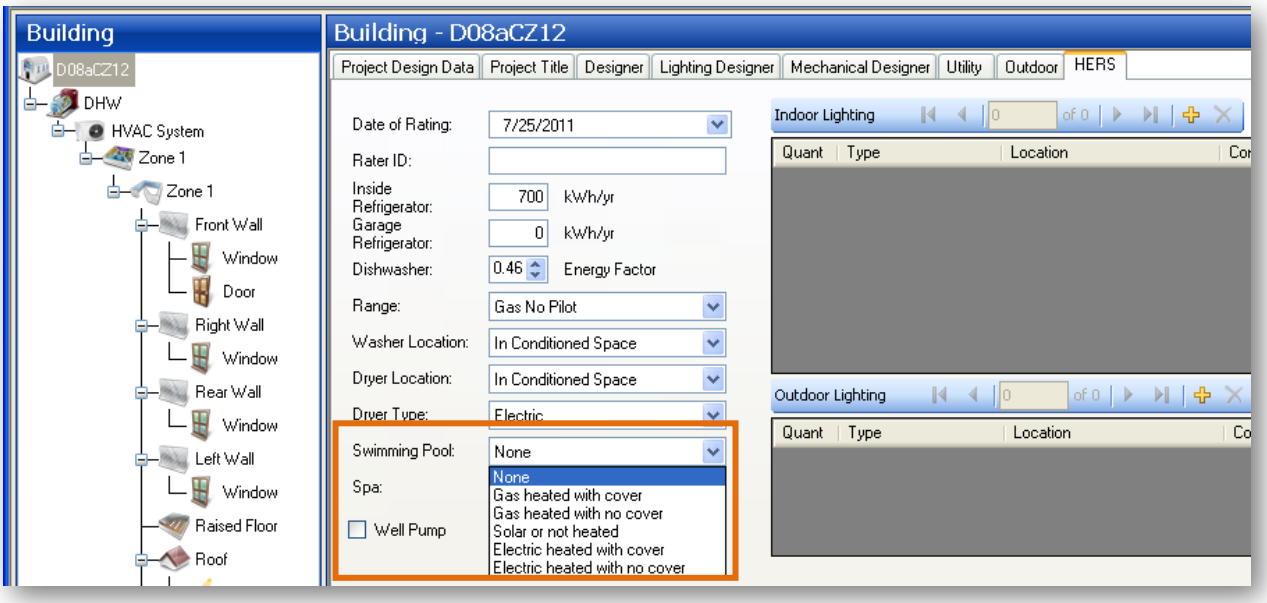
The ***Utility*** tab is not used in the Clean Energy Sacramento program.

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

1. 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***.

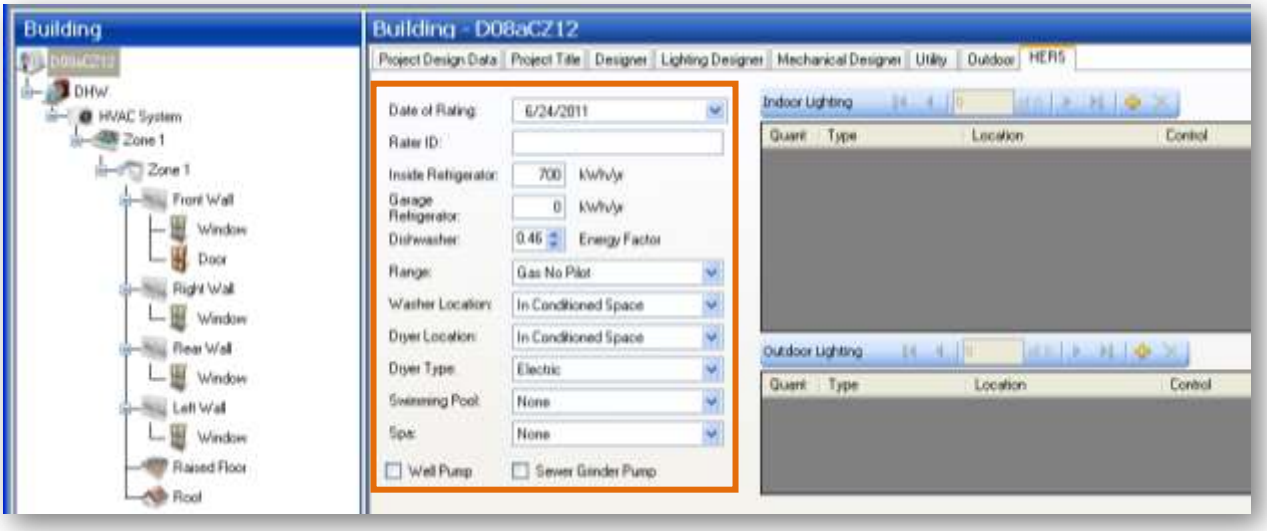
NOTE: EnergyPro requests only the presence of a pool/spa, the designated heat source for the pool/spa, and whether the pool has a cover. You cannot specify the pump efficiency or heating schedule. If the home being upgraded has a pool or spa, this needs to be reflected in the EnergyPro model in order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



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.*

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.



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***.

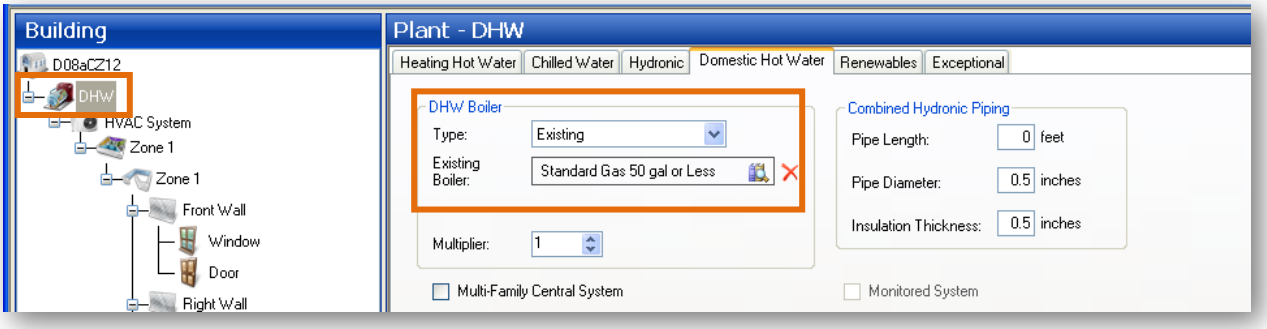
Click the new ***Undefined Plant*** icon, and rename the DHW system in the ***Name*** field on the ***Heating Hot Water*** tab according to your naming preferences.

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*.



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.).

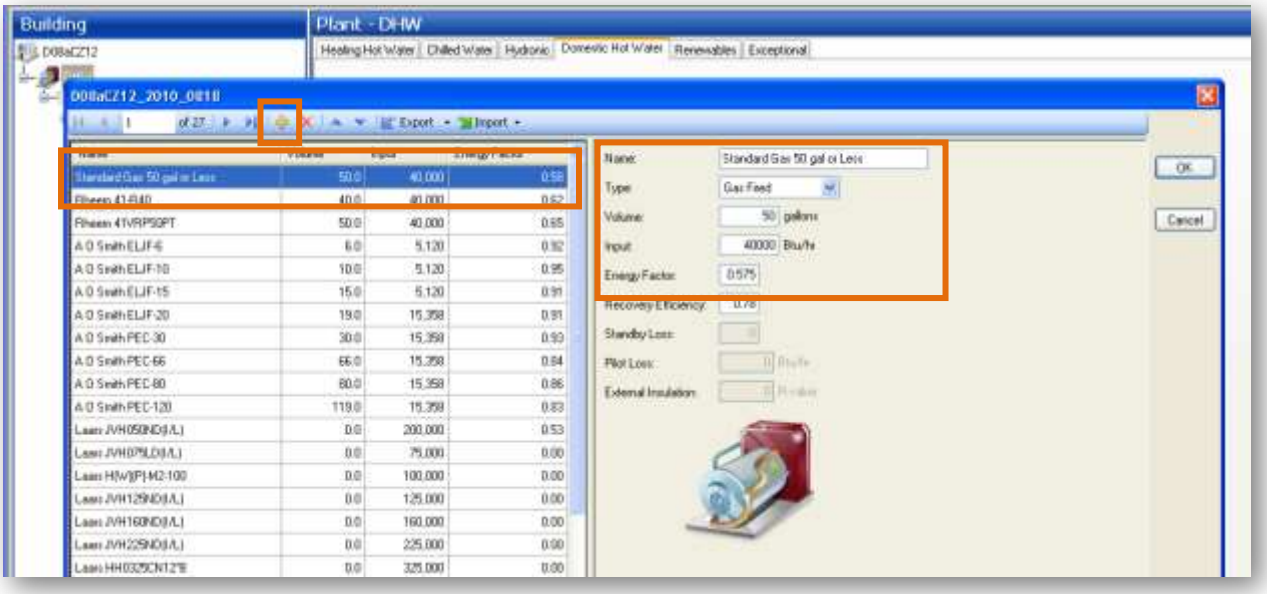
b. Click the yellow "+" to make a copy of the default equipment in the library. Rename the copy in the ***Name*** section (e.g., ***Homeowner Last Name: Existing DHW***).

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

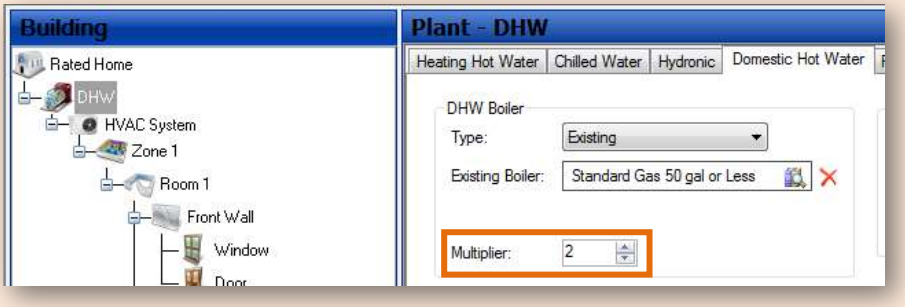
1. Same fuel type, same specifications

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*** to two systems.



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.

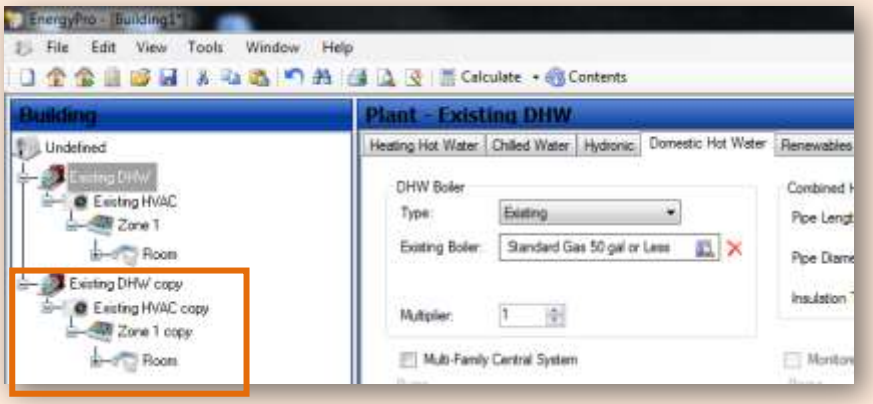
If a home has multiple DHW systems but only one HVAC system, make a copy of the existing HVAC equipment so the base building tree shows two HVAC systems. The software calculates the heating/cooling load primarily based on volume of conditioned space associated with that system, and having a duplicate 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***.



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 non-hydronic 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.

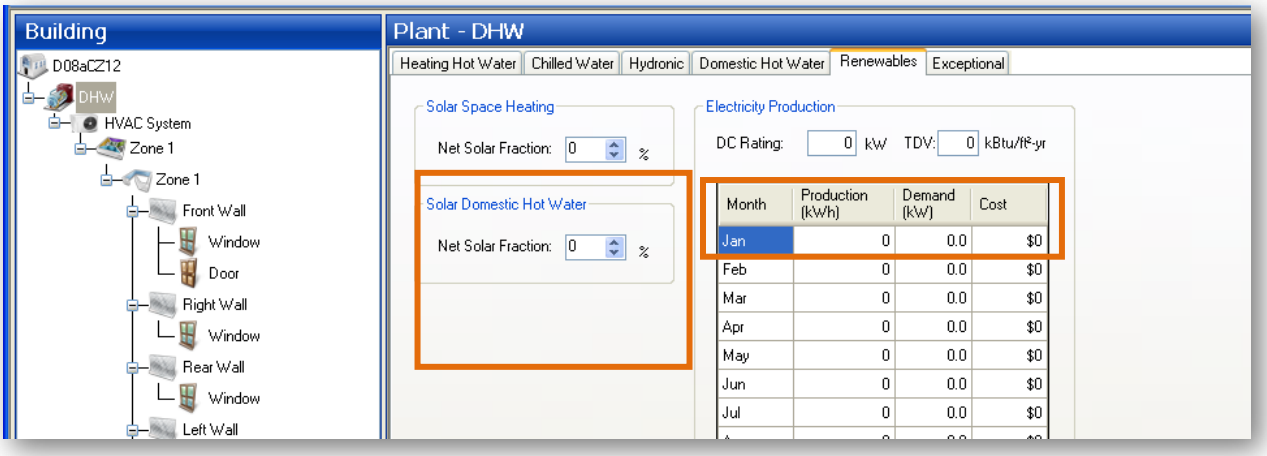
    c. For existing on-site electricity production, follow the instructions provided in the EnergyPro Help section.

        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_calculator.php**



8. System level: HVAC icon

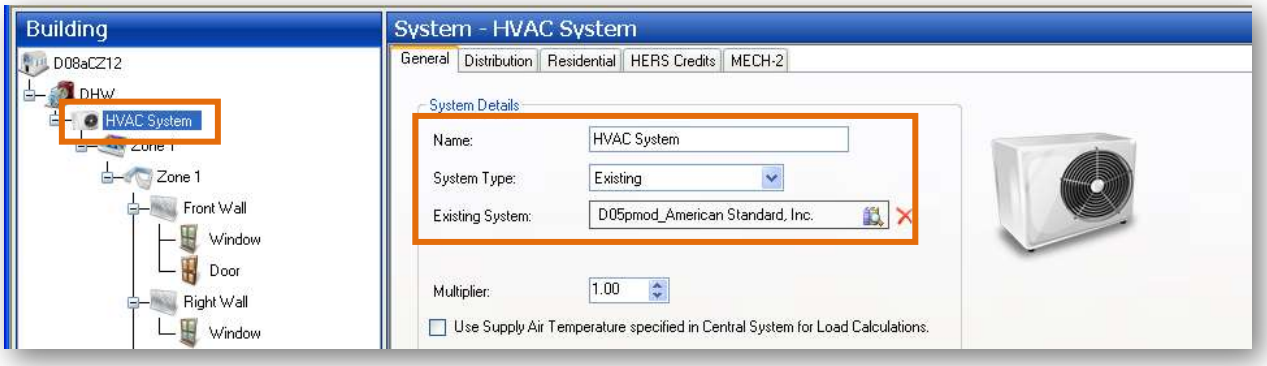
To add an HVAC system to your EnergyPro file, right-click the DHW icon and select ***Add System***.

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***.

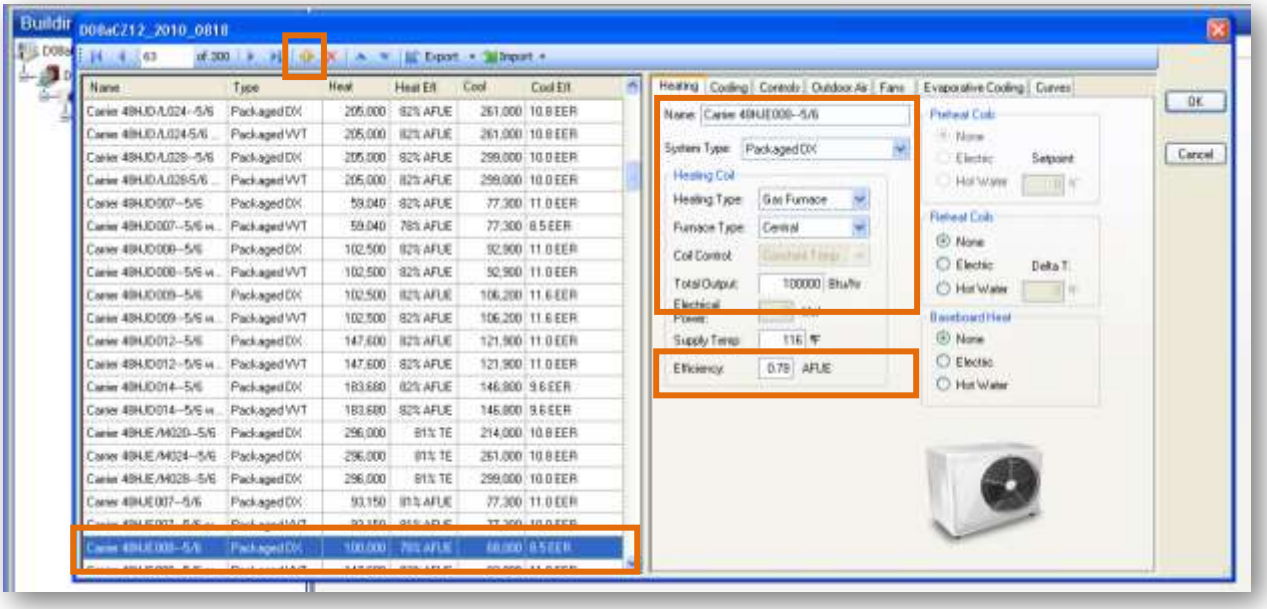


   Click the magnifying glass icon to open the HVAC system library.

   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***).

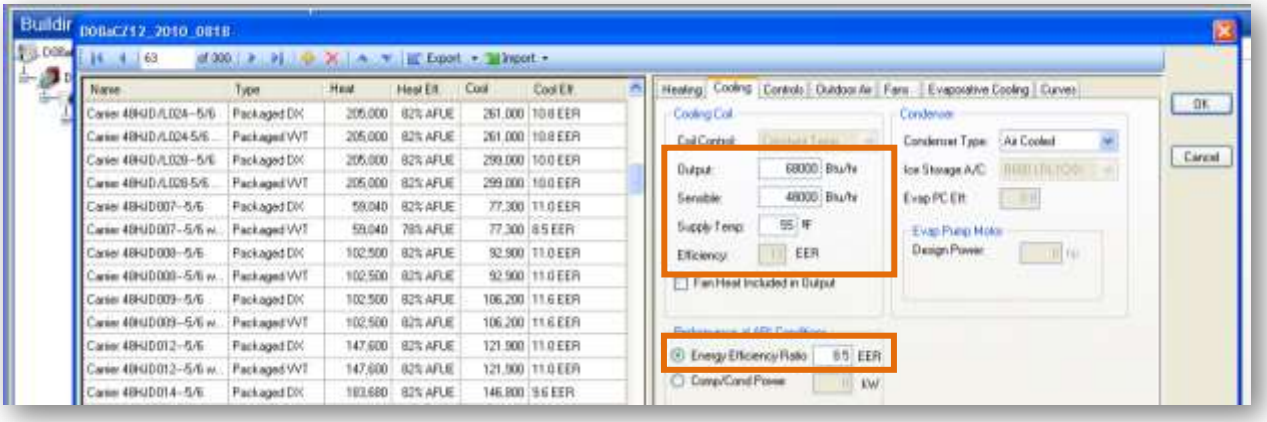
   c. Adjust the ***System Type***, ***Heating Type***, ***Furnace Type***, ***Total Output***, and ***Efficiency*** inputs to accurately reflect the existing equipment.



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.



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.

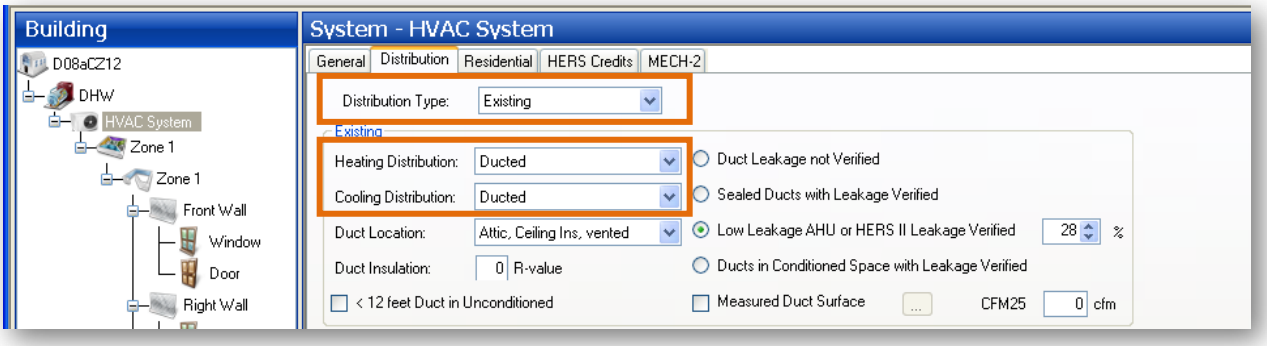
See the **Two-model simulations** section of the handbook for instructions on how to model multiple post-upgrade HVAC systems with varying specifications.

NOTE: If the existing home has a hydronic system and you are upgrading to a non-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. Distribution tab

1. Set Distribution Type to Existing.

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



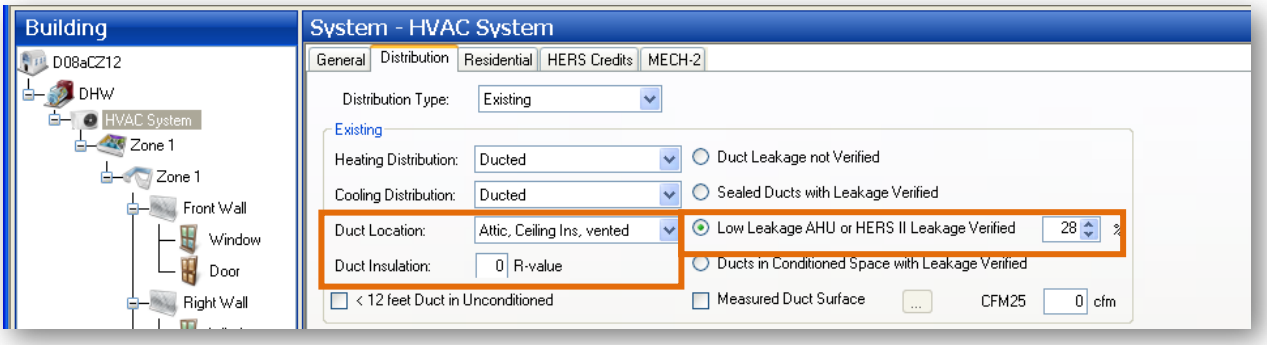
Select the correct ***Duct Location*** from the drop-down menu. The model assumes all duct runs in the house are in this location.

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



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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.

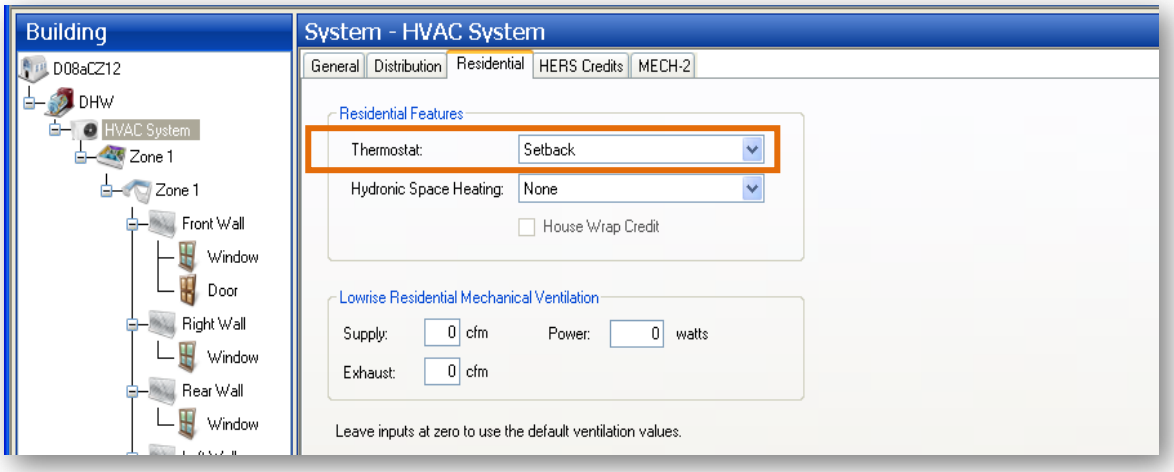
The fraction on the vintage table refers to the fraction of supply and return flow that stays within the system. If the table indicates .86, for example, then .14 of each run is lost due to If the supply and report runs lose 14% each, the total loss is 28% of total flow.

c. Residential tab

In the ***Residential Features*** section, confirm that the ***Thermostat*** is set to ***Setback*** on the drop-down 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.

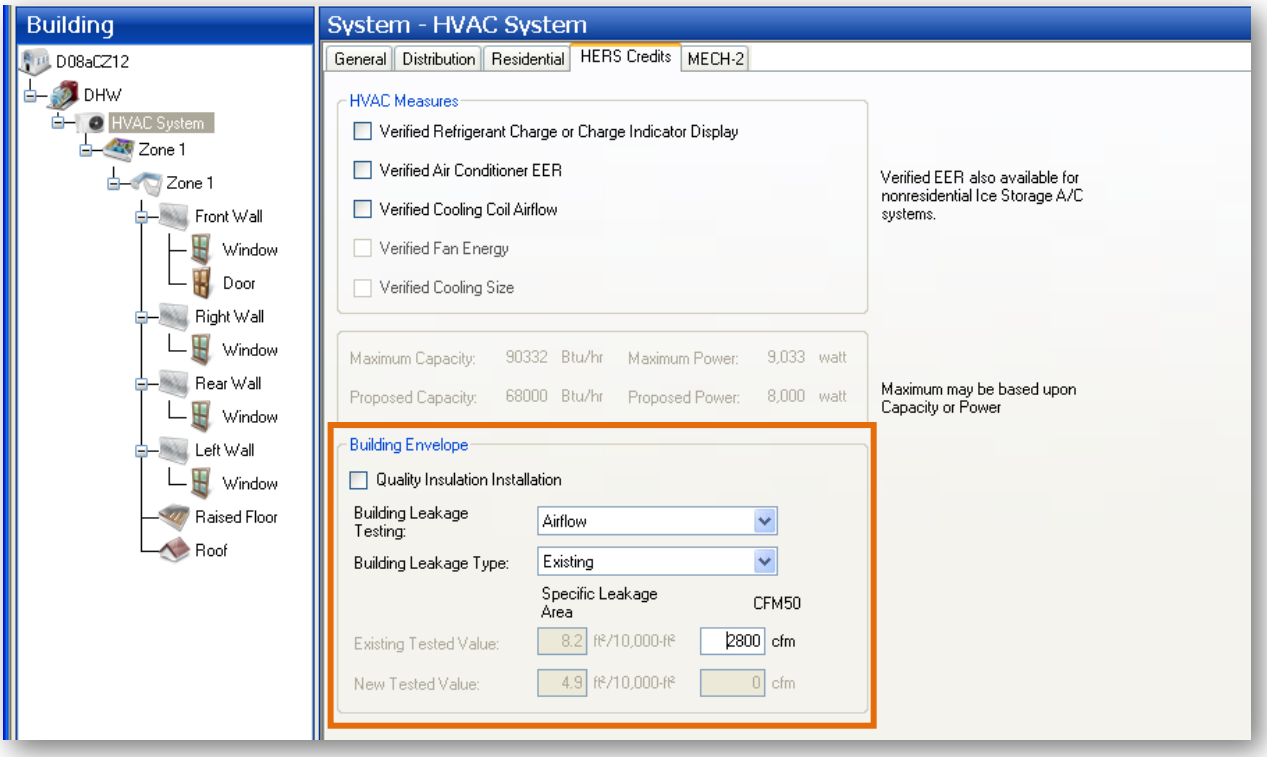


d. HERS Credits tab

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***.

Enter the blower door results (CFM50) in the ***cfm*** field.



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.

$$SLA = 3.819 \times (CFM50/CFA)$$

Where:

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

CFA = conditioned floor area (ft^2)

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

1. 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.
3. 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 ft^2, zone 2 = 600 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 ft^2/1000 ft^2). 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.

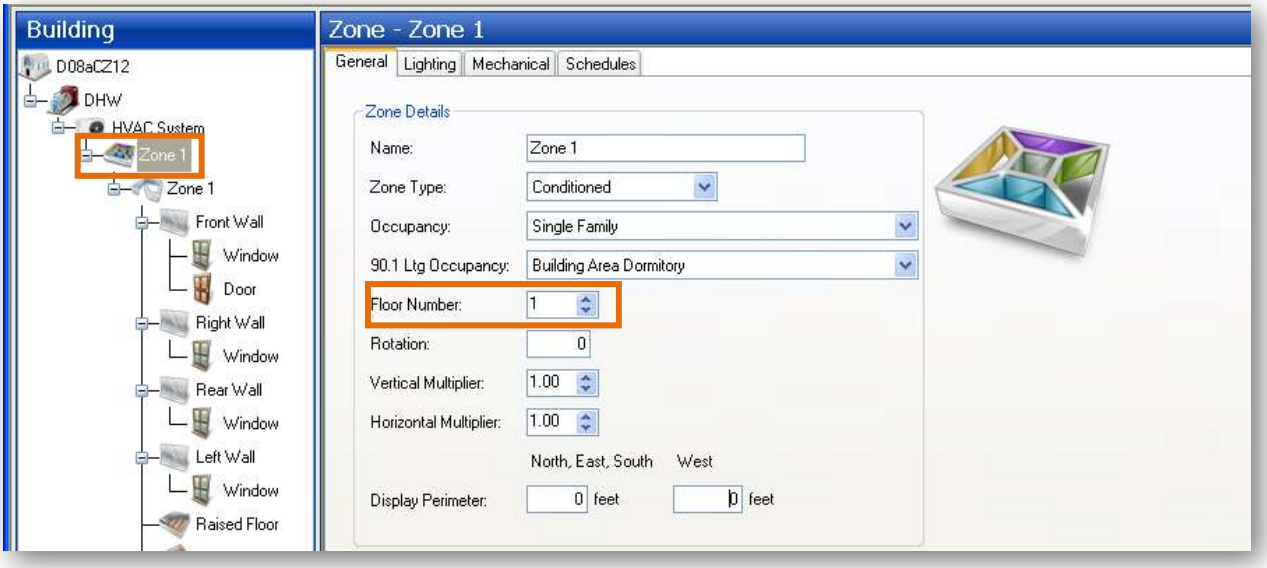
9. Zone level: Multiple rooms icon

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.



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.

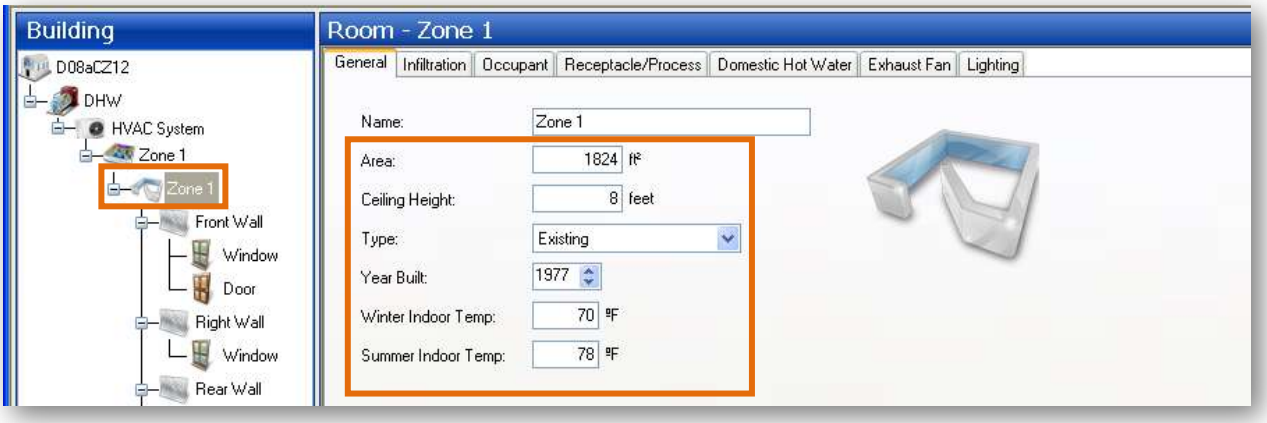
   Set ***Type*** to ***Existing***.

   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:

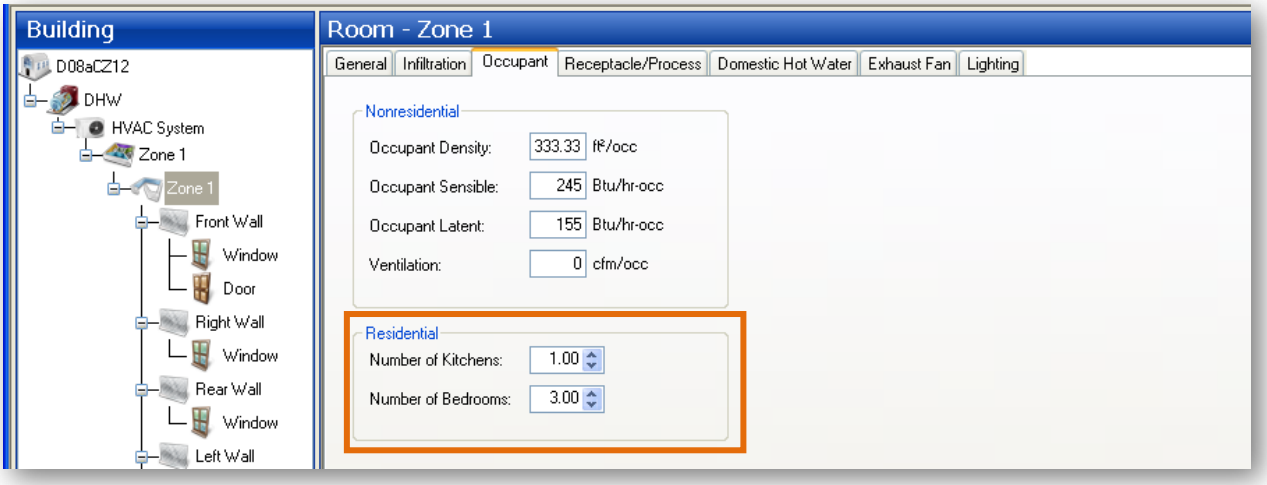
a. ***Winter Indoor Temp*** set to 70 degrees

b. ***Summer Indoor Temp*** set to 78 degrees



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.



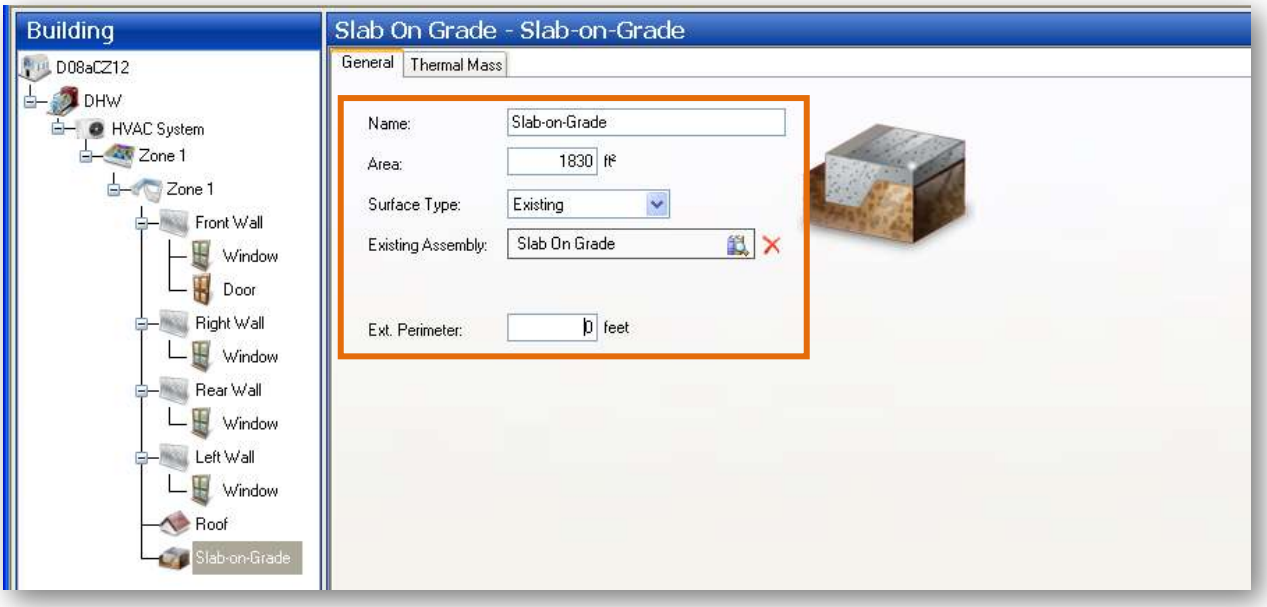
NOTE: These room totals must be entered correctly. EnergyPro incorporates these room totals into the energy base load calculation.

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

a. Slab-on-Grade

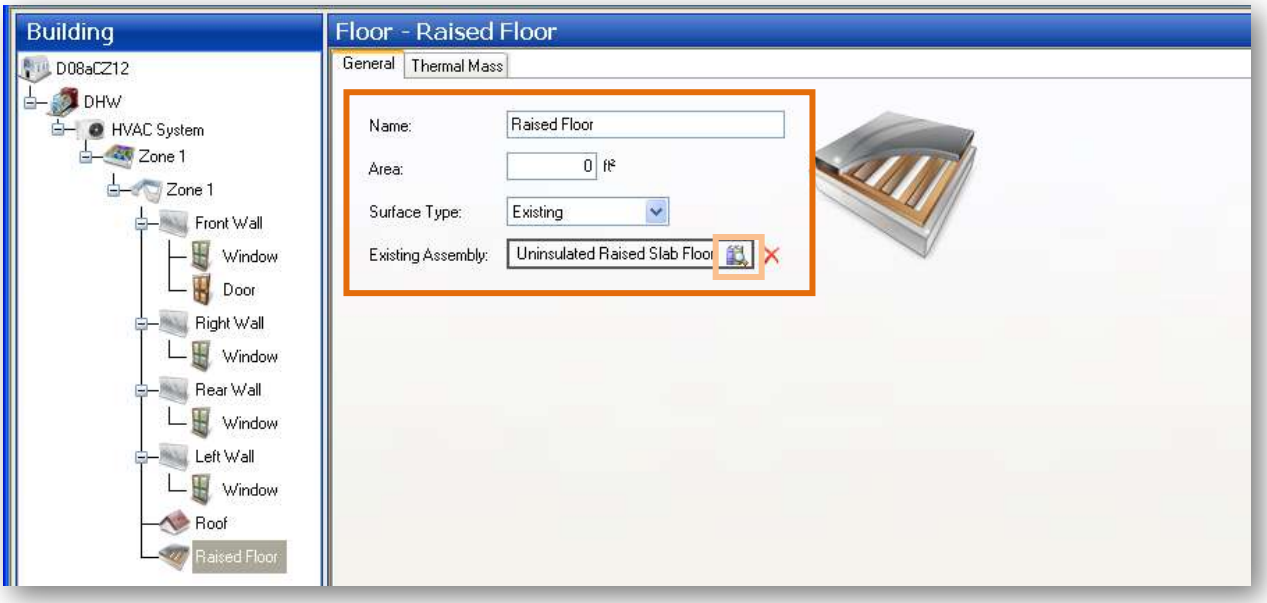
1. If the home has a slab foundation, right-click the room level icon, place the mouse over ***Add***, and select ***Slab-on-Grade*** from the list of assemblies. Click the slab-on-grade icon.

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



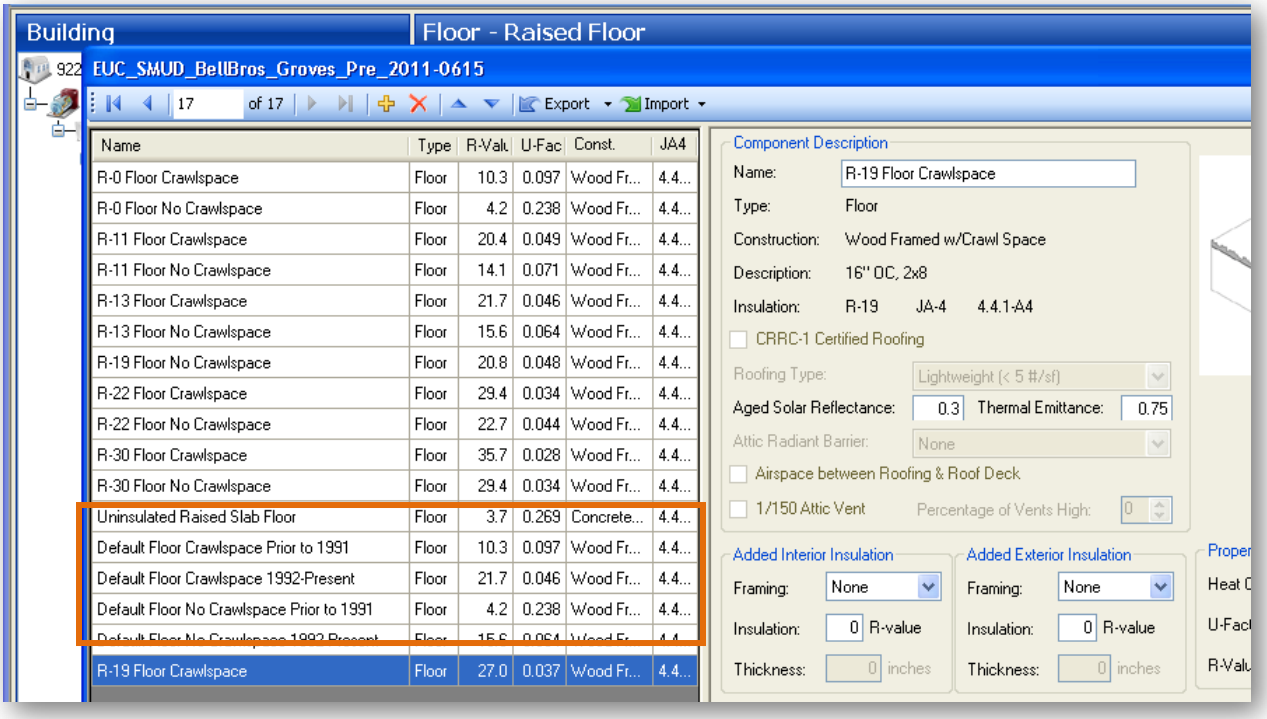
b. Raised Floor

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.



4. Click the magnifying glass icon to open the floor assembly library.

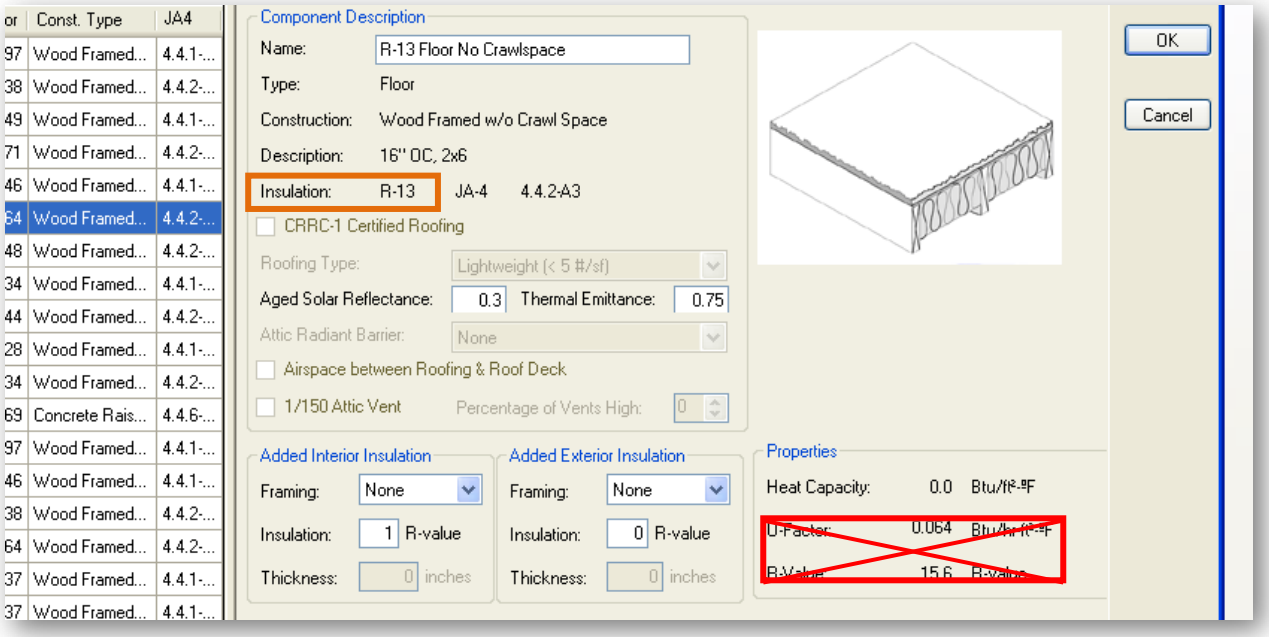
    a. Select the default floor assembly from the library based on the age of the existing home. Select the correct floor designation (***Default Floor Crawlspace*** or ***Default Floor No Crawlspace***).



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:

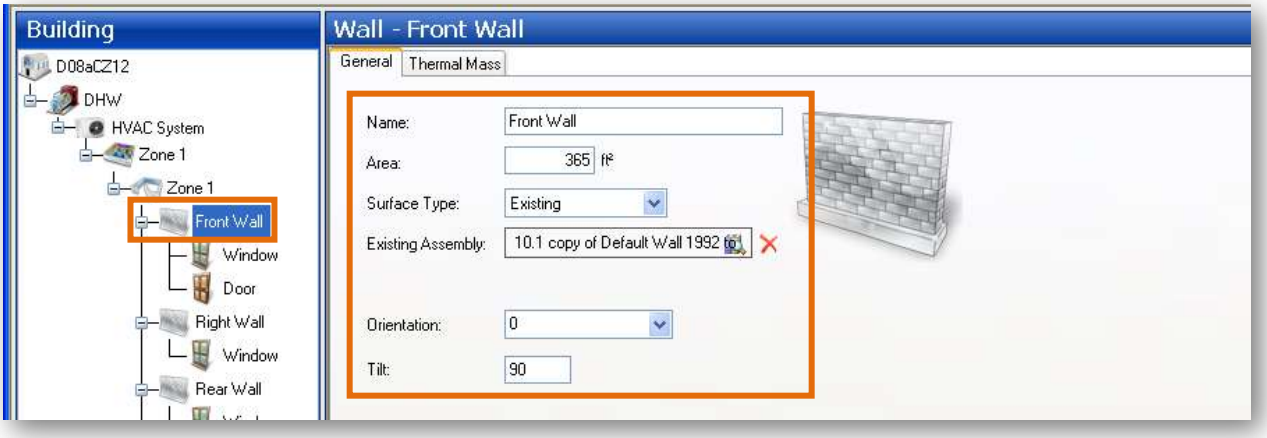
- Floor over garage: R-0 Floor With Crawlspace
- Floor over carport: R-0 Floor No Crawlspace
- Cantilevered room floor: R-0 Floor with Crawlspace



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.



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.

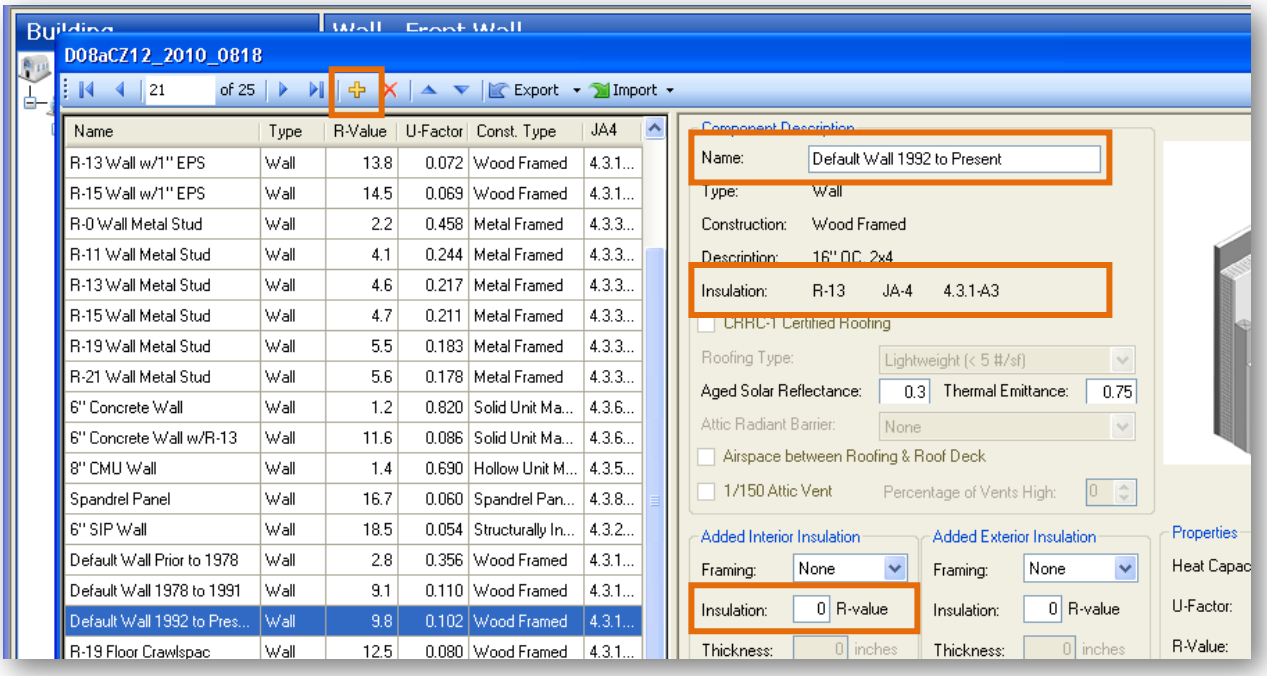
   b. If the wall insulation has water damage, compaction of loose fill, or other deterioration, the BPI Analyst may choose to de-rate the existing condition in the home. To enter a de-rated assembly, select the assembly from the library that best matches the existing home conditions.

      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.



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 ***0*** 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.

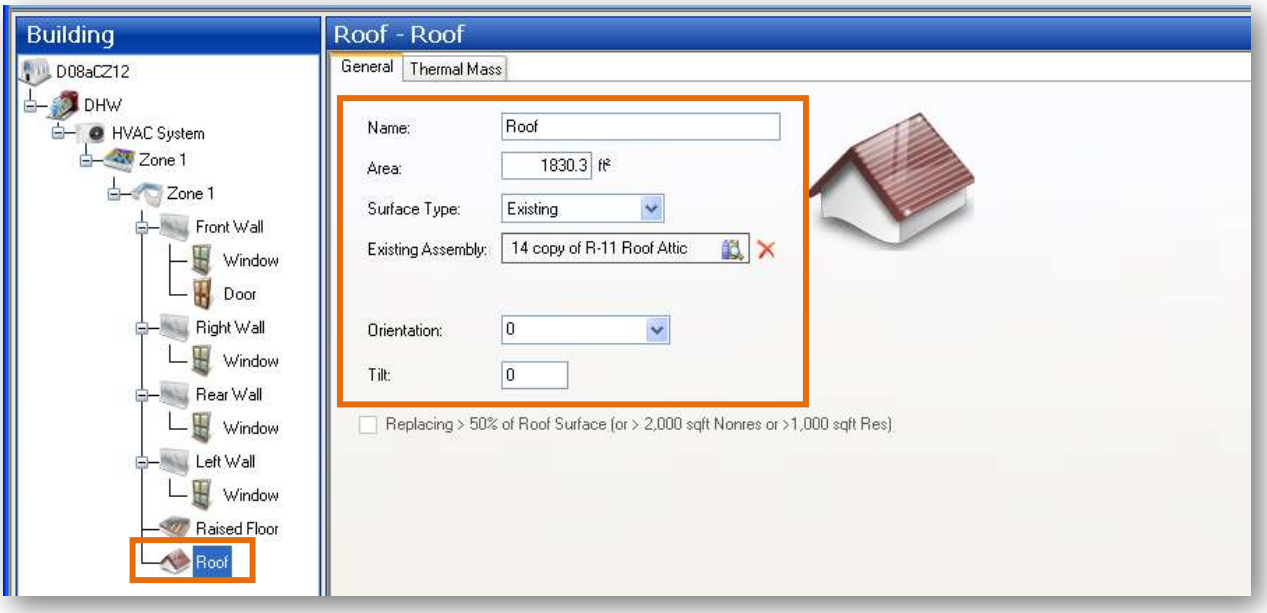
      NOTE: If a home contains two different roof assembly types (e.g., an attic and a cathedral roof in the same home), both roof types must be added to the model. If only one of the two roof types is being upgraded, see the **Partial upgrades: New vs. existing** section for instructions on how to model this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



2. Click the magnifying glass icon to open the roof assembly library.

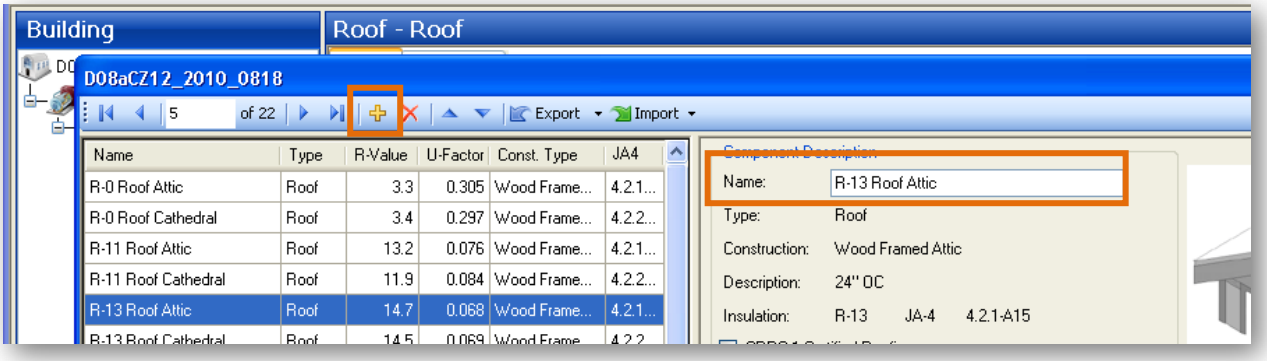
   a. Select the roof assembly from the library that best matches the existing home conditions. It may be best to select a default assembly based on the home age. If you are using default assemblies, skip instructions b. through d. below.

   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.



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.

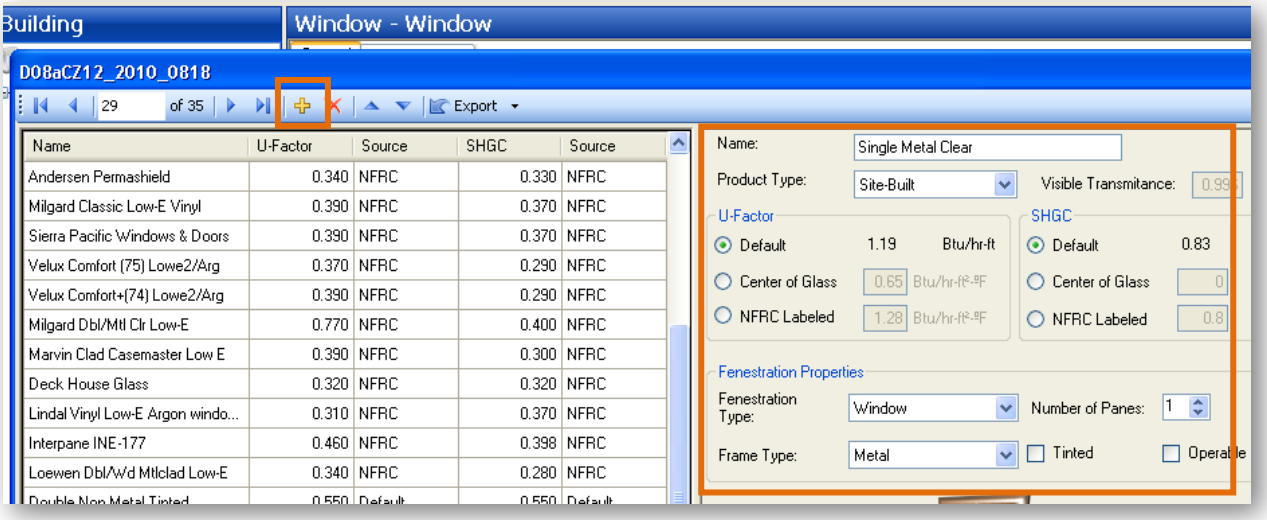
12. Room features level: Windows, doors, skylights

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***.

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***.



> ***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

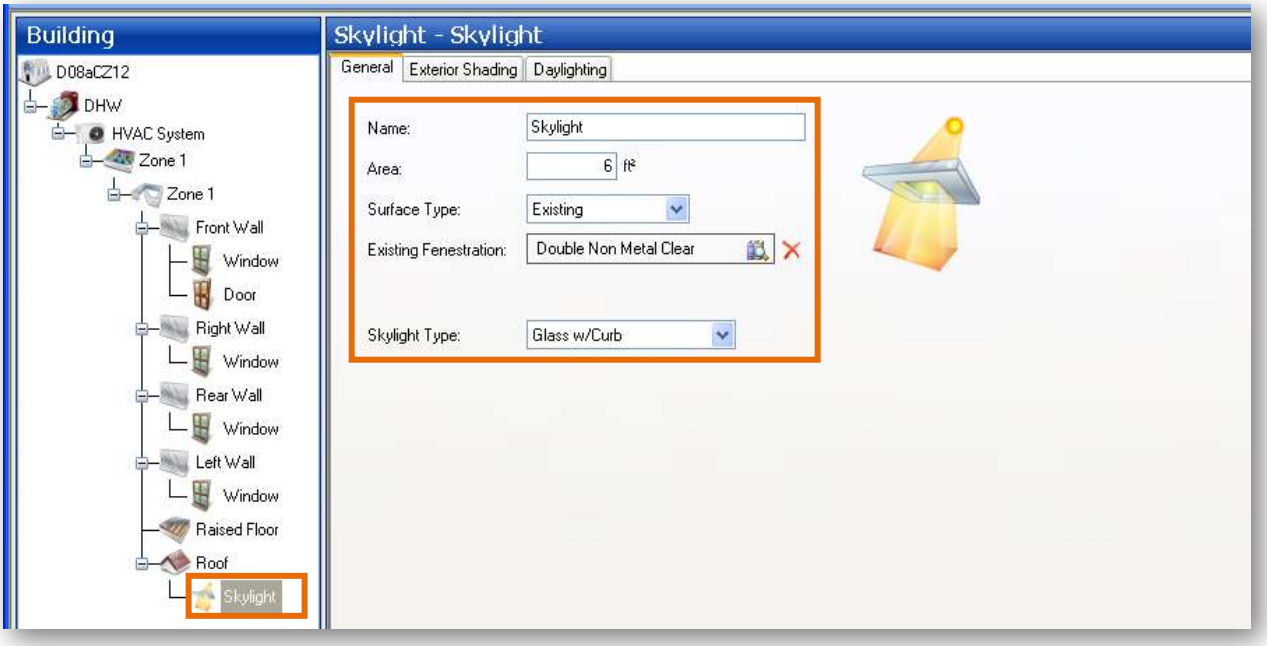
1. Right-click the appropriate exterior wall icon and click ***Add Door***. Click the door icon.
   a. Enter the ***Area*** of the door.
   b. Set ***Surface Type*** to ***Existing***.

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.

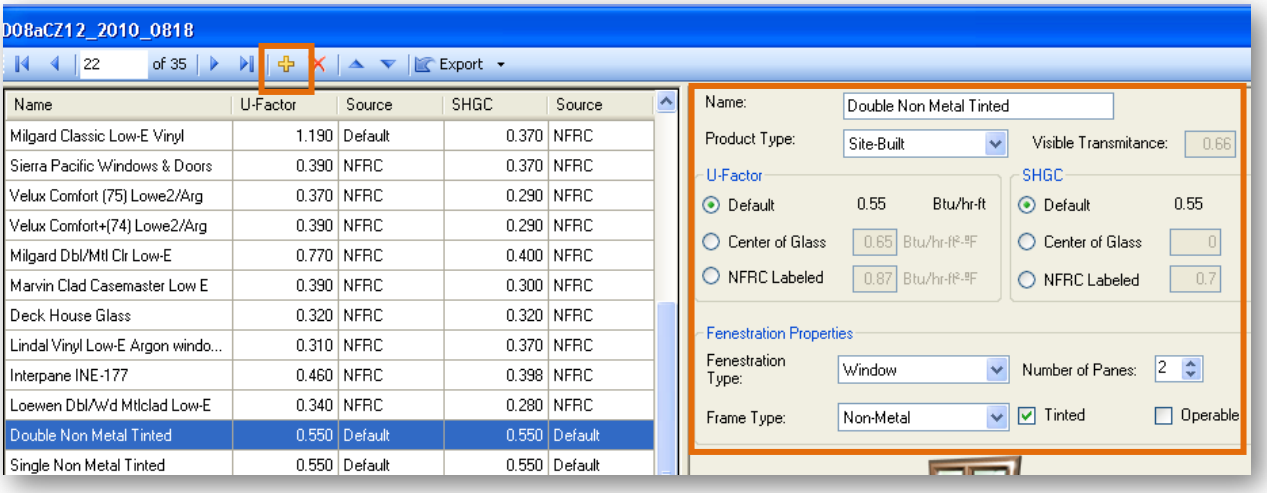
c. Adjust the assembly to match the information provided and to accurately reflect the existing assembly.

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.



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***.



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

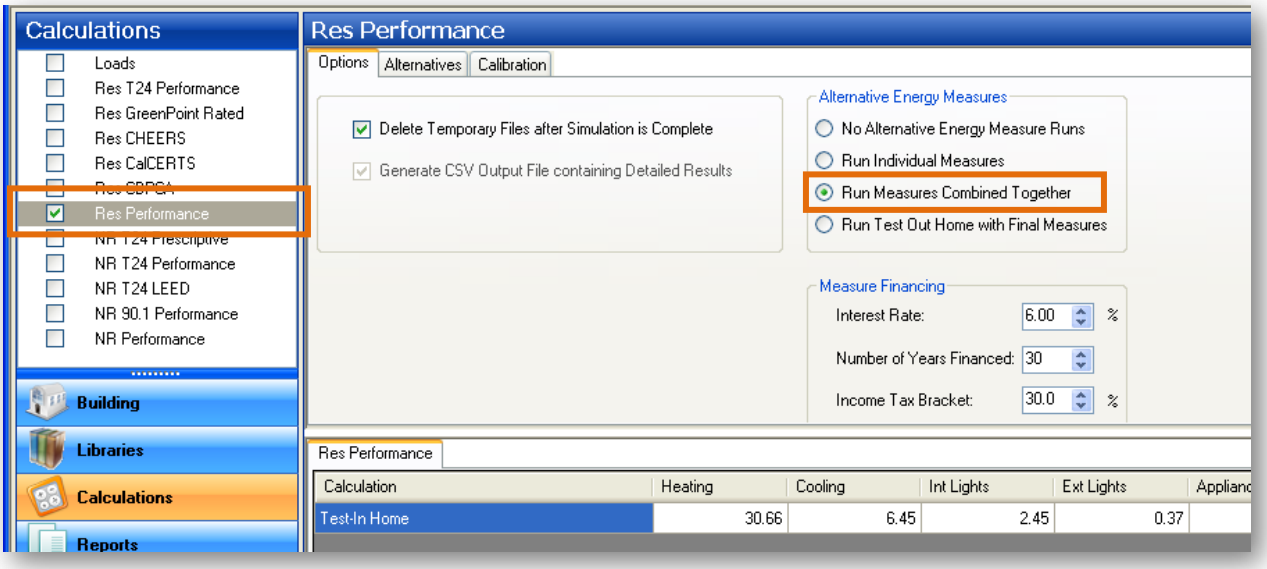
Proposed and final upgrade measures should be indicated in the ***Alternatives*** tab of the ***Ygrene*** calculations section of EnergyPro.

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***.

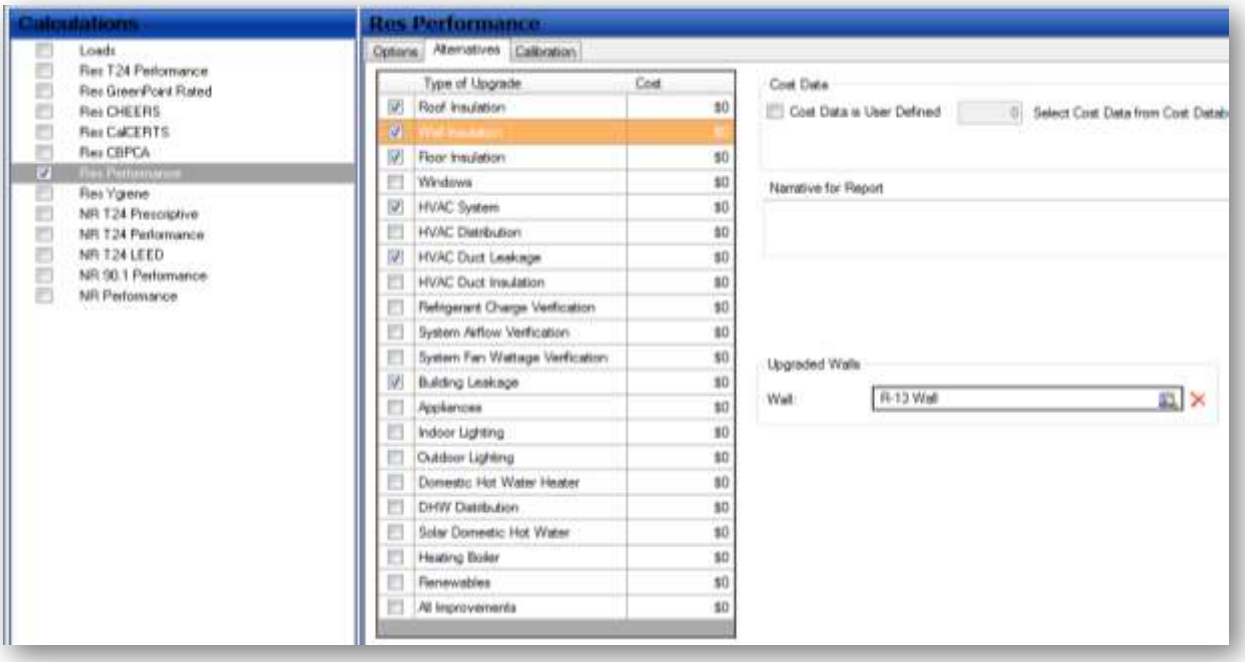


NOTE: The ***Measure Financing*** section is not needed for the Clean Energy Sacramento program.

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.



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 post-upgrade 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***.

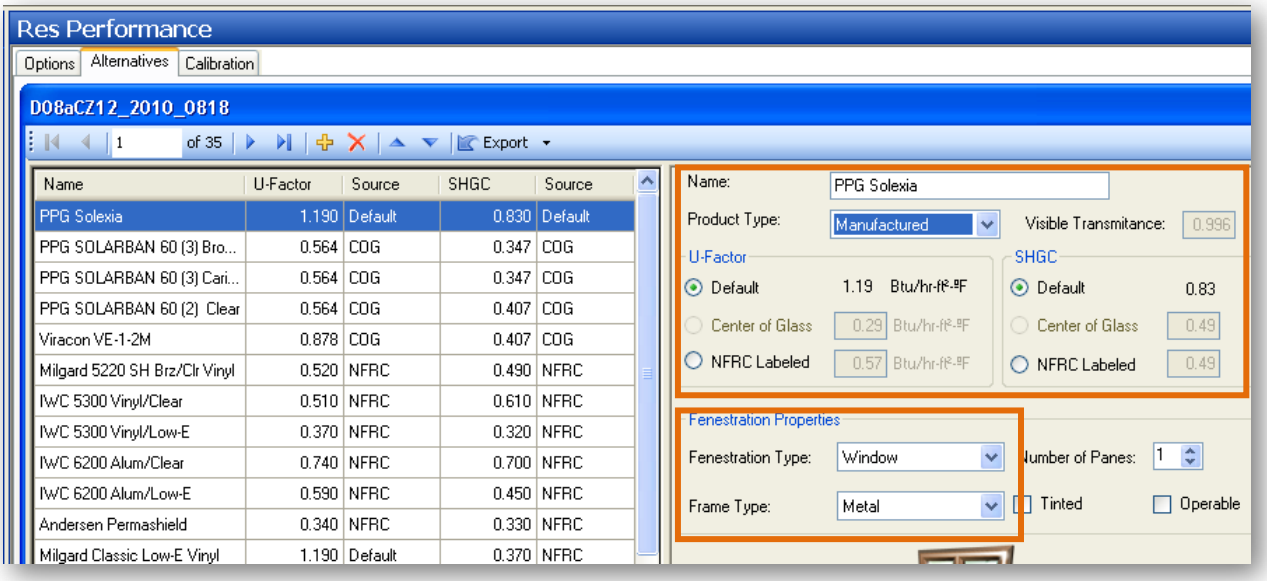
      ii. If specifications can be pulled from product or literature, enter the specific ***U-Factor*** and ***SHGC***.

      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.



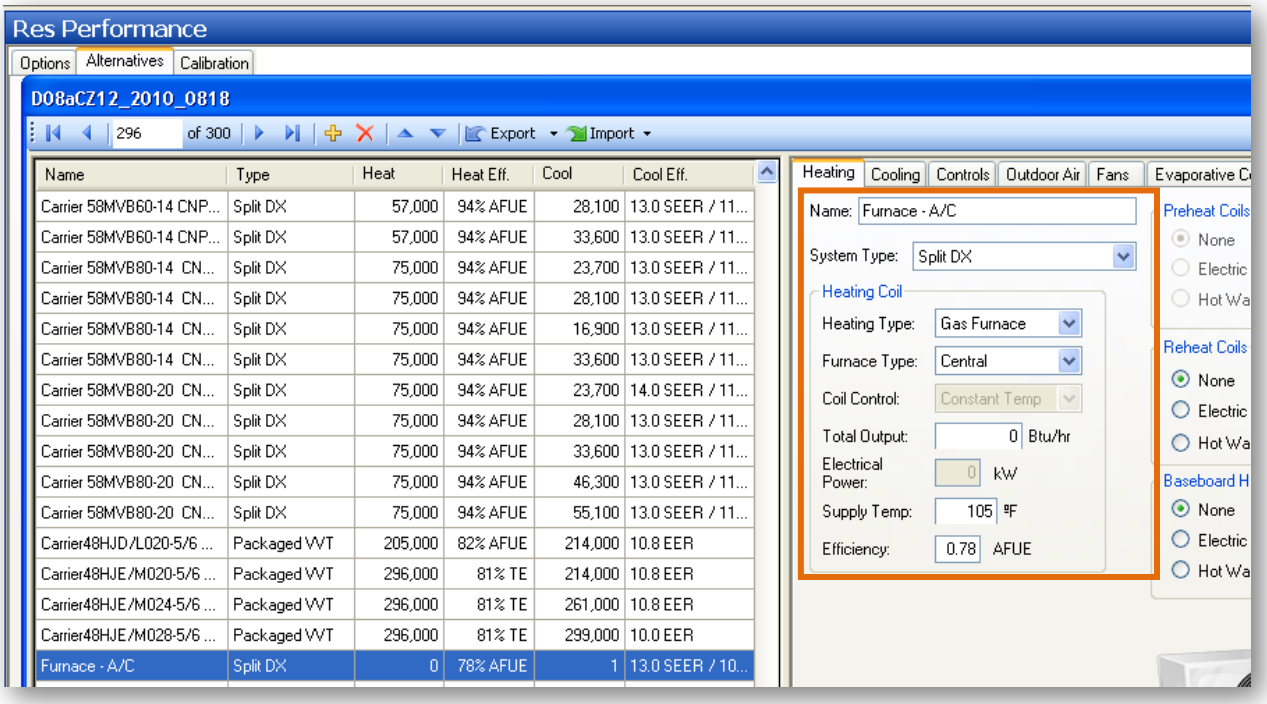
f. HVAC System

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***).

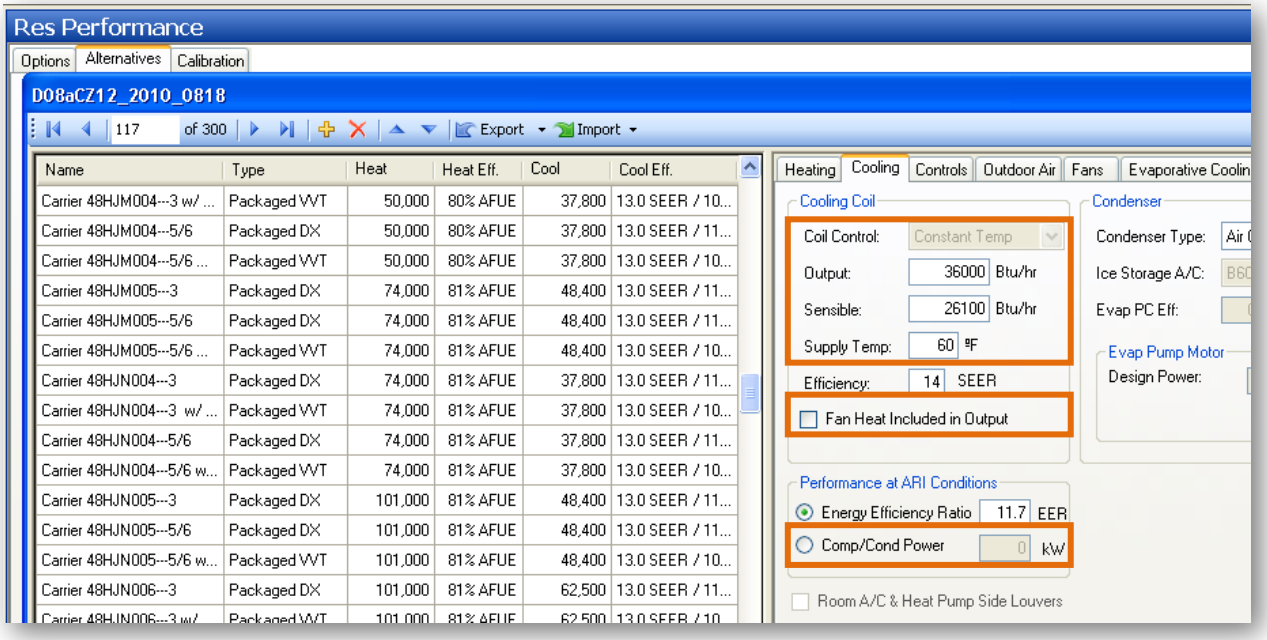
   c. Adjust the ***System Type***, ***Heating Type***, ***Furnace Type***, ***Total Output***, and ***Efficiency*** inputs to match the information provided to accurately reflect the post-upgrade equipment.



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.



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.

l. 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.

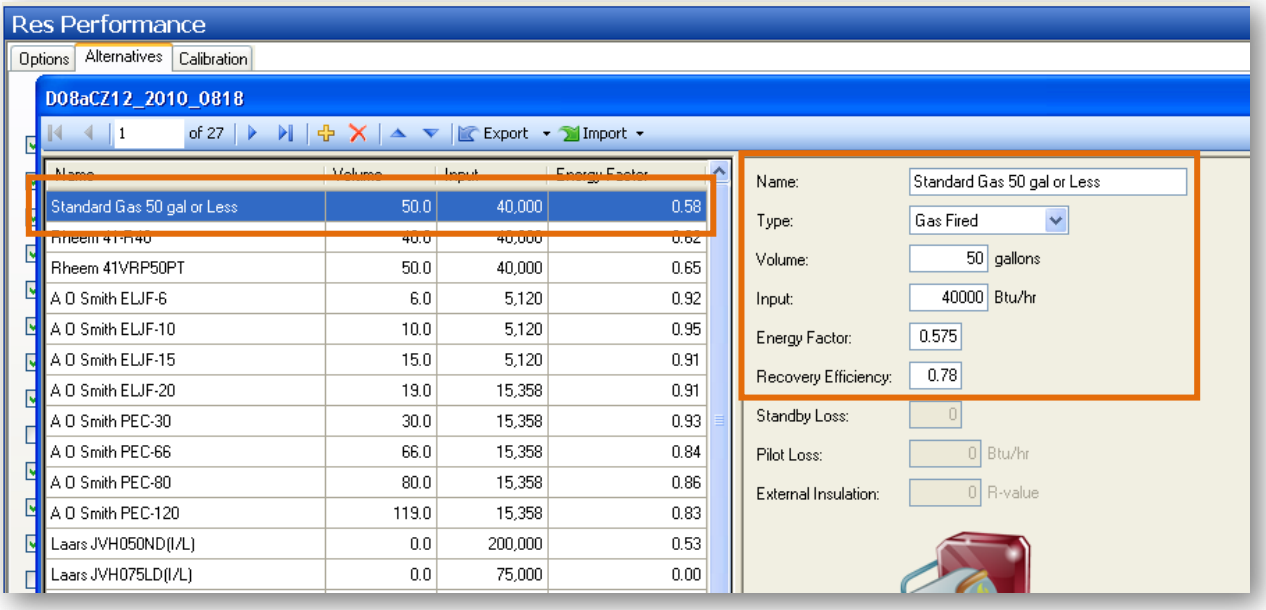
   a. Select the piece of equipment from the library that best matches the post-upgrade home equipment. It may be best to select a default DHW as a starting condition (listed as ***Standard Gas 50 gal or less***, ***Default Gas Prior to 1999***, ***Default Tankless***, etc.) and then use the following steps 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.

   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

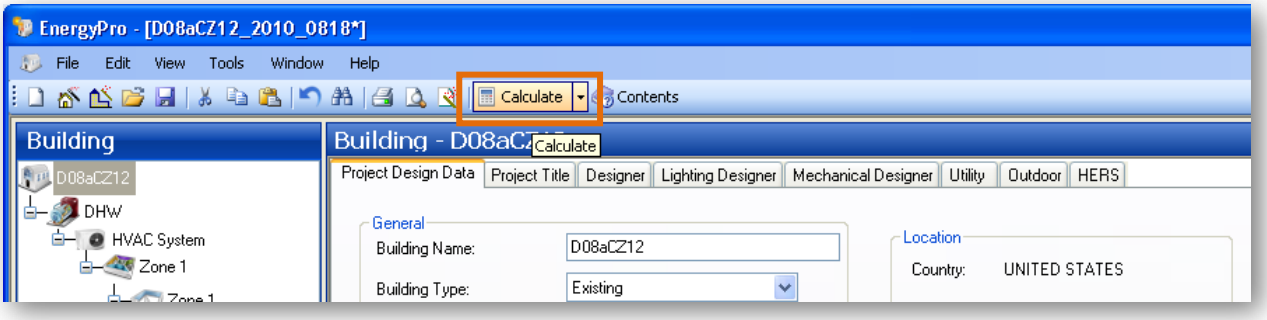
Program policy: Pre-upgrade home conditions locked into place when job is authorized to proceed

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.

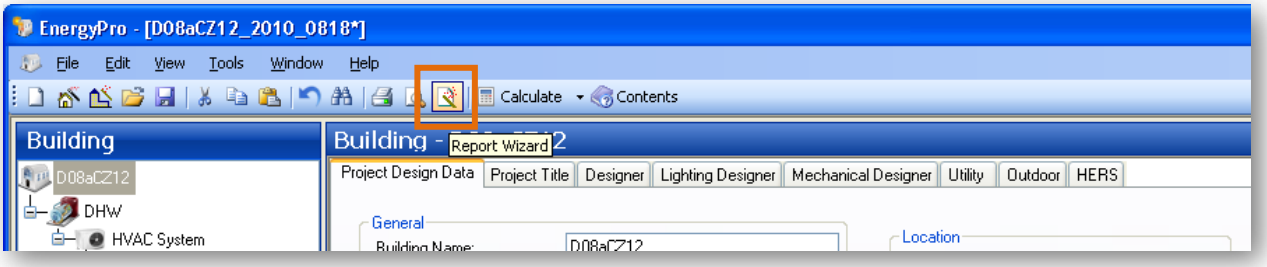


EnergyPro tip: Check for updates

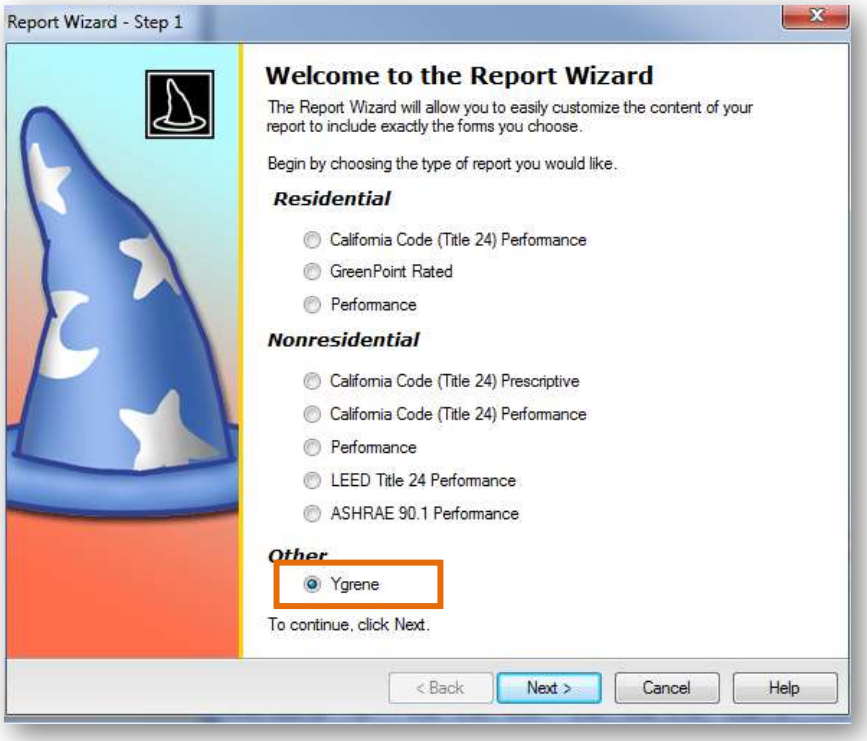
Please check for software updates before performing calculations in EnergyPro. The final energy savings value will be based on model calculations performed by the most recent version of EnergyPro available on the day the incentive is approved. To check for EnergyPro updates, go to ***Help*** in the menu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

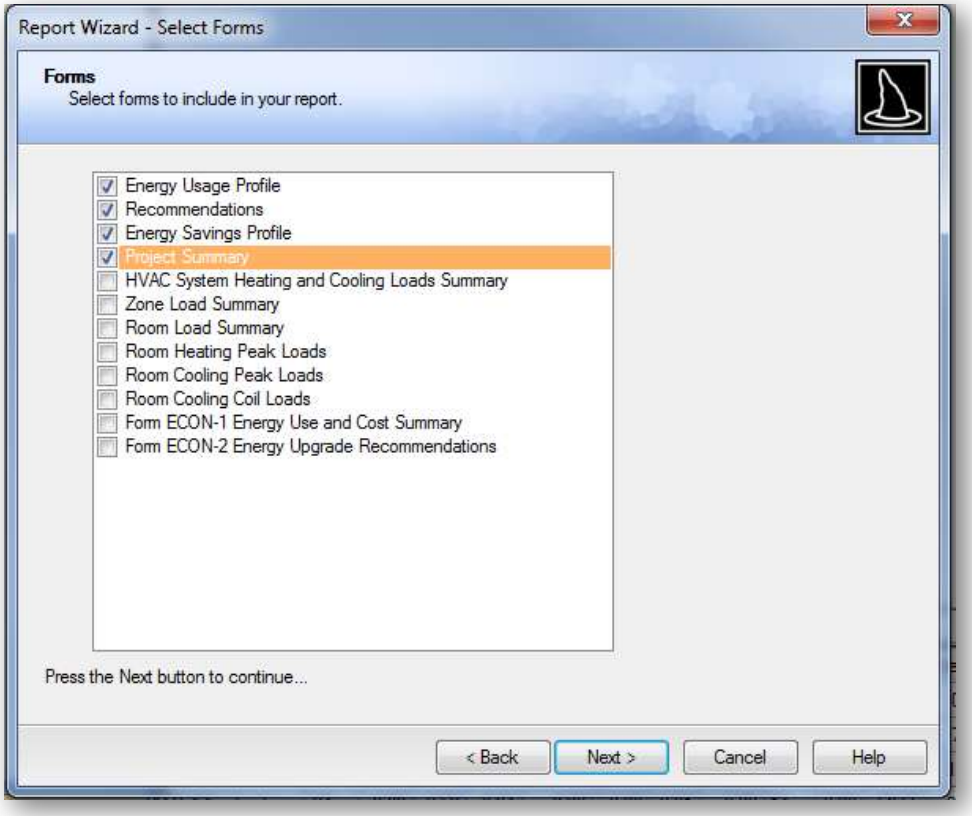
   The ***Report Wizard*** icon is located below the top menu, between the ***Print Preview*** and ***Calculate*** buttons.



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

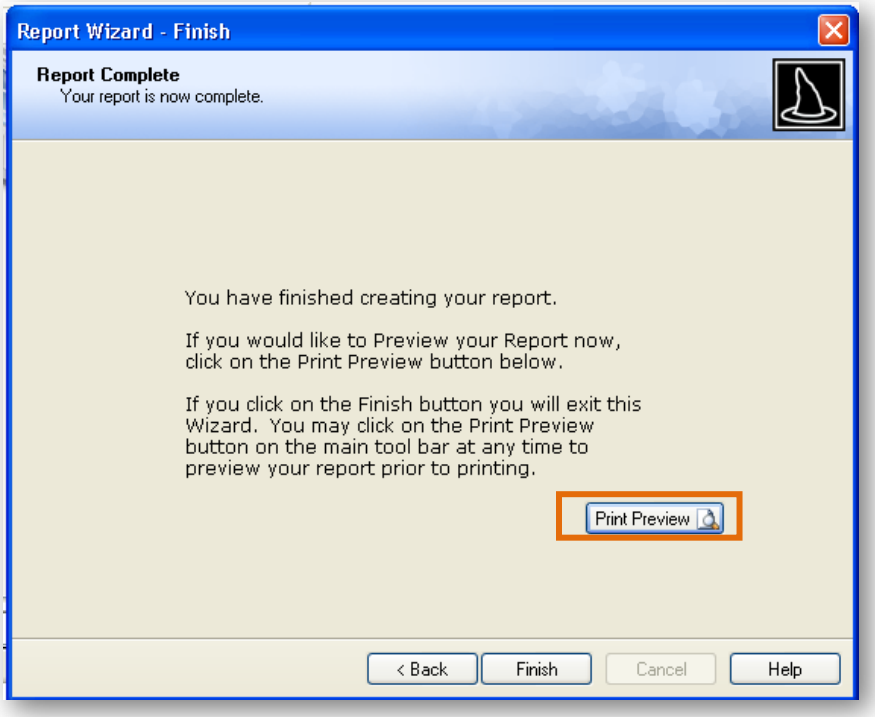


Select ***Energy Usage Profile, Recommendations, Energy Savings Profile,*** **and** ***Project Summary*** for the type of form. Click ***Next***.



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.

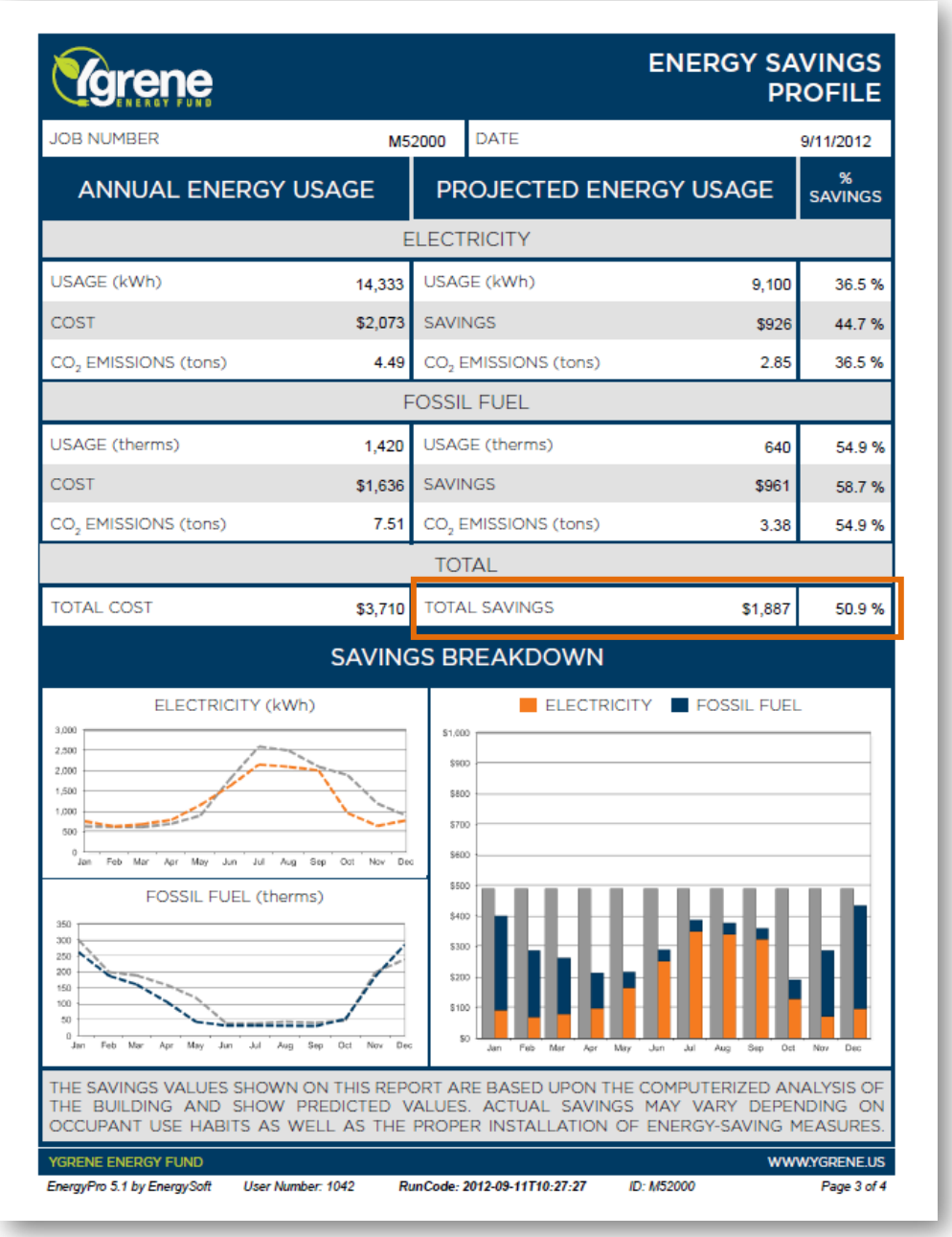
Click ***Print Preview*** to create a PDF of the Ygrene energy report.



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

1. 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.



ENERGY SAVINGS PROFILE

JOB NUMBER	M52000	DATE	9/11/2012	
ANNUAL ENERGY USAGE		**PROJECTED ENERGY USAGE**		**% SAVINGS**
ELECTRICITY				
USAGE (kWh)	14,333	USAGE (kWh)	9,100	36.5 %
COST	$2,073	SAVINGS	$926	44.7 %
CO_2 EMISSIONS (tons)	4.49	CO_2 EMISSIONS (tons)	2.85	36.5 %
FOSSIL FUEL				
USAGE (therms)	1,420	USAGE (therms)	640	54.9 %
COST	$1,636	SAVINGS	$961	58.7 %
CO_2 EMISSIONS (tons)	7.51	CO_2 EMISSIONS (tons)	3.38	54.9 %
TOTAL				
TOTAL COST	$3,710	TOTAL SAVINGS	$1,887	50.9 %

SAVINGS BREAKDOWN

THE SAVINGS VALUES SHOWN ON THIS REPORT ARE BASED UPON THE COMPUTERIZED ANALYSIS OF THE BUILDING AND SHOW PREDICTED VALUES. ACTUAL SAVINGS MAY VARY DEPENDING ON OCCUPANT USE HABITS AS WELL AS THE PROPER INSTALLATION OF ENERGY-SAVING MEASURES.

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EnergyPro 5.1 by EnergySoft User Number: 1042 RunCode: 2012-09-11T10:27:27 ID: M52000 Page 3 of 4

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.

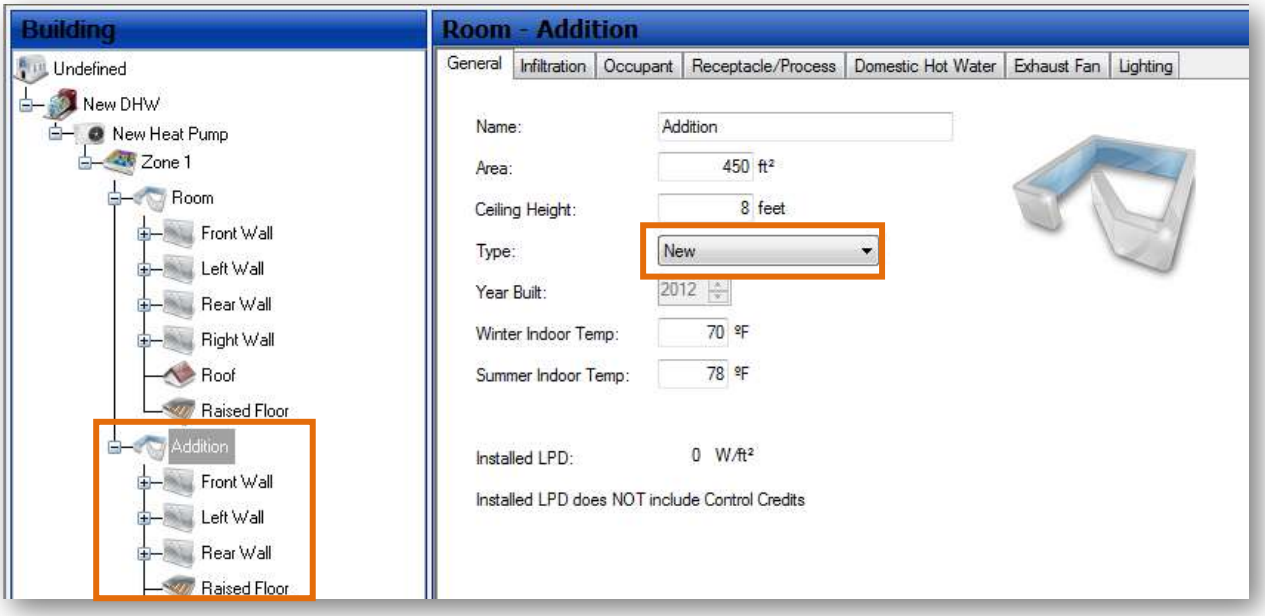
e. Home additions

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 pre-upgrade conditions, without the additional square footage.

   Improved model: The improved model should represent the home as it exists during post-upgrade 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.



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

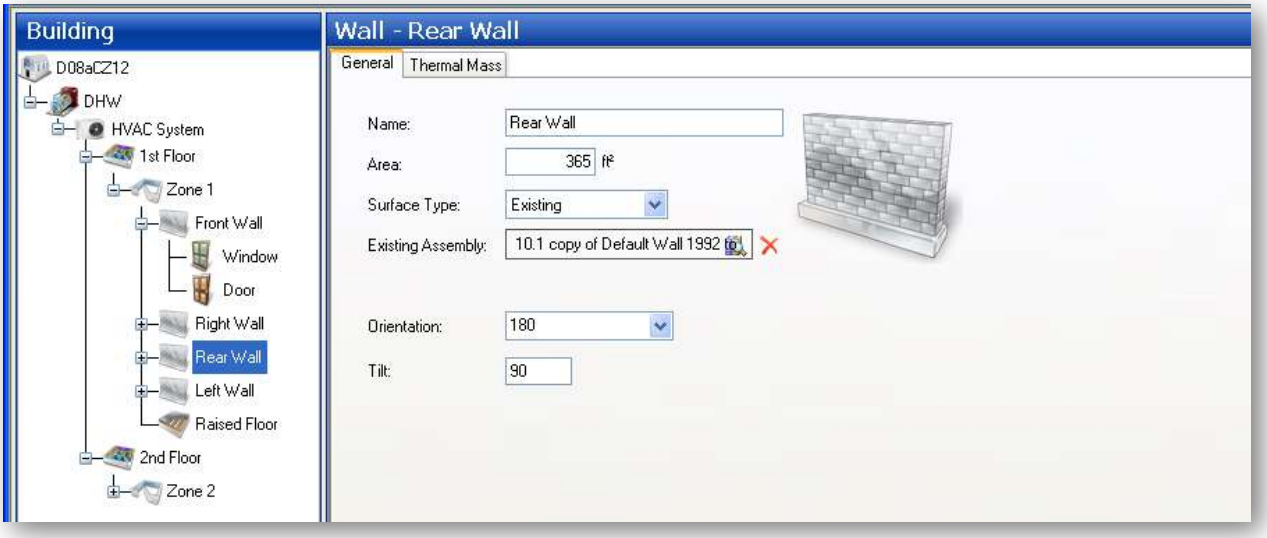
All two-story homes need to be modeled as two-story homes in EnergyPro, rather than as a single-story building with a 16-foot ceiling height. Individual floors need to be broken out within the model and assigned the appropriate ceiling height, total area, walls, and roof and/or foundation, if applicable. 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.



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

1. 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 ft^2, zone 2 = 600 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 ft^2/1000 ft^2). 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.

1. 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.*

l. 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

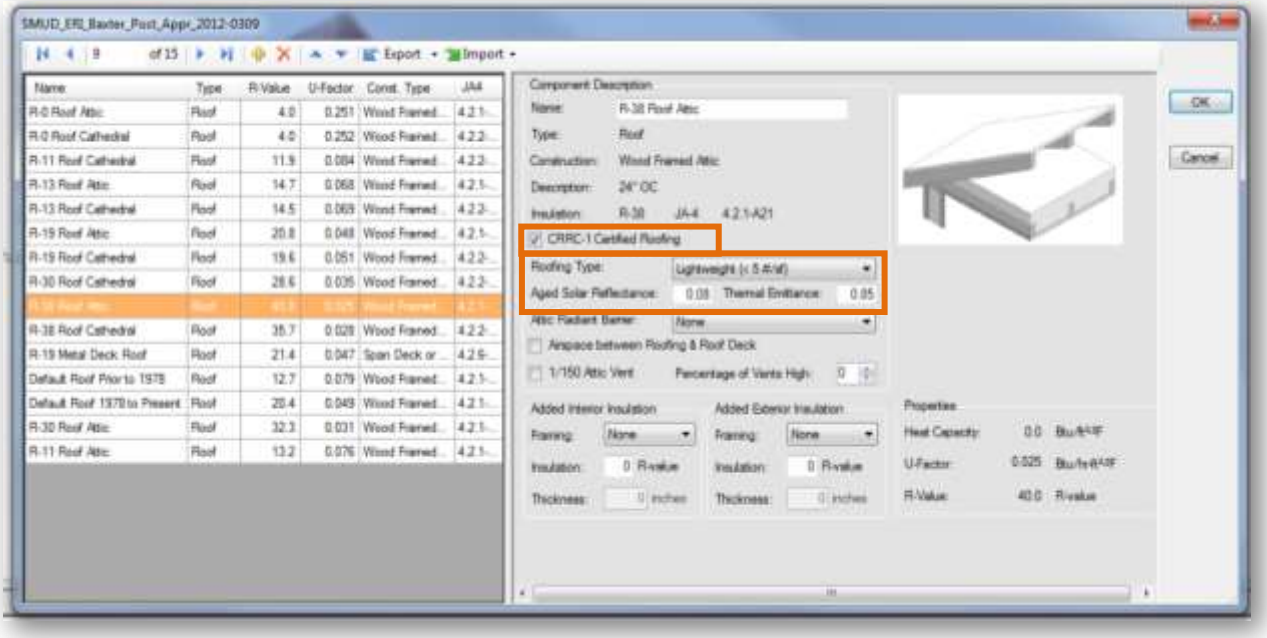
1. To model a cool roof, click the roof icon in the building tree, and click the magnifying glass to open the roof assembly library.

   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.



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.

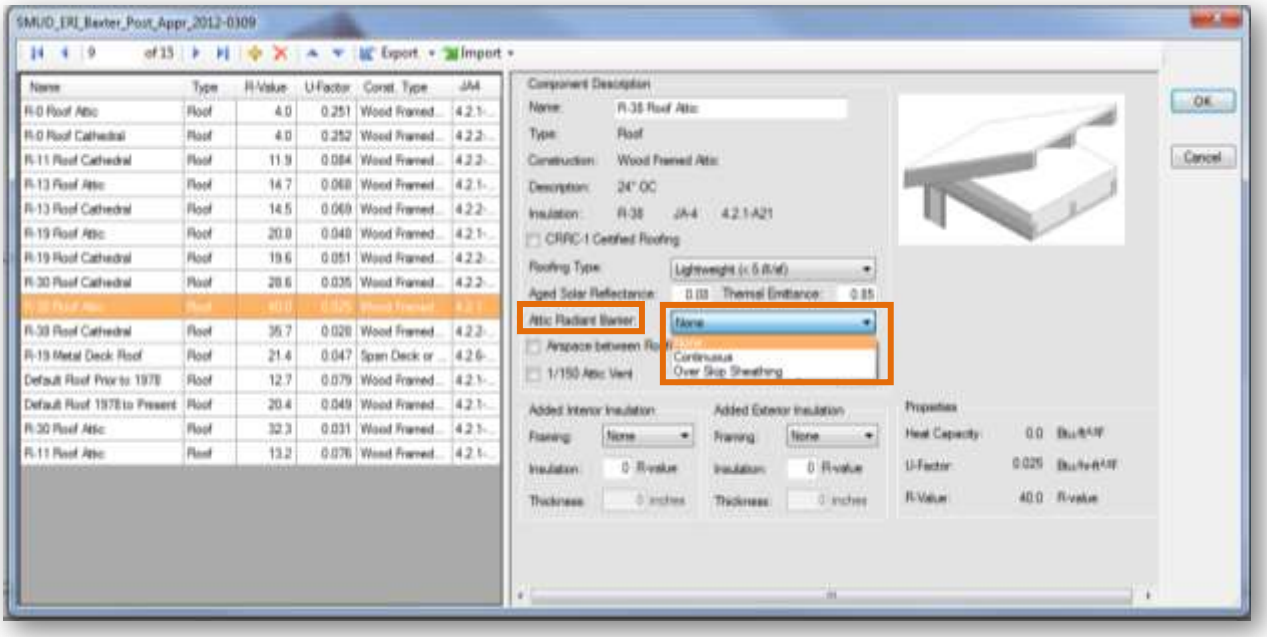
NOTE: Credit for adding a cool roof is available only if there is no radiant barrier installed. In the Ygrene module, the cooling benefit of a cool roof is assumed to be equal to that of a radiant barrier. Also, EnergyPro assumes no heating impact within the cool roof calculations despite potential increased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



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

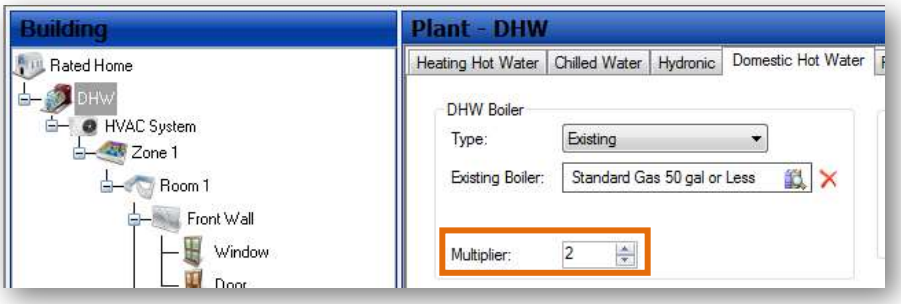
1. Same fuel type, same specifications

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.



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.