Weatherization Assistant 8.9

NEAT / MHEA Manual

CHP Energy Research & Training

By: Scott Katznelson

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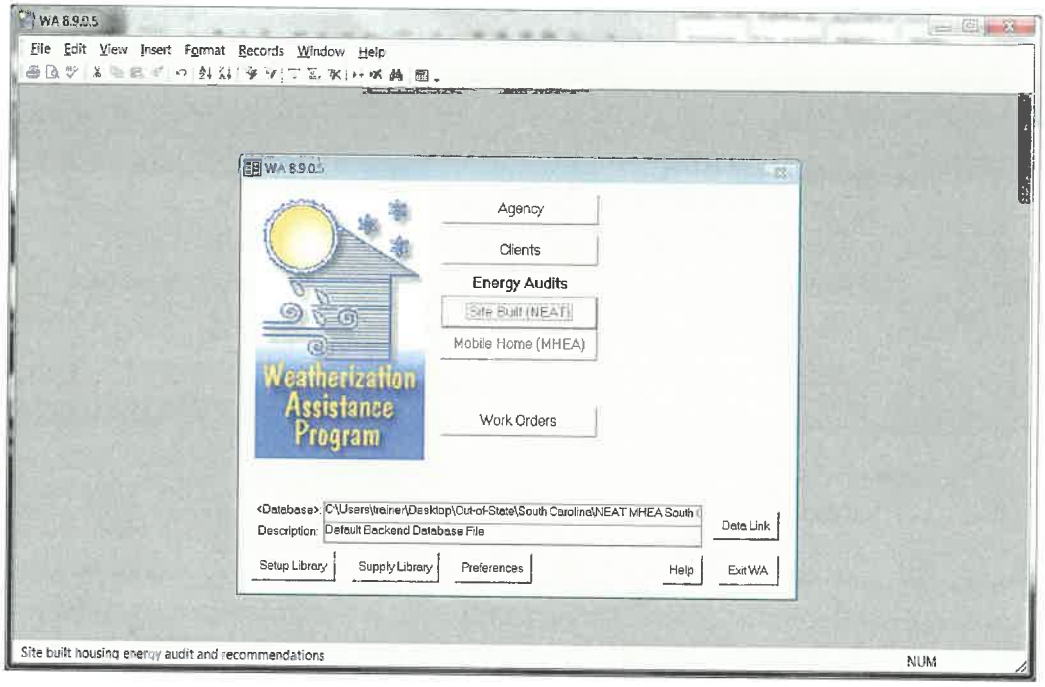
OPENING THE WEATHERIZATION ASSISTANT



AGENCY Tab – To create or modify your agency data

CLIENT Tab – To create or modify client data

SITE BUILT (NEAT) – To enter or view data for an audit of a site-built home

MOBILE HOME (MHEA) – To enter or view data for an audit of a manufactured home

SETUP LIBRARY – Source of Measure Costs, Fuel Costs, Replacement Equipment Efficiencies, etc..

SUPPLY LIBRARY – Source for prices of replacement Fridges and Water Heaters. More functionality is possible but rarely used.

DATA LINK – To input/export client files; Also, to change Database (Library)

PREFERENCES - To alter certain preferences including Range Check and Report Sections

Note: Close the program using the button **Exit WA**. If you do not, there is some chance that the work you have done will fail to be saved.

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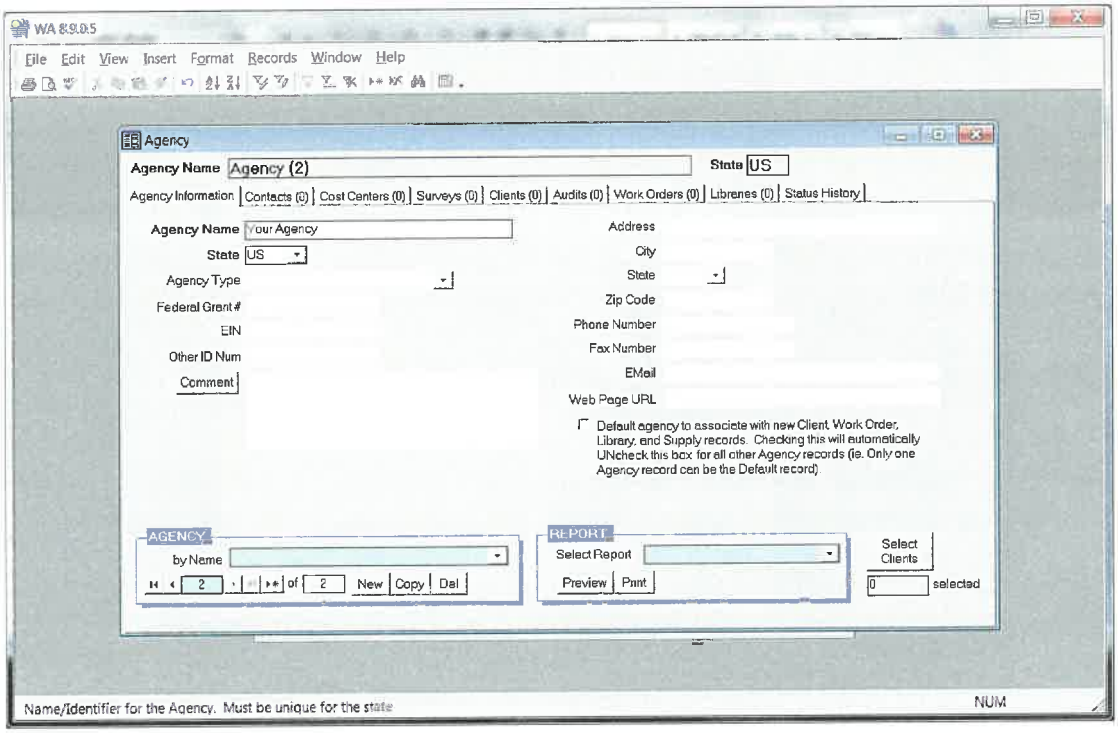
AGENCY



Inputs boxed with a black line are mandatory inputs.

If the box is not bordered with a black line, then the input is not mandatory.

In most cases, this page will only need to be input once, when you are first setting up NEAT MHEA for your agency.

Unless you are working for more than one single agency, only one record is needed. Look on the lower left corner of the page to determine how many agency records you have on your database.

(1) Input **Agency Name**. If your NEAT MHEA database was provided by us, you can simply replace the name of our agency with your agency's name.
(2) Input the **State** in which the agency exists.
(3) Optional: under the next tab (**CONTACTS**), the names of any auditor using this same copy of NEAT MHEA can be input, so that each user can "sign" the audits they input. (See Page 1 of NEAT or MHEA audit section)
(4) Close the page by clicking on the red X at the top right corner. You do not need to SAVE.

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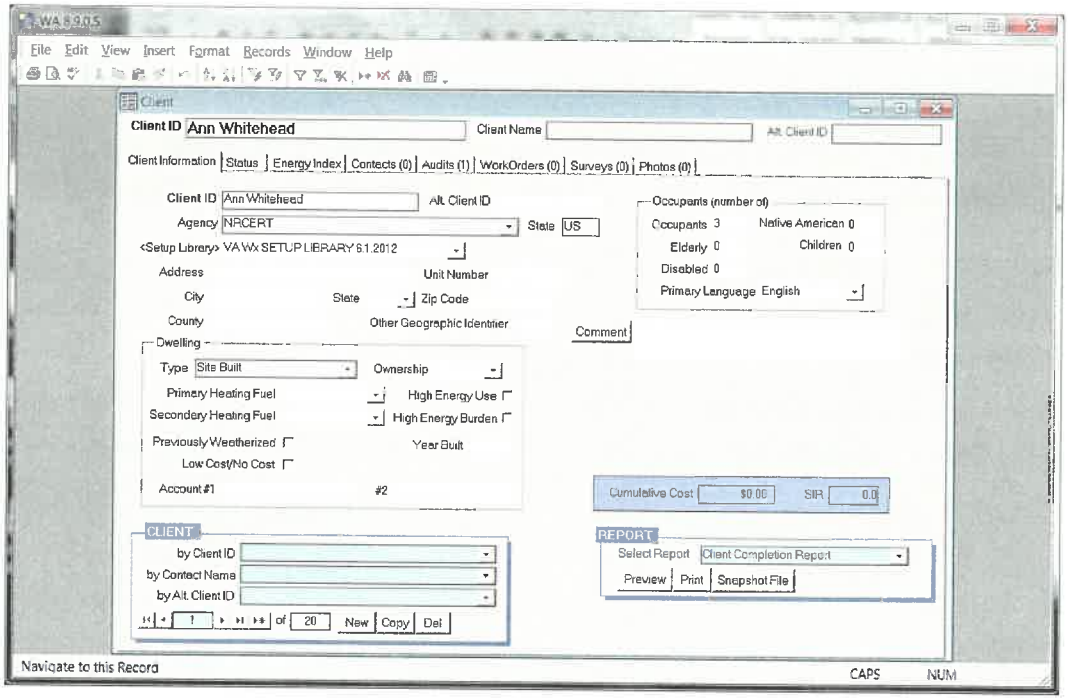
CLIENTS



(1) In all cases (except the first time this program is used), the **NEW** button (near the bottom left of the screen) MUST be pressed. Not creating a NEW record means that you will be overwriting the data of an existing client.

(2) **Client ID** will, by default, say Client (*) with a number instead of the asterisk. It is important to change this to the actual name of the client, or some other unique designation such as the job number.

(3) Ensure that the appropriate agency is listed in the **Agency** box. The Agency you defined as Default will show up here automatically.

> Note the downwards arrow in the right edge of this box. That designates this box as being a dropdown and only records already in this dropdown list can be input here.

(4) Choose a **Setup Library** to associate with this client. As with Agency, this box is a dropdown and will populate automatically unless you have more than one Setup Library.

(5) Input the client address, City, State, if desired.

(6) In the upper right box on the screen, designate the number of **Occupants** in the home.

(7) Enter the **TYPE** of the dwelling: Choose from the dropdown list.

(8) If desired, go to the **CONTACTS** tab to enter client name, address and phone number. If address was input on the first Clients page, this data can be imported by pressing the **Copy Client Addr** box.

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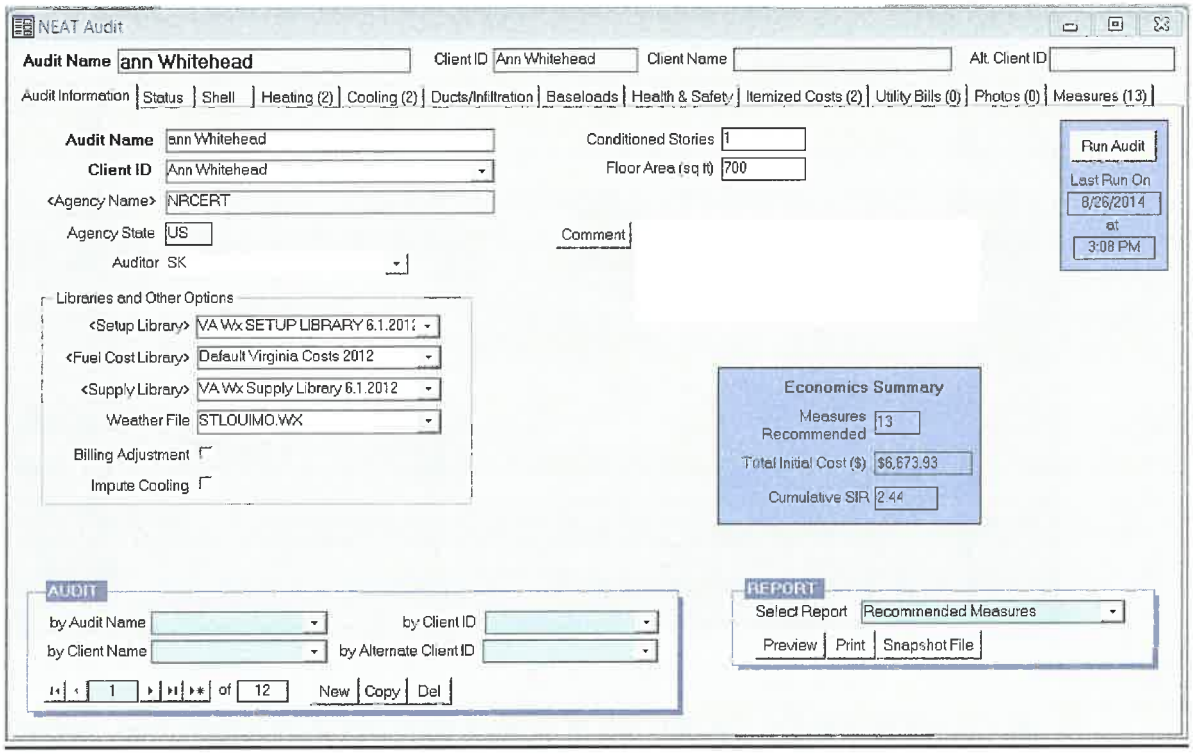
ENERGY AUDITS: SITE BUILT (NEAT) only

1: OPENING PAGE



(1) In all cases (except the first time this program is used), the **NEW** button (near the bottom left of the screen) MUST be pressed. Not creating a NEW record means that you will be overwriting the data of an existing audit.

(2) After a NEW audit is created, the cursor will automatically go to **Client ID**. Choose from the dropdown list the client for whom you want to create an audit.

(3) Next, provide an **Audit Name**. You can use any sort of naming convention, such as simply the client's name, or the job number, or any other combination of data. It is recommended that you choose a convention and be stick to it across all audits.

(4) Under **Auditor**, choose yourself from the dropdown of auditors.

(5) Made sure **<Setup Library>**, **<Fuel Cost Library>** and **<Supply Library>** boxes are all populated. If not, choose the appropriate one from the dropdown.

(6) Choose the **Weather File**. You can use the dropdown, or if you know the code for the city you wish to choose, you can type the first few letters until you see the city of your choice. Note that the city you choose will not always be the geographically closest city to your client. It might even be in another state. You are looking for the weather file that most closely approximates the HDD and CDD of your client's location.

(7) **Billing Adjustment**, if checked, will allow the model to be modified by the utility data you can optionally input under the **Utility Bills** Tab.

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(8) **Impute Cooling** will rarely be used. It implies that there is a cooling load in the home that cannot be defined under the **Cooling** tab. It also allows the possibility that a new AC can be recommended even when none currently exist.

(9) **Conditioned Stories**. Input the number of conditioned stories in the home. This can include ½ stories (as with a finished attic, or loft). It should also include a conditioned basement, so long as that basement is either mostly above grade and/or has a door directly accessing the outdoors.

(10) **Floor Area**. Input the total square footage of all conditioned floor areas in the home.

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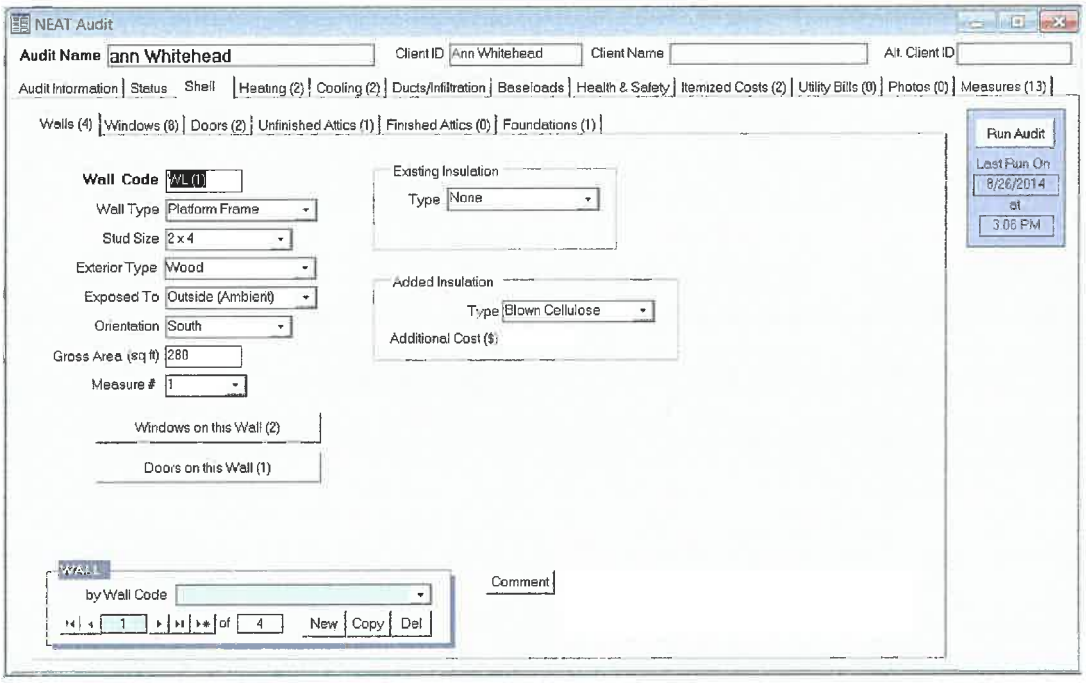
2: SHELL - Walls

This is where we input all the data for the physical characteristics of the home. Note that there are six sub-tabs under the Shell tab. It is recommended that you complete each sub-tab before proceeding to the next.



(1) A **Wall Code** must be input. You can use the TAB button on your keyboard or you can type in your own. Try to keep the codes for all walls sequential and matching the codes you wrote on your footprint diagram, so that anyone can easily determine which wall is referenced by each Wall Code.

(2) Define the Wall Type of the home. Use the dropdown to make your selection, or type the first letter of the type you want to choose.

(3) **Stud Size** will show up for wood framed homes only and will, by default, show up as 2x4. Change this if necessary.

(4) **Exterior Type.** What is the siding type of this home? Choose from the dropdown.

(5) Is the wall you are describing **Exposed To** Outside (Ambient); or to Buffered Space (an unconditioned space that buffers this wall from the outside); or to an Attic Space (usually a top section of wall in a cathedral or vaulted space that is adjacent to unconditioned attic).

(6) What is the **Orientation** of this wall?

(7) Calculate the **Gross Area** of this wall. It is the width of the wall x the height (usually measured from indoors). If the home is more than a single story, you can define the height as the sum of ceiling heights on each floor adjacent to that wall.

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(8) **Measure #.** This number should stay the same for every wall that have all the same characteristics (not including Area and Orientation). Choose a new measure number for a wall that, for example, is a buffered wall, or is insulated while other walls are not.

(9) Input the Type and R-Value of **Existing Insulation**.

(10) What type of **Added Insulation** do you request, if NEAT provides new insulation?

(11) In most cases, there will be no **Additional Cost**. This is to be input if there is an unusual and unique extra cost to insulate this particular wall that is beyond the price defined in the Library. Examples could include the extra cost to blow insulation from the inside; or a repair to the siding that is necessary before insulation can be added.

(12) To input a new wall, there are two choices. In the lower left hand of the screen, choose NEW to create a blank record; or choose COPY to copy all the data of this wall to a new record. If COPY is chosen, be sure to change the Wall Code, so that all wall entries remain sequential and match the numbering on the footprint diagram. Then change only those fields that are different from the previous wall.

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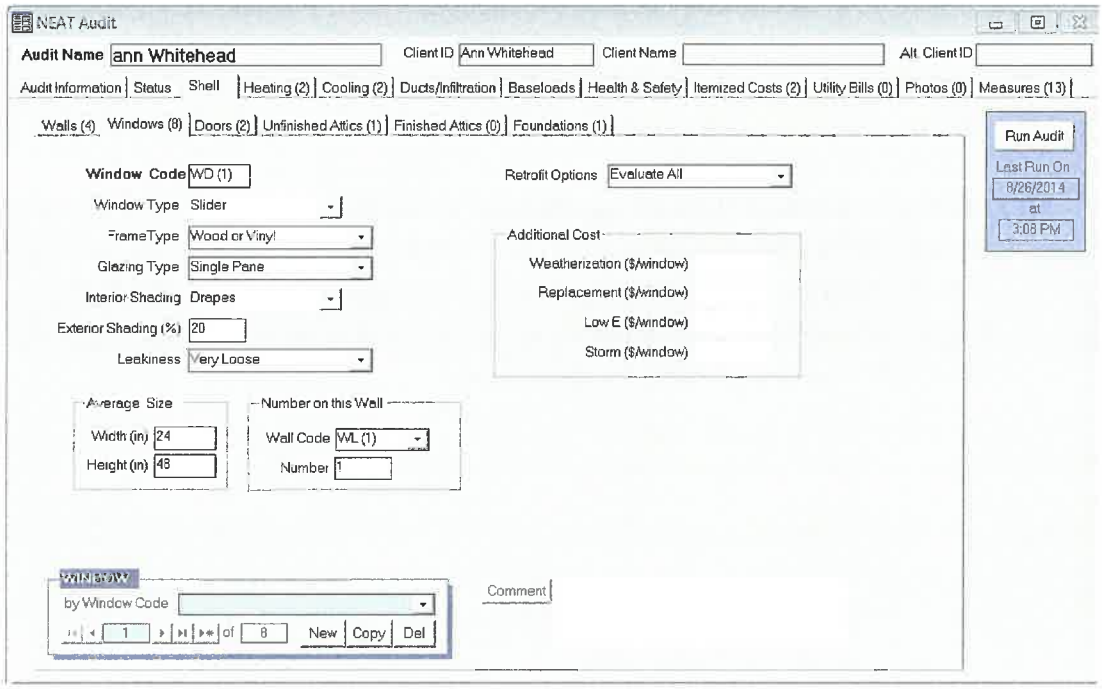
3: SHELL – Windows



(1) A **Window Code** must be input. You can use the TAB button on your keyboard or you can type in your own. Try to keep the codes for all windows sequential and matching the codes you wrote on your footprint diagram, so that anyone can easily determine which window is referenced by each Window Code.

(2) What is the **Window Type**? Choose from the dropdown. Use the F1 key to see an image of each window type, if you need help. Casement windows should be input as Awning. Sliding Glass doors can be input here or under the Door tab, but not both.

(3) Choose the appropriate **Frame Type** from the dropdown list.

(4) Choose the appropriate **Glazing Type** from the dropdown list.

(5) Choose the appropriate **Interior Shading** from the dropdown list.

(6) **Exterior Shading %**. This input asks you to judge the amount of shade provided by the inset of a window; by trees or shrubs; and by such things as awnings and porch roofs. It does NOT ask you to consider what orientation the wall is facing.

(7) Choose the most appropriate **Leakiness** level for this window. This is always a judgment call but try to back up your claim with photos, especially if you are defining the window as Very Loose. This refers only to the body of the window itself, not to the glass. A broken pane of glass is much cheaper to replace than a whole window and will be dealt with as an Infiltration issue.

(8) **Average Size**. Input the Width and Height of the window you are defining. It is not recommended to average the size of multiple similar windows.

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(9) **Wall Code**. Choose from the dropdown the Wall Code for the wall on which this window exists.

(10) **Number**. This input allows you to define how many windows of the exact same characteristics exist on this wall. It is recommended to leave this number always as '1', and to create a unique record for each window, even if they are identical.

(11) **Retrofit Options**. In most cases, choose Evaluate All. Any other choice will mandate that a window will or will not have a retrofit measure applied to it.

(12) In most cases, there will be no **Additional Cost**. This is to be input if there is an unusual and unique extra cost to apply a weatherization measure to this particular window that is beyond the price defined in the Library. Examples could include the extra cost to remove and reattach security bars that cover the window; or repairs necessary to the window frame to allow the replacement of the window.

(13) To input a new window, there are two choices. In the lower left hand of the screen, choose NEW to create a blank record; or choose COPY to copy all the data of this window to a new record. If COPY is chosen, be sure to change the Window Code, so that all window entries remain sequential and match the numbering on the footprint diagram. Then change only those fields that are different from the previous window.

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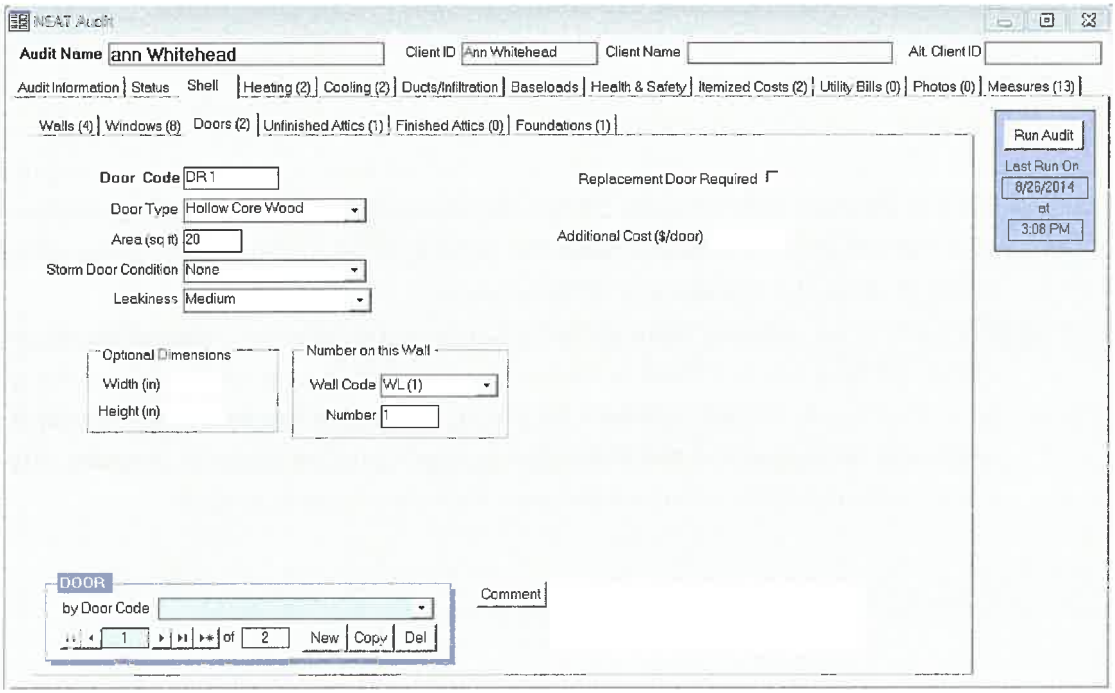
4: SHELL – Doors



(1) A **Door Code** must be input. Type in your own (the Tab function does not work for this page). Try to keep the codes for all doors sequential and matching the codes you wrote on your footprint diagram, so that anyone can easily determine which door is referenced by each Door Code.

(2) Choose the appropriate **Door Type** from the dropdown list.

(3) Calculate the area of the door in square feet. Doors are typically measured in inches, so use the following equation: $\frac{\text{Width (in)} \times \text{Height (in)}}{144}$

(4) Choose the appropriate **Storm Door Condition** from the dropdown list.

(5) Choose the appropriate **Leakiness** from the dropdown list. Remember that you are describing the door, not the lack or presence of weatherstripping. Loose should only be chosen if the door is warped, or rotted, or otherwise cannot be reasonably air-sealed.

(6) **Optional Dimensions**. Remember that anytime NEAT uses the words OPTIONAL, it means that the data is not only optional but will not even be used in any way.

(7) **Wall Code**. Choose from the dropdown the Wall Code for the wall on which this door exists.

(8) **Number**. As with Windows, it is recommended to leave this number always as '1', and to create a unique record for each door, even if they are identical.

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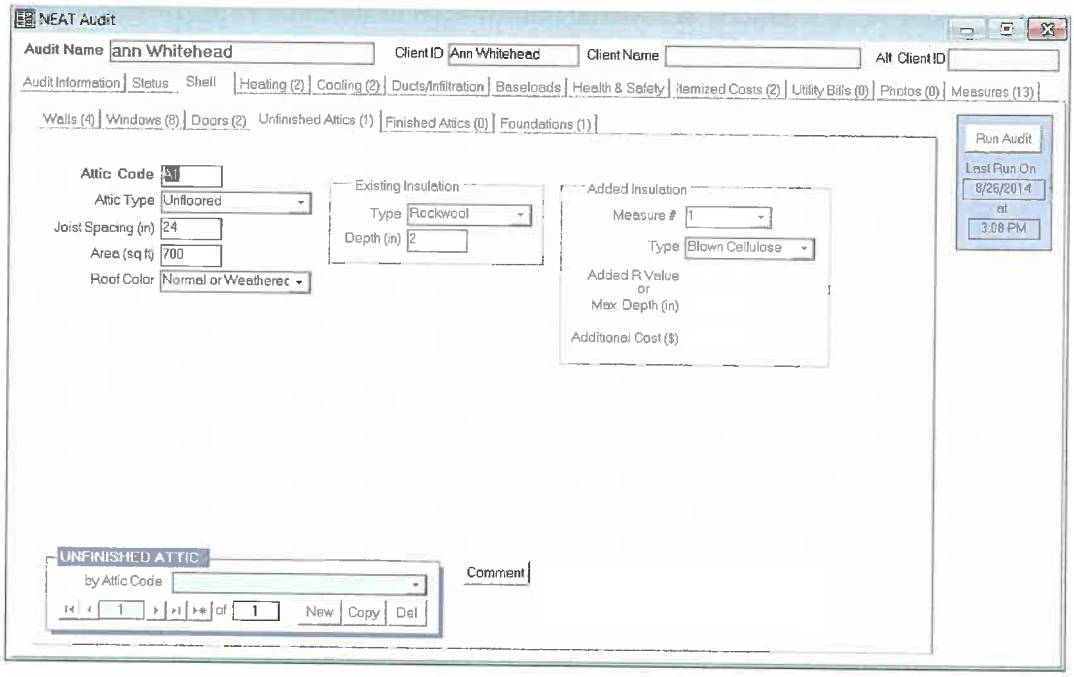
5: SHELL – Unfinished Attics



(1) An **Attic Code** must be input. You can use the TAB button on your keyboard or you can type in your own.

(2) Choose the appropriate **Attic Type** from the dropdown list.

(3) The default **Joist Spacing** is 24", which you can achieve by hitting the TAB key. Otherwise, input the appropriate spacing of the ceiling joists.

(4) Define the **Area** of the attic. In many cases, this will be the same as the conditioned area of a single-story home.

(5) The **Roof Color** is almost always Normal or Weathered. Choose White, Reflective only if the roof color is clean enough to effectively function as a white or reflective roof.

(6) Choose the Type and Depth for the **Existing Insulation** in the attic. Note that Depth is in inches, not in R-Value. If the insulation is degraded; or there are many gaps; or it is very uneven, calculate (or estimate) the actual R-Value and translate that back into inches. If this is done, it is recommended to note this in the **Comments**.

(7) **Added Insulation**. Choose **Measure #** 1. If there is more than one attic, each should have its own measure number.

(8) Choose the appropriate **Added Insulation Type** from the dropdown list.

(9) In most cases, it is optimal to leave inputs for **Added R-Value** and **Max. Depth** blank. This allows NEAT to calculate the amount it thinks is best. Note, if you do wish to input a value in either of these boxes, it is similar to mandating a change and will not allow NEAT to offer

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any other options. **Added R-Value** is the amount of R-Value you wish to add; **Max. Depth** is the final depth of insulation (existing plus added) that you wish to achieve.

(10) With Attics, there will often be an **Additional Cost**. For example, this could be due to the necessity to install dams around flues or chimneys; or due to the difficulty of maneuvering through a tight attic; or due to the time needed to clear stored goods from the client's attic.

(11) If there is more than one attic, press NEW at the lower left of the screen to create a new record.

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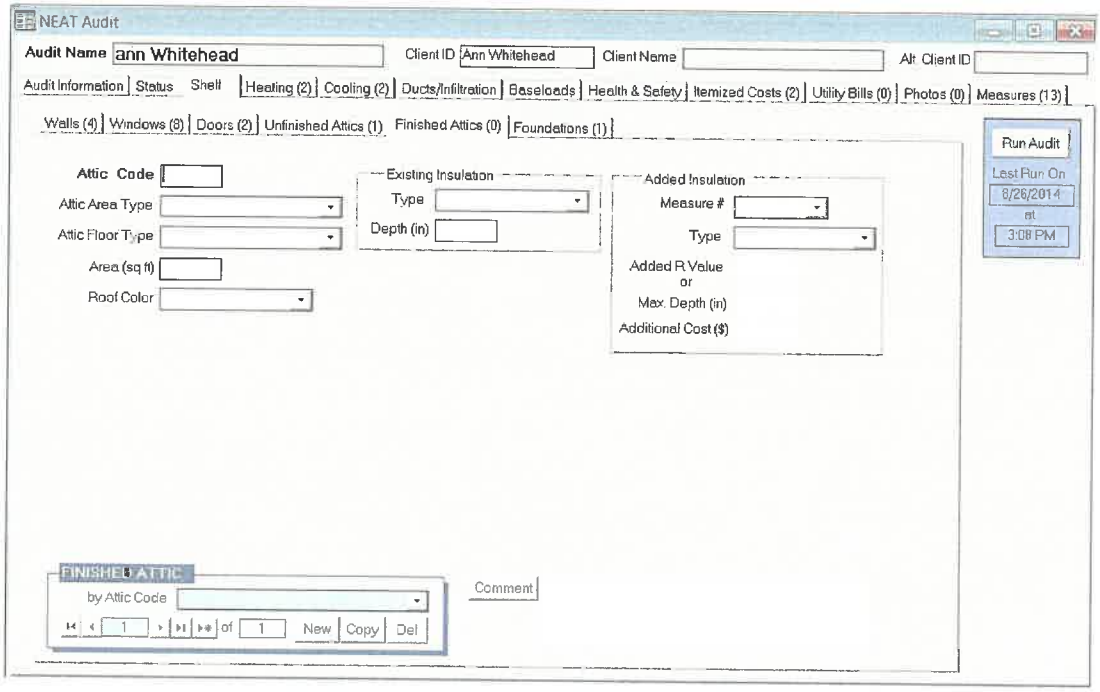
6: SHELL – Finished Attics



(1) An **Attic Code** must be input. You can use the TAB button on your keyboard or you can type in your own.

(2) **Attic Area Type**. Most Finished Attics have all four elements that are described here, and each type must be modeled individually (using the NEW button at the bottom left to create a new record for each). However, to save time, it is acceptable to combine the square footage of both areas of the same type (say, both Kneewalls, or both Roof Rafters) into a single record. Use the F1 Key if you need help to understand what each element describes.

(3) All inputs here are essentially the same as on the Unfinished Attics page. Three things to note:

1. When modeling the Roof Rafters, it is necessary to input for **Max. Depth** the width of the Rafters (usually 6 or 8")
2. The Outer Ceiling Joists are understood by NEAT to be unconditioned space. Do NOT model this area as a separate attic under Unfinished Attics.
3. Due to the high cost of two-part foam (which is currently one of the options for Kneewall insulation), the measure may not be provided due to a too-low SIR. If this is the case, take note and return to the audit and choose Fiberglass Batts instead.

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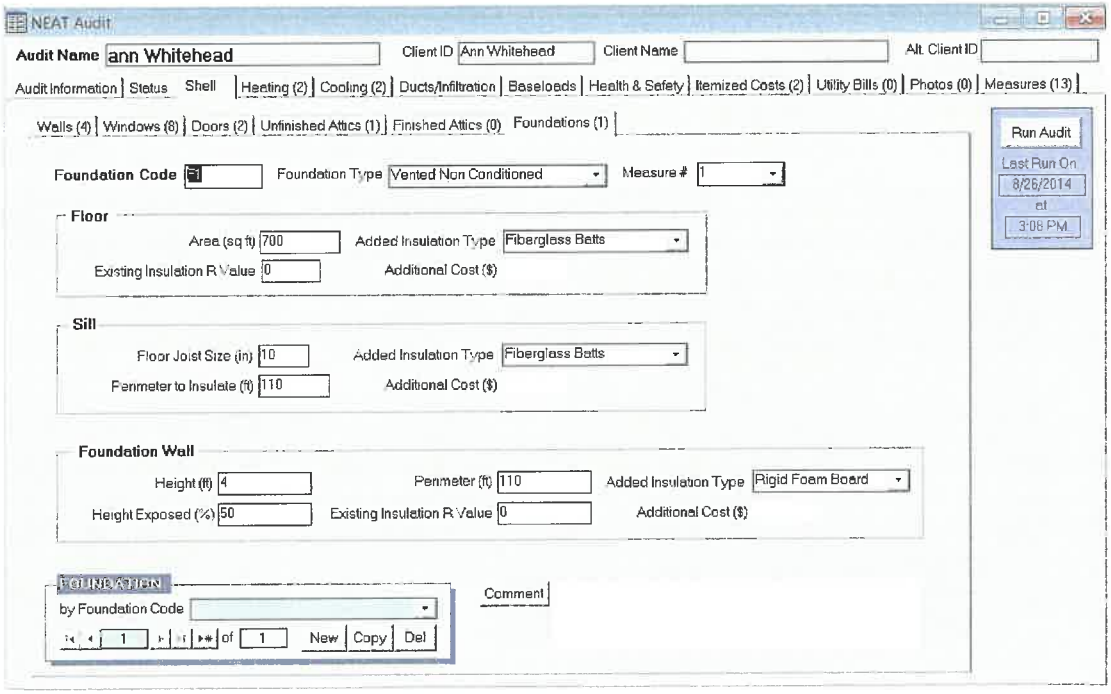
7: SHELL – Foundations



(1) A **Foundation Code** must be input. You can use the TAB button on your keyboard or you can type in your own.

(2) Choose the appropriate **Foundation Type** from the dropdown list. Use the F1 key, if needed, to help understand the definition of the different Foundation Types.

(3) Note that a cantilevered floor is counted as its own foundation, of type Exposed. This can be true of the underside of a bay window, too.

(4) Choose a unique **Measure #** for each foundation. Note that it is acceptable to define a single foundation as two, in the case where part of the previously insulated floor is in good condition and the other is in need of new insulation. Use the appropriate square footage for each area, so long as the total is true to the actual area of the foundation.

(5) **Floor - Area**. Input the square footage of the foundation.

(6) Define the **Existing Insulation R-Value**. Use '0' for none.

(7) Choose the appropriate **Added Insulation Type** from the dropdown list.

(8) **Sill – Floor Joist Size**. Input only the blank: 2 x ____

(9) **Perimeter to Insulate**. Perimeter is the sum of the lengths of all the foundation walls. If you use the TAB key, NEAT will assume the Area defined above is for a perfectly square area, which will give you an inaccurate number.

(10) Choose the appropriate **Added Insulation Type** from the dropdown list.

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(11) **Foundation Wall – Height**. This is the height from the floor to the bottom edge of the floor joists. If the floor is uneven, estimate an average height over the whole area.

(12) **Height Exposed** is the percentage of the Foundation Wall Height that is above grade. For example, if 2' of a 4' height crawlspace is above grade, then the Height Exposed is 50%.

(13) Perimeter. It is accurate enough to use the same Perimeter that was calculated for the Sill (above).

(14) Define the **Existing Insulation R-Value**. Use '0' for none.

(15) Choose the appropriate **Added Insulation Type** from the dropdown list.

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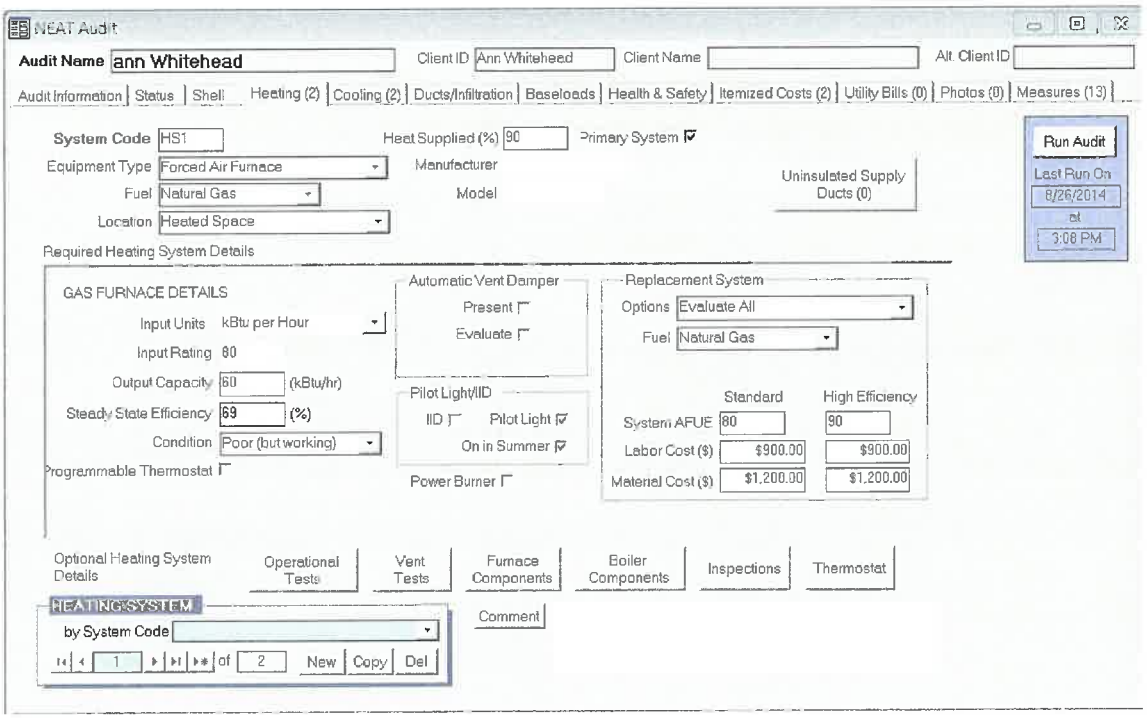
8: HEATING



(1) Note that inputs here are for functioning heating systems. A broken-down heating system should not be modeled, with the exception defined in line (11) below.

(2) A **System Code** must be input. You can use the TAB button on your keyboard or you can type in your own.

(3) Choose the appropriate **Equipment Type** from the dropdown list. Note that both Vented and Unvented Space Heaters refer to combustion heaters, including wood stoves.

(4) Choose the appropriate **Fuel Type** from the dropdown list.

(5) **Location**. Is the heating unit located in Heated Space; Unconditioned Space; or Unintentionally Heated Space where waste heat from the appliance significantly heats an otherwise unconditioned space?

(6) **Heat Supplied** is the percentage of heat supplied by this unit. If there is more than one unit, estimate the percentage from each. The total must add up to 100.

(7) Enter the Manufacturer and Model # if desired.

(8) **Input Units** and **Input Rating** can be input but are not needed unless the Steady State Efficiency is not measured nor known. They are used only to calculate the SSE.

(9) **Output Capacity** can be taken from the nameplate of the heating unit or calculated based on the system type and Input Capacity.

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(10) **Steady State Efficiency** should be measured in the field. If this is not possible, then the AFUE can be entered instead. It is not allowed to make up an SSE in order to achieve a replacement as an energy conservation measure (ECM).

(11) Note that in the case of a non-functional unit, it is sometimes still beneficial to model it, to receive other measures (such as duct sealing and insulating). In such a case only, it is permissible to reduce the original AFUE of the unit by 5% only. This should be noted in the Comments.

(12) Choose the appropriate **Condition** from the dropdown list. Note that there is no option for a unit that is non-functional.

(13) Check this box if the home has a **Programmable Thermostat**.

(14) **Automatic Vent Damper**. We do not currently use this function.

(15) **Pilot Light / IID**. Check if it is an IID or Pilot light. Check, too, if the Pilot Light remains on throughout the summer.

(16) **Power Burner**. Only for oil or coal fired systems that have been converted to gas.

(17) **Replacement System – Options**. Choose Evaluate All, in almost all cases.

(18) **Fuel**. Choose the same fuel as is used by the existing system, unless special permission has been granted for a fuel switch. In such a case, this should be noted in the Comments.

(19) **System AFUE** (Combustion only). Enter the AFUE of the proposed replacement system. Note that, at this point in time, a Standard Efficiency of all combustion furnaces is 80%. High Efficiency is 90-94% for gas and propane; 85% for oil.

(20) Note: if your agency will replace only if a High Efficiency unit can be installed, then input the same Labor Cost and Material Cost for both.

(21) Look back up to near the top right of the page. Press the **Uninsulated Supply Ducts** button if there are uninsulated supply ducts that you wish to insulate. Return ducts can also be input here if your agency typically insulated return ducts.

(22) If you input a second heating system, note that there will be a checkbox that, when checked, tells NEAT that this secondary system will no longer be used if a replacement of the primary unit is allowed.

(23) Note for heat pumps only: If a Mandatory Replacement is required (whether as an ECM or H&S), this option must be chosen on this page **AND** on the Cooling page.

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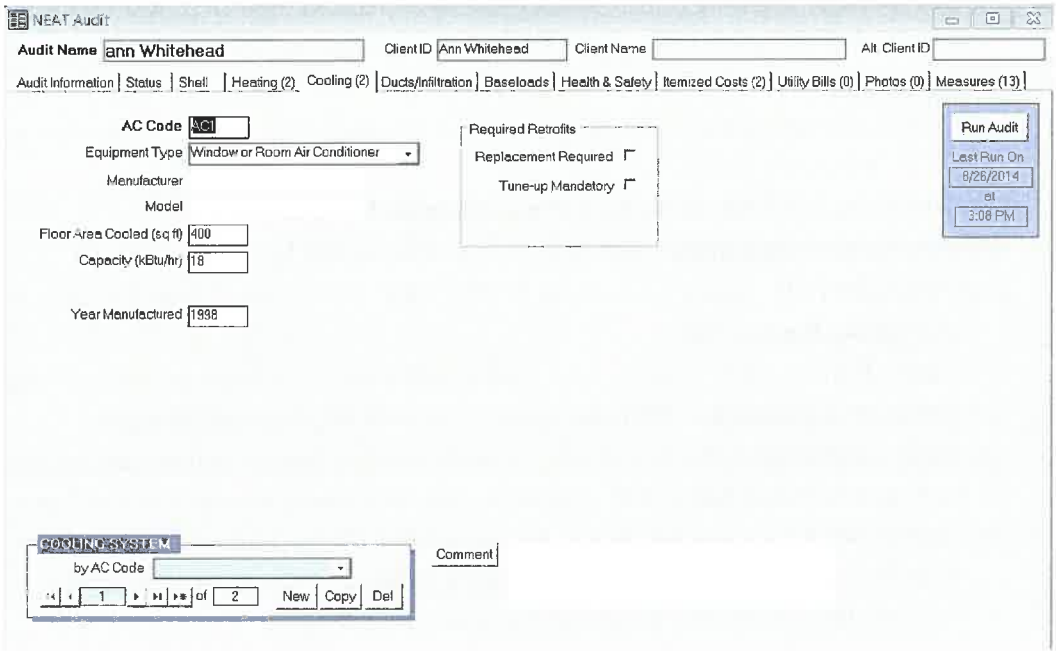
9: COOLING



(1) An **AC Code** must be input. You can use the TAB button on your keyboard or you can type in your own.
(2) Choose the appropriate **Equipment Type** from the dropdown list.
(3) Enter the Manufacturer and Model # if desired.
(4) What is the **Floor Area Cooled** by this unit? If it is a central AC or heat pump, it will likely be every room in the home with the possible exception of rooms not tied into the duct system.
(5) Enter the **Capacity** of the unit in KBTU/hr. Remember that 1 ton is equal to 12 KBTU/hr.
(6) Enter either the **SEER** or the **Year Manufactured**. Only one input is allowed - the other box disappears.
(7) If the unit being modeled is a Window AC, the efficiency will be given as EER. This must be converted to SEER. The appropriate calculation is available by hitting the F1 key while the cursor is in the SEER box.

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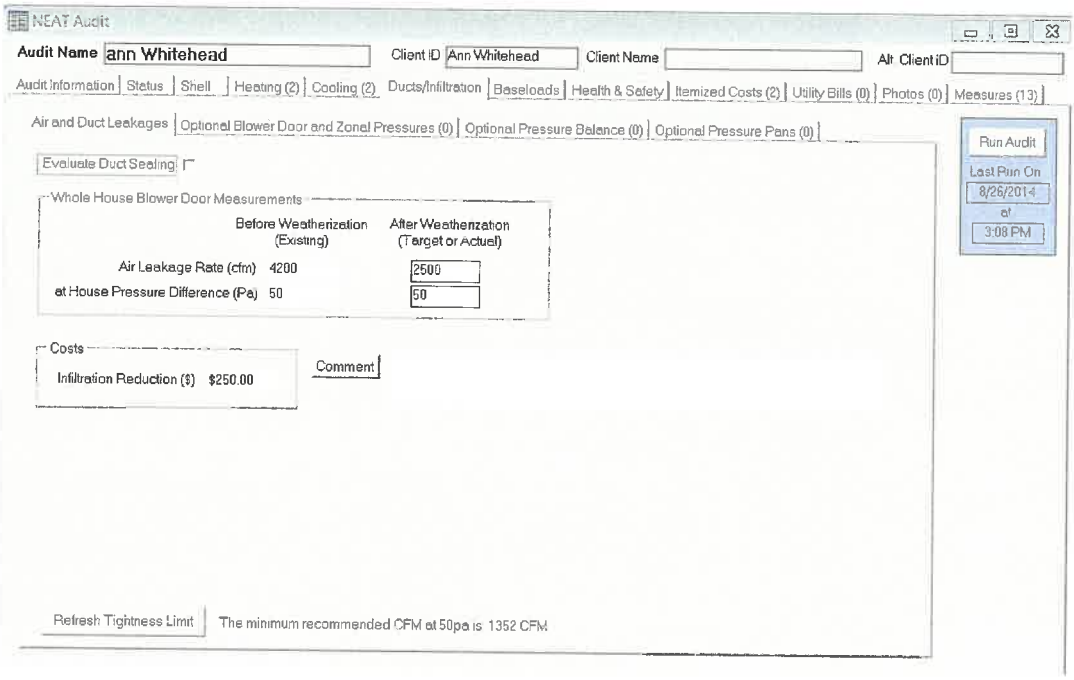
10: DUCTS / INFILTRATION



(1) Check the box **Evaluate Duct Sealing** only if you want to get additional funds for duct sealing. Extra on-site measurements will be required. (See next page)

(2) **Before Weatherization**. Enter the blower door results achieved at pre-audit.

(3) **After Weatherization**. Enter the target blower door results. Target is calculated by an approved method, usually set by the state.

(4) **Costs- Infiltration Reduction**. Enter here the amount of money you wish to receive for ALL air sealing measures on this home. You can test what the maximum allowable value is by inputting $1 and running the audit. On the Recommended Measures, the SIR for air sealing at a cost of $1 will be the equivalent of how much can be spent for an SIR of 1.0.

(5) Note that all other tabs start with the word **Optional**. This indicates that any data entry within these tabs will not be recognized or used by NEAT.

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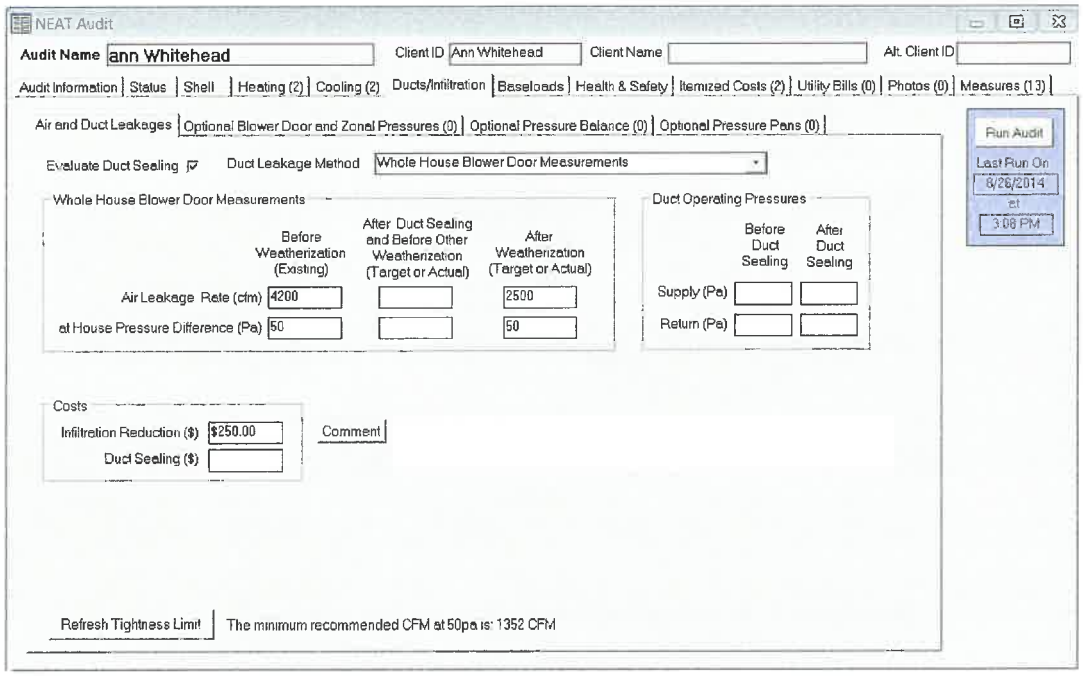
11: DUCTS / INFILTRATION – duct sealing



(1) This is the simplest of the three choices for **Duct Leakage Method**.

(2) **After Duct Sealing and Before Other Weatherization**. Enter here a target blower door number assuming that duct sealing has occurred only. No other air sealing measures have been performed on the home. The number MUST be between the Before Weatherization Air Leakage Rate and the After Weatherization rate.

(3) Note that if you choose an Air Leakage Rate close to the After Weatherization rate, then you are telling NEAT that little improvement will occur from any other air sealing measures. As a result, NEAT would provide very little money for Infiltration Reduction other than Duct Sealing. In most cases, reduction from Duct Sealing ONLY will be not more than 300 CFM50.

(4) **Duct Operating Pressures - Before Duct Sealing**. Both Supply and Return static pressures need to be measured in the field. This means with the furnace air blower on, but no blower door. Use a pressure probe to read the pressure at, or close to, the plenum.

(5) **Duct Operating Pressures - After Duct Sealing.** After the ducts are tightened, the pressure should increase. A good rule of thumb is simply to target a 5 Pa increase for both Supply and Return.

(6) Duct Sealing $. You can use the same $1 trick as with Infiltration Reduction to determine the maximum available money for duct sealing.

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(7) Note that for a MHEA audit, the same is true but there is a fourth option for **Duct Leakage Method**. This is the method of choice for MHEA audits. It is called **Pressure Pan Measurements.** Instead of a target blower door for after duct sealing, it asks for a sum of all pressure pan readings in the home. The target is the simply the number of registers in the home, as we aim for 1.0 Pa per register (or less)

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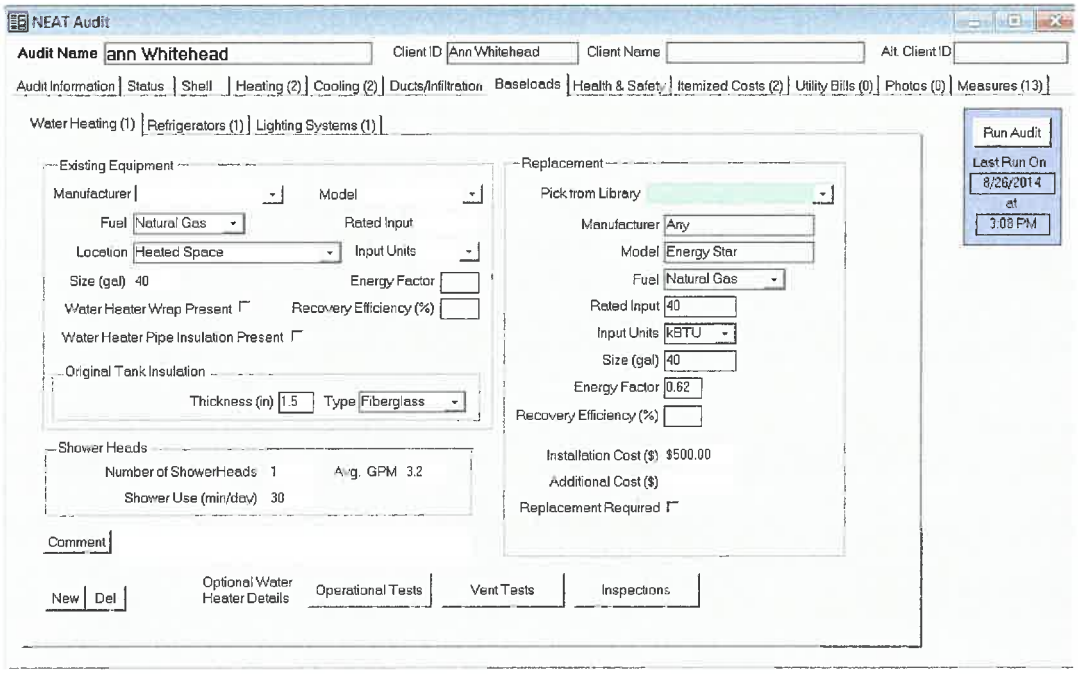
ENERGY AUDITS: NEAT and MHEA

12: Baseloads – Water Heating



(1) NEAT holds a large database of water heater data. If you can locate your client's water heater in the database, there will be more efficiency data available to NEAT than you could otherwise enter yourself.
(2) Choose the appropriate **Manufacturer** from the dropdown list.
(3) Choose the appropriate **Model** from the dropdown list. If you cannot find the relevant model, then leave this field blank. Do not choose a different model from that which you are trying to model.
(4) Choose the appropriate **Fuel** from the dropdown list.
(5) Enter the **Rated Input** and define the **Input Units**, if you desire. This is not required.
(6) Choose the appropriate **Location** from the dropdown list.
(7) Enter the **Size** of the storage tank. Normally this will be 30, 40 or 50 gallons.
(8) Check if **Water Heater Wrap Present**. NEAT will not provide water heater wrap if this is checked.
(9) Check if **Water Heater Pipe Insulation Present**. NEAT will not provide water heater pipe insulation if this is checked.
(10) **Original Tank Insulation.** Enter EITHER the R-value OR the Thickness and Type of the internal tank insulation. This is rarely marked on the tag. Direct measurement can be taken by removing an access cover and measuring thickness. Alternatively, so long as the tank CAN be insulated, inputting an existing **R5** is approximately accurate and also ensures the measure will be provided.

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(11) **Shower Heads.** Enter the **Number of Showerheads** in the home; the total **Shower Use** per day; and the **Avg. GPM** (gallons per minute).

(12) **Replacement – Pick from Library**. Choose the appropriate Water Heater type and size from the dropdown list.

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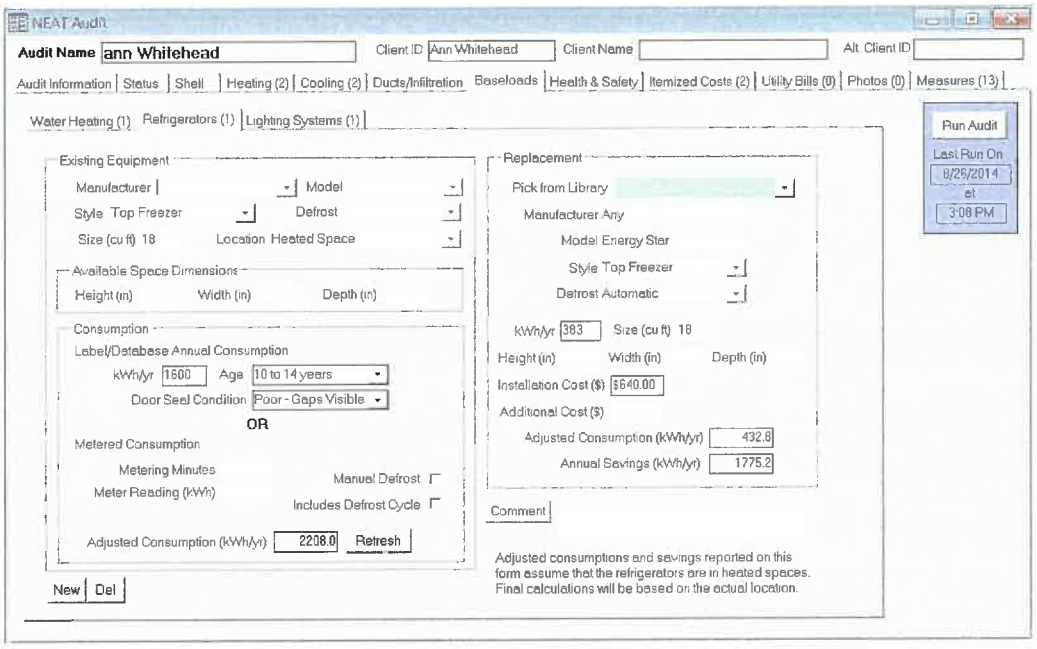
13: Baseloads – Refrigerators



(1) NEAT holds a large database of refrigerator data. If you can locate your client's refrigerator in the database, you should do so. Note that many of the Model numbers use asterisks to indicate any variety of number or letter.

(2) Note also that none of the specifications of the existing fridge are required inputs, except for the **Consumption** data.

(3) Choose the appropriate **Manufacturer** from the dropdown list.

(4) Choose the appropriate **Model** from the dropdown list. If you cannot find the relevant model, then leave this field blank. Do not choose a different model from that which you are trying to model.

(5) Choose the appropriate **Style** from the dropdown list.

(6) Choose the appropriate **Defrost** method from the dropdown list.

(7) Input the **Size** of the fridge, in cubic feet.

(8) Choose the appropriate **Location** from the dropdown list. As only one fridge can be modeled, this input will almost always be Heated Space.

(9) **Consumption – Label/Database Annual Consumption.** If you found the relevant fridge in the database, then two of these fields – **KWh/yr** and **Age** - will already be filled. If not, input this data, unless you have **Metered Consumption** data taken on-site.

(10) Choose the appropriate **Door Seal Condition** from the dropdown list.

(11) **Metered Consumption. Metering Minutes:** Enter the number of minutes you metered the fridge (typically 120 minutes is the minimum). Enter the **Meter Reading** in KWh.

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(12) If you noticed a spike during metering that may indicate the fridge entered a Defrost Cycle during metering, then check the box **Includes Defrost Cycle.**

(13) **Replacement – Pick from Library**. Choose the appropriate Refrigerator type and size from the dropdown list.

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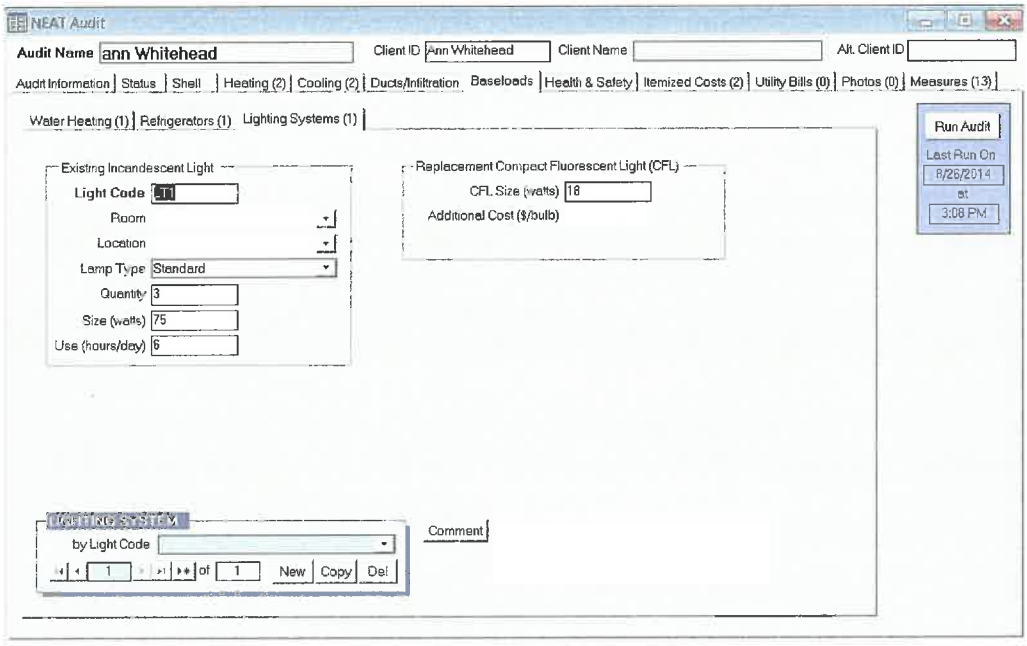
14: Baseloads – Lighting Systems



(1) A **Light Code** must be input. You can use the TAB button on your keyboard or you can type in your own.
(2) Remember you are only inputting existing incandescent lights here.
(3) It is unnecessary to input the **Room** and **Location** of the lights, although you can if you choose. I would recommend inputting as a single record, every light in the home that is the same wattage and is used for approximately the same amount of time.
(4) Choose the appropriate **Lamp Type** from the dropdown list. In most cases, it will be Standard.
(5) Input the **Quantity** of this type of light.
(6) Input the **Size** in Watts of this type of light.
(7) Input the average **Use** in hours/day of this type of light.
(8) The replacement wattage of an equivalent CFL will automatically be input. This can be changed if you choose.

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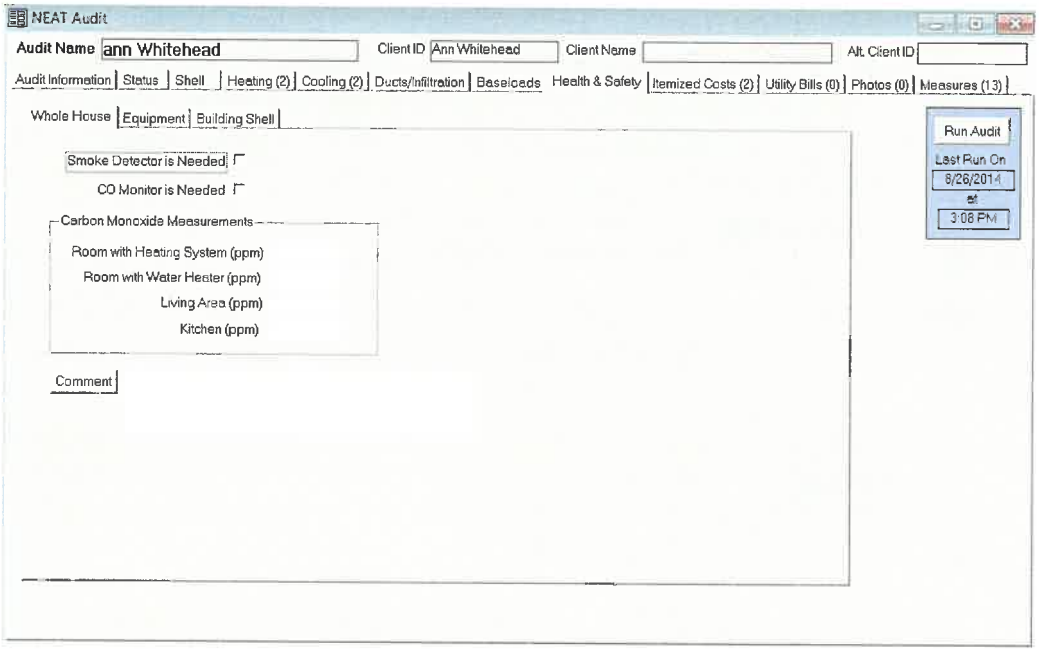
15: Health & Safety



(1) It is my recommendation that this tab can be skipped over entirely. Any Health & Safety items can be input directly under Itemized Costs and will be defined as such simply by NOT checking the **Include in SIR** box.

(2) If you want to complete data in the three sub-tabs of Health & Safety, take careful note that NEAT will NOT automatically provide any measure based on these inputs.

(3) The only exception to this is if function #11 under Preferences / Features is checked. This will allow NEAT to automatically add checked H&S items to Itemized Costs. However quantities and prices MUST be adjusted on a case by case basis.

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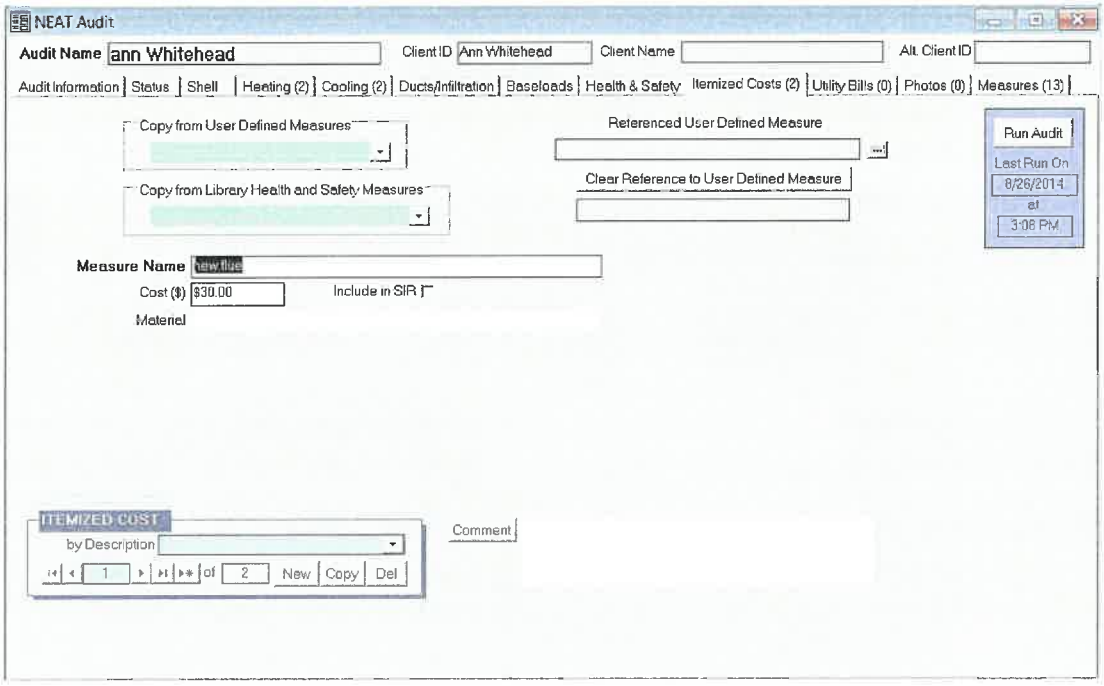
16: Itemized Costs



(1) The easiest and fastest way to input data here is simply to type it yourself.

(2) Input an appropriate **Measure Name**, which will be understandable by both yourself and others.

(3) Input a **Cost** for this measure.

(4) **Include in SIR**. At its simplest, this is asking you whether the measure you are defining will be an Incidental Repair or a Health & Safety measure. **Incidental Repairs will be checked** because the zero SIR of an Incidental Repair (Yes, Incidental Repairs will show up on the Report with an SIR = 0) is meant to negatively affect the Cumulative Whole House SIR of this job. **Health & Safety measures are not checked** because they do not affect the Cumulative Whole House SIR.

(5) Press **NEW** in the lower left of the page to create a new blank record for additional Itemized Costs.

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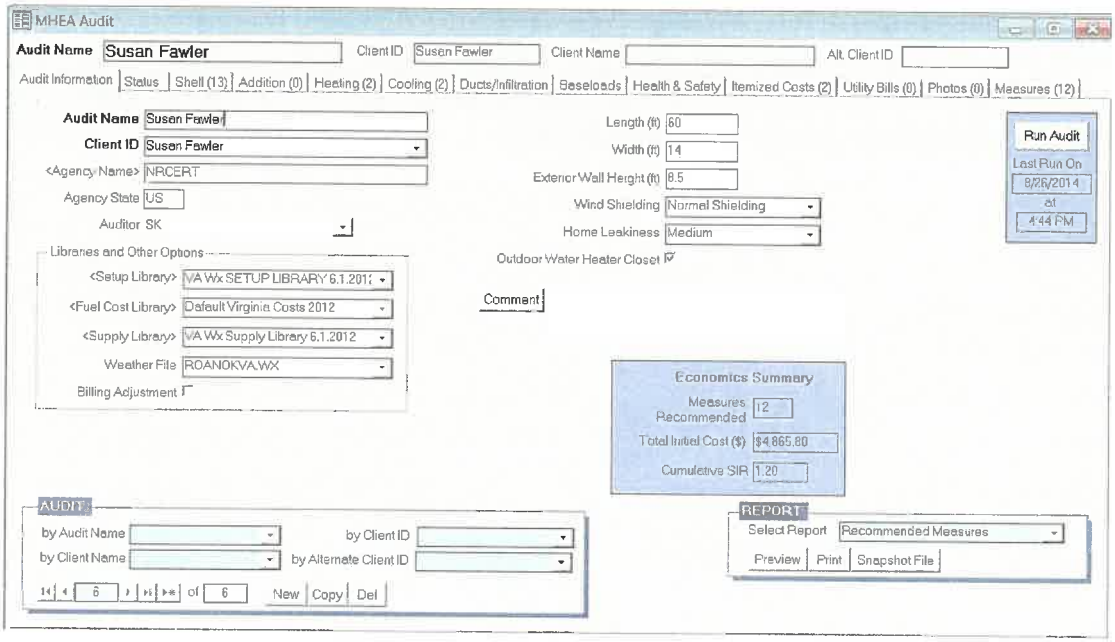
17: Opening Page



(1) In all cases (except the first time this program is used), the **NEW** button (near the bottom left of the screen) MUST be pressed. Not creating a NEW record means that you will be overwriting the data of an existing audit.

(2) After a NEW audit is created, the cursor will automatically go to **Client ID**. Choose from the dropdown list the client for whom you want to create an audit.

(3) Next, provide an **Audit Name**. You can use any sort of naming convention, such as simply the client's name, or the job number, or any other combination of data. It is recommended that you choose a convention and be stick to it across all audits.

(4) Under **Auditor**, choose yourself from the dropdown of auditors.

(5) Made sure **<Setup Library>**, **<Fuel Cost Library>** and **<Supply Library>** boxes are all populated. If not, choose the appropriate one from the dropdown.

(6) Choose the **Weather File**. You can use the dropdown, or if you know the code for the city you wish to choose, you can type the first few letters until you see the city of your choice. Note that the city you choose will not always be the geographically closest city to your client. It might even be in another state. You are looking for the weather file that most closely approximates the HDD and CDD of your client's location.

(7) **Billing Adjustment**, if checked, will allow the model to be modified by the utility data you can optionally input under the **Utility Bills** Tab.

(8) Input the **Length** and **Width** of the mobile home. If there are any additions, they are not considered until we reach the **Additions** tab.

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(9) Input the **Exterior Wall Height.** This should be measured from the interior along an exterior wall and is typically 7'.

(10) Choose the appropriate **Wind Shielding** from the dropdown list.

(11) Choose the appropriate **Home Leakiness** from the dropdown list. Note that this entry is disregarded by MHEA as soon as actual blower door data is input.

(12) Check **Outdoor Water Heater Closet** if the mobile home as an exterior access to the water heater closet. If checked, this will automatically reduce the volume of the home by the appropriate amount (about 60 cubic feet).

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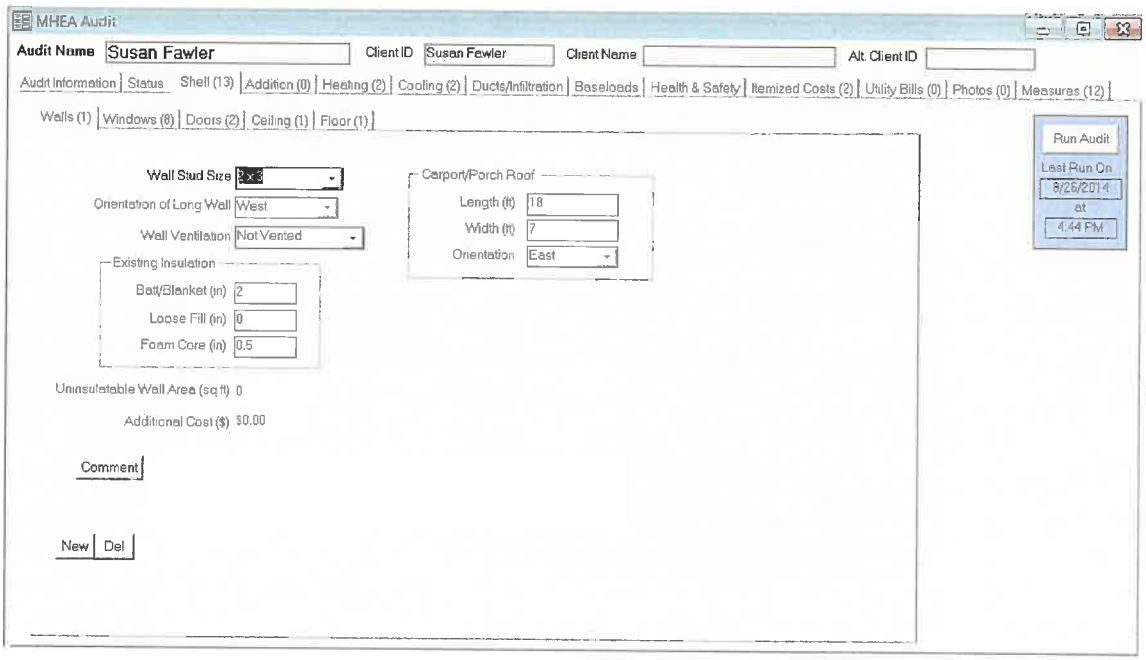
18: SHELL - Walls



(1) MHEA understands that a mobile home is fairly standard. As such the description of the physical structure is much easier than with NEAT. Only one record (one page) is allowed for the Walls section.

(2) Choose the appropriate **Wall Stud Size** from the dropdown list.

(3) Choose the appropriate **Orientation of Long Wall** from the dropdown list. This can be either direction, i.e., if the long wall faces East and West, then you can choose either East or West. Both would be correct.

(4) Choose the appropriate **Wall Ventilation** from the dropdown list. In almost all cases, the appropriate response will be Not Vented.

(5) Define the **Existing Insulation**. MHEA allows for the possibility that there is more than one type of insulation. Enter the thickness of each, with a 0 where there is none.

(6) Input the **Uninsulatable Wall Area**, if any. This would be an area of wall that cannot be insulated. Examples of this are wall sections removed due to an addition; or a window AC that is mounted through a wall.

(7) If there is a carport or porch attached to the mobile home, input the **Carport/Porch Roof – Length, Width and Orientation**. Note that the Length should be the dimension that is parallel to the manufactured home.

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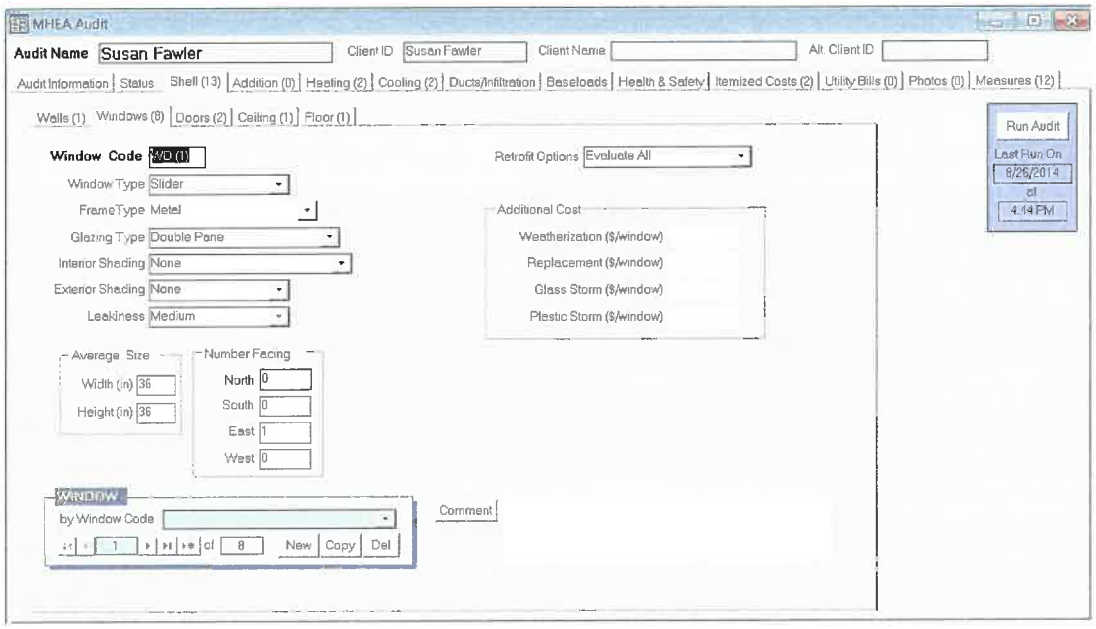
19: SHELL - Windows



(1) Note that this section is for Doors on the original manufactured home only, not on any addition that may exist.

(2) A **Window Code** must be input. You can use the TAB button on your keyboard or you can type in your own.

(3) The inputs are mostly the same as with NEAT, though some of the options are different.

(4) Choose the appropriate **Window Type** from the dropdown list.

(5) Choose the appropriate **Frame Type** from the dropdown list.

(6) Choose the appropriate **Glazing Type** from the dropdown list.

(7) Choose the appropriate **Interior Shading** from the dropdown list.

(8) Choose the appropriate **Exterior Shading** from the dropdown list. Note that there is no option to input the % shading, so a lot of auditor judgment is involved here. If a window is partially shaded, the auditor must decide if this should be defined as NONE or AWNING. Also, the presence of a Low E film on the windows can only be defined here.

(9) Choose the appropriate **Leakiness** from the dropdown list.

(10) Input the **Width** and **Height** of the window being modeled

(11) **Number Facing**. MHEA allows you to input every identical window on ANY wall in a single record. Each window MUST have every characteristic except orientation the same. Enter 0 for any orientation that does not have one of these windows.

(12) **Retrofit Options**. In most cases, choose Evaluate All.

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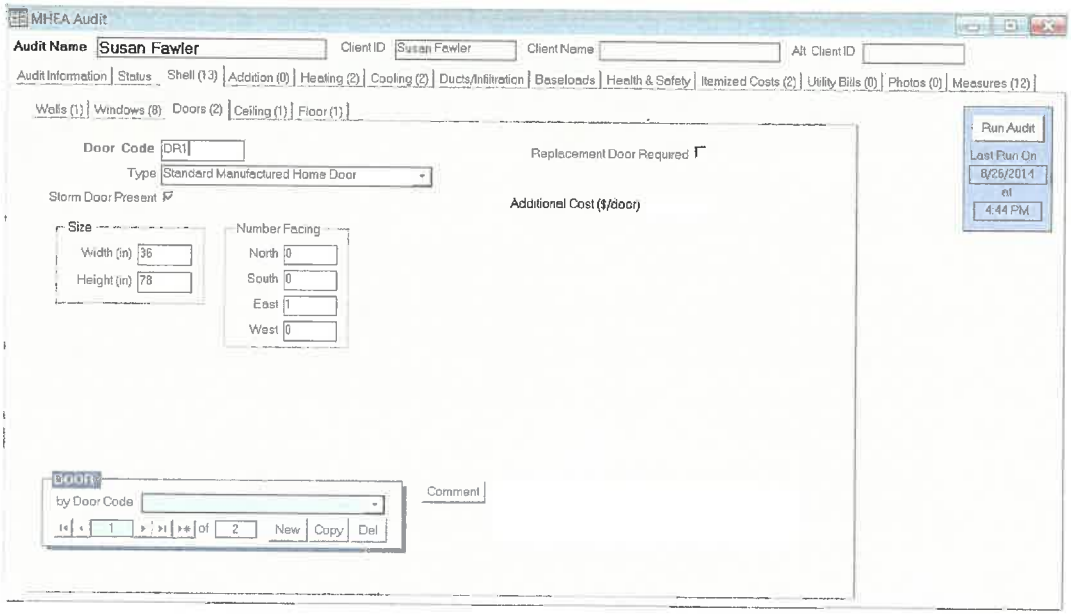
20: SHELL - Doors



(1) Note that this section is for Doors on the original manufactured home only, not on any addition that may exist.

(2) A **Door Code** must be input. You can use the TAB button on your keyboard or you can type in your own.

(3) Choose the appropriate **Type** from the dropdown list.

(4) Check if a **Storm Door Present.** There is no ability to define the condition of the storm door, so if it is in poor condition, it is best to claim there is none. This should be mentioned in the Comments.

(5) Enter the **Width** and **Height** of the door.

(6) Number Facing. As with windows, you can input every identical door on any wall within the same record. Each orientation requires an input even if that is 0.

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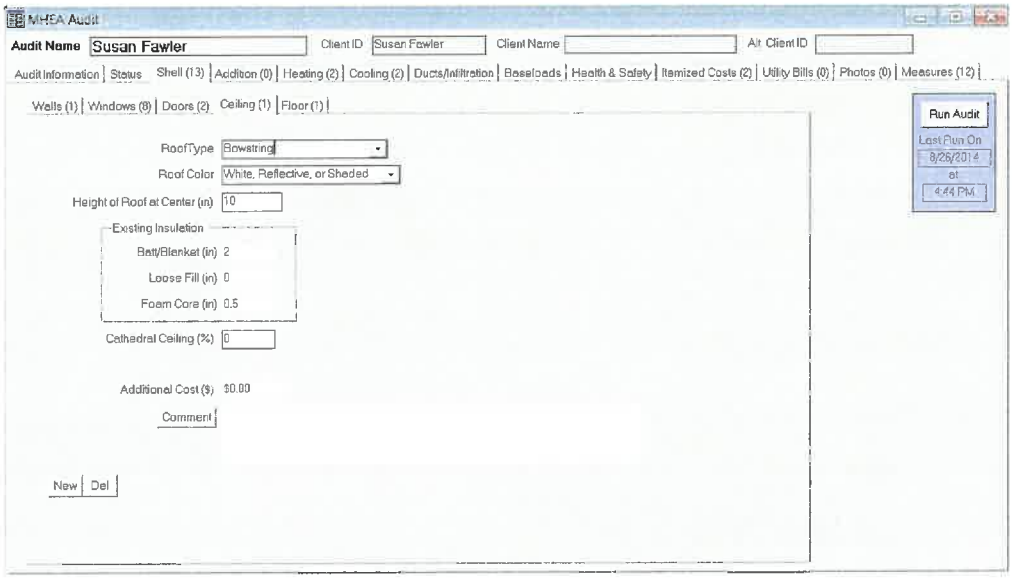
21: SHELL – Ceiling



(1) Note that this section is for Ceilings/attics on the original manufactured home only, not on any addition that may exist.

(2) Choose the appropriate **Roof Type** from the dropdown list. Use F1, if needed, to get a better visual of each different Roof Type.

(3) The **Roof Color** is almost always Normal or Weathered. Choose White, Reflective only if the roof color is clean enough to effectively function as a white or reflective roof.

(4) This entry will change depending on Roof Type but is always asking how much space there is for more insulation. Note that for Bowstring roofs, you are asked to measure from the ceiling panel to the highest point of the bowstring. However for Pitched roofs, you are meant to measure the amount of space between the top of the existing insulation and the peak of the roof.

(5) Define the **Existing Insulation**. MHEA allows for the possibility that there is more than one type of insulation. Enter the thickness of each, with a 0 where there is none.

(6) If the home has **Cathedral Ceilings**, calculate the percentage of total floor area that has cathedral ceilings.

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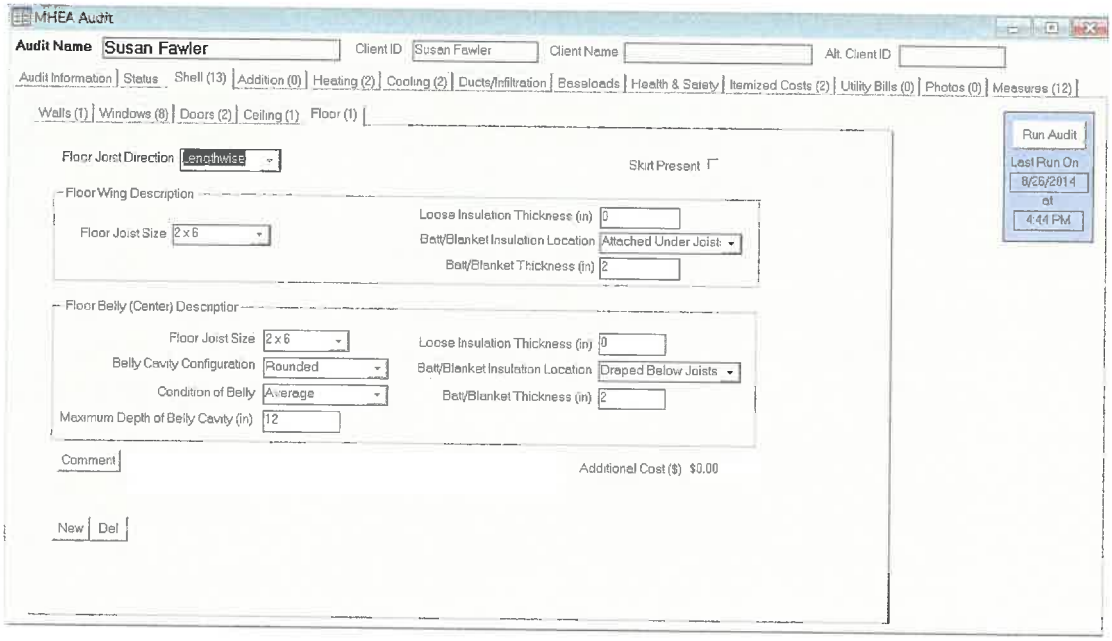
22: SHELL – Floor



(1) Note that this section is for the Floor on the original manufactured home only, not on any addition that may exist.

(2) **Floor Joist Direction**. Choose whether joists run Widthwise or Lengthwise.

(3) Check if there is a mobile home **Skirt Present**. If it covers only part of the home, the auditor must make a judgment call whether to call it present or not.

(4) MHEA allows for the possibility that the **Floor Wings** and the **Floor Belly** may be different, which is rare in modern manufactured homes.

(5) Choose the appropriate **Floor Joist Size** from the dropdown list.

(6) Input the appropriate amount of **Loose Insulation Thickness** and/or **Batt/Blanket Thickness**. Choose the appropriate **Location** for the Batt/Blanket insulation.

(7) Choose the appropriate **Belly Cavity Configuration** from the dropdown list. Press the F1 key for a visual that may help you define each configuration.

(8) Choose the appropriate **Condition of Belly** from the dropdown list. This refers to what is generally called the Belly Board.

(9) Input the **Maximum Depth of Belly Cavity**. This tells MHEA how many bags of insulation can be blown between the home floor and the Belly Board.

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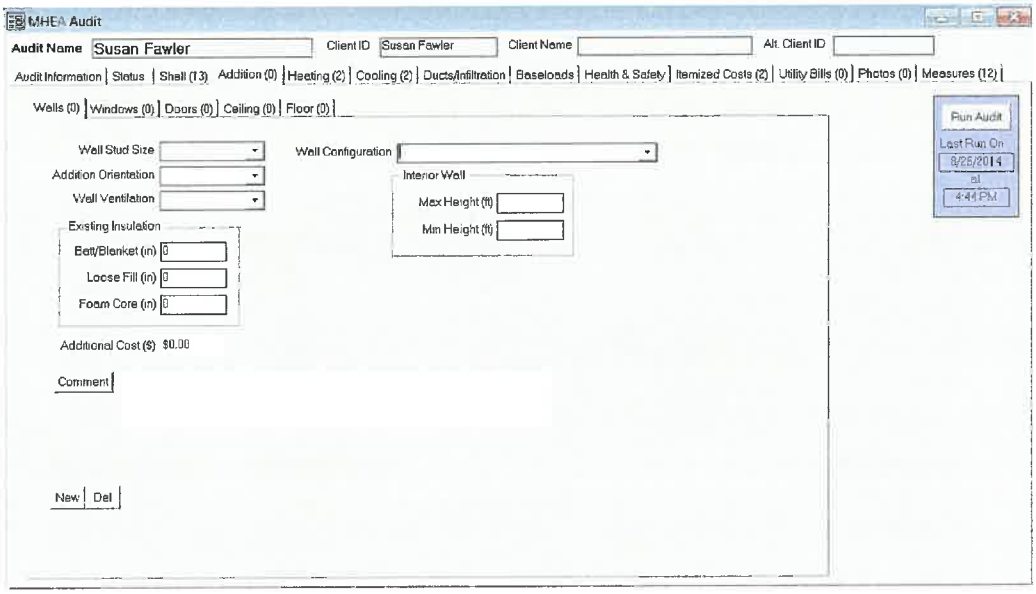
23: ADDITION



(1) All windows, doors of the Addition must be modeled here only, not in the previous Shell section.

(2) All inputs are essentially the same as what you have input previously in the Shell with one exception....

(3) **Wall Configuration**. There are three choices here and they all refer to the slope of the ceiling from within the addition. Either the ceiling slopes downwards away from the mobile home; or it is cathedral style; or the ceiling is flat.

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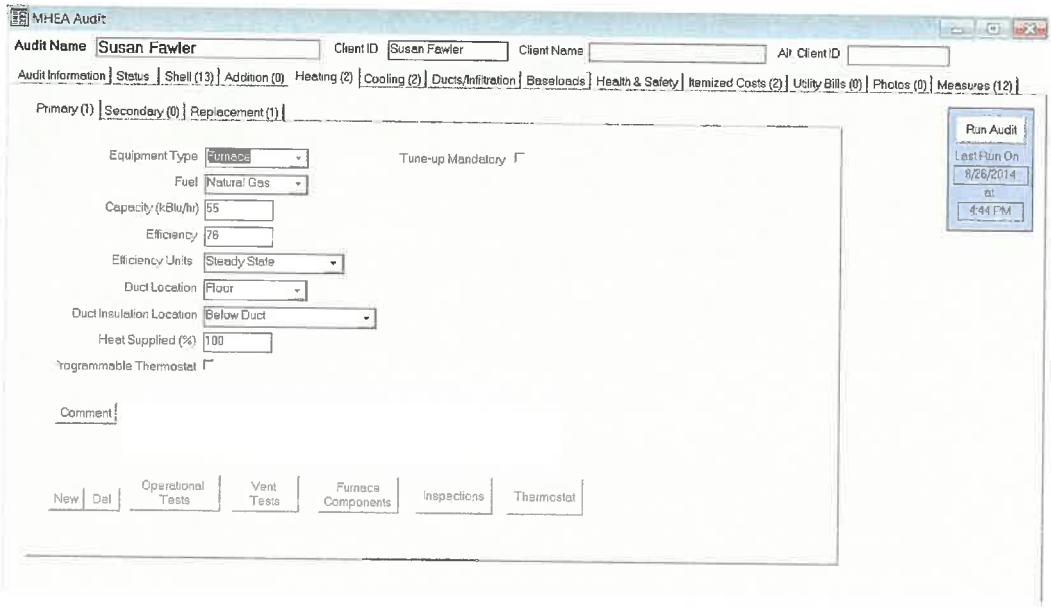
24: HEATING – Existing Unit(s)



(1) Input for the **Primary** Heating System first. Use the Secondary input only if there is a secondary unit.
(2) Choose the appropriate **Equipment Type** from the dropdown list.
(3) Choose the appropriate **Fuel** from the dropdown list.
(4) Choose the appropriate **Capacity (KBTU/hr)** from the dropdown list. Note that, unlike NEAT, this is the INPUT capacity, not the output.
(5) Choose the appropriate **Efficiency** from the dropdown list. Remember that electric resistance heat, even in the form of a forced air furnace, is still 100% efficient.
(6) Choose the appropriate **Efficiency Units** from the dropdown list. Steady State should be measured in the field where possible for all combustion units, otherwise input AFUE. HSPF is for Heat Pumps. COP can be used also for heat pumps, and is the best choice for all electric resistance heating systems (COP = 1.0)
(7) Choose the appropriate **Duct Location** from the dropdown list. Floor, Ceiling, or none.
(8) Choose the appropriate **Duct Insulation Location** from the dropdown list.
(9) **Heat Supplied**. Input 100% if the primary unit is the only source of heat. Otherwise estimate the % supplied by each of the primary and secondary units.

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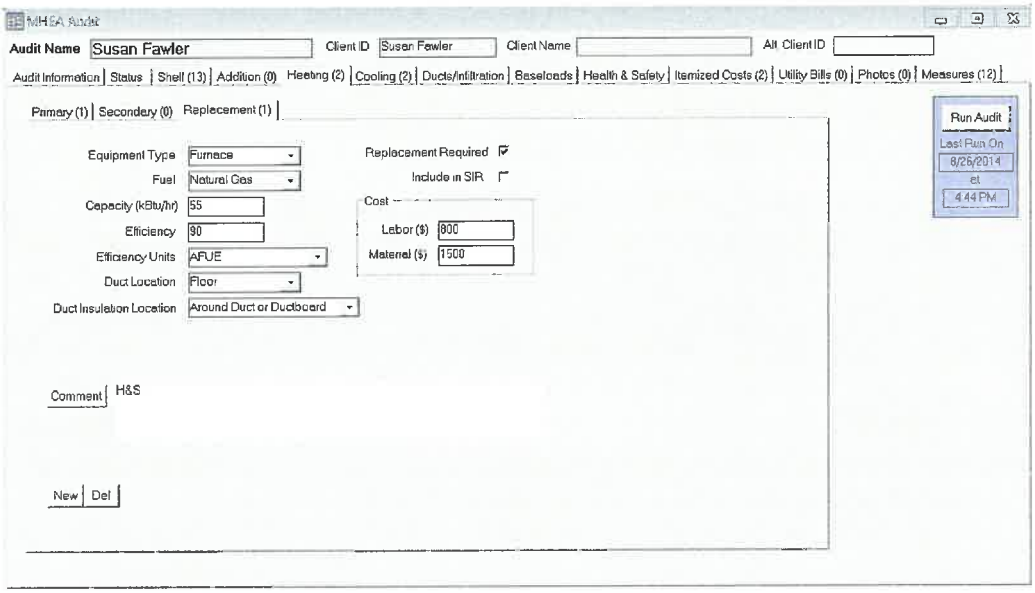
ENERGY AUDITS: Mobile Home (MHEA) only

25: HEATING – Replacement unit



(1) Choose a **Replacement** Heating System. Note that <u>if the Replacement tab is not completed, MHEA is not able to consider whether a replacement is needed because it has nothing to compare the existing unit with.</u>

(2) Inputs are the same as for the existing Heating System

(3) **Efficiency units**. Remember that a new unit that has not been installed CANNOT have a Steady State. Choose <u>AFUE</u> for all combustion units. All electric resistance heaters of any type have a <u>COP</u> of 1.0. Heat Pump efficiencies are generally stated in terms of <u>HSPF</u>.

(4) **Note**: **Heat Pump Replacement**. MHEA, unlike NEAT, does not recognize that a heat pump serves both heating AND cooling functions. Therefore, if a new heat pump is sought, the total cost for that heat pump can be divided between the <u>Heating Replacement</u> and the <u>Cooling Replacement</u>. Those costs can be divided ANY way that works, so long as both the Heating and Cooling Replacements provide an SIR of 1.0 or greater.

(5) **For example**: A Heat Pump with a total install cost of $5000 can be divided as:

<u>Heating</u>	<u>Cooling</u>
$2500	$2500
$1000	$4000
$4500	$500

Any combination of costs, so long as the combined cost equals the total install cost.

(6) Check **Replacement Required** if the replacement of the Heating System is mandatory.

(7) Check **Include in SIR** if the mandatory replacement is an ECM measure. Leave unchecked if the replacement is to paid for by Health & Safety funds.

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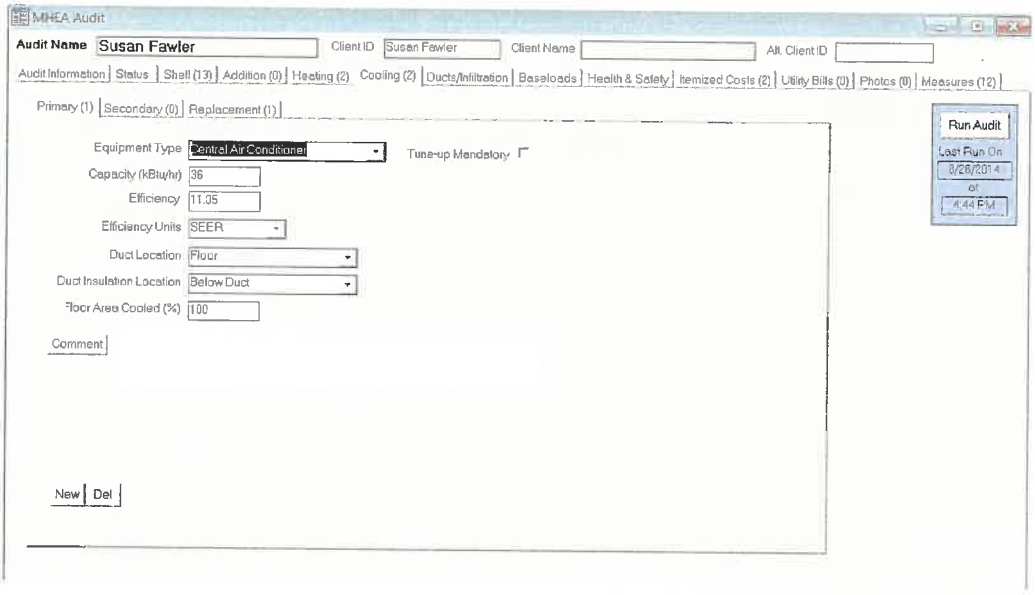
26: COOLING



Inputs are essentially the same as for Heating Systems.

Notes:

(1) **Capacity**. Remember that 1 ton equals 12000 BTU.
(2) **Efficiency Units**. Note that, unlike with NEAT, it is possible to input EER without the need to convert the EER to SEER.

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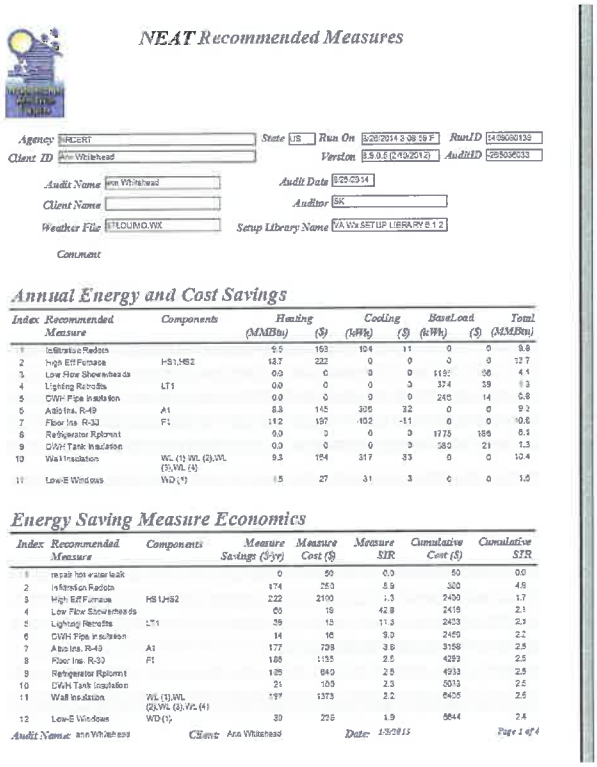
ENERGY AUDITS: NEAT and MHEA

27: Recommended Measures



NEAT Recommended Measures

Agency: HRCERT State: VA Run On: 5/20/2014 3:08:59 P RunID: 1409080139
Client ID: Ann Whitehead Version: 6.5.0.5 (2/13/2012) AuditID: 1253036033
Audit Name: ann Whitehead Audit Date: 5/20/2014
Client Name: Auditor: BK
Weather File: BLOUMO.WX Setup Library Name: VA Wx SETUP LIBRARY 6.1.2
Comment:

Annual Energy and Cost Savings

Index	Recommended Measure	Components	Heating (MMBtu)	($)	Cooling (kWh)	($)	BaseLoad (kWh)	($)	Total (MMBtu)
1	Infiltration Reduct		9.6	163	104	11	0	0	9.8
2	High Eff Furnace	HS1,HS2	13.7	232	0	0	0	0	12.7
3	Low Flow Showerheads		0.0	0	0	0	1192	86	4.1
4	Lighting Retrofits	LT1	0.0	0	0	0	374	39	1.3
5	DWH Pipe Insulation		0.0	0	0	0	245	14	0.8
6	Attic Ins. R-49	A1	8.8	145	305	32	0	0	9.2
7	Floor Ins. R-30	F1	11.2	197	-102	-11	0	0	10.6
8	Refrigerator Rplcmnt		0.0	0	0	0	1175	186	0.1
9	DWH Tank Insulation		0.0	0	0	0	383	21	1.3
10	Wall Insulation	WL (1),WL (2),WL (3),WL (4)	9.3	164	317	33	0	0	10.4
11	Low-E Windows	WD (1)	1.5	27	31	3	0	0	1.6

Energy Saving Measure Economics

Index	Recommended Measure	Components	Measure Savings ($/yr)	Measure Cost ($)	Measure SIR	Cumulative Cost ($)	Cumulative SIR
1	repair hot water leak		0	50	0.0	50	0.0
2	Infiltration Reduct		174	253	5.9	303	4.8
3	High Eff Furnace	HS1,HS2	222	2100	1.3	2400	1.7
4	Low Flow Showerheads		69	19	42.8	2419	2.1
5	Lighting Retrofits	LT1	39	15	11.3	2433	2.3
6	DWH Pipe Insulation		14	16	9.0	2449	2.2
7	Attic Ins. R-49	A1	177	738	3.6	3188	2.5
8	Floor Ins. R-30	F1	188	1155	2.5	4293	2.5
9	Refrigerator Rplcmnt		135	640	2.5	4933	2.5
10	DWH Tank Insulation		21	100	2.3	5013	2.5
11	Wall Insulation	WL (1),WL (2),WL (3),WL (4)	197	1378	2.2	6405	2.5
12	Low-E Windows	WD (1)	30	226	1.9	6644	2.4

Audit Name: ann Whitehead Client: Ann Whitehead Date: 1/5/2015 Page 1 of 4

Index	Recommended Measure	Components	Measure Savings ($/yr)	Measure Cost ($)	Measure SIR	Cumulative Cost ($)	Cumulative SIR
13	new flue		0	30	0.0	6674	0.0

Materials

Index	Material	Type	Quantity	Units
1	Wall Insulation	Blown Cellulose - 2x6 Filled	776	SqFt
2	Floor Insulation	Fiberglass Batts - R-30	700	SqFt
3	Low E Window		1	Each
4	Compact Fl.	15 Watt	5	Each Lamp
5	DHW Tank Insulation		1	Each
6	DHW Pipe Insulation		1	Each
7	Low Flow Shower Heads		2	Each
8	Attic Insulation	Blown Cellulose - R-49	700	SqFt
9	High Eff. Furnace	60 kBtuh NG Existing, 80 - 89 kBtuh NG Fuel	1	Each
10	New Refrigerator	EnergyStar	1	Each

Pre/Post Retrofit Energy and Loads

	Pre Retrofit		Post Retrofit	
	Heating	Cooling	Heating	Cooling
Annual load (MBtu/yr)	44.2	27.5	10.5	20.3
Annual Energy (MBtu/yr)	52.9	9.2	11.6	6.5
Heat loss/gain (kBtu/hr)	46.6	26.9	17.4	10.5
Output required (kBtu/hr/Btuh/hr)	53.8	2.0	20.0	1.0

Approximate Component Contributions to Peak HEATING Load

Component Type	Component Name	Area or Volume (Inf)	Pre Retrofit Load (Btuh)	Post Retrofit Load (BTUh)
Wall	WL (1)	244	4503.1	1387.4
Wall	WL (2)	144	2657.5	818.3
Wall	WL (3)	244	4503.1	1387.4
Wall	WL (4)	144	2657.5	818.3
Window	WD (1)	8	638.6	196.4
Window	WD (2)	8	538.6	538.6
Window	WD (3)	8	538.6	538.6
Window	WD (4)	8	538.6	538.6
Window	WD (5)	8	538.6	538.6
Window	WD (6)	8	258.4	258.4
Window	WD (7)	8	538.6	538.6
Window	WD (8)	8	538.6	538.6
Door	DR1	20	761.6	761.6
Door	DR2	20	761.6	761.6

Audit Name: ann Whitehead Client: Ann Whitehead Date: 1/5/2015 Page 2 of 4

(1) After the Run Audit button is pressed, this report will be generated.

(2) The most important information will be in the section called **Energy Saving Measure Economics**.

(3) Note the column headings of the **Energy Saving Measure Economics** section. The heading titled: Measure SIR is the most important of these. No weatherization measure is allowed that has an SIR of less than 1.0. However this is NOT true for Incidental Repairs and Health & Safety measures.

(4) **Incidental Repairs** (if any) will always show up at the top of the list and have an SIR = 0.0

(5) **Health and Safety** items will always show up at the bottom of the list. Most H&S items will have an SIR = 0.0. The only exception is for weatherization measures that are replaced as a mandatory H&S item. These will show up below Weatherization Measures, and will NOT count towards the Cumulative SIR, but the measure SIR may be higher than 0.0. If you are not sure which it is, look all the way to the right. The number for this measure under Cumulative SIR should be 0.0.

(6) Look to the right-most column along the line of the very last Weatherization Measure. There you will see the **Cumulative SIR** for this project. This number must be 1.0 or greater.

(7) Below the Cumulative SIR will be all 0.0. These are H&S items.

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(8) Above the Cumulative SIR, the numbers may be anything from 0.0 upwards. This does not mean anything. The only number in this column that is significant is the number adjacent to the last Weatherization Measure.

(9) Note that all Weatherization Measures are listed in a priority of descending SIR, except for Air Sealing (Infiltration Reduction, Duct Sealing, and General Air Sealing) which are ALWAYS the first Weatherization Measure.

(10) If any measure was input as a Mandatory Replacement (AND included in SIR), then this measure will show up right below Infiltration Reduction and Duct Sealing, regardless of its measure SIR. This measure will be provided for you even if the Measure SIR is below 1.0, but if this is the case, it MUST be removed. No Weatherization Measure is allowed with an SIR below 1.0.

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NEAT MHEA Software Course

Introduction

What is NEAT/ MHEA?

The Weatherization Assistant is a family of easy-to-use but advanced energy audit computer programs that identify the cost-effective energy-efficiency retrofit measures for a home after taking into account local weather conditions, retrofit measure costs, fuel costs, and specific construction details of the home.

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NEAT

National Energy Audit Tool

site-built single-family homes

NEAT/MHEA Software Course

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MHEA

Manufactured Home Energy Audit

mobile homes

How it works

- A windows based program – Microsoft Access

Best Uses of The Program

- Specifically designed for state and local agencies for the DOE weatherization program
- Can and is also used by private contractors in the public industry

SIR = Saving to Investment Ratio

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S.I.R.
Savings to Investment Ratio

$$\frac{\text{Measure savings per year}}{\text{Cost of Measure}} \times \text{Expected life of measure}$$

SIR must be 1.0 or greater, otherwise the savings will never equal the initial investment

Note: In NEAT, SIR will never be calculated over a period longer than **15 years**, even if the measure is expected to last longer than that.

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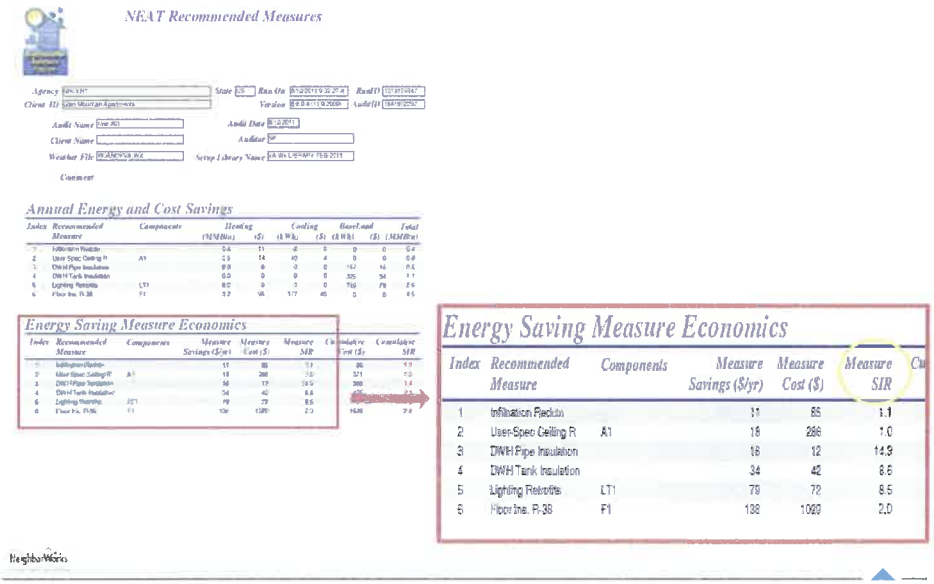
NEAT Recommended Measures


NEAT Recommended Measures

Annual Energy and Cost Savings

Energy Saving Measure Economics

Energy Saving Measure Economics

Index	Recommended Measure	Components	Measure Savings ($/yr)	Measure Cost ($)	Measure SIR	Cu
1	Infiltration Reduction		11	85	1.1	
2	Ulser-Spec Ceiling R	A1	18	288	1.0	
3	DWH Pipe Insulation		18	12	14.9	
4	DWH Tank Insulation		34	42	8.6	
5	Lighting Retrofits	LT1	78	72	9.5	
6	Floor Ins. R-38	F1	138	1080	2.0	

Other DOE Approved Energy Auditing Tools

- TREAT
- EAQuip
- REMRATE
- Etc.

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www.waptac.org

www.weatherizationassistanttraining.org

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Data Entry Issues

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Incorrect Data Entry Impacts

- Prevents NEAT and MHEA from evaluating potentially cost-effective measures
- Forces NEAT and MHEA to recommend measures that are not cost effective
- Forces NEAT and MHEA to recommend less cost-effective measures before more cost-effective measures

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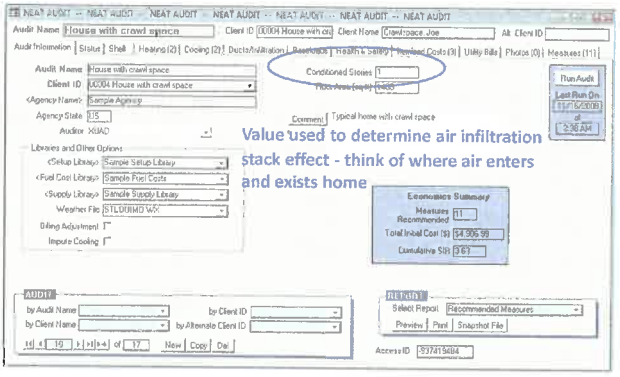
General Information Tab - NEAT



- Include a basement only if it is conditioned and most of the wall area is above grade
- A conditioned "walkout" basement is a story
- Count finished attics as 0.5 stories (preferred) or 1 story

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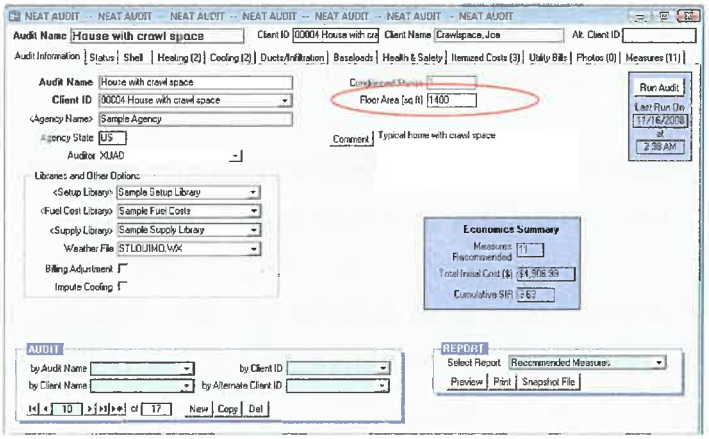
General Information Tab - NEAT



- Conditioned area only
- Consider which floors were considered conditioned

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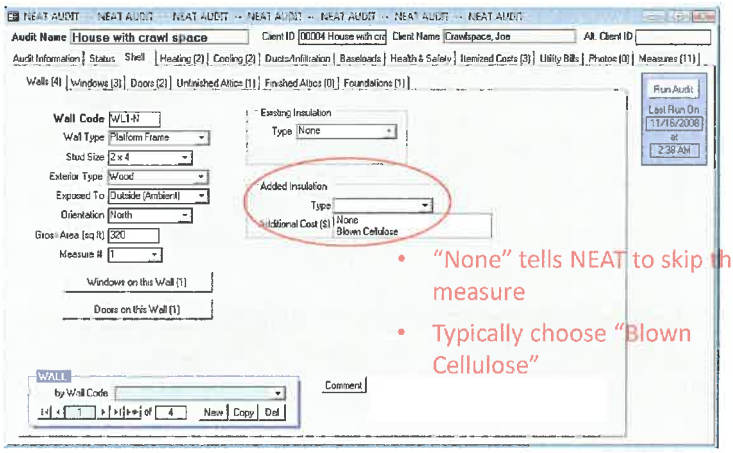
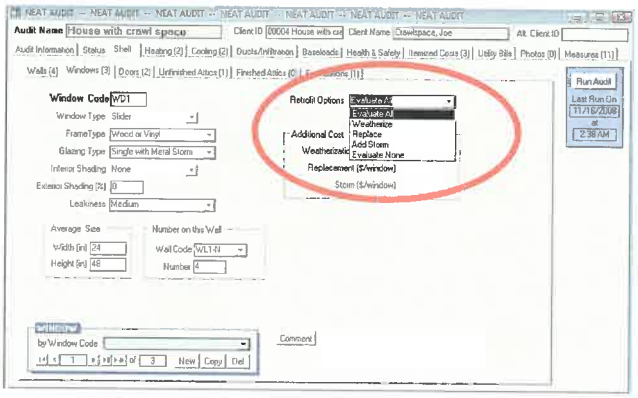
Walls Tab - NEAT



- "None" tells NEAT to skip the measure
- Typically choose "Blown Cellulose"

Windows Tab - NEAT



- "Weatherize", "Replace", and "Add Storm" forces NEAT to recommend measure without considering other options even if not cost effective
- Typically choose "Evaluate All" to allow NEAT to determine most cost-effective option, if any

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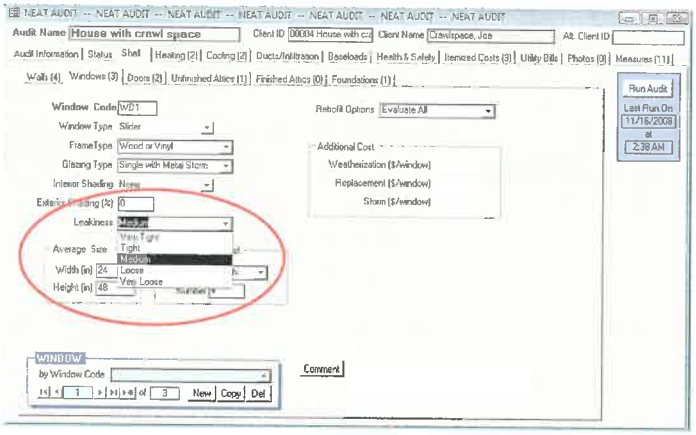
Windows Tab - NEAT



- Allows window retrofits to be credited with portion of anticipated air leakage reduction
- Selection impacts recommendations
- Tendency is to over use "Loose" and "Very Loose"
- Use help for guidance

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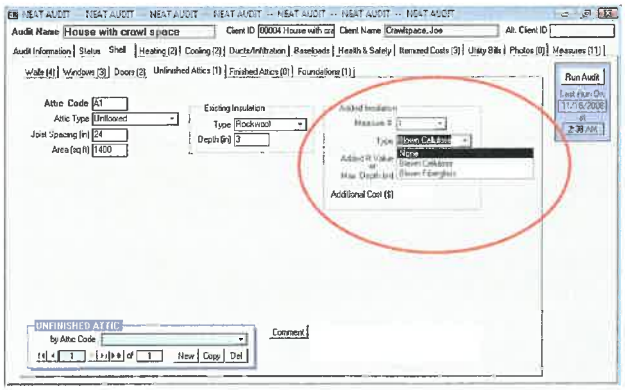
Unfinished/Finished Attic Tab - NEAT



- "None" or max. depth of "0" tells NEAT to skip the measure
- Typically choose "Blown Cellulose"
- Leave Added R Value and Max Depth blank to allow NEAT to choose best option

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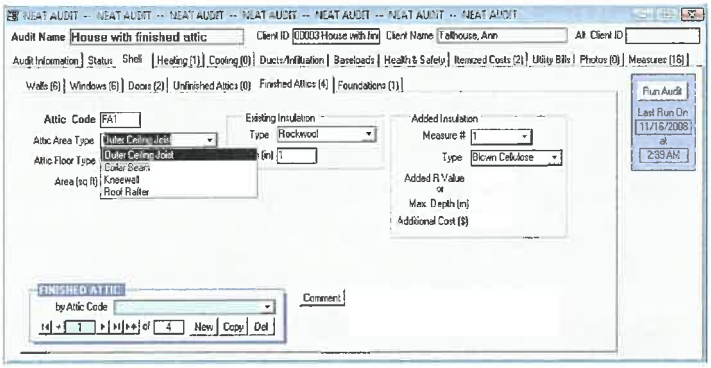
Finished Attic Tab - NEAT



- Page used to describe finished attics that have kneewalls, dormers, etc.
- Don't duplicate attic areas in Unfinished Attics or Walls tabs

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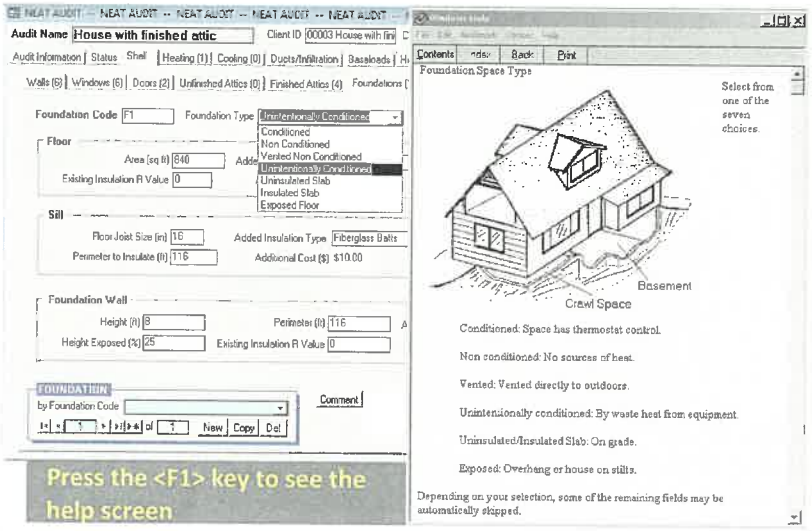
Foundations Tab - NEAT



NeighborWorks

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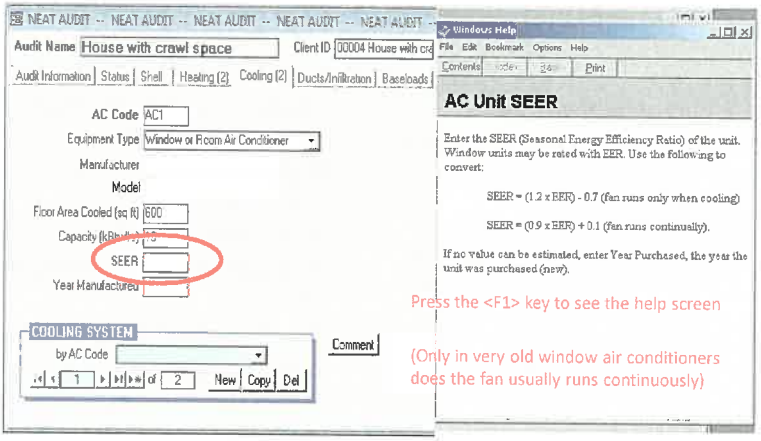
Cooling Tab – NEAT



- SEER number found only for central systems. Input SEER or Year (not both)
- For window units, calculate SEER using EER and equations
- Do not degrade nameplate/rated values by more than 0.5 for age, etc.

NeighborWorks

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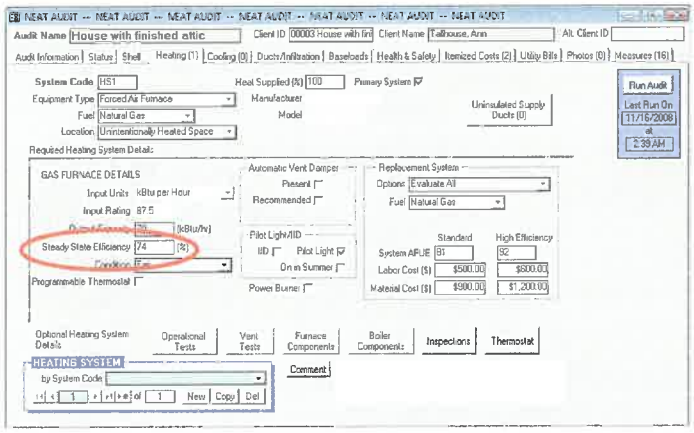
Heating Systems Tab - NEAT



- The efficiency that would be measured from a flue gas analysis
- Do not enter the AFUE. AFUE is inferred by Input and Output Capacity
- Use 98-100% for electric resistance units

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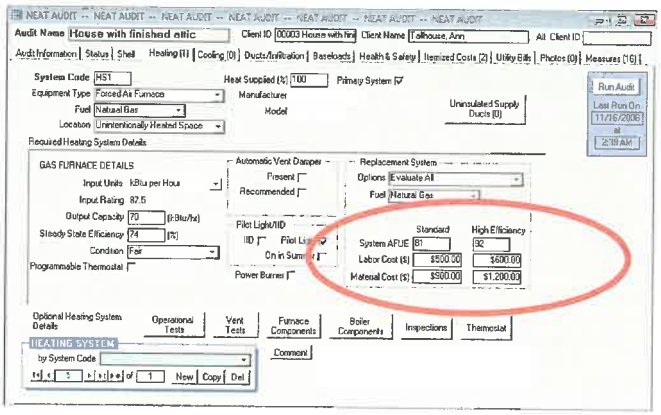
Heating System Tab - NEAT

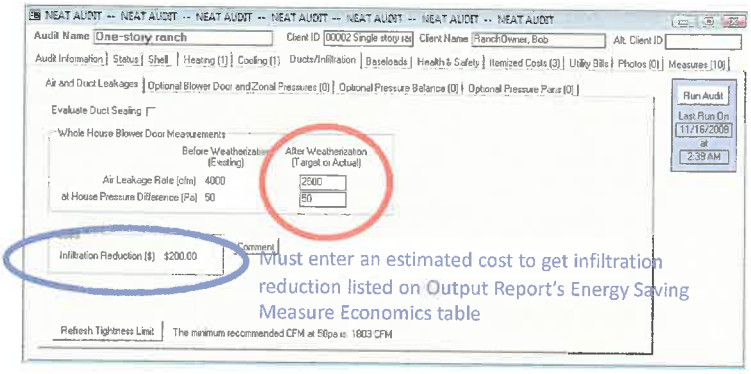
- "Optional [Evaluate All]" - Allows NEAT to determine most cost-effective option, if any
- "Tuneup Performed"
  - Tells NEAT to determine the most cost-effective of the remaining options, if any
  - Efficiency entered for existing system is the value after the tuneup
- "Tuneup Mandatory", "Standard-" and "High-" "Efficiency Replacement Mandatory", Forces NEAT to recommend measure without considering other options even if not cost effective
- "Don't Replace"-Tells NEAT to not consider the two replacement options
- "Evaluate None" – Evaluates no heating system options

Heating Systems Tab - NEAT



- Mandatory inputs for combustion appliances, if a Status other than "Don't Replace" is selected
- Input same labor and material cost for both if agency installs only High Efficiency units.

Ducts & Infiltration Tab - NEAT/MHEA



Must enter an estimated cost to get infiltration reduction listed on Output Report's Energy Saving Measure Economics table

- A "target" value because an actual value is not known at the time of the audit. Usually Target is determined by specific State method.
- Input $1 and Run Audit to determine Max allowable funds (measure SIR at $1 is equivalent to $ allowed for SIR=1.0)

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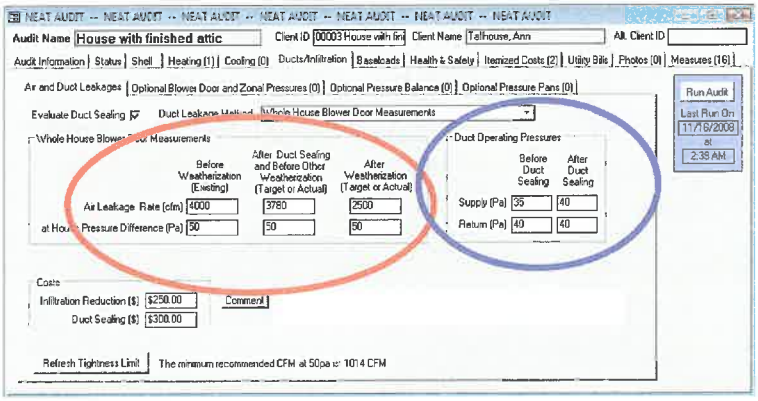
Ducts & Infiltration Tab - NEAT/MHEA



- Measurements must be internally consistent for "Pre/Post Whole House Blower Door" and "Blower Door Subtraction" methods
- Duct operating pressures are static pressures in the ducts with the air handler fan on

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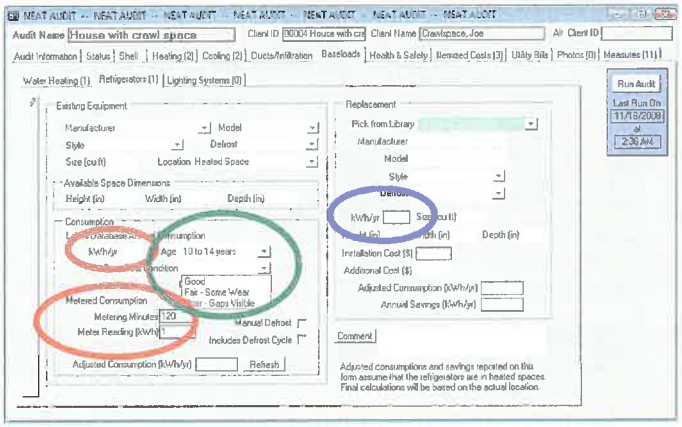
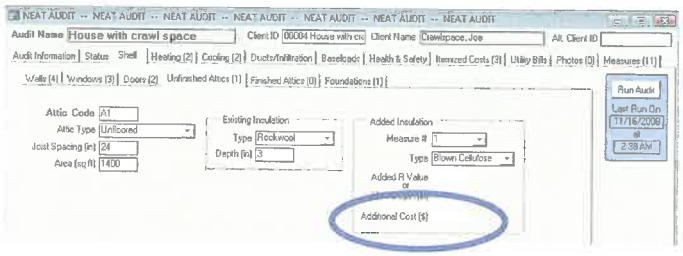
Baseloads - Refrigerator Tab - NEAT/MHEA



- If metered consumption data entered, then the "kWh/Yr" field is blanked
- **Input only if consumption if not metered**
- The energy use of the replacement unit only. Will populate automatically if replacement chosen from library

Added/Additional Cost Field - NEAT/MHEA



- If extra work is absolutely needed to do the measure and will only be done if the measure is done, then include added cost with measure
- If extra work will still be done if measure not done
  - Include as a an item on the Itemized Cost tab
  - If measure turns out to be cost effective, include the cost with the measure rather than as Itemized Cost, rerun audit, and see if measure is still cost effective

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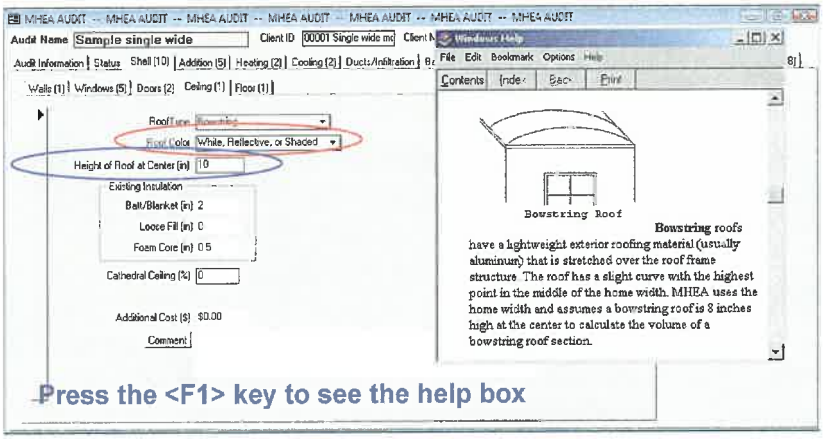
MHEA

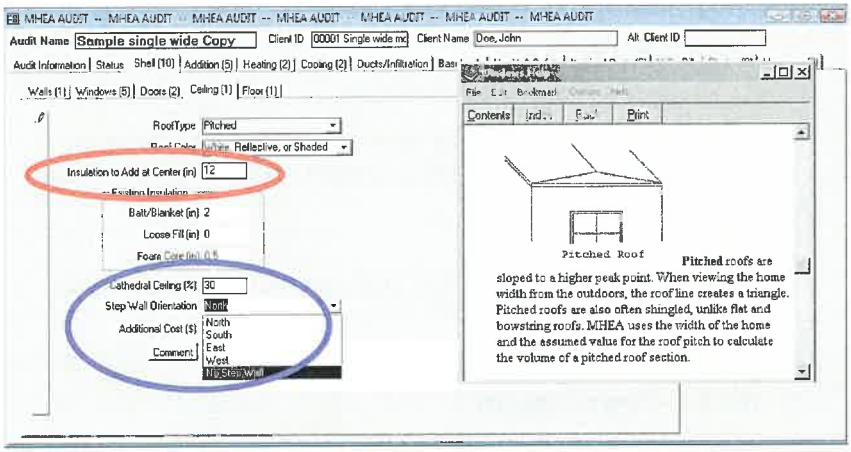
- General Information Tab
  - Height is the non-cathedral height
  - Home leakiness not used if blower door readings entered on Ducts & Infiltration tab (see parameter set for values associated with descriptive names)
- Walls
  - Wall vented if siding has manufactured perforations (or is very leaky)
  - Add lengths if two or more carports/porches
- Window - Exterior Shading
  - Use carport or porch if completely shaded by tree, etc.
  - Use awning if shaded 50% by other objects

Ceiling Tab - MHEA



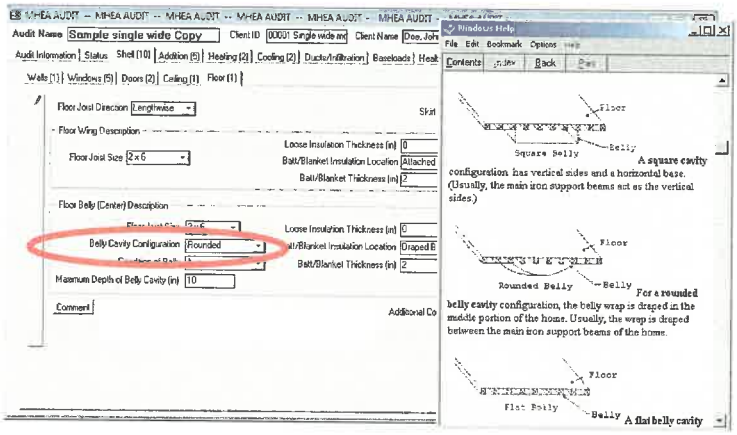
- "White or Reflective" roof color only if special coating - usually "Normal or Weathered"
- On bowstring roof, NEAT assumes remaining space in roof will be filled with insulation. Measure from Highest point to ceiling.

Ceiling Tab - MHEA



- On pitched roofs, you specify how much insulation will be added on top of existing
- On pitched (and flat) roofs, cathedral ceilings possible - must enter step wall orientation if one exists

Floor Tab - MHEA



- Press the <F1> key to see the help screen
- Most mobile homes you will find are ROUNDED

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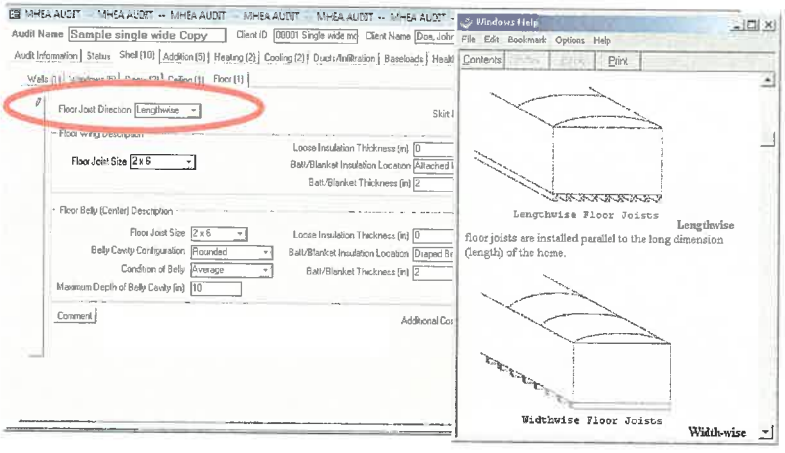
Floor Tab - MHEA



- Press the <F1> key to see the help screen

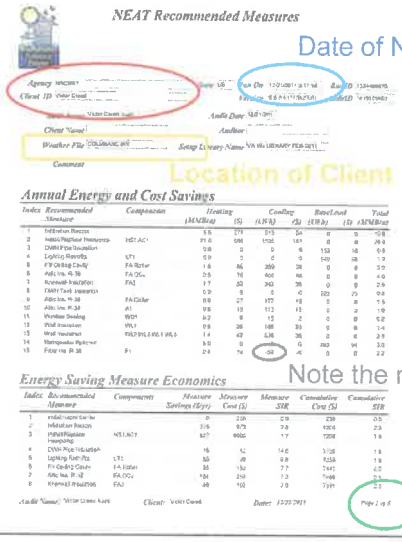
MHEA

- Air Conditioning
  - Efficiency: SEER is applicable to central system and EER to window/room units
  - Duct insulation location must be consistent with information on Floor tab
  - Percent cooled for primary and secondary units do not need to add to 100%
- Heating Systems
  - Duct insulation location must be consistent with information on Floor tab
  - Percent heated for primary and secondary units do add to 100% (no input for secondary)

ENERGY SOLUTIONS

NEAT MHEA Software Course

Interpreting the Recommended Measures



Energy Saving Measure Economics

Index	Recommended Measure	Components	Measure Savings ($/yr)	Measure Cost ($)	Measure SIR	Cumulative Cost ($)	Cumulative SIR
1	Install vapor barrier				0.0	238	0.0
2					2.8	1208	2.3
3	Fill Ceiling Cavity	FA Flatte	17	102	14.3	1390	3.8
4	DWH Pipe Insulation		16	12	14.0	1402	3.9
5	Attic Ins. R 38	FA OCJ	231	258	13.6	1660	5.4
6	Kneewall Insulation	FA3	163	192	12.9	1852	6.2
7	Attic Ins. R 38	FA Collar	84	128	10.0	1980	6.4
8	Lighting Retrofits	LT1	58	39	8.8	2019	6.5
9	Attic Ins. R-38	A1	57	102	8.5	2121	6.6
10	DWH Tank Insulation		23	42	5.9	2163	6.6
11	Wall Insulation	WL1	81	329	3.7	2492	6.2
12	Wall Insulation	WL2,WL3,WL4, WL5	139	613	3.4	3105	5.7
13	Floor Ins. R-38	F1	155	954	2.5	4059	4.9
14	Window Sealing	WD2	5	26	1.7	4085	4.9
15	Low-E Windows	WD1,WD3	52	566	1.4	4651	4.5
16	Refrigerator Reloc		94	640	1.2	5291	4.1
17	CO Monitor is Needed x2		0	120	0.0	5411	0.0
18	Fix Improper Venting (Clothes Dryer)				0.0		0.0
19	Smoke Detector is Needed x 3			180	0.0	5616	0.0

INCIDENTAL REPAIRS

HEALTH & SAFETY

ARE MY ITEMIZED COSTS IN THE RIGHT PLACE?

DO ANY WEATHERIZATION MEASURES HAVE AN SIR BELOW 1.0?

Energy Saving Measure Economics

Index	Recommended Measure	Components	Measure Savings ($/yr)	Measure Cost ($)	Measure SIR	Cumulative Cost ($)	Cumulative SIR
1	Install vapor barrier		0	238	0.0	238	0.0
2	Infiltration Redctn		326	970	2.8	1208	2.3
3	Fill Ceiling Cavity	FA Rafter	171	182	14.3	1390	3.8
4	DWH Pipe Insulation		16	12	14.0	1402	3.9
5	Attic Ins. R-38	FA OCJ	231	258	13.6	1660	5.4
6	Kneewall Insulation	FA3	163	192	12.9	1852	6.2
7	Attic Ins. R-38	FA Collar	84	128	10.0	1980	6.4
8	Lighting Retrofits	LT1	58	39	8.8	2019	6.5
9	Attic Ins. R-38	A1	57	102	8.5	2121	6.6
10	DWH Tank Insulation		23	42	5.9	2163	6.6
11	Wall Insulation	WL1	81	329	3.7	2492	6.2
12	Wall Insulation	WL2,WL3,WL4, WL5	139	613	3.4	3105	5.7
13	Floor Ins. R-38	F1	155	954	2.5	4059	4.9
14	Window Sealing	WD2	5	26	1.7	4085	4.9
15	Low-E Windows	WD1,WD3	52	566	1.4	4651	4.5
16	Refrigerator Rplcmnt		94	640	1.2	5291	4.1
17	CO Monitor Is Needed x2		0	120	0.0	5411	0.0
18	Fix Improper Venting (Clothes Dryer)		0	25	0.0	5436	0.0
19	Smoke Detector Is Needed x 3		0	180	0.0	5616	0.0

ENERGY SOLUTIONS

NEAT/MHEA Software Course

IS THE WHOLE HOUSE SIR ABOVE 1.0?

Energy Saving Measure Economics

Index	Recommended Measure	Components	Measure Savings ($/yr)	Measure Cost ($)	Measure SIR	Cumulative Cost ($)	Cumulative SIR
1	Install vapor barrier		0	238	0.0	238	0.0
2	Infiltration Redctn		326	970	2.8	1208	2.3
3	Fill Ceiling Cavity	FA Rafter	171	182	14.3	1390	3.8
4	DWH Pipe Insulation		16	12	14.0	1402	3.9
5	Attic Ins. R-38	FA OCJ	231	258	13.6	1660	5.4
6	Kneewall Insulation	FA3	163	192	12.9	1852	6.2
7	Attic Ins. R-38	FA Collar	84	128	10.0	1980	6.4
8	Lighting Retrofits	LT1	58	39	8.8	2019	6.5
9	Attic Ins. R-38	A1	57	102	8.5	2121	6.6
10	DWH Tank Insulation		23	42	5.9	2163	6.6
11	Wall Insulation	WL1	81	329	3.7	2492	6.2
12	Wall Insulation	WL2,WL3,WL4, WL5	139	613	3.4	3105	5.7
13	Floor Ins. R-38	F1	155	954	2.5	4059	4.9
14	Window Sealing	WD2	5	26	1.7	4085	4.9
15	Low-E Windows	WD1,WD3	52	566	1.4	4651	4.5
16	Refrigerator Rplcmnt		94	640	1.2	5291	4.1
17	CO Monitor Is Needed x2		0	120	0.0	5411	0.0
18	Fix Improper Venting (Clothes Dryer)		0	25	0.0	5436	0.0
19	Smoke Detector Is Needed x 3		0	180	0.0	5616	0.0

CUMULATIVE COST OF ALL MEASURES

ENERGY SOLUTIONS

Materials

Index	Material	Type	Quantity	Units
1	Wall Insulation		736	SqFt
2	Attic Insulation	Blown Cellulose - R-38	320	SqFt
3	Kneewall Insulation	Fiberglass Batts - R-13	240	SqFt
4	Window Sealing		1	Each Windo
5	Low E Window		2	Each
6	Compact Fl.	13 Watt	8	Each Lamp
7	DHW Tank Insulation		1	Each
8	DHW Pipe Insulation		1	Each
9	Floor Insulation	Fiberglass Batts - R-38	680	SqFt
10	Attic Insulation	Blown Cellulose - 8 in.	240	SqFt
11	New Refrigerator	Energy Star	1	Each
12	CO monitor		1	Each
13	dryer vent		1	Each
14	vapor barrier 680 sq ft		1	Each
15	smoke detector		1	Each

Defined in 'materials' of Itemized Costs
Otherwise default wording (See the User Defined Measure for a list of materials.)

Pre/Post Retrofit Energy and Loads

	Pre Retrofit		Post Retrofit	
	Heating	Cooling	Heating	Cooling
Annual load (MBtu/yr)	48.3	62.6	11.6	33.8
Annual Energy (MBtu/yr)	48.3	23.6	11.6	12.7
Heat loss/gain (Btu/hr)	65.5	41.6	18.5	17.1
Output required (kBtu/hr)(ton)	65.5	4.4	18.5	1.9

Manual J

ENERGY SOLUTIONS

Index	Recommended Measure	Measure SIR
1	Install vapor barrier	0.0
2	Infiltration Redctn	2.8
3	Fill Ceiling Cavity	14.3
4	DWH Pipe Insulation	14.0
5	Attic Ins. R-38	13.6
6	Kneewall Insulation	12.9
7	Attic Ins. R-38	10.0
8	Lighting Retrofits	8.8
9	Attic Ins. R-38	8.5
10	DWH Tank Insulation	5.9
11	Wall Insulation	3.7
12	Wall Insulation	3.4
13	Floor Ins. R-38	2.5
14	Window Sealing	1.7
15	Low-E Windows	1.4
16	Refrigerator Rplcmnt	1.2
17	CO Monitor is Needed x2	0.0
18	Fix Improper Venting (Clothes Dryer)	0.0
19	Smoke Detector is Needed x 3	0.0

Gone!

Index	Recommended Measure	Measure SIR
1	Install vapor barrier	0.0
2	Infiltration Redctn	2.8
3	Install/Replace Heatpump	1.7
4	DWH Pipe Insulation	14.0
5	Lighting Retrofits	8.8
6	Fill Ceiling Cavity	7.7
7	Attic Ins. R-38	7.3
8	Kneewall Insulation	7.0
9	DWH Tank Insulation	5.9
10	Attic Ins. R-38	5.4
11	Attic Ins. R-38	4.6
12	Window Sealing	2.4
13	Wall Insulation	2.1
14	Wall Insulation	1.9
15	Refrigerator Rplcmnt	1.2
16	Floor Ins. R-38	1.1
17	CO Monitor is Needed x2	0.0
18	Fix Improper Venting (Clothes Dryer)	0.0
19	Smoke Detector is Needed x 3	0.0

MANDATORY REPLACEMENT

ENERGY SOLUTION

Materials

Programming Artifact (has no meaning)

Index	Material	Type	Quantity	Units
1	Wall Insulation	Blown Cellulose - 2x4 Filled	736	SqFt
2	Attic Insulation	Blown Cellulose - R-38	1120	SqFt
3	Window Sealing		2	Each Windo
4	Low E Window		1	Each
5	Compact Fl.	13 Watt	8	Each Lamp
6	DHW Tank Insulation		1	Each
7	DHW Pipe Insulation		1	Each
8	Floor Insulation	Fiberglass Batts - R-38	680	SqFt
9	High Eff. Furnace (not used)	80 kBtu/h NG Existing, 21 - 29 kBtu/h NG Post	1	Each
10	New Refrigerator	Energy Star	1	Each
11	CO monitor		1	Each
12	dryer vent		1	Each
13	vapor barrier 680 sq ft		1	Each
14	smoke detector		1	Each

Existing Furnace Output

Manual S Output Prediction

Manual J Output Prediction, after all WX work is completed

ENERGY SOLUTIONS

Special Notes

NOTE: Heat loss and Output required are only guides to sizing equipment.
NOTE: See NEAT User's Manual for further sizing details.
NOTE: Read cautions in NEAT User's Manual related to sizing results.
NOTE: (+) in the Materials list indicates there are more related User Defined Materials.

Default Notes – NOT user-defined

Comments

All comments input in audit will show up here

Type	Code	Comment
Door	DR3	Sliding door seal is adequate
Attic	A1	Unfinished attic space (A1) - 80 sq ft
Infiltration		Weatherstrip both doors $120 Air seal both attics $400 Air seal crawlspace $150 Patch plumbing penetrations $50 Patch drywall holes $250

List of all Infiltration Measures. Sum of all costs should equal total Infiltration Reduction Cost.

Retrofit Measures NOT Considered

Attic Insulation R49
Electric vent damper
Electric vent damper IID
Evaporative cooler
Flame retention burner
Foundation wall insulation
IID
Low flow showerheads
Smart thermostat

List of Measures turned off In Setup Library

ENERGY SOLUTIONS
RESEARCH & TRAINING
Community Housing Partners
550 Industrial Drive, Christiansburg, VA 24073 | (540) 260-9081 fax: (540) 260-9084 | www.CommunityHousingPartners.org

NEAT Math Guide

SIR (Saving-to-Investment Ratio) = (Annual Savings X Lifespan of Measure) / Initial Cost

Area = Length x Height, or Length x Width

Door area (square feet) = Length (inches) x Height (inches) / 144

Inches of Insulation = R-value / 3.5 (approximate)

Perimeter = sum of all exterior wall lengths (only count walls adjacent to outside)

% Height Exposed = above ground height / total height

Output Capacity = Input Capacity x AFUE (eg: 80% which is same as 0.8)

Standard Efficiency Combustion Furnace = 80% AFUE

High Efficiency Combustion Furnace = 90% AFUE

Electric heat = 100% AFUE

Unvented space heater = 100% AFUE

New Heat Pump = 8 HSPF (Heating Seasonal Performance Factor) minimum

New Central AC = 14 SEER (Seasonal Energy Efficient Ratio) minimum

12,000 BTU (12Kbtu) = 1-ton

Kilowatts (KW) = WATTS / 1000

KBTU = BTU / 1000

13 seer HP August 2006

2 ton

1998 10 seer 6.8 package

Feb 2003 10 seer pak.6.8

Heating and Cooling Efficiencies Based on Manufactured Date

March 20, 2015

Manufactured Date	Cooling Efficiency				Heat Pump Heating Efficiency
	Central Air Conditioner or Heat Pump	Room or Window Air Conditioner			
	(SEER)	(EER)	(SEER)[1]	(SEER)[2]	(HSPF)
<1970	6.0	6.0	5.5	6.5	5.0
1970	6.0	6.0	5.5	6.5	5.0
1971	6.1	6.0	5.5	6.5	5.2
1972	6.3	6.0	5.5	6.5	5.2
1973	6.5	6.1	5.6	6.7	5.3
1974	6.6	6.3	5.7	6.8	5.4
1975	6.8	6.4	5.9	7.0	5.4
1976	7.0	6.5	6.0	7.1	5.5
1977	7.2	6.7	6.1	7.3	5.6
1978	7.4	6.8	6.2	7.4	5.6
1979	7.5	6.9	6.3	7.6	5.7
1980	7.7	7.0	6.4	7.8	5.8
1981	7.9	7.2	6.6	7.9	5.8
1982	8.1	7.3	6.7	8.1	5.9
1983	8.2	7.4	6.8	8.2	6.0
1984	8.4	7.6	6.9	8.4	6.1
1985	8.6	7.7	7.0	8.5	6.1
1986	8.8	7.8	7.1	8.7	6.2
1987	9.0	8.0	7.3	8.8	6.3
1988	9.1	8.1	7.4	9.0	6.3
1989	9.3	8.2	7.5	9.2	6.4
1990	9.5	8.3	7.6	9.3	6.5
1991	9.7	8.5	7.7	9.5	6.5
1992	9.9	8.6	7.8	9.6	6.6
1993	10.0	8.7	8.0	9.8	6.7
1994	10.2	8.9	8.1	9.9	6.7
1995	10.4	9.0	8.2	10.1	6.8
1996	10.6	9.0	8.2	10.1	6.9
1997	10.7	9.0	8.2	10.1	6.9
1998	10.8	9.0	8.2	10.1	7.0
1999	10.9	9.0	8.2	10.1	7.1
2000	11.0	9.25	8.4	10.4	7.2
2001	11.1	9.5	8.7	12.1	7.2
2002	11.1	9.75	8.9	11.0	7.3
2003	11.2	9.75	8.9	11.0	7.3
2004	11.6	9.75	8.9	11.0	7.4
2005	11.9	9.75	8.9	11.0	7.5
2006	12.3	9.75	8.9	11.0	7.6
2007	12.7	9.75	8.9	11.0	7.6
2008	13.0	9.75	8.9	11.0	7.7
>2008	13.0	9.75	8.9	11.0	7.7

[1]Fan runs continuously (assumed in Version 8.3)

[2]Fan runs only when cooling

Below are the equations used in the Weatherization Assistant's National Energy Audit Tool (NEAT) on the Heating and Cooling forms to convert a manufactured date for a heat pump or air conditioner into an efficiency. These equations were used to develop the values in the preceding table.

Central Air Conditioner or Heat Pump Cooling Efficiency (SEER)

1970 and earlier	SEER = 6.0
1971 – 1996	SEER = [(year manufactured - 1990) x 0.1786] + 9.5
1997 - 2002	SEER = [(year manufactured - 1997) x 0.075] + 10.75
2003 - 2007	SEER = [(year manufactured - 2003) x 0.36] + 11.2
2008 and later	SEER = 13.0

Heat Pump Heating Efficiency (HSPF)

1970 and earlier	HSPF = 5.0
1971 - 2007	HSPF = [(year manufactured - 1976) x 0.06875] + 5.5
2008 and later	HSPF = 7.7

Room (Window) Air Conditioner Cooling Efficiency (EER)

1972 and earlier	EER = 6.0
1973 - 1994	EER = [(year manufactured - 1972) x 0.1304] + 6.0
1995 - 1998	EER = 9.0
1999 - 2001	EER = [(year manufactured - 1999) x 0.25] + 9.0
2002 and later	EER = 9.75

Conversion of Room Air Conditioner EER to SEER

SEER = (EER x 0.9) + 0.1	Fan runs continuously (assumed in Version 8.3)
SEER = (EER x 1.2) – 0.7	Fan runs only when cooling

ENERGY SOLUTIONS

RESEARCH & TRAINING

DERATING EFFICIENCY BY AGE (WITH 0.99 MAINTENANCE FACTOR)

AGE (years)	ORIGINAL EFFICIENCY (SEER, EER or HSPF)								
	5	6	7	8	9	10	11	12	13
1	5.0	5.9	6.9	7.9	8.9	9.9	10.9	11.9	12.9
2	4.9	5.9	6.9	7.8	8.8	9.8	10.8	11.8	12.7
3	4.9	5.8	6.8	7.8	8.7	9.7	10.7	11.6	12.6
4	4.8	5.8	6.7	7.7	8.6	9.6	10.6	11.5	12.5
5	4.8	5.7	6.7	7.6	8.6	9.5	10.5	11.4	12.4
6	4.7	5.6	6.6	7.5	8.5	9.4	10.4	11.3	12.2
7	4.7	5.6	6.5	7.5	8.4	9.3	10.3	11.2	12.1
8	4.6	5.5	6.5	7.4	8.3	9.2	10.2	11.1	12.0
9	4.6	5.5	6.4	7.3	8.2	9.1	10.0	11.0	11.9
10	4.5	5.4	6.3	7.2	8.1	9.0	9.9	10.9	11.8
11	4.5	5.4	6.3	7.2	8.1	9.0	9.8	10.7	11.6
12	4.4	5.3	6.2	7.1	8.0	8.9	9.8	10.6	11.5
13	4.4	5.3	6.1	7.0	7.9	8.8	9.7	10.5	11.4
14	4.3	5.2	6.1	6.9	7.8	8.7	9.6	10.4	11.3
15	4.3	5.2	6.0	6.9	7.7	8.6	9.5	10.3	11.2
16	4.3	5.1	6.0	6.8	7.7	8.5	9.4	10.2	11.1
17	4.2	5.1	5.9	6.7	7.6	8.4	9.3	10.1	11.0
18	4.2	5.0	5.8	6.7	7.5	8.3	9.2	10.0	10.8
19	4.1	5.0	5.8	6.6	7.4	8.3	9.1	9.9	10.7
20	4.1	4.9	5.7	6.5	7.4	8.2	9.0	9.8	10.6

For appliances older than 20 years, you must use the formula:

Derated efficiency = original efficiency x $(0.99)^{age}$

Home Energy Saver Equipment Efficiencies

Lawrence Berkeley National Laboratory
http://hes-documentation.lbl.gov/calculation-methodology

Heating and Cooling Equipment Efficiencies - Legacy System

In the detailed inputs level of the model, users can select the purchase year for their heating and cooling systems as an alternative to entering an efficiency value for the equipment. In these cases, we derive a shipment-weighted efficiency based on the purchase year of the equipment. A shipment-weighted efficiency is the average efficiency for all units sold within a particular year weighted by the number of units in each efficiency bin (AHAM 1996). Efficiencies for furnaces are measured as AFUE, or Annual Fuel Utilization Efficiency rating, which represents the seasonal or annual efficiency of the furnace. Heat pumps efficiency is shown as HSPF, Heating Seasonal Performance Factor.

The cooling efficiency for Central Air Conditioners and Electric Heat Pumps are rated by the seasonal efficiency of the equipment or SEER. Room Air Conditioners are rated by EER or Energy Efficiency Ratio, the ratio of the cooling output (in BTU) divided by the electrical energy consumption (in watt-hours).

Green shaded values did not have data available so the last available year is copied forward.

Yellow shaded values did not have data available so the first available year is copied backward.

Heating Equipment Efficiencies

Year	Gas Furnace (AFUE)	Electric Furnace (AFUE)	Oil Furnace (AFUE)	Propane Furnace (AFUE)	Gas Boiler (AFUE)	Oil Boiler (AFUE)	Heat Pump (HSPF)	Wall Furnace (AFUE)
1970	60.0	98	70.0	60.0	70.0	72.0	6.21	50.0
1971	61.4	98	71.8	61.4	71.2	73.6	6.21	54.8
1972	62.7	98	73.6	62.7	72.3	75.2	6.21	59.5
1973	62.7	98	73.6	62.7	72.3	75.2	6.21	59.5
1974	62.7	98	73.6	62.7	72.3	75.2	6.21	59.5
1975	65.8	98	73.6	62.7	72.3	75.2	6.21	59.5
1976	66.1	98	74.1	63.0	72.3	75.2	6.21	59.5
1977	66.4	98	74.5	63.3	72.3	75.2	6.21	59.5
1978	66.7	98	75.0	63.6	72.3	75.2	6.21	59.5
1979	68.7	98	75.5	64.8	72.3	75.2	6.21	59.5
1980	70.6	98	76.0	65.9	72.3	75.2	6.21	59.5
1981	70.4	98	76.8	67.1	77.4	77.4	6.21	63.1
1982	70.3	98	77.5	68.4	77.4	77.4	6.21	63.1
1983	70.1	98	78.3	69.6	77.4	77.4	6.20	63.1
1984	72.6	98	78.6	73.0	77.4	77.4	6.36	63.1
1985	72.9	98	78.6	73.8	77.4	77.4	6.39	63.1
1986	73.7	98	79.6	74.3	78.2	81.6	6.55	64.2
1987	74.3	98	79.8	75.1	78.2	81.6	6.71	64.2
1988	74.9	98	80.4	75.8	78.2	81.6	6.88	64.2
1989	74.7	98	80.4	75.5	79.7	83.1	6.92	65.6
1990	76.7	98	80.3	75.7	79.7	83.1	7.03	65.6
1991	77.5	98	80.8	76.9	79.7	83.1	7.06	65.6
1992	82.1	98	80.8	83.2	79.7	83.1	7.10	65.6
1993	82.4	98	80.9	83.8	79.7	83.1	7.10	65.6
1994	82.4	98	80.9	83.9	79.7	83.1	7.10	65.6
1995	82.3	98	80.9	84.1	79.7	83.1	7.10	65.6
1996	82.7	98	80.9	84.1	79.7	83.1	7.40	65.6
1997	82.9	98	80.9	84.1	79.7	83.1	7.10	65.6
1998	82.6	98	80.9	84.1	79.7	83.1	7.40	65.6
1999	82.6	98	80.9	84.1	79.7	83.1	7.40	65.6
2000	82.6	98	80.9	84.1	79.7	83.1	7.40	65.6
2001	83.1	98	80.9	84.1	79.7	83.1	7.40	65.6
2002	83.1	98	80.9	84.1	79.7	83.1	7.40	65.6
2003	83.5	98	80.9	84.1	79.7	83.1	7.40	65.6
2004	83.6	98	80.9	84.1	79.7	83.1	7.40	65.6
2005	83.9	98	80.9	84.1	79.7	83.1	7.40	65.6
2006	84.0	98	80.9	84.1	79.7	83.1	7.90	65.6
2007	84.1	98	80.9	84.1	79.7	83.1	7.90	65.6
2008	84.8	98	80.9	84.1	79.7	83.1	7.90	65.6
2009	84.8	98	80.9	84.1	79.7	83.1	7.90	65.6
2010	84.8	98	80.9	84.1	79.7	83.1	7.90	65.6

Cooling System Efficiencies

Year	Room AC (EER)	Central AC (SEER)	Heat Pump (SEER)
1970	5.80	6.50	5.50
1971	5.89	6.58	5.86
1972	5.98	6.66	6.21
1973	6.00	6.75	6.21
1974	6.10	6.85	6.21
1975	6.20	6.97	6.21
1976	6.40	7.03	6.87
1977	6.55	7.13	6.89
1978	6.72	7.34	7.24
1979	6.87	7.47	7.34
1980	7.02	7.55	7.51
1981	7.06	7.78	7.7
1982	7.14	8.31	7.79
1983	7.29	8.43	8.23
1984	7.48	8.66	8.45
1985	7.70	8.82	8.56
1986	7.80	8.87	8.70
1987	8.06	8.97	8.93
1988	8.23	9.11	9.13
1989	8.48	9.25	9.26
1990	8.73	9.31	9.46
1991	8.80	9.49	9.77
1992	8.88	10.46	10.60
1993	9.05	10.56	10.86
1994	8.97	10.61	10.94
1995	9.03	10.68	10.97
1996	9.08	10.68	11.00
1997	9.09	10.66	10.97
1998	9.08	10.92	11.29
1999	9.07	10.96	11.29
2000	9.30	10.95	11.21
2001	9.63	11.07	11.30
2002	9.75	11.07	11.31
2003	9.75	11.19	11.46
2004	9.71	11.29	11.56
2005	9.95	11.32	11.60
2006	10.02	13.17*	13.17*
2007	9.81	13.66	13.66
2008	9.93	13.76	13.76
2009	9.93	13.76	13.76
2010	9.93	13.76	13.76

*New Federal CAC/HP standard took effect January 23, 2006. Standard level is 13 SEER. Because no SWEF data are available since 2003 that splits out CAC from HP, both products are set to the average for the combined product class (per AHRI data for DOE rulemaking).

COMMON ERRORS IN NEAT / MHEA

- ✓ Make sure to use correct efficiencies for heating and cooling units.
  - Electric units – 100%
  - Heat Pumps – about 5 -8 (not 50 – 80) HSPF
  - AC – about 6 – 13 SEER
- ✓ Non-functioning HVAC units should NOT be modeled. Some exceptions apply.
- ✓ Heating and cooling unit capacities are in KBTU/hr – for example, input 30 – NOT 30,000.
- ✓ For window AC units, EER on tag must be converted to SEER
- ✓ Walls that are buffered cannot be modeled together with an unbuffered wall
- ✓ Conditioned basements that are below grade but have no door directly to the outside DO count towards total square footage, but DO NOT count as a story.
- ✓ The Outer Ceiling Joist of a Finished Attic describes the unconditioned space behind the kneewall. A separate unfinished attic does not have to be modeled to describe this unconditioned area.
- ✓ Include in SIR must be checked, if measure is an incidental repair
- ✓ Check through the Recommended Measures. Make sure all measures have an SIR of 1.0 or greater. (Exception: Windows may have an SIR below 1.0 if specific permission has been given for this measure)

WATER HEATER R-VALUES

- Recommended to add insulation to any water heater R16 or less (DOE says R24 or less)
- Existing (internal) tank insulation can be physically measured or, if this is not possible or practical, touch the top of the tank. If it is warm, insulating jacket is called for.
- Inputting existing insulation as 1.5" fiberglass is a rough approximation of most pre-2003 water heaters. Try 2" for those 2003 and later, if no data is available.
- Some new water heaters specify NOT to wrap. Take note of this.

REFRIGERATOR DATA

- NEAT/MHEA uses a comprehensive refrigerator database
- If more information is needed, try: http://www.kouba-cavallo.com/refmods.htm [Note: Model number letters must be input as Capital Letters. Also, if having trouble, replace part of model number with an asterisk (*) to broaden your search.]

Math for NEAT MHEA

To calculate SEER from year only:

Choose the appropriate calculation, from the Equipment Efficiencies sheet

Example: 2001 Central AC unit

SEER = 10.75 + 0.075 * (year of manufacture – 1997)

= 10.75 + 0.075 * (2001 – 1997)

= 10.75 + 0.075 * (4)

= 10.75 + 0.3

= 11.05

To calculate output capacity of furnace:

Example: input capacity of 120 kBTU, and an original AFUE of 70%

Output capacity = Input capacity * AFUE

= 120 kBTU * 70%

= 120 kBTU * 0.70

= 84 kBTU

To calculate area (square foot) of door:

Example: door is 32" x 80"

Area = (width * height) / 144

= (32 * 80) / 144

= (2560) / 144

= 17.8 square feet

To calculate SEER from EER:

Example: EER 10 (assume fan runs only when cooling)

SEER = (EER * 1.2) – 0.7

= (10 * 1.2) – 0.7

= (12) – 0.7

= 11.3

To calculate percentage:

Example: what percentage of mobile home is cathedral ceiling, if 100 square feet is vaulted and total square footage is 800.

Percentage cathedral ceiling = (cathedral area / total area) * 100

= (100/800) * 100

= (0.125) * 100

= 12.5 %

To Derate SEER (or HSPF):

Example: SEER 8, manufactured in 1991 (now: 2013)

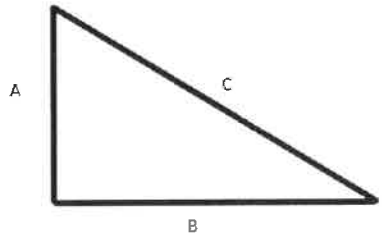
SEER (derated) = SEER (original) * $(0.99)^{age}$

= 8 * $(0.99)^{22}$

= 8 * 0.802

= 6.41

Calculate Area of a Vaulted or Cathedral Ceiling:



$$A^2 + B^2 = C^2$$

Example: A home is 30 feet wide with 8 foot walls and a peak height for the cathedral ceilings of 14 feet.

To get area of the cathedral ceiling, first find **C**:

$A^2 + B^2 = C^2$

$(14-8)^2 + (30/2)^2 = C^2$

$C^2 = (6)^2 + (15)^2 = 36 + 225 = 261$

$C = \sqrt{261} = 16.15$

If the home is 50 feet long, then area of each side of the roof is:

50' x 16.15' = 807 sq ft

Total area is twice that, or 2 x 807 = 1614 square feet

Window Leakiness Guidelines

May 21, 2009

In the Weatherization Assistant, there is a data field under the "Windows" tab of both NEAT and MHEA called "Leakiness" that allows the user to describe the air leakage characteristics of each window entered. NEAT and MHEA use this input to calculate the energy savings due to reduced air infiltration for window replacements, storms windows, and window weatherization (NEAT only). For each window retrofit measure, NEAT and MHEA add the energy savings due to reduced air infiltration to other energy savings associated with the measure to obtain the total energy savings.

Five options are allowed under the "Leakiness" data field: very tight, tight, medium, loose, and very loose. Guidance on the applicability of these options to various window types is described below. In addition, the leakiness of a typical window that is frequently encountered in homes served by the Weatherization Assistance Program across the country is identified.

- **Fixed windows** — Fixed windows are sealed in their frames and cannot be opened. Fixed windows can include most skylights (windows in the ceiling), decorative windows in doors, and large picture windows. *The leakiness of a typical fixed window is **very tight**.*

- **Casement windows** — Casement windows have one or two sashes that are hinged at the side and almost always project outwards. They usually have a cranking mechanism to open and close the sashes, and the sashes close by pressing against the frame. They also usually have a locking/latching mechanism that seals the window by forcing the sash against the frame and any installed weatherstripping. On casement windows with two sashes, a vertical framing bar is often present in the middle of the window that houses the locking mechanism. *The leakiness of a typical casement window is **tight**.*

    - Very tight (typical) — Weatherstripping is present and in good condition. The locking mechanism is operable and securely presses the sash into the weatherstripping and window frame.
    - ***Tight (typical)**— A good seal is visually achieved between the sash and frame with the aid of a functional locking mechanism even though weatherstripping is absent or deteriorated.*
    - Medium — A reasonable seal is visually achieved between the sash and frame when the window is closed as far as the cranking mechanism allows even though weatherstripping is absent. The locking mechanism is inoperative or does not help press the sash into the weatherstripping or frame.
    - Loose — A gap 1/8 inch or smaller exists between the sash and window frame when the sash is closed as far as the cranking/locking mechanism allows.
    - Very loose — A gap 1/8 inch or larger exists between the sash and window frame when the sash is closed as far as the cranking/locking mechanism allows.

- **Single- or double-hung (vertical slider) windows** — Windows with sashes that move up and down are vertical slider windows. In double-hung units, both sashes can slide vertically past one another. Only the bottom sash slides up and down in a single-hung window. *The leakiness of a typical new vertical slider window is **tight** and the leakiness of a typical older window found in older homes is **medium**.*

    - Very tight — Each moveable sash is secure in its track and weatherstripping is present and must be in excellent condition (especially the brush-type weatherstripping at the sash to sash interface and the compression weatherstripping at the head (i.e., top) or sill (i.e., bottom)). A locking mechanism presses the two sashes together at their interface and presses each moveable sash into the head and/or sill.
    - ***Tight (typical of newer windows)*** *— Each moveable sash is secure in its track although some slight play may be present. Weatherstripping is present and in good to fair condition (especially the brush-type weatherstripping at the sash to sash interface and the compression weatherstripping at the head or sill). A locking mechanism presses the two sashes together at their interface and presses each moveable sash into the head and/or sill.*
    - ***Medium (typical of older windows found in older homes)*** *— Each moveable sash is still operable in its track although play may be present and the sash may not sit perfectly horizontal when closed. Weatherstripping is absent or deteriorated (especially the brush-type weatherstripping at the sash to sash interface), but there are no visible gaps. A locking mechanism helps press each moveable sash into the head and/or sill but is not effective at pressing the two sashes together at their interface.*
    - Loose — One (or both) moveable sash is loose in its track and the sash cannot be closed without leaving a gap 1/8 inch or smaller at the head or sill. There is some play (rattling) between sashes. Weatherstripping is absent or deteriorated (especially the brush-type weatherstripping at the sash to sash interface). The locking mechanism does not hold the two sashes together at their interface nor does it press each moveable sash into the head and/or sill.
    - Very loose —One (or both) moveable sash no longer fits in its track and the sash cannot be closed without leaving a gap 1/8 inch or greater at the head or sill. There is considerable movement (rattling) between sashes. Weatherstripping is absent (especially the brush-type weatherstripping at the sash to sash interface). The locking mechanism is inoperative.

- **Horizontal slider windows** — Windows with sashes that move sideways are horizontal slider windows. Both sashes can slide horizontally past one another in a double-sliding window, and only one sash slides in a single-sliding window. Sliding glass doors are included in this window type. Horizontal slider windows are usually a little more leaky than comparable vertical slider windows. *The leakiness of a typical horizontal slider window is* ***medium****.*

    - Very tight — Each moveable sash is secure in its track and weatherstripping is present and must be in excellent condition (especially the brush-type weatherstripping at the sash to sash interface and the compression weatherstripping at the end jamb (i.e., side)). A locking mechanism presses the two sashes together at their interface and presses each moveable sash into the end jamb .
    - Tight — Each moveable sash is secure in its track although some slight play may be present. Weatherstripping is present and in good to fair condition (especially the brush-type weatherstripping at the sash to sash interface and the compression weatherstripping at the end jamb). A locking mechanism presses the two sashes together at their interface and presses each moveable sash into the end jamb.
    - ***Medium (typical)*** *— Each moveable sash is still operable in its track although play may be present and the sash may not sit perfectly vertical when closed. Weatherstripping is absent or deteriorated (especially the brush-type weatherstripping at the sash to sash interface), but there are no visible gaps. A locking mechanism helps press each moveable sash into the end jamb but is not effective at pressing the two sashes together at their interface.*
    - Loose — One (or both) moveable sash is loose in its track and the sash cannot be closed without leaving a gap 1/8 inch or smaller at the end jamb. There is some play (rattling) between sashes. Weatherstripping is absent or deteriorated (especially the brush-type weatherstripping at the sash to sash interface). The locking mechanism does not hold the two sashes together at their interface nor does it press each moveable sash into the end jamb.
    - Very loose —One (or both) moveable sash no longer fits in its track and the sash cannot be closed without leaving a gap 1/8 inch or larger at the end jamb. There is considerable movement (rattling) between sashes. Weatherstripping is absent (especially the brush-type weatherstripping at the sash to sash interface). The locking mechanism is inoperative.

- **Awning and hopper windows** — One type of awning window and most hopper windows are like casement windows. Both usually have just one sash, with the awning window being hinged at the top and opening outward and the hopper window being hinged at the bottom and opening inward. Like casement windows, the sash closes by pressing against the frame and a locking/latching mechanism is usually present that seals the window by forcing the sash against the frame and any installed weatherstripping. They may or may not have a cranking mechanism to open and close the sashes. The leakiness guidelines for casement windows should be followed to determine the leakiness of these types of awning and hopper windows. *The leakiness of a typical awning and hopper window that are like casement windows is* ***tight****.*

  Another type of awning window is like a jalousie window in that several window sashes are connected to a common crank so that the sashes open and close together at the same angle. Compared to jalousie windows, awning windows of this type have fewer sashes (just two to four sashes per window versus multiple window panes in jalousie windows), larger sashes (10 to 18 inches wide rather than 3 to 8 inches), and framed sashes (a lightweight frame supports each pane in the awning window) as apposed to the use of just window panes in jalousie windows. Awning windows of this type may have a locking mechanism that helps ensure complete window closure, whereas jalousie windows close and seal only as well as the cranking mechanism allows. *The leakiness of a typical awning window that is like a jalousie window is* ***medium****.*

  - Very tight — Generally not applicable to awning windows that are like jalousie windows.
  - ***Tight (typical of awning windows that are like casement windows)*** *— The cranking mechanism is in good working order and all window sashes are securely attached to the cranking mechanism. Weatherstripping is present and must be in excellent condition. A locking mechanism presses the separate sashes to one another and to the window frame so that a tight seal is visually evident.*
  - ***Medium (typical of awning windows that are like jalousie windows)*** *— The cranking mechanism is in good working order and all window sashes are securely attached to the cranking mechanism. Weatherstripping is present but is only in fair condition. A locking mechanism helps to put the separate sashes in contact with one another and to the window frame, but the seals are not tight.*
  - Loose — One or two window sashes are not securely attached to the cranking mechanism. Weatherstripping is absent or deteriorated. One or more of the interfaces where the window sashes overlap or the sash meets the window frame are not tight (1/8 inch gap or smaller) when the window is closed as far as the cranking/locking mechanism allows.
  - Very loose — Multiple window sashes are not securely attached to the cranking mechanism. Weatherstripping is absent. Visible gaps (1/8 inch or larger) are evident at several of the interfaces where the window sashes overlap or the sash meets the window frame when the window is closed as far as the cranking

mechanism allows. The locking mechanism is inoperative or does not help press the sashes together or into the frame.

- **Jalousie windows** — Jalousie windows are louvered windows, typically constructed of multiple horizontal panes (usually about 3 to 8 inches wide) that all open at the same angle when a crank near the bottom of the window is turned. *The leakiness of a typical jalousie window is* ***loose****.*

    - Very tight — Generally not applicable to jalousie windows.
    - Tight — Generally not applicable to jalousie windows.
    - Medium — The cranking mechanism is in good working order, all window panes are securely attached to the cranking mechanism, and a tight glass to glass seal is visually obtained at the overlap of all windows panes.
    - ***Loose (typical)*** *— One or two window panes are not securely attached to the cranking mechanism, or one or more of the glass to glass interfaces where the window panes overlap are not tight when the window is closed as far as the cranking mechanism allows.*
    - Very loose — Multiple window panes are not securely attached to the cranking mechanism, or visible gaps are evident at several of the glass to glass interfaces where the window panes overlap when the window is closed as far as the cranking mechanism allows.

The guidance provided above based on window type should be modified as follows to take into account the condition of the window panes and the presence of storm windows:

- **Window panes tightness** — Degrade the leakiness description one level if the window panes themselves have become significantly loose in their mounting and/or a small (i.e., half-dollar-sized) piece of window is broken out. Degrade the leakiness two levels if there is a larger hole in a window pane and/or an entire pane is missing.

- **Storm window presence** — Upgrade the leakiness description one level if a storm window in average or better condition is installed.