Wisconsin Weatherization Assistant Guide

The Wisconsin Weatherization Assistance program mission is to reduce energy costs for eligible low-income households by improving the energy efficiency of their homes while ensuring their health and safety.

Table of Contents

Chapter 1 Database Management....1

1.0 Introduction to the Weatherization Assistant (WA)....1
1.1 Features of Version 8.9....1
1.2 Weatherization Assistance Help....2
1.3 Hardware Requirements....2
1.4 Installation Procedure....2
1.5 Network Installation....4
1.5 How to Import Weatherization Assistant 8.9 Client Records....5
1.6 How to Export Weatherization Assistant 8.9 Client Records....10

Chapter 2 Set-up and Supply Libraries....15

2.0 Overview....15
2.1 Setup Library Tabs....16
2.1.1 Setup Library Information....16
2.1.2 Key Parameters....17
2.1.3 Fuel Costs....17
2.1.4 Fuel Price Indices....17
2.1.5 Library Measures....18
2.1.6 User Defined Measures....19
2.1.7 User Defined Insulation Types....20
2.2 Supply Library Description....20
2.2.1 General Information Tab....21
2.2.2 Supply Name – Required....21
2.2.3 Agency – Required....22
2.2.4 State....22
2.2.5 Description – Optional....22
2.2.6 Comment – Optional....22
2.3 Hot Water Equipment and Refrigerator Forms....22
2.3.1 Description – Required....22
2.3.2 Manufacturer – Required....22
2.3.3 Model – Required....23
2.3.4 Supplier – Optional....23
2.3.5 Units – Required....23
2.3.6 Cost/Unit – Required....23
2.3.7 Energy Details....23
2.4 Water Heaters....23
2.5 Refrigerators....24
2.6 Labor....24

Chapter 3 Client Records....25

3.0 Description....25
3.1 Completing Client Data Records....26
3.1.1 Client Navigation Block....26
3.1.2 Client Report Block....27
3.1.3 Other Client Information Fields....27
3.2 Other Client Identification Screens....28

3.2.1 Status Tab 28
3.2.2 Contacts Tab 29
3.2.3 Audit Tab 29

Chapter 4 The NEAT and MHEA Audits 31

4.0 General Information 31
4.1 NEAT and MHEA Audit Information 31
4.1.1 Agency 31
4.1.2 Measure Cost Entry 31
4.1.3 Run Audit Button 32
4.1.4 Economics Summary 32
4.1.5 Record Navigation Block 32
4.1.6 Report Block 32
4.2 Energy Audit Forms 32
4.2.1 Audit Information 33
4.2.2 Status 34
4.3 Ducts and Infiltration 34
4.3.1 Evaluate Duct Sealing 34
4.3.2 Whole House Blower Door Measurements 34
4.4 Baseloads 35
4.4.1 Domestic Water Heating (DWH) 35
4.4.2 Refrigerators 41
4.5 Itemized Costs 46
4.6 Fuel Records/Utility Bills 52
4.6.1 Entering Billing Data 53

Chapter 5 NEAT/MHEA Shell Data Entry 56

5.0 Modeling the Building Shell 56
5.0.1 Walls 56
5.0.2 Windows 60
5.0.3 Doors 64
5.0.4 Unfinished Attic Areas 66
5.0.5 Finished Attics 69
5.0.6 Foundations 71
5.1 Modeling the 5-24 Unit Building Shell 75
5.1.1 Ceiling or Attic Areas 76
5.1.2 Sidewall Insulation 76
5.1.3 Foundation Insulation 76
5.1.4 Window Replacement 77
5.1.5 Door Replacement 77
5.2 Modeling Manufactured Homes in the MHEA Shell Tab - Including Additions 77
5.2.1 Walls 78
5.2.2 Windows 79
5.2.3 Doors 82
5.2.4 Ceilings 83
5.2.5 Floors 86

Chapter 6 NEAT/MHEA Heating System Data Entry 89

6.0 NEAT Heating Systems 89

6.0.1 Heating System Code − Required 89
6.0.2 Heating System Equipment Type − Required 90
6.0.3 Heating System Fuel Type – Required 90
6.0.4 Heating System Location − Required 90
6.0.5 Percent of Heat Supplied − Required 91
6.0.6 Primary Heating System − Check Box 91
6.0.7 Eliminate with Primary System Replacement − Check Box 91
6.0.8 Manufacturer Name and Heating System Model − Optional 92
6.0.9 Heating System Details − Required 92
6.1 Fuel Switching/Conversion of Heating Systems 95
6.1.1 Fuel Switching/Conversion of Heating Systems Audit Procedures 95
6.1.2 Electric to Fossil Fuels 96
6.2 5-24 Unit Heating Systems 96
6.3 MHEA Data Entry – Heating 98
6.3.1 Primary Heating System 98
6.3.2 Equipment Type – Entry Required 98
6.3.3 Fuel Type – Entry Required 98
6.3.4 Capacity 99
6.3.5 Efficiency 99
6.3.6 Heating System Efficiency Units 99
6.3.7 Heating Duct Location 99
6.3.8 Heating Duct Insulation Location 99
6.3.9 Percent of Total Heat Supplied (%) 99
6.3.10 Programmable Thermostat Installed? 100
6.3.11 Secondary Heating System 100
6.3.12 Replacement Heating System 100
6.3.13 Capacity 100
6.3.14 Heating System Efficiency Units 101
6.3.15 Labor and Material Costs 101

Chapter 7 Wisconsin Protocols and Specific Modeling Procedures 102

7.0 Audits 102
7.1 Ducts and Infiltration 102
7.2 2-4 Unit Building: Single Audit 103
7.2.1 Modeling for Multiple Heating System Replacements 105
7.3 OPTIONAL: 2-4 Unit Buildings: Separate Unit Audits 106
7.4 Replacing Multiple Space Heaters with a Forced Air or Boiler System 106
7.5 Client Record and Audit for Baseload Savings Calculations 107
7.6 Modeling Conversion from Wood, Coal or Other to Gas 111

Chapter 8 Reports 114

8.0 Input Reports 114
8.1 Output Reports – Recommended Measures 114
8.2 Output Report - Energy Saving Measure Economics 115

Chapter 9 WisWAP Reporting 116

9.1 Reporting 2-4 Unit Buildings in WisWAP 116

Appendix A: Glossary 117

Chapter 1 Database Management

1.0 Introduction to the Weatherization Assistant (WA)

The Weatherization Assistant modeling software has been developed for use by local and state agencies under the Department of Energy's (DOE) Weatherization Assistance Program. It is intended to assist state and local agencies in the selection of cost effective, energy efficient, weatherization measures that can be installed in homes of eligible participants of the Weatherization Assistance Program. The modeling software is comprised of two separate modeling components plus additional functionality to aid in the coordination of weatherization activities.

Weatherization Assistant energy modelling is used to assess the cost-effectiveness of planned weatherization work, improving program effectiveness and integrity. An effective audit is composed of three parts; a description of the building and its occupants, information about existing energy-consuming appliances and their energy use, and information about changes to the shell or appliances that might be made to save energy and reduce energy costs for the household. An accurate energy model estimates the energy use in the house at the time of the audit, and predicts whether planned changes will reduce energy costs enough to "pay for themselves". WA provides its information by estimating an "SIR" (Savings-to-Investment Ratio) for planned work. A cost-effective measure will have a "measure SIR" of 1.0 or greater. A cost-effective package of measures (often including required Repair or Health & Safety work that won't save energy) will have a "cumulative SIR" of 1.0 or greater. The "Cumulative SIR" displayed with the last, least cost-effective Energy Conservation Measure (ECM) on a WA "Recommended Measures" report is the cumulative SIR for the entire job.

The National Energy Audit Tool (NEAT) is designed for single-family site-built homes; it can also be used for multi-family residences of 24 units or smaller. The Manufactured Home Energy Audit (MHEA) is designed for manufactured (or mobile) homes.

This manual was written to support WA v8.9. In this manual, "WA" is used as an abbreviation for the current version of "Weatherization Assistant". The National Energy Audit Tool module of WA used to audit site-built homes is referred to as "NEAT". The module used for modeling manufactured homes is referred to as "MHEA".

Weatherization Assistant was written and is maintained by DOE and Oak Ridge National Laboratory. Since WA was written for all states, it has a number of limitations that affect use in Wisconsin's program. Wisconsin WAP also provides and requires the use of a variety of workbooks to process information used in WA. They are used to assist in accurate normalization of existing utility bills, estimation of measure costs, or analysis of specialized measures.

1.1 Features of Version 8.9

The features of Version 8.9 in the Weatherization Assistant were incorporated into the program to allow NEAT and MHEA to be used almost as stand-alone programs. Separate buttons on the Main Menu take a user directly to either NEAT or MHEA.

The Weatherization Assistant incorporates an extensive client status tracking system allowing agencies to track the progress of audits, and recommended measures.

1.2 Weatherization Assistance Help

This manual provides instructions on how to operate the Weatherization Assistant User Guide software, with added information regarding policies specific to Wisconsin's Weatherization Assistance Program. Most of this language is located in the help file of the program, which is available in the top menu under *Help* by selecting *Weatherization Assistant Help*, or by pressing F1. Please see table below for additional Weatherization Assistant help information

For help with…	Best source…	Secondary Source
MHEA or **NEAT** audit screens	**F1** (think "Friend One")	**Wx Assistant Manual**
Agency, Client, Work order, Setup, Supply, Data Link screens	**Wx Assistant Manual**	**F1** (think "Friend One")

1.3 Hardware Requirements

Computers, laptops, tablets, and desktop PCs, shall use a version of Microsoft(MS) Windows® operating system. Productivity software loaded on the computers shall be a version of MS Office® compatible with Division software to allow for transmittals of files in the form of a .wdz (compressed MS Access) files.

Weatherization Assistant uses your existing Windows printer setup to both display and print results and reports. Thus, even though you may not have a printer physically attached to your computer, you must have an acceptable printer driver loaded and selected as the default to display the results. Output produced by the program is stored in the audit database and displayed in rich-text format from within the program.

Version 8.9 of the Weatherization Assistant utilizes Microsoft Access to store the information from running the program. Information for all homes is stored in a single file: the ".mdb" database file. Within this file, information is stored in linked tables, with each table composed of as many "records" as is required to store the information. When data pertaining to a new customer is entered into a WA form, a new record is added to the client table.

1.4 Installation Procedure

Installers must have administrative rights to proceed. The procedure used to install the Weatherization Assistant onto a computer uses the standard Windows process for the platform being used.

1) Close any applications currently open. If installing the program from a CD, place the CD in the CD ROM drive and note the drive letter assigned to the drive on your computer. If installing from a downloaded file, note the location of the file on the computer.

2) Installation is initiated by executing the file “waxxxx.exe,” either from the CD or from the download location, where the “xxxx” represents the version number, (for example “8905”). This may be done in any of the ways Windows installation provides. Once found, double click on the executable file to run it. Or, use Windows Explorer, or the browse window under the Start/Run option. The control panel of Windows versions also has an “Add and Remove Programs” entry from which the file can be executed. Refer to a Windows manual or consult your system administrator.

3) The installation procedure will generate the license agreement. Read the agreement and click the “I Agree” button if you agree with its contents. Otherwise, click on Cancel to abort the installation process. Any time “Cancel” is chosen, you will be asked to confirm this choice.

4) If proceeding, a “Welcome” screen will provide a second opportunity to go to the “Next” screen or “Cancel” the process.

5) The release version number contains four digits (e.g., "8905"). Any installation having a version number whose first three digits differ from a previously installed version is considered a new installation, i.e. a major version change. However, if the first three digits are the same as an existing version on the machine, the installation is considered an “update”. Depending on the new version number, select update or install from the window. An update will not affect the settings or data already entered. It will only affect the operation of the program. A new installation will provide a completely separate program with a new *empty* data set and default settings. The new installation, however, will not affect any previous installation. In this instance, following this new installation, there will be two icons for this version of the program on the computer, each linking to the different installations. This form is only informational, but still gives an opportunity to continue with installation by choosing "OK", or exit the process by selecting "Cancel."

6) The next screen in the installation process allows selection of the location on your computer where the program files will be copied, the “Destination Directory.” If this major version has not been installed previously, the default location will be “c:\ProgramFiles\Weatherization Assistant xxx,” where “xxx” stands for the major version number being installed. If this major version was installed previously, the location displayed will be wherever the program was previously installed. This is why the prior form (discussed in step 5 above) instructed the user to “accept the default installation path name” in order to “update.”

7) If this default location is satisfactory, choose “Next.” Otherwise, click on the “Browse” button and select the preferred location from the drives (bottom) and folders (middle) sub-windows presented. The destination field at the top of this window will change according to the selection made. This destination field can also be modified by entering a selection directly. If the selected entry does not correspond to an existing location, confirmation to create the location will be required. If the selected entry corresponds to an existing installation, a choice to confirm the installation will appear.

Click “OK” to accept the location specification or “Cancel” to return to using the default or previously accepted location. When satisfied with the selection as displayed in the box containing the Browse button, click on the “Next” button to continue.

Note that this screen will display the “free disk space” available on the drive selected as well as the expected remaining free disk space after Installation.

1) The next screen summarizes the version being installed, the date of installation, and the choice of the destination directory. If the summary is correct, choose "Next" to continue the installation. Otherwise, choose "Back" to return to the previous screen to modify the selections or "Cancel" to exit the installation process without having installed the program. Anytime a choice to “Cancel” the installation is made, confirmation of the choice will be required.

2) If the selection of destination directory does not exist on the computer, notification of the situation will appear on the screen. Click the *OK* button to confirm receipt of this notification. The next window will display a bar which meters the progress of installing the necessary files. At the conclusion of this process, the “Installation Completed” notice will appear. Finish the installation with or without viewing the “User Notes.” If viewing the notes, they will appear in a Notepad window.

This installation process will automatically place the Weatherization Assistant icon on the desktop, containing the version number in its name. The installation process will copy a file into the Weatherization Assistant destination directory chosen above. This file contains the default national data already entered into to the program. The name of the file will reflect the version of the Weatherization Assistant with which it is to be used, (e.g., "wa895.mdb"). Though not necessary, it is recommended that the system administrator make a copy of this file before using the program. A default agency database file is provided on an annual basis by DEHCR for Wisconsin Weatherization Agencies.

1.5 Network Installation

One advantage of using a standard database environment is that standard multi-user features are available. Microsoft Access strategy separates the "front-end" interface (the forms and reports) and the "back-end" database (just data tables). The Weatherization Assistant uses this design strategy to allow it to be operated on networks. The front-end, located in the "wa.mde" file, can be installed on each employee’s computer while the back-end, located by default in the "waxxx.mdb" file (where xxx is the version number), can be installed in a shared folder on a network. The front-end can connect (or link) to any back-end file located anywhere on the employee’s computer's file system including shared network drives. Below are some installation instructions that might be suitable for your situation:

CASE #1

Multiple users on different computers on a local area network need to share data:

1) Install the Weatherization Assistant using the installation executable file on each of the employee’s computers.
2) Install the Weatherization Assistant using the installation executable file on the server computer OR copy the "waxxx.mdb" file from one of the employee’s

computers to a shared folder on the server. Make sure that shared folder has no read or write security restrictions.

3) Run the Weatherization Assistant on each employee's computer and use the *Data Link* feature on the *Main Menu* to link each employee's computer to the shared "mdb" file on the server.
4) (Optional) Erasing the "mdb" files on each of the employee's computers may avoid any confusion.

CASE #2

Multiple users, some with portable computers used in the field for data collection:

1) Follow all the steps for CASE #1 above.
2) Install the Weatherization Assistant using the installation executable on each portable computer. Do NOT link to the "mdb" file on the server. Each portable then has an independent "mdb" back-end file. Auditors with portable computers should use the Import/Export feature under the *Data Link Main Menu* item to move jobs manually to/from their computer.

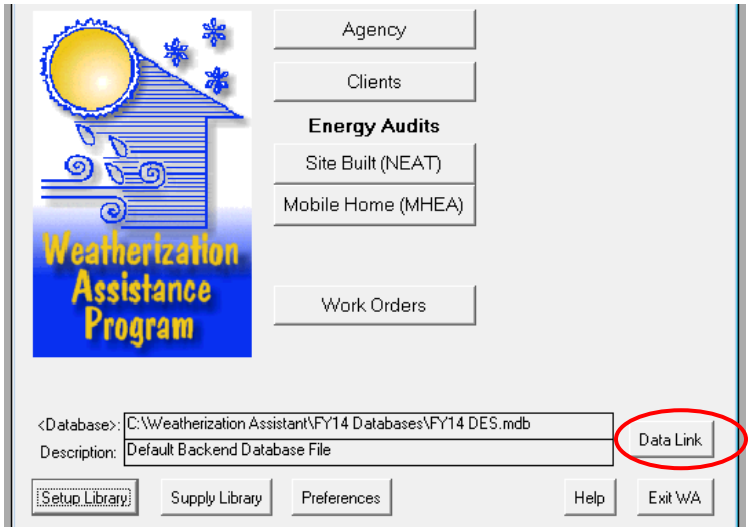
Client records created on different computers linked to a shared back-end database file will not conflict. However, if several employee's computers linked to the same back-end database file attempt to access the same client record, conflicts could arise. Microsoft Access handles these conflicts with "record locking." The first person to open a record "wins", and the second person is locked out of editing (the computer just beeps whenever attempts to change a locked field are made) until the first person is finished editing the record. So, when sharing a back-end, there is a very important rule to follow: Always finish edits to unlock the record for other users. Never leave edits in process for extended periods since the record (and potentially some adjacent records) will remain locked for other users. To finish edits, just change tabs, or back out of the form being worked on. This writes the record to the back-end database and unlocks the record for other users.

If all users install the Weatherization Assistant software and do NOT link to a shared database, there will be independent back-end database files, each with their own set of client records and its own Agency record on each machine.

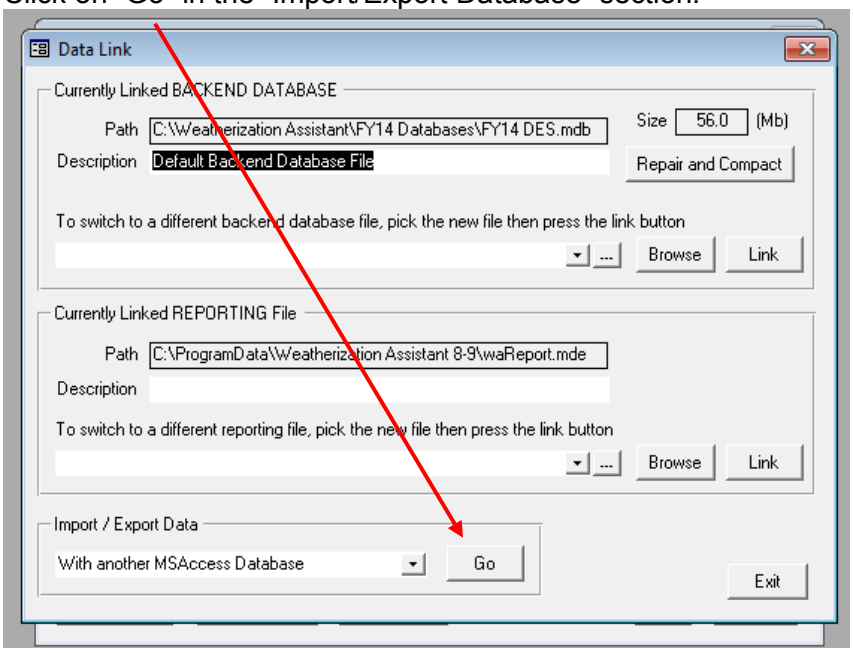
1.5 How to Import Weatherization Assistant 8.9 Client Records

The following directions should be used when importing NEAT or MHEA audits sent from another user of the Weatherization Assistant Software. Files are exported as compressed ".wdz" files, moved to another computer (as an e-mail attachment, data file on a portable drive, etc.) and then imported into the existing WA database on the second computer. When an import is completed, a database file that includes all information related to the selected client record is unzipped and copied into the second computer's WA database. This information includes the agency record and all audits assigned to the client as well as the supply and setup libraries used by the audits.

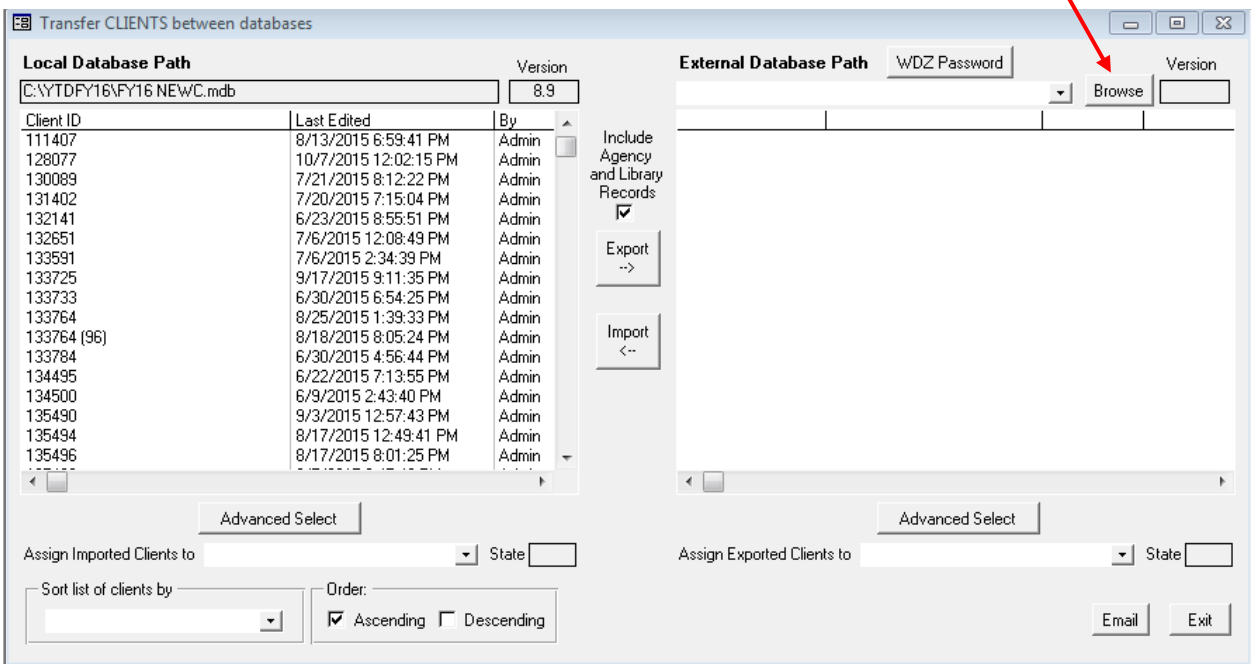
1) Select "Data Link" from the main Weatherization Assistant menu.



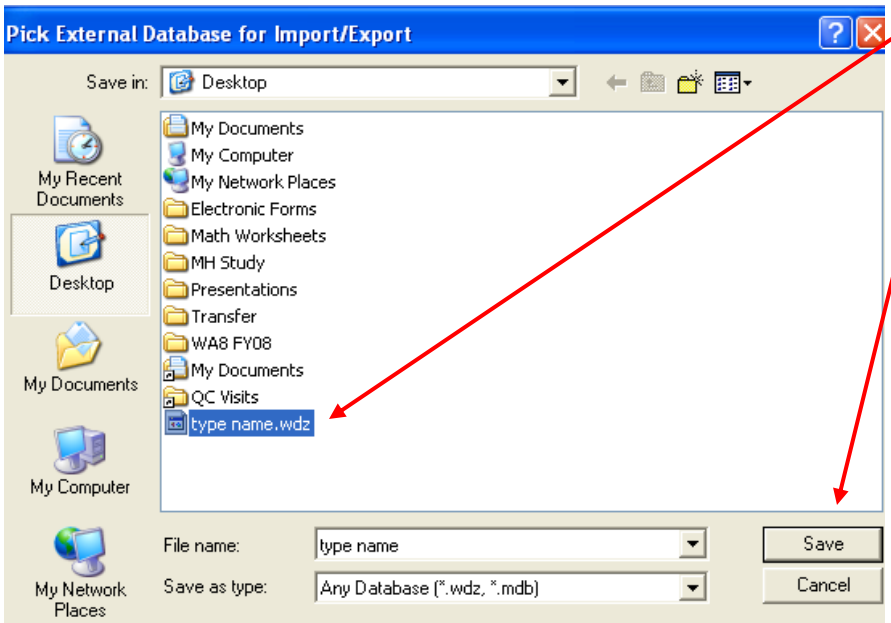
2) Click on “Go” in the “Import/Export Database” section.



3) A window labeled “Transfer CLIENTS between databases” will appear. The first thing to do is to locate the zipped database file to be imported. Click on the “Browse” button to locate the WDZ file that contains the client records to be imported into your database.



4) Select the folder location that contains the WDZ file to be imported. Highlight the file to be imported in the list, double click on it or click “Save.”

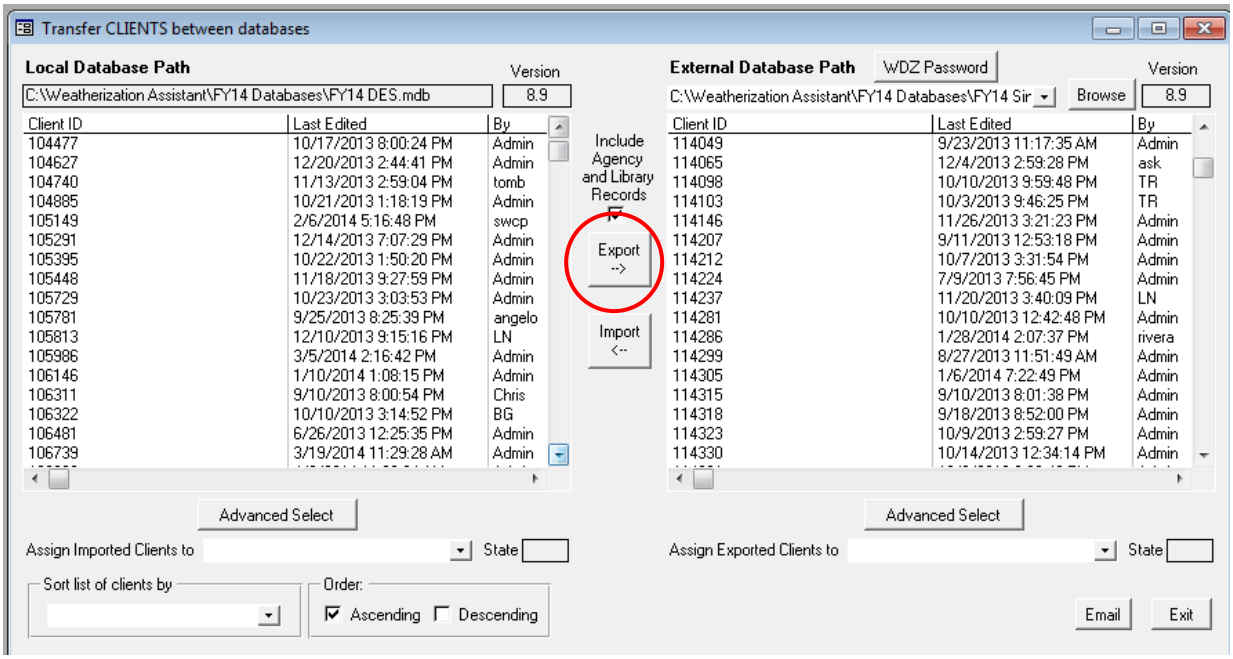


Double click on file name

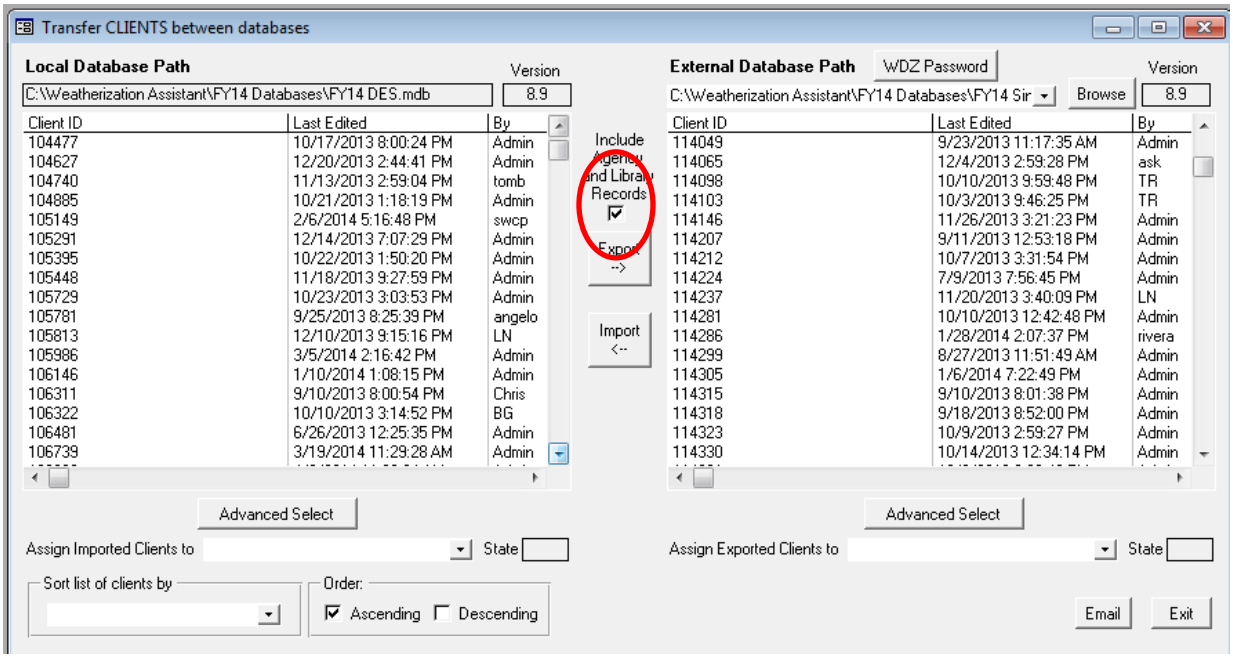
OR

Click Save

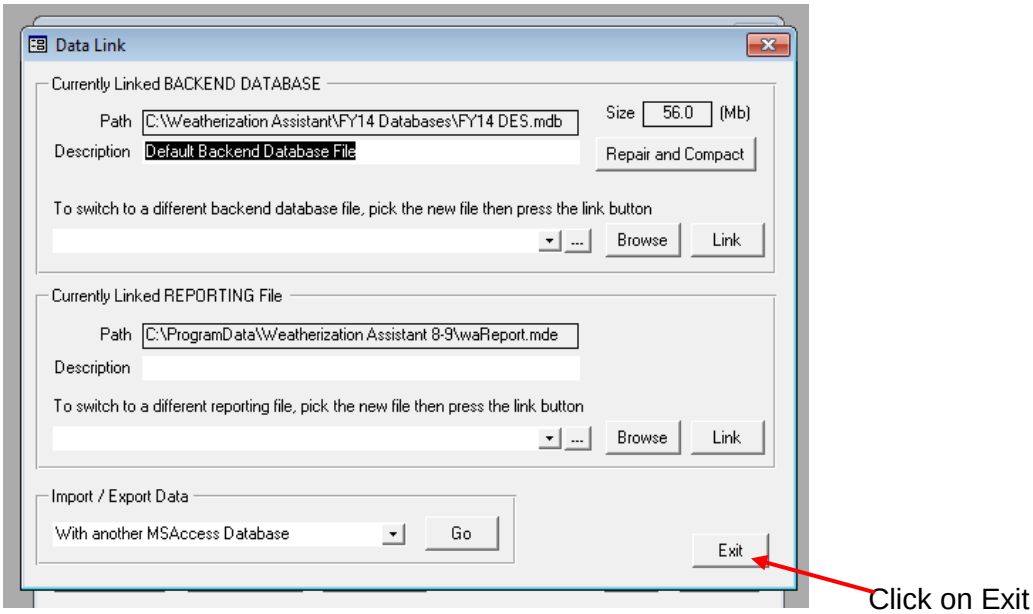
5) Next, highlight the jobs to be imported on the right-hand side of the screen, and click the "Import" button to copy the client records into the database where the WA 8.9 software is linked. (Note: to select multiple records, hold the CRTL key down and click each one—or just click on the first and last jobs in the list while holding down SHIFT to select all client records.) If the client record already exists, it will be "edited." Any existing information that doesn't match the new record will be removed, and those fields will be updated to contain whatever data is in the imported file.



To keep existing agency or library information, make sure this box is NOT checked. Also, if importing previous year records do not check this box.
Click on Import to move client records into the database.



6) All of the jobs to be imported on the right-hand side under “External Database Path” should now appear on the left-hand side under “Local Database Path.” Close this window by clicking exit, and back out of the Data Link screen.



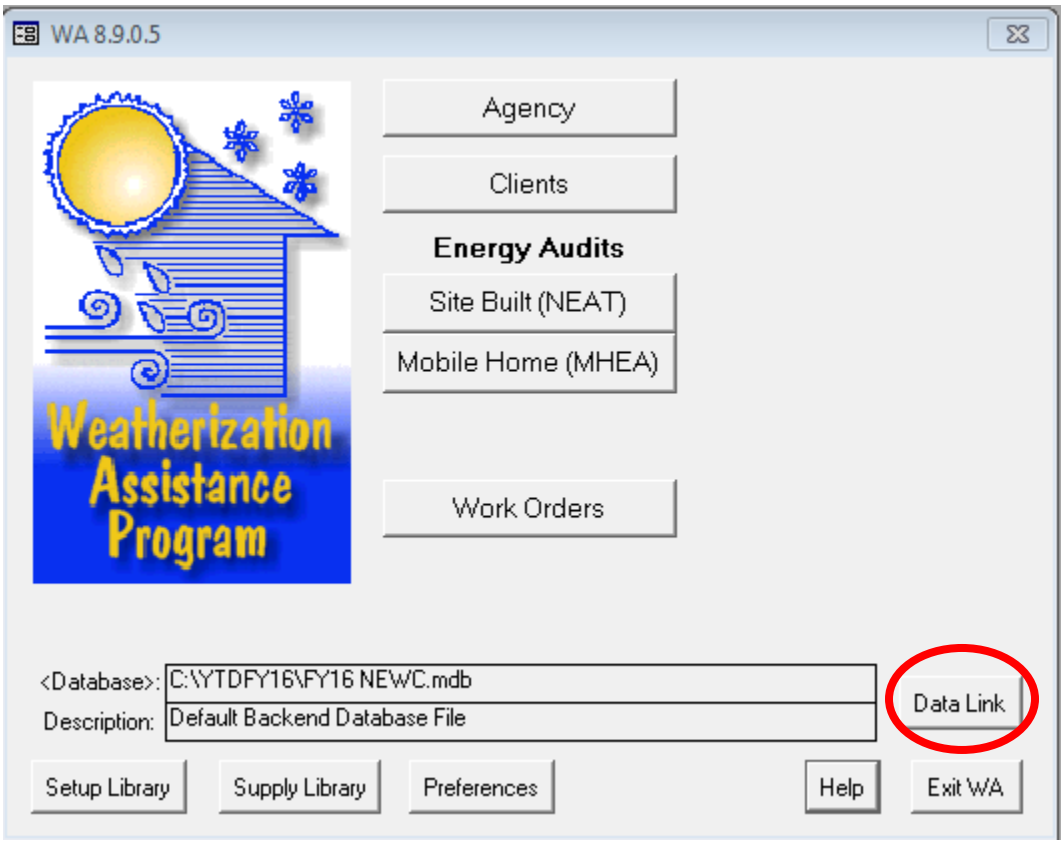
Click on Exit

7) Any of the client records or audits that were imported from the main menu screen of the WA 8.9 software can now be opened. Please note that if the agency or library information was not imported in Step 5, these values must be selected in the imported records as needed.

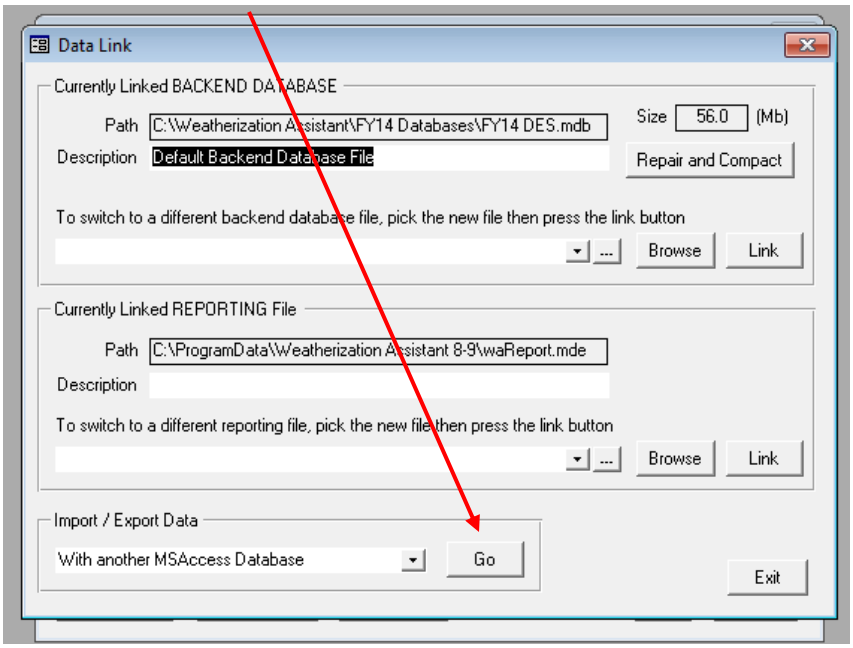
1.6 How to Export Weatherization Assistant 8.9 Client Records

The following directions should be used whenever sending NEAT or MHEA audits to another user of the Weatherization Assistant Software. When completing an export, a zipped/compressed database is created that includes all information related to the selected client record. This information includes the agency record and all audits assigned to the client as well as the supply and setup libraries used by the audits.

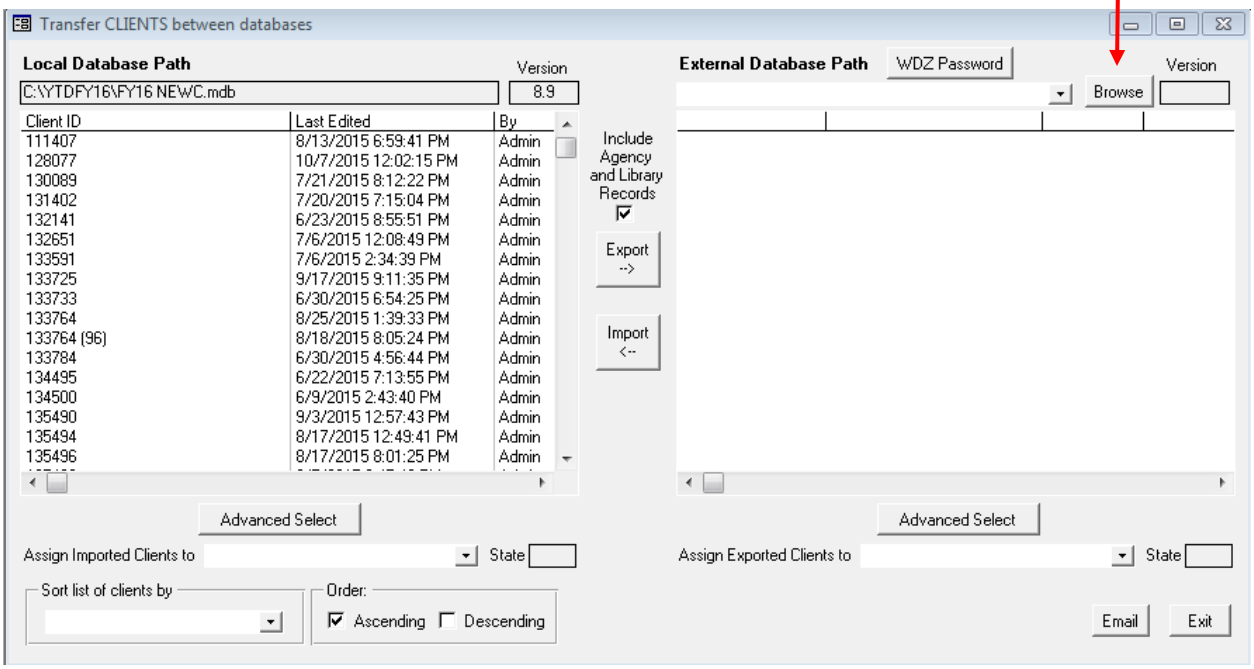
1) Select “Data Link” from the main Weatherization Assistant menu.



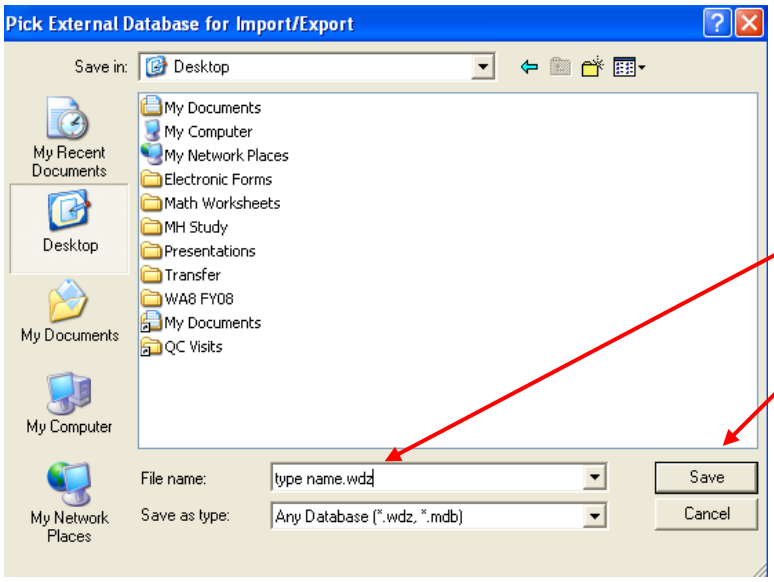
2) Click on “Go” in the “Import/Export Database” section



3) A window labeled “Transfer between databases” will appear, and the first thing to do is create a new database file to hold the exported client record(s). Click on the “Browse” button to open a new window to create and name the zipped database that will contain the record export.



4) Select a folder location to save the export file. One method is to save it to your desktop so it can easily be located. When naming the file, be sure to type the .wdz extension in the file name to ensure that it is saved as a WDZ and not a MDB file. Give the program a path and file name, and click "Save."

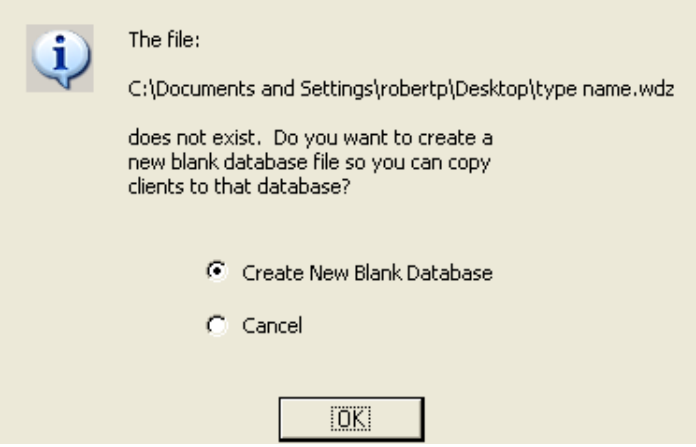


Click on *Desktop* icon to save there

Type in and save a name for the file that describes what is being exported

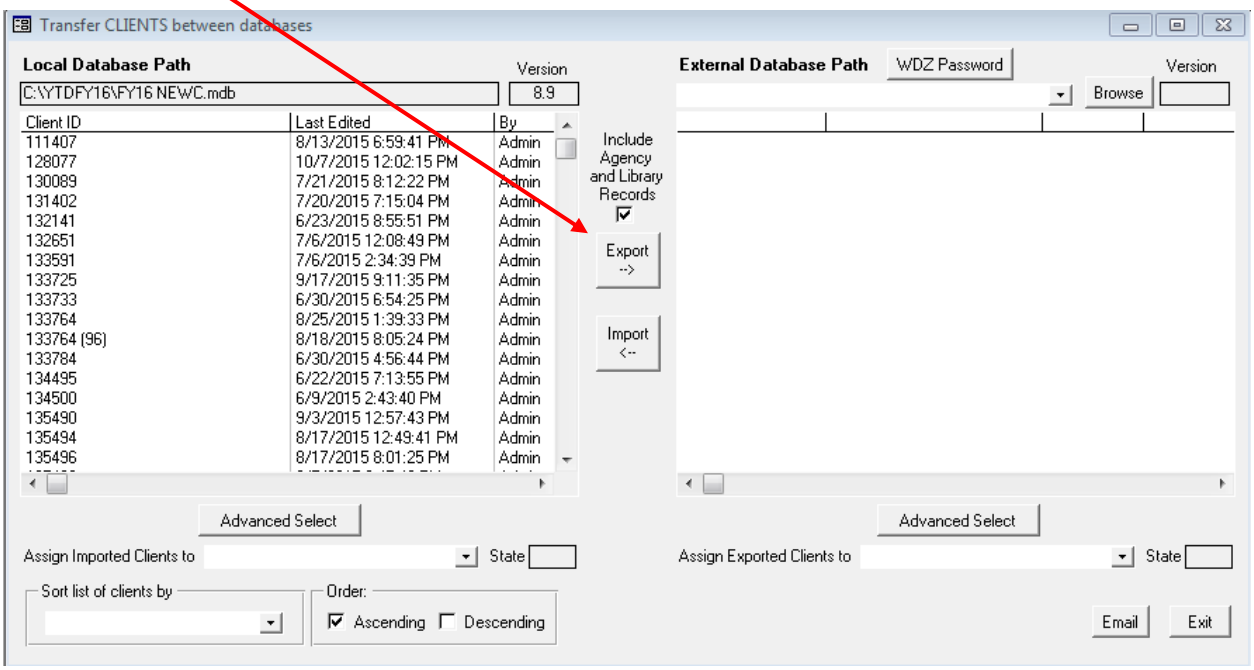
Click Save

5) The following window will appear before the export file can be created. Make sure to note the location of this file: you will need to find it on your computer later. Click "OK" to create the new blank database.

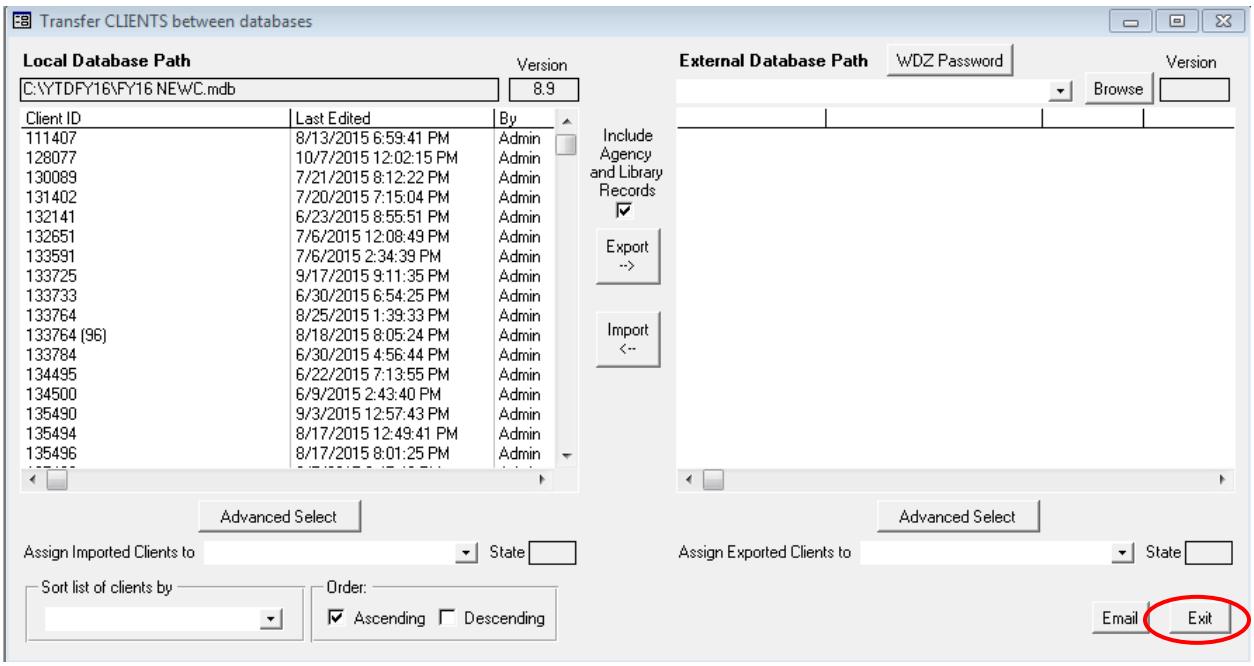


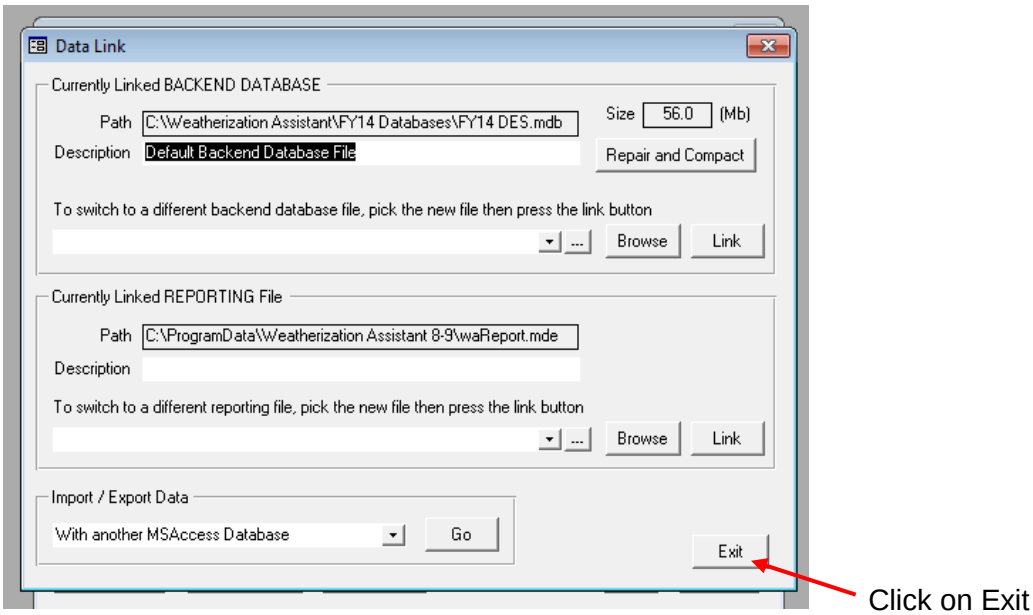
6) Back in the "transfer" window, highlight the jobs to be exported on the left-hand side of the screen, and click the "Export" button to send the jobs to the export file. (Note: to select multiple records, hold the CRTL key down and click each one—or just click on the first and last jobs in the list while holding down SHIFT to select all client records.) You do not need to include your agency libraries; however, it is best to include them.

Click on Export



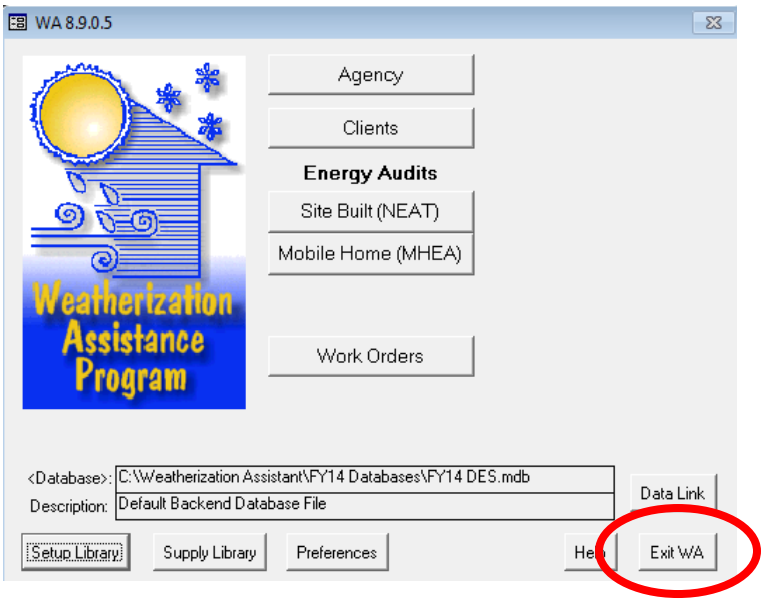
7) All of the jobs to be exported on the left-hand side under “Local Database Path” should now appear on the right-hand side under “External Database Path.” You can now exit this window, and back out of the Data Link screen. DO NOT USE THE Email BUTTON. Click on Exit



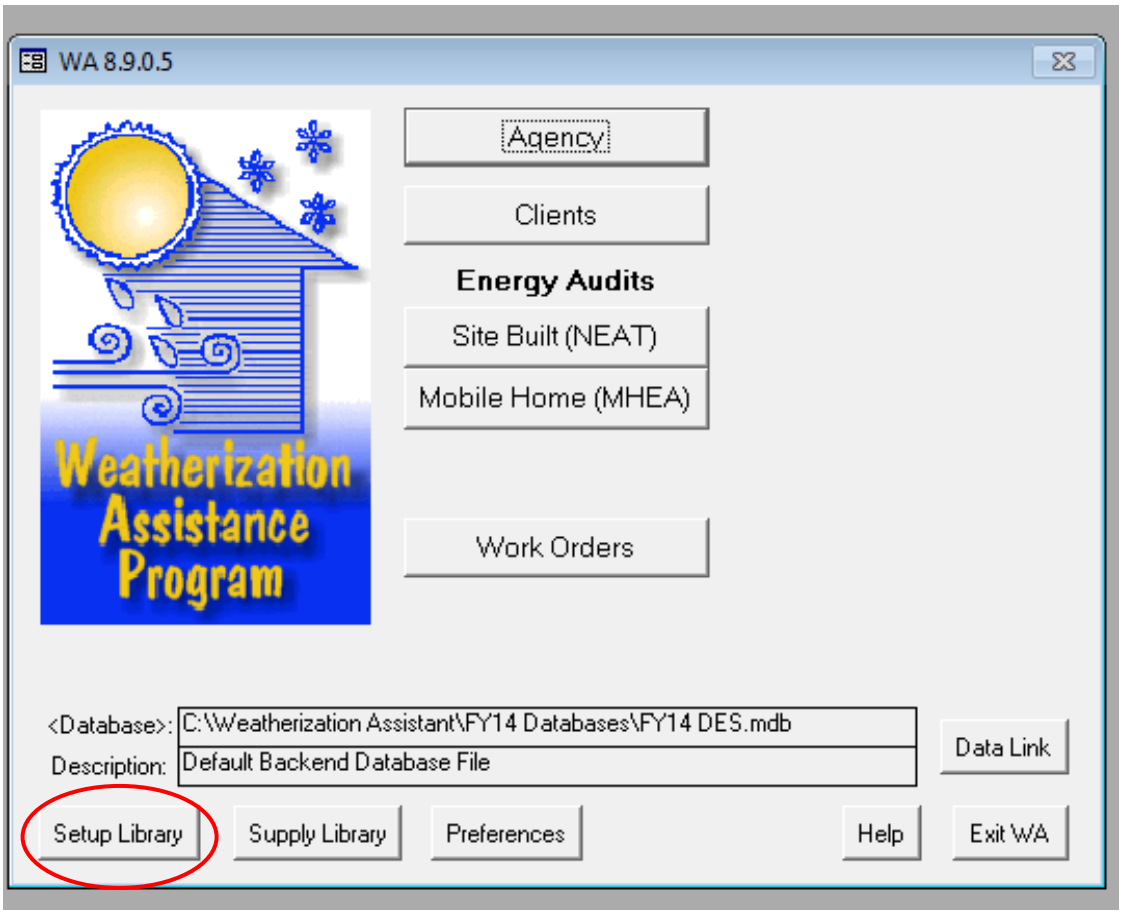


Click on Exit

8) Exit the WA 8.9 Software when you are finished with exporting client records.



9) Locate the export database file you created on your computer to verify that it was created. If not found you will need to start over from the beginning. The new "namefile.wdz" zipped database file can now be attached to an e-mail to send to another user or copied to a network location for other users to import.

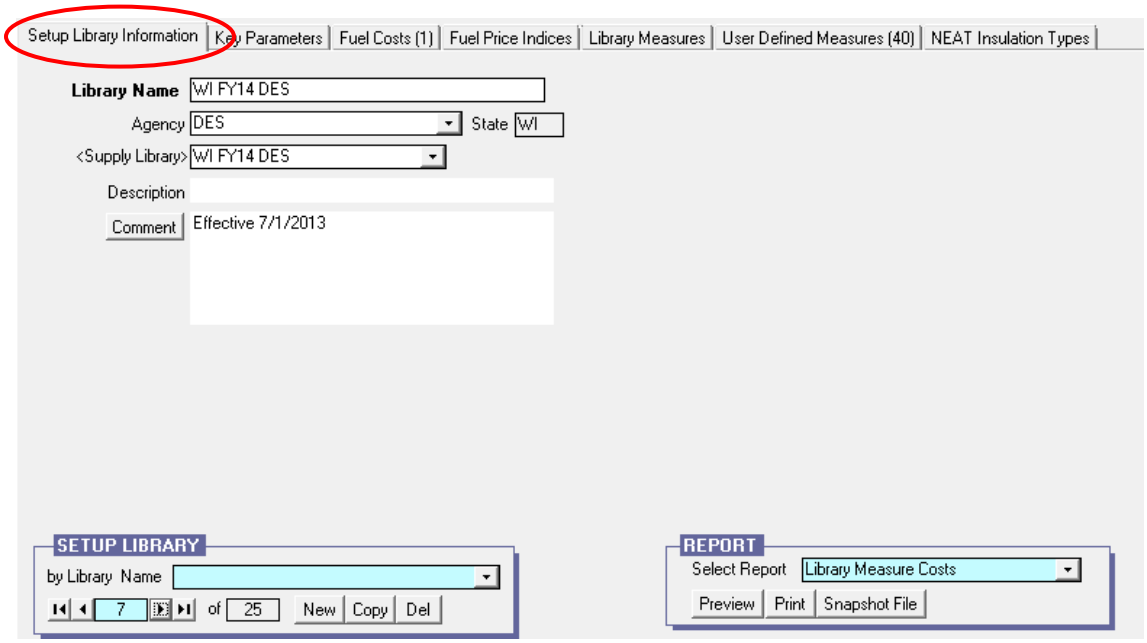


2.0 Overview

The *Setup Library* is a data structure where measure costs, fuel prices, and other required data is entered to customize the Weatherization Assistant for a particular area (such as the State of Wisconsin or an agency). Any number of different setup library records can be created and associated with the identified area.

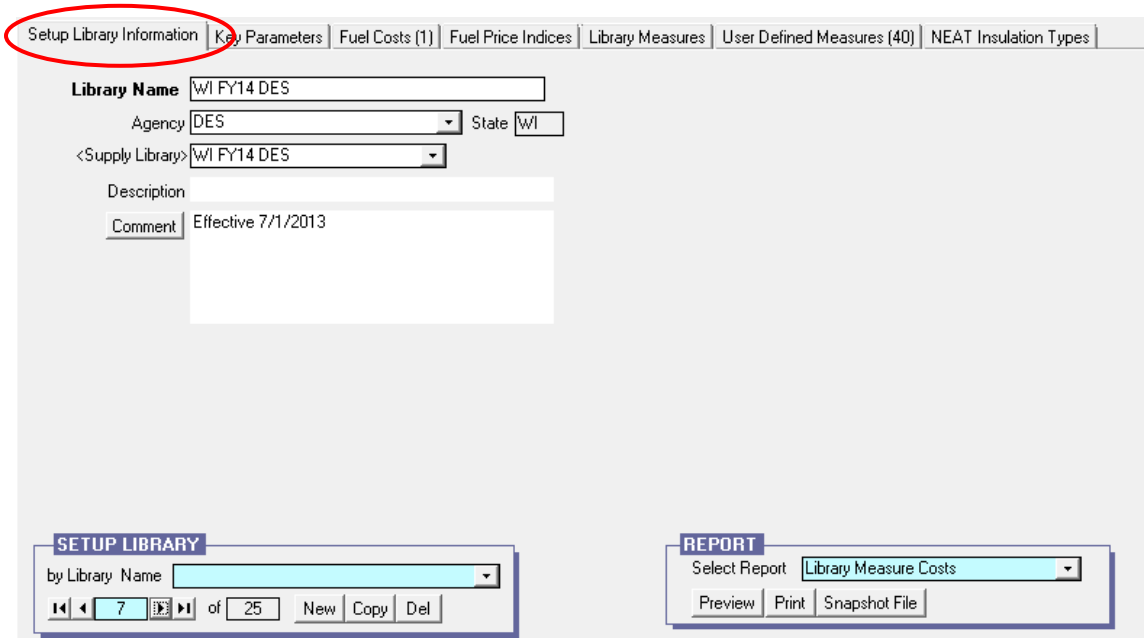
The set-up library customizes the program to Wisconsin. In Wisconsin, the set-up library stores information like material costs, fuel costs, and other adjustable parameters that relate to most of Wisconsin's audit jobs. The parameters in Wisconsin's set-up library are determined and set by the Division. Agencies receive a unique agency set-up library at the beginning of each contract year with the current fiscal year parameters as well as agency-specific costs. Changes in the setup library (cost details for example) WILL affect the generation of audit recommendations.

2.1 Setup Library Tabs



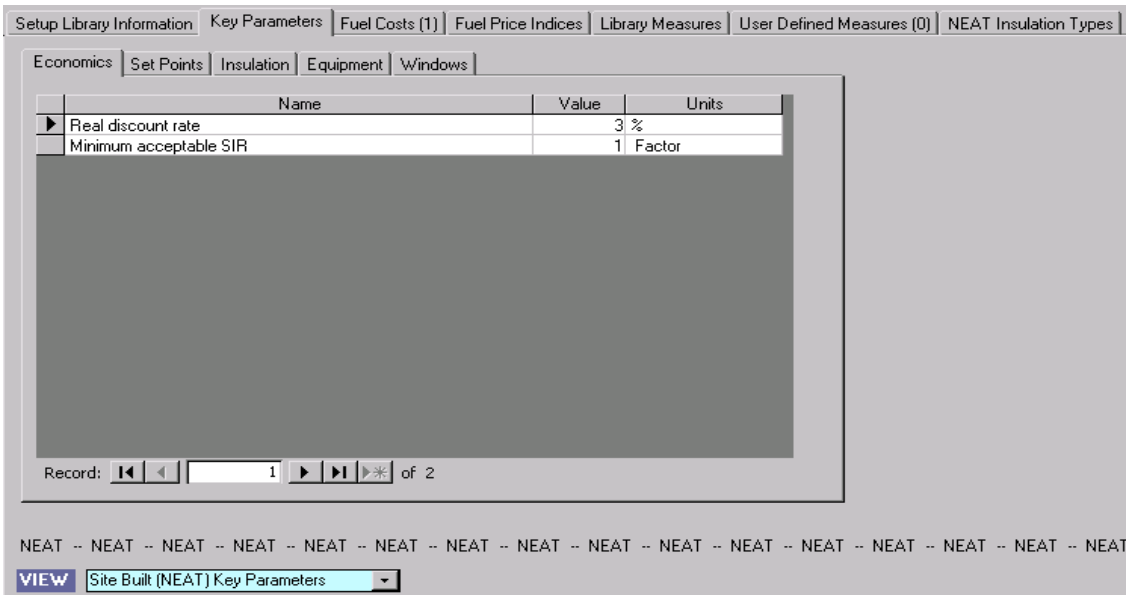
2.1.1 Setup Library Information

On this tab, general information about the setup library record is entered. The library name will show as the program year and the agency code. The *Agency* field will display the name of the agency. Choose the appropriate supply library selection from the *Supply Library* dropdown.



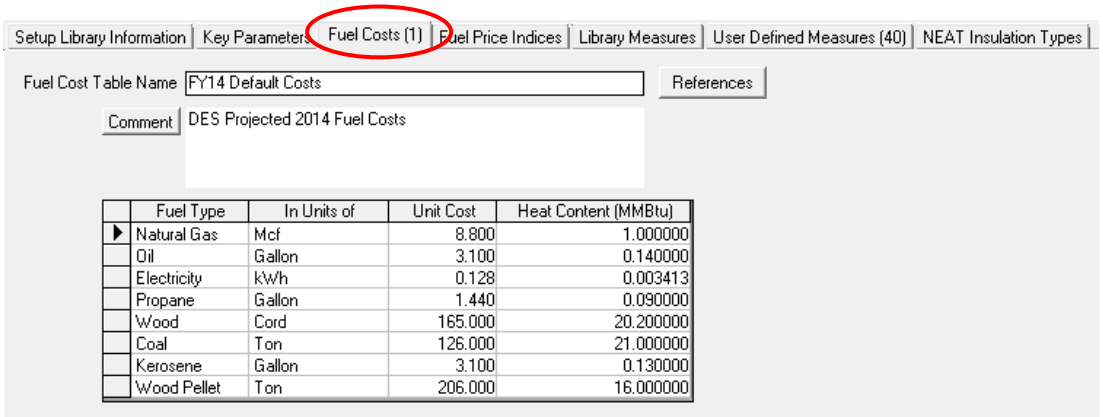
Note: Boxes outlined in black indicate a required field.

2.1.2 Key Parameters



Key parameters in Wisconsin are pre-defined by the Division. Any changes to key parameters are approved and directed by Division staff and should not be changed by agencies. Choose to view either NEAT or MHEA parameters by using the *View* dropdown box in the lower left corner of the *Key Parameters* form. A banner line just above the View dropdown box will indicate which set is currently being displayed (e.g., “NEAT - - NEAT - - NEAT...”). The sub-tabs under the *Key Parameters* tab divide the parameters into different categories.

2.1.3 Fuel Costs



The Division enters the fuel costs for the state, based on state-wide average data. Do not change any of the fuel costs.

2.1.4 Fuel Price Indices

The *Fuel Price Indices* show the fuel price escalation index values for each fuel for the current year out to 25 years. These values are based on US average fuel price escalation factors

released by the Energy Information Agency (EIA). There is no need to modify these indices. Values are obtained from the annual Supplement to NIST Handbook 135.

Setup Library Information | Key Parameters | Fuel Costs (1) | Fuel Price Indices | Library Measures | User Defined Measures (40) | NEAT Insulation Types

Fuel Type	Year	Price Index	UPW Factor
Natural Gas	0	1.00	1.00
Natural Gas	1	0.96	0.93
Natural Gas	2	0.98	1.86
Natural Gas	3	0.98	2.76
Natural Gas	4	0.99	3.63
Natural Gas	5	1.00	4.50
Natural Gas	6	1.01	5.35
Natural Gas	7	1.03	6.19
Natural Gas	8	1.07	7.03
Natural Gas	9	1.10	7.87
Natural Gas	10	1.13	8.71
Natural Gas	11	1.14	9.53
Natural Gas	12	1.16	10.34
Natural Gas	13	1.17	11.14
Natural Gas	14	1.19	11.93
Natural Gas	15	1.20	12.69
Natural Gas	16	1.21	13.45
Natural Gas	17	1.23	14.19
Natural Gas	18	1.24	14.92
Natural Gas	19	1.26	15.64
Natural Gas	20	1.28	16.35
Natural Gas	21	1.32	17.06
Natural Gas	22	1.35	17.77

Record: 1 of 208

2.1.5 Library Measures

Setup Library Information | Key Parameters | Fuel Costs (1) | Fuel Price Indices | Library Measures | User Defined Measures (41) | NEAT Insulation Types

#	Measure Type	Measure Name	Active	Default Contractor	Default Cost Center	Life (yr)	
1	Building Insulation	Attic insulation R11	☑			20	Costs
2	Building Insulation	Attic insulation R19	☑			20	Costs
3	Building Insulation	Attic insulation R30	☑			20	Costs
4	Building Insulation	Attic insulation R38	☑			20	Costs
5	Building Insulation	Attic insulation R49	☑			20	Costs
6	Building Insulation	Fill ceiling cavity	☑			20	Costs
7	Building Insulation	Sillbox insulation	☑			20	Costs
8	Building Insulation	White roof coating	☐			7	Costs
9	Building Insulation	Foundation wall insulation	☑			20	Costs
10	Building Insulation	Floor insulation R11	☑			20	Costs
11	Building Insulation	Floor insulation R19	☑			20	Costs
12	Building Insulation	Floor insulation R30	☑			20	Costs
13	Building Insulation	Floor insulation R38	☑			20	Costs

Record: 1 of 45

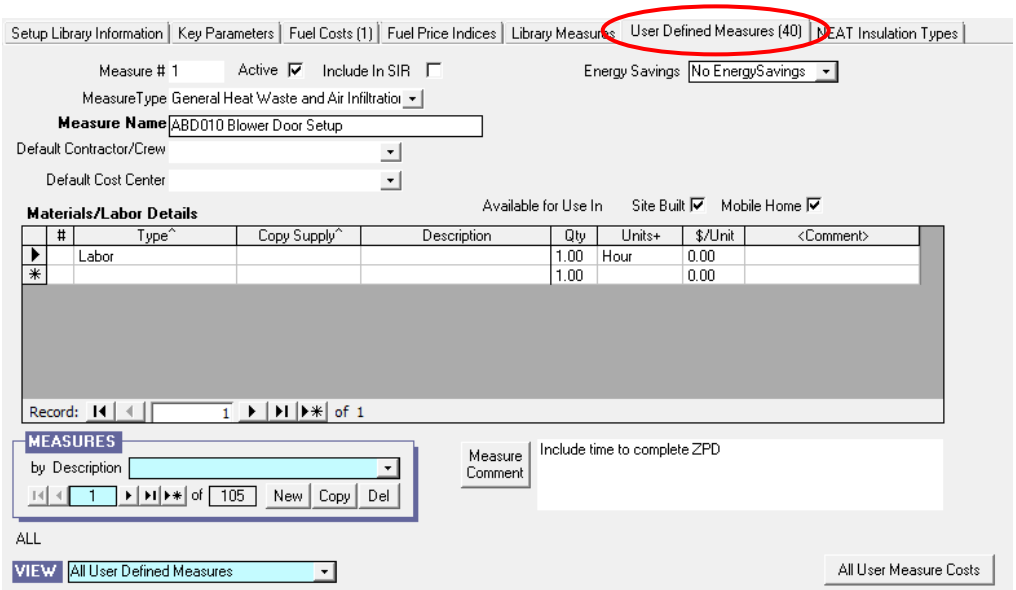
NEAT

VIEW Site Built (NEAT) Measures | Select All | UnSelect All | Invert Select | All Library Measure Costs

This tab shows the list of standard measures approved by the Division that will be considered by the audit analysis engine. Measures are active or inactive based on Wisconsin's weatherization

program protocols. Do not change the active flags. Each measure listed on the *Library Measures* tab of the *Setup Library Main Menu* item has its own "Costs" button. This button displays agency specific measure prices based on data analyzed in WisWAP. Audits will use these costs to determine the recommended measures. The VIEW drop down box in the lower left corner is used to switch between NEAT and MHEA library measures.

2.1.6 User Defined Measures



Under the *User Defined Measures* tab, the default database lists energy conservation, repair and Health and Safety measures.

All repair measures are marked as “include in Savings to Investment Ratio (SIR)” by default to ensure that all repairs selected in an audit are included in the SIR.

Users should remember to follow H&S program guidance when selecting the Health and Safety measures to be included in the SIR. See Section 4.5 Itemized Costs/User Defined Measures below and Weatherization Program Manual Section 8.8 Health and Safety Measures.

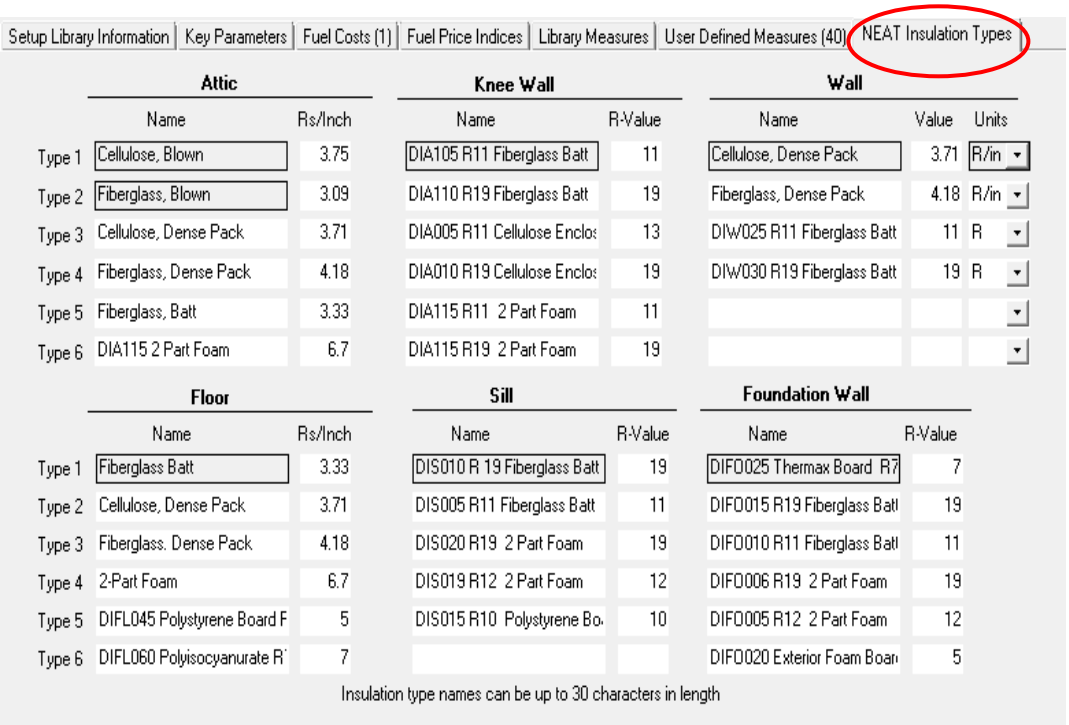
All energy conservation measures not modeled directly by the audit are also listed in the library. Some measures are placed here by the Division rather than having the audits select the measures. Measures may or may not be included in the SIR by default.

Use the "Available for Use In" check boxes to specify the appropriate audit application (NEAT or MHEA or both). The VIEW dropdown in the bottom left of the form is used to switch the view between different categories of records.

Agencies may enter default costs for any of the user defined measures to assist in efficiency of data entry for users. Duplicate or additional measures can be added to allow for different default costs for certain measures.

2.1.7 User Defined Insulation Types

This tab names and characterizes insulation types for attic spaces, knee walls, walls, floors, sills, and foundation walls for use in the NEAT audit. All insulation types and their respective R-values are established and approved by the Division and should not be changed by agencies.



Setup Library Information | Key Parameters | Fuel Costs (1) | Fuel Price Indices | Library Measures | User Defined Measures (40) | NEAT Insulation Types

	Attic		Knee Wall		Wall		
	Name	Rs/Inch	Name	R-Value	Name	Value	Units
Type 1	Cellulose, Blown	3.75	DIA105 R11 Fiberglass Batt	11	Cellulose, Dense Pack	3.71	R/in
Type 2	Fiberglass, Blown	3.09	DIA110 R19 Fiberglass Batt	19	Fiberglass, Dense Pack	4.18	R/in
Type 3	Cellulose, Dense Pack	3.71	DIA005 R11 Cellulose Enclos	13	DIW025 R11 Fiberglass Batt	11	R
Type 4	Fiberglass, Dense Pack	4.18	DIA010 R19 Cellulose Enclos	19	DIW030 R19 Fiberglass Batt	19	R
Type 5	Fiberglass, Batt	3.33	DIA115 R11 2 Part Foam	11			
Type 6	DIA115 2 Part Foam	6.7	DIA115 R19 2 Part Foam	19			

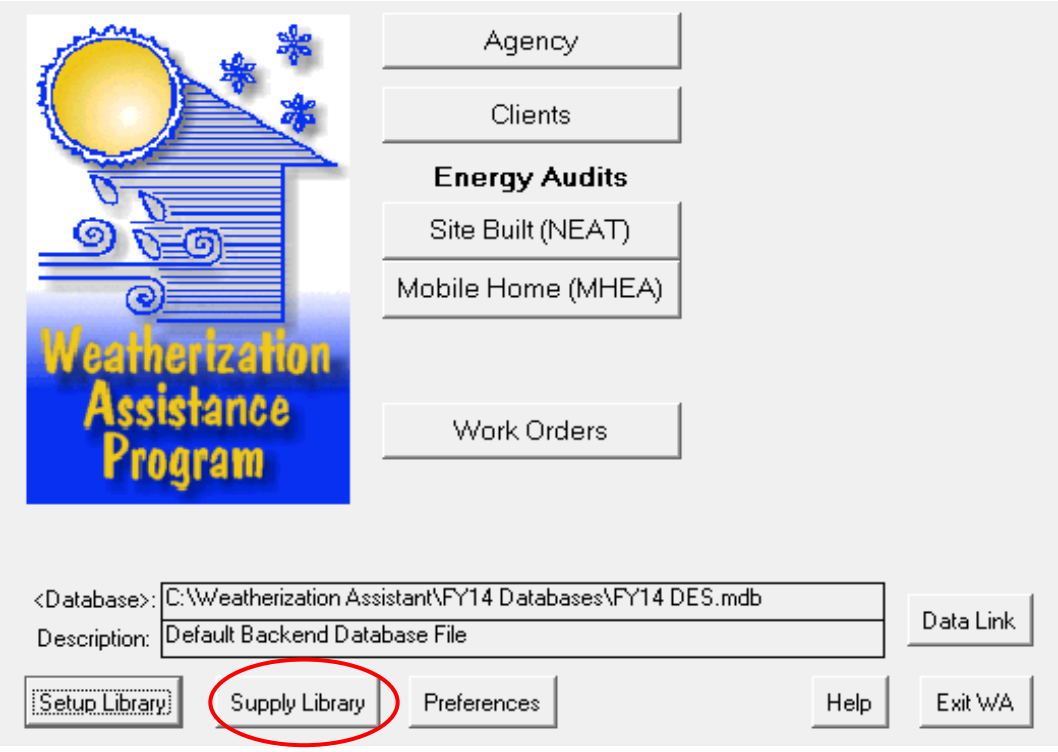
	Floor		Sill		Foundation Wall	
	Name	Rs/Inch	Name	R-Value	Name	R-Value
Type 1	Fiberglass Batt	3.33	DIS010 R 19 Fiberglass Batt	19	DIFO025 Thermax Board R7	7
Type 2	Cellulose, Dense Pack	3.71	DIS005 R11 Fiberglass Batt	11	DIFO015 R19 Fiberglass Batt	19
Type 3	Fiberglass. Dense Pack	4.18	DIS020 R19 2 Part Foam	19	DIFO010 R11 Fiberglass Batt	11
Type 4	2-Part Foam	6.7	DIS019 R12 2 Part Foam	12	DIFO006 R19 2 Part Foam	19
Type 5	DIFL045 Polystyrene Board F	5	DIS015 R10 Polystyrene Bo	10	DIFO005 R12 2 Part Foam	12
Type 6	DIFL060 Polyisocyanurate R	7			DIFO020 Exterior Foam Boar	5

Insulation type names can be up to 30 characters in length

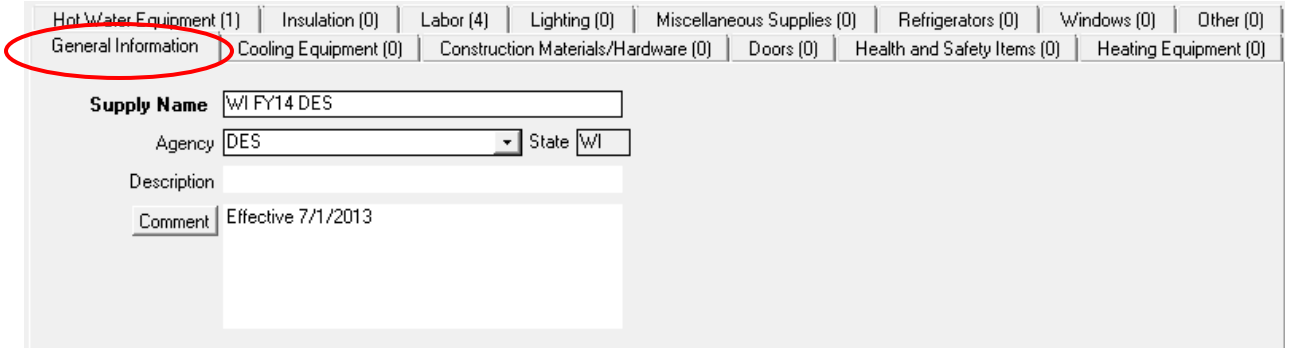
2.2 Supply Library Description

The NEAT and MHEA audits use the *Supply Library* as a repository for replacement refrigerators and water heaters used in the Baseloads tab in either audit. Agencies are required to keep an updated supply library with current bid prices active in all auditors' WA program files.

Each of the material category tabs under the *Supply Library Main Menu* item may be viewed and edited in either *Form* or Subform *Data Sheet* views. (Right click to select and change the view to Subform Data sheet). The Subform *Data Sheet* view offers a convenient way of reviewing the materials in the library. Records in the view may be copied and pasted between Weatherization Assistant databases or from the program to a spreadsheet application such as Excel.



2.2.1 General Information Tab



Note: Boxes outlined in black indicate a required field.

2.2.2 Supply Name – Required

Enter a name to identify the *Supply Library*. Most often, an agency will have only one *Supply Library*. If more than one is created, the name may contain an abbreviated indication as to why one differs from another. For example, if an agency changes vendors during a fiscal year, an updated library can be created. Save any lengthy explanations for the *Description* and *Comment* fields. A default name appears if a new *Supply Library* is created. The name will use the installation's ID or the default name will contain the time the library was created. The entry is limited to 50 characters.

2.2.3 Agency – Required

This field identifies the agency to which the *Supply Library* is associated. Since the only way to create a new *Supply Library* is to copy an existing one or import one with a client, this entry will initially be complete.

2.2.4 State

This un-editable field displays the state associated with the *Agency* entered in the previous field.

2.2.5 Description – Optional

This field may describe the intended use of the *Supply Library*, particularly if the agency uses more than one supply library.

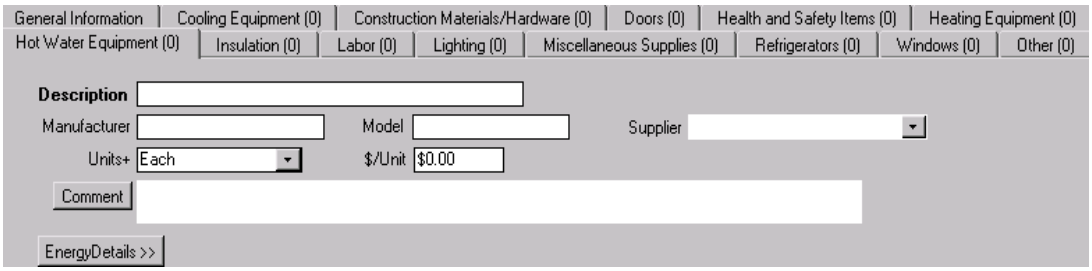
2.2.6 Comment – Optional

Comments related to the supply Library may be entered directly in the comment field on the form. The comment will not be displayed anywhere else in the program and is for the user's benefit only.

2.3 Hot Water Equipment and Refrigerator Forms

The *Supply Library's* listings for *Hot Water Equipment* and *Refrigerators* are the only categories of materials in the library with data that may be selected in an audit and used in the audit calculations themselves. Entries made under these categories determine the cost effectiveness of the water heater and refrigerator replacement measures. Information about a replacement refrigerator can be entered directly into NEAT's and MHEA's audit input forms, but data on replacement water heaters must be entered in the program's *Supply Library* in order for the audits to consider replacing a unit. Most of the entry items and controls are common to both refrigerator and water heater category tabs in the supply library.

2.3.1 Description – Required



Enter a description of the item category. Entries are limited to 80 characters. Descriptions can be unique to each agency's situation. For example, if an agency has separate bid/prices for each county they serve, the description can be tailored to identify the water heater to be used in each county.

2.3.2 Manufacturer – Required

Enter the name of the manufacturer of the item. Entries are limited to 50 characters.

2.3.3 Model – Required

Enter the model of the described item. This information can alternatively be included in the description entry.

2.3.4 Supplier – Optional

Choose the supplier of the material. This dropdown list will be determined by the information the Weatherization agency enters into the *Supplier* screen accessed through the *Home* screen of the Weatherization Assistant Program. Agencies can choose to tailor the drop down so that it is the same as their internal reporting system.

2.3.5 Units – Required

Enter the unit(s) by which the item is priced. The choices for water heater equipment and refrigerators will be "each."

2.3.6 Cost/Unit – Required

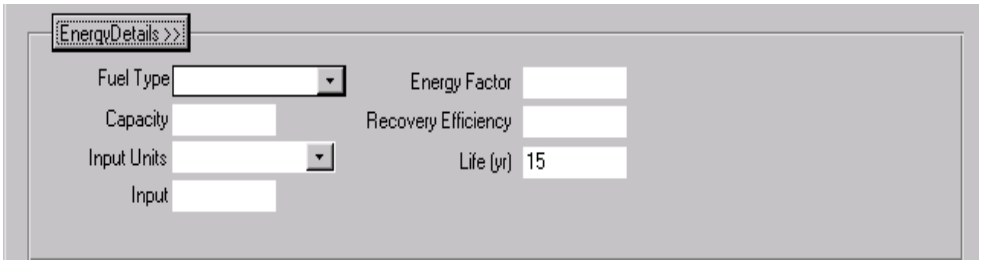
Enter the cost of the item in the Units entered in the previous field. Both the *Units* and the *$/unit* will be copied to any use of the item in the *Work Orders*.

2.3.7 Energy Details

For *Refrigerators* and *Hot Water Equipment*, entries in the indicated fields are required in order to provide sufficient information for use in the audits.

2.4 Water Heaters

All water heaters that an agency uses shall be entered here. When a water heater is "considered" for replacement it is selected from the drop down list in the base-load tab. All data on the form is required in order to evaluate the cost effectiveness of the water heater replacement in NEAT and MHEA.



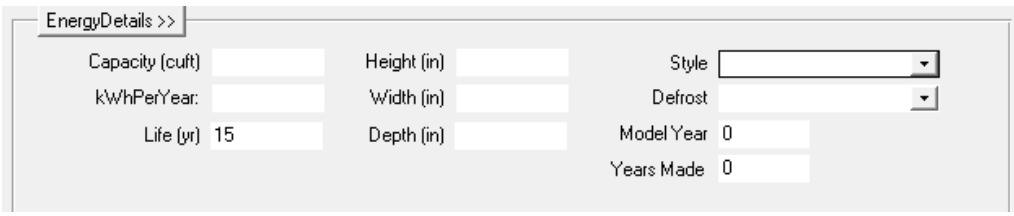
- Fuel type choices are: Natural Gas, Electric, and Propane.
- Capacity is the gallon size of the water heater.
- The input rating is metered in units of kBtu or kW.
- The Energy Factor and Recovery Efficiency are ratings of a water heater's efficiency and are available from AHRI - https://www.ahridirectory.org/ahridirectory/pages/home.aspx - or from agency vendors.
- In 2017, the Energy Factor rating was replaced with the "Uniform Energy Factor" standard, and AHRI may report only the UEF value. For natural gas and propane units, add .03 to the reported UEF to get an Energy Factor to enter into WA. (A unit with a published UEF of 0.64 is entered in WA as having an EF of 0.67). For electric water heaters, add .02

to the reported UEF to get an Energy Factor to enter into WA. (A unit with a published UEF of 0.93 is entered in WA as having an EF of 0.95).

- The standard life used is 15 years.
- **Tip**: Enter Recovery Efficiency as a decimal, not a whole number. Example being a water heater with 75% recovery efficiency should be entered as .75.

2.5 Refrigerators

The Energy Details form for refrigerators includes data necessary for the NEAT and MHEA audits to evaluate the cost-effectiveness of replacing an existing refrigerator with a unit described here.



Required entries include:

- Capacity (in cubic ft)
- Annual Consumption (kWh/Year) - available from the agency vendor or Energy Star: http://www.energystar.gov/index.cfm?fuseaction=find_a_product..showProductGroup&pgw_code=RF
- Expected life (15 years is standard)
- Model Year – when it was first sold, and the number of years it was available. Estimates are acceptable.
- Style: Top Freezer, Side by Side, Single Door, Single Door with Freezer, Bottom Freezer, and Other.
    - Note: Replacement refrigerators are limited to one per household and shall be a top freezer style. For households with accessibility considerations, written approval from the Division is required prior to installing a bottom-freezer or side-by-side style (see Weatherization Program Manual Section 8.7.3).

Tip: Dimensions of the refrigerator are optional entries, but may be important if the existing unit is located in a restrictive space.

2.6 Labor

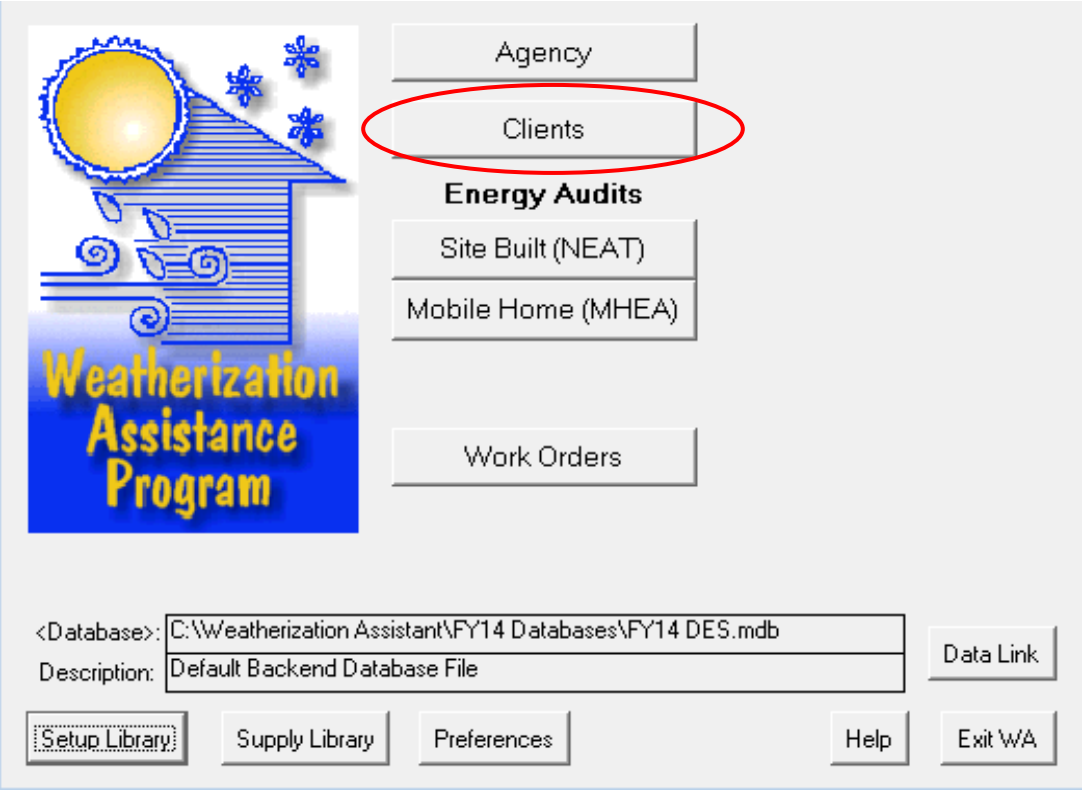
The labor tab is used as a placeholder for typical default costs. Agencies may enter a record for their direct labor rate. None of these values are directly used by the audits.

Note: All other supply library tabs are not required for agency use.

Chapter 3 Client Records

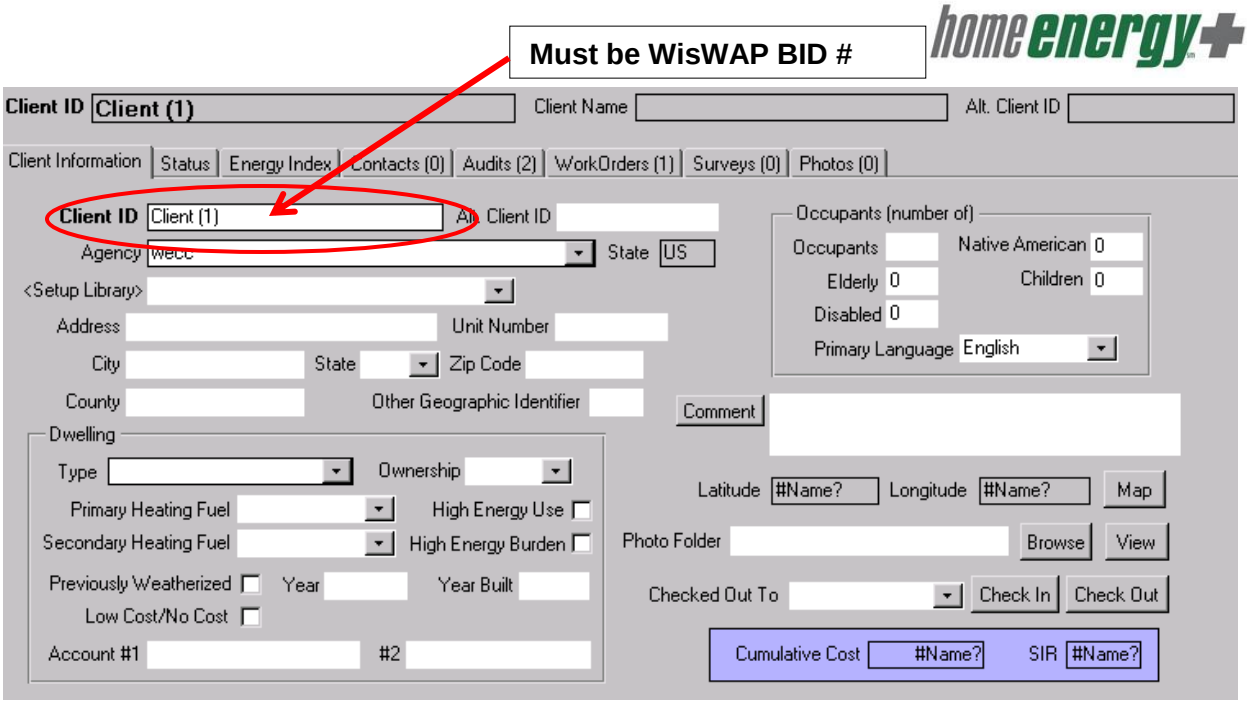
3.0 Description

Before a MHEA or NEAT audit can be completed, there must be a client record.



The *Client ID* screen is where client contacts, overall work status, and overall dwelling and occupant data are stored. Audits and work orders are organized under a client record. New client records are added from “Clients” on the main menu.

Client records are designed to be the key parameter identifying the client to your agency. Every client record must be unique. **In Wisconsin, the client record must be the WisWAP Building Identification Number (BID#).** Agencies can use the Alt. *Client ID* field for alternative ways to identify clients such as their agency job number or other criteria. NEAT/MHEA has other locations in which to enter the client’s name.

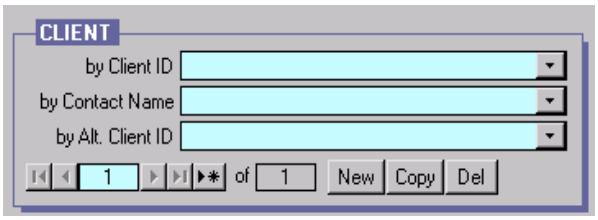


Note: Boxes outlined in black indicate a required entry field. Occupant's entry is also required on this screen.

3.1 Completing Client Data Records

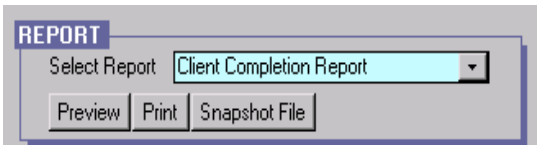
The *Client Information* screen catalogs general information about the client and the client dwelling. This tab also has the *Client Record Navigation* block in the lower left hand corner of the screen and the *Client Report Block* in the lower right hand corner of the screen.

3.1.1 Client Navigation Block



The Client Navigation Block may be used to find and access client descriptions or initiate new clients. Only clients associated with the agency bookmarked on the *Agency Information* tab will be displayed.

3.1.2 Client Report Block



The client report block provides access to reports and forms. Reports display information entered into Weatherization Assistant. Client Information Forms and NEAT/MHEA Data Collection Forms (blank) can be printed to use in gathering new or additional information.

The NEAT/MHEA Data Collection forms are printed with client information once it has been entered.

3.1.3 Other Client Information Fields

3.1.3.1 Client ID – Required

In Wisconsin, this must be the WisWAP BID#. The *Client ID* is one of several fields used to locate information on an existing client.

3.1.3.2 Alt. Client ID – Optional

This field allows agencies to assign a second identity to each client such as the agency project number. Agencies may enter an Agency Job Number or Identifier in this field. The *Client Record Navigation* block can search for a client by this designation as well as the *Client ID*. The entry is limited to 50 characters.

3.1.3.3 Agency - Required

This field automatically displays the name or identification of your agency.

3.1.3.4 Set up Library

This field is used to select the current setup library to be assigned to the client and any audits for the client.

3.1.3.5 Address, Unit Number, City, County, State, and Zip Code – Optional

3.1.3.6 Geographic Identifier − Optional

3.1.3.7 Dwelling Data

The information in the *Dwelling Data* block in the *Client Information* tab is primarily optional with the exception of the dwelling type. Agencies should consider whether to use the information in the optional fields for internal tracking or contract management.

Type − Required
Choose the type which best describes the dwelling: (1) Site Built, (2) Mobile Home, (3) Duplex, (4) Triplex, (5) 4-Plex, (6) Multifamily (5 or more units per building), (7) Shelter, and (8) Other.

Optional fields

- Ownership
- Primary Heating Fuel
- Secondary Heating Fuel
- High Energy Use
- High Energy Burden
- Previously Weatherized
- Low Cost/No Cost
- Year Built

3.1.3.8 Occupant Data-Required

The total number of occupants must be entered to ensure accuracy of water heater and refrigerator replacement SIR calculations. All other data entry is optional.

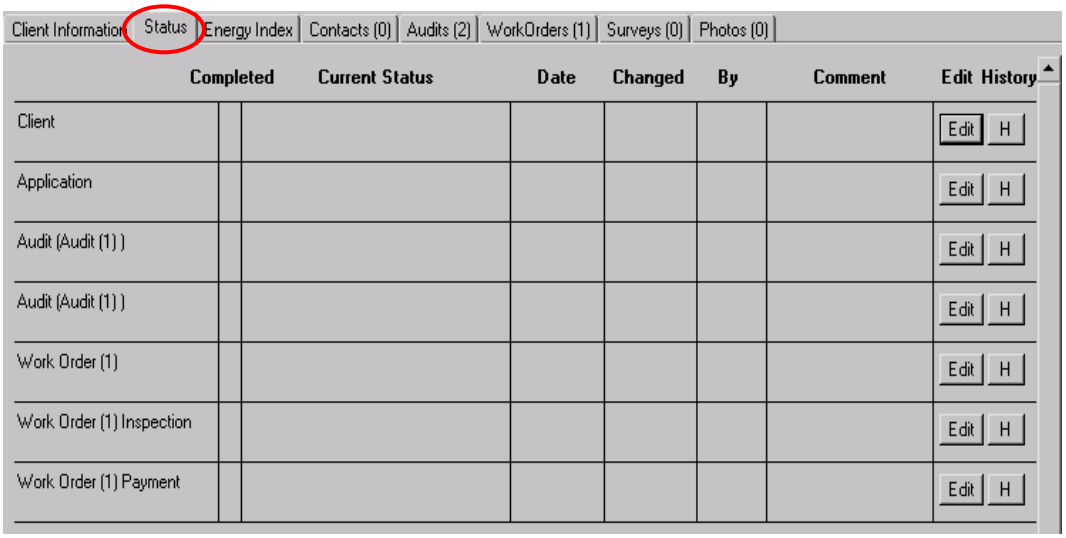
3.1.3.9 Comments – Optional

Tip: This is a good location to put comments in when not using actual fuel records.

3.2 Other Client Identification Screens

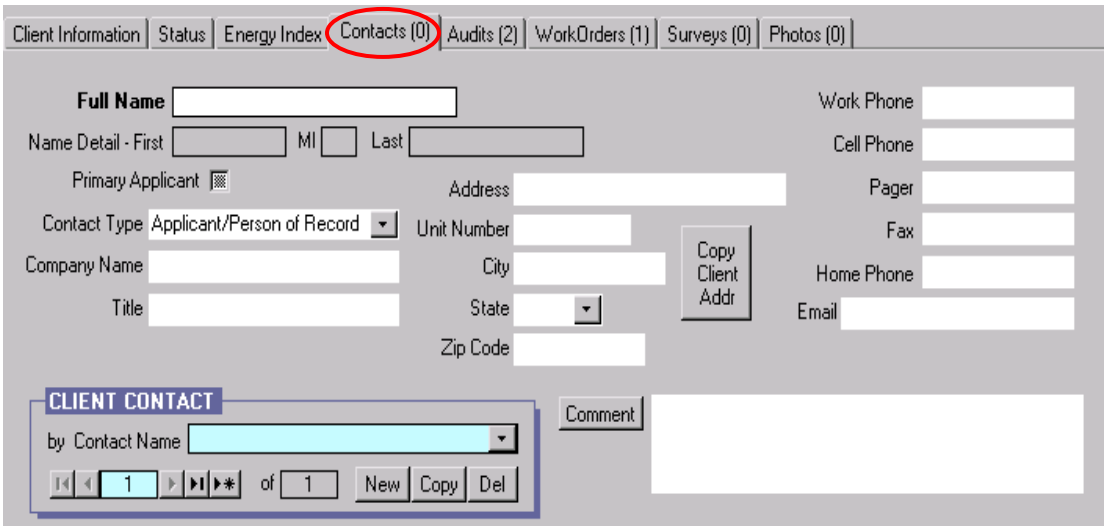
The *Contacts* tab must be filled out to assign a name to the client record. Typically this is the weatherization client's name. The *Status, Energy Index, Audit, Work Orders,* and *Survey* screens are not regularly used but available for the functions described. The *Photo Browser* tab is not used in Wisconsin.

3.2.1 Status Tab



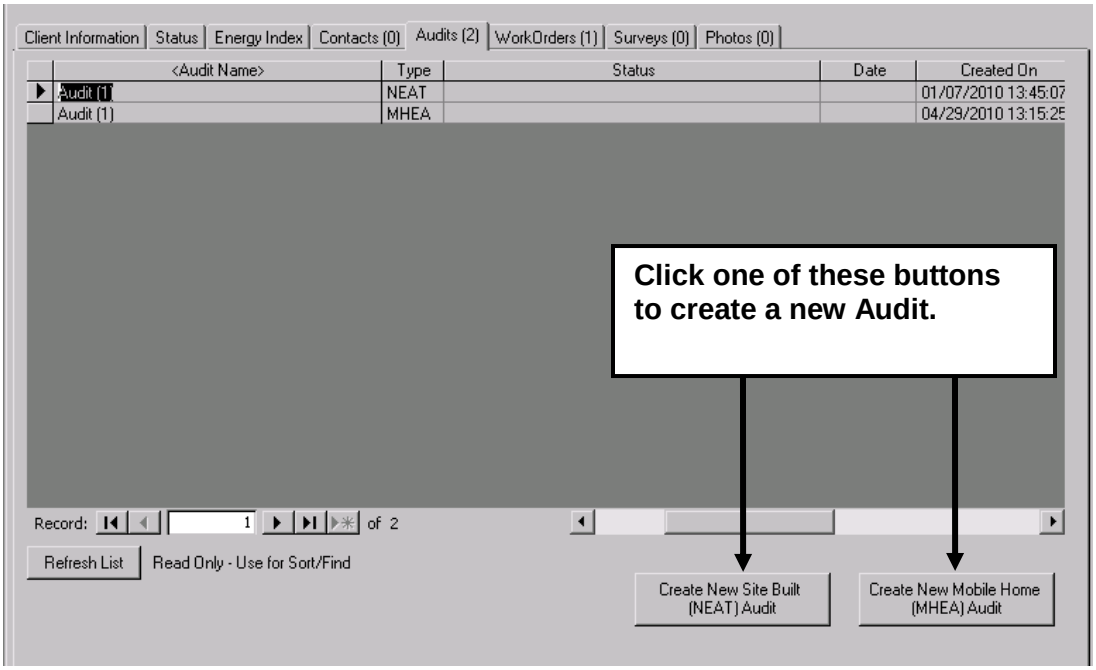
This tab shows the status of the client record as well as the status of all audits ran and work orders for this client.

3.2.2 Contacts Tab



The record marked “primary applicant” will be displayed whenever client records are selected from lists. Enter the name of the client to enable sorting and searching by name of client in the records. In the Full Name field, names entered as First, Last will display as Last, First.

3.2.3 Audit Tab



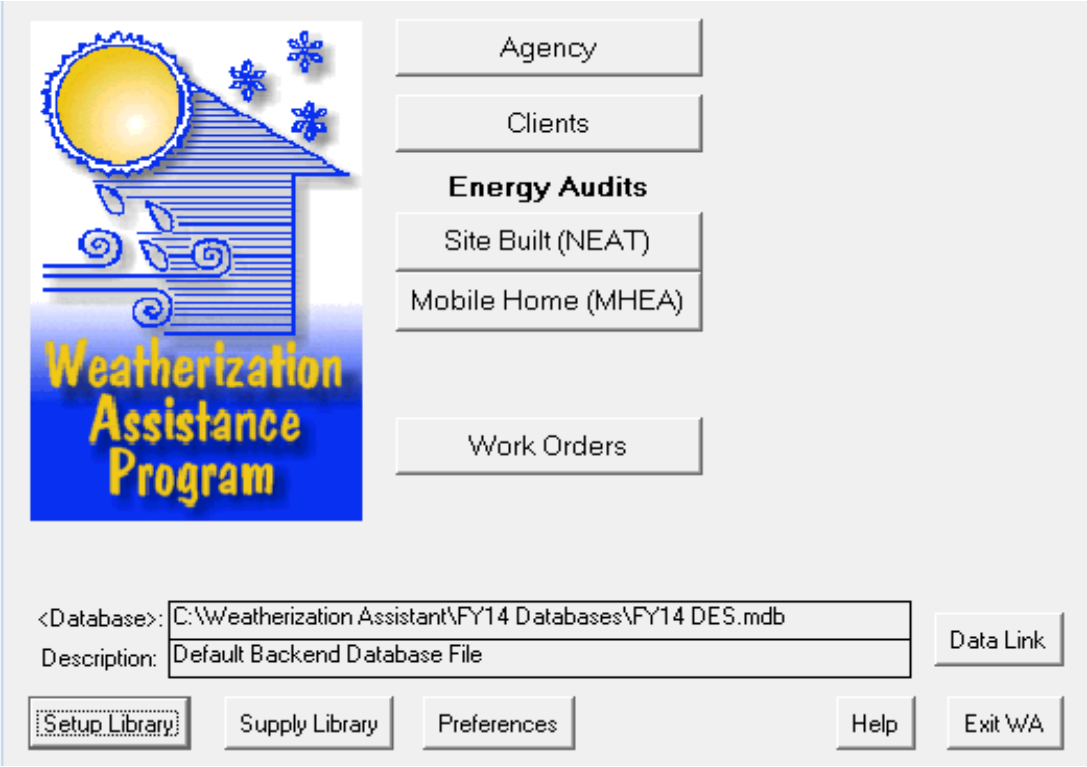
Use the Audit tab to list the audits associated with a client record. Buttons in the bottom right corner of this screen can be used to generate new NEAT or MHEA audits associated with the client. This is the best way to create a new audit to ensure that it is associated with the correct client information

Chapter 4 The NEAT and MHEA Audits

4.0 General Information

When performing energy audits for site built residential structures, use the National Energy Audit Tool (NEAT).

When performing energy audits for manufactured homes, use the Manufactured Home Energy Audit program (MHEA).



4.1 NEAT and MHEA Audit Information

This tab on the main NEAT and MHEA forms can be used to enter overall audit information about the house. Client information is entered using the Client button on the main menu. Then, the NEAT or MHEA buttons on the main menu can be used to enter overall audit information about the house.

4.1.1 Agency

This un-editable field displays the agency to which the client whose house is being audited is assigned.

4.1.2 Measure Cost Entry

The Set up Library includes an agency's typical cost for many common measures. Where actual costs are likely to be different for the particular unit being audited, consider adjusting the default cost to reflect your best estimate of what the measure will actually cost. If the default cost is adjusted you should briefly explain the reason in the Comment field for that measure.

Job cost reduction funds shall **not** be used to reduce the cost of a measure in Weatherization Assistant. Always model the full (estimated) cost of measures.

4.1.3 Run Audit Button

After describing the house on the audit data forms, use the "Run Audit" button to have the audit perform its calculations and produce energy efficiency measure recommendations for the home. Within the same data block as the *Run Audit* button are un-editable fields showing the date and time the currently accessed audit was "Last Run On." If the audit has not yet been run for this specific house description, the date field will display "Not Run." Multiple audits may be run, but the recommendations from any previous runs will be overwritten. To save the recommendations from previous audits on the same house, use the "Copy" button in the *Record Navigation* block (lower left hand corner) to copy the house description. Then, give the house description a new audit name (a variation of the original name), make any modifications to the house description, then use the *Run Audit* button to produce another set of recommendations.

Note: The Run Button is available from all Audit forms and may be activated from any of these forms once it has been decided that changes to the building description are complete.

4.1.4 Economics Summary

For completed audits with NEAT or MHEA recommendations, the *Economics Summary* block will display a summary of the recommendations:

- The number of Measures Recommended.
- The Total Initial Cost of the recommendations.
- The Life Cycle Savings to Investment Ratio (SIR) for all recommended work included in the SIR calculations.

If the audit has not been run on the house, the number of Measures Recommended will be "0" and the other fields will be blank. All of the fields within the *Economics Summary* block are un-editable.

4.1.5 Record Navigation Block

The Record Navigation block in the lower left corner of the form allows the user to find, copy, delete, and navigate to audits in the database.

4.1.6 Report Block

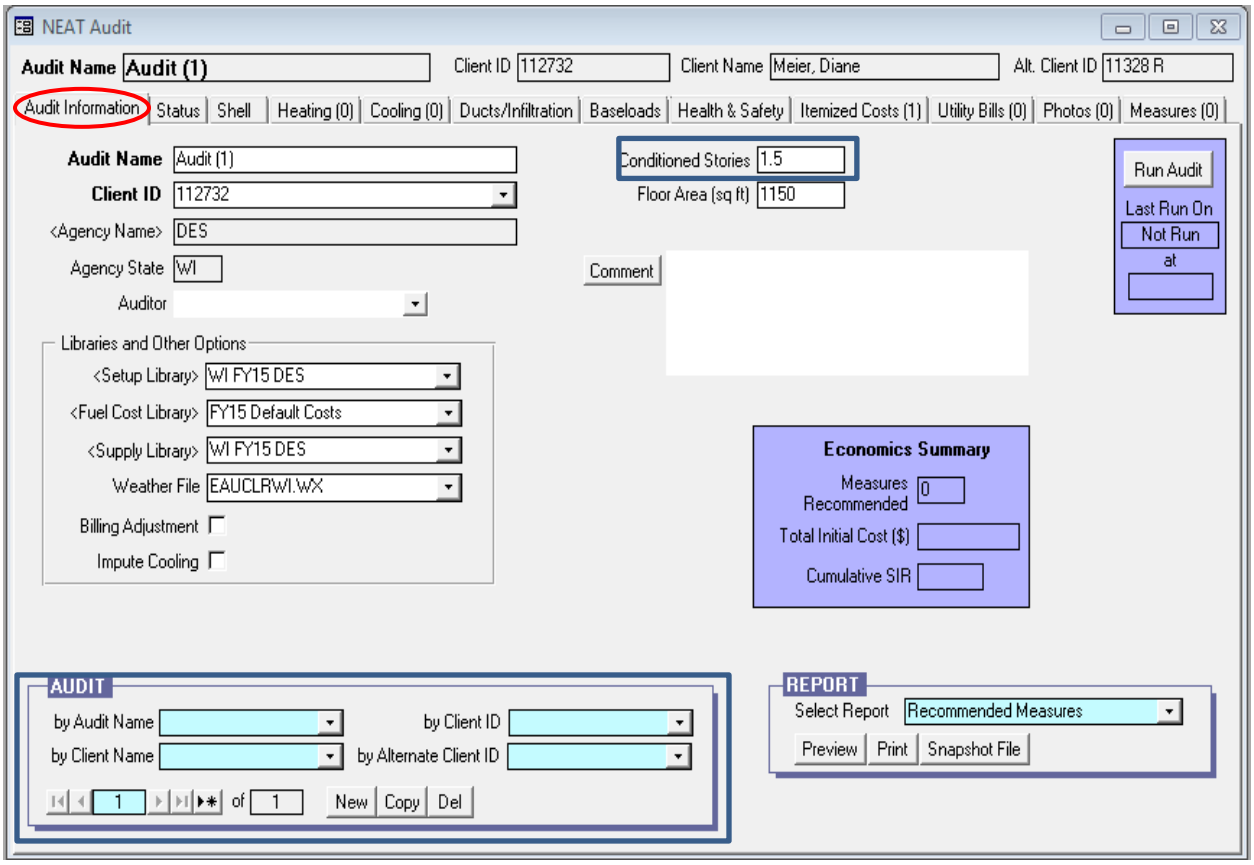
The Report Block located in the lower right corner of the main NEAT and MHEA forms allows access to the various reports available in the audit. The reports may be displayed on the monitor, printed, or sent as an attachment to an e-mail, copied to a disc, or shared by some other means. Use the drop-down list to view and choose from the various reports.

4.2 Energy Audit Forms

Get to the NEAT energy audit form by pressing the Site Built (NEAT) or Mobile Home (MHEA) energy audit button on the main menu. The main form contains record navigation aids, command buttons, and multiple tabs for all the different audit information that is entered. The

main form is where audits are copied, new audit records are defined, and audit information is entered. Users can make analysis runs, view recommended measures, and optionally, generate work orders.

4.2.1 Audit Information



Note: Boxes outlined in black indicate a required entry field.

Wisconsin requires selection/entry of an auditor for related audit evaluation projects.

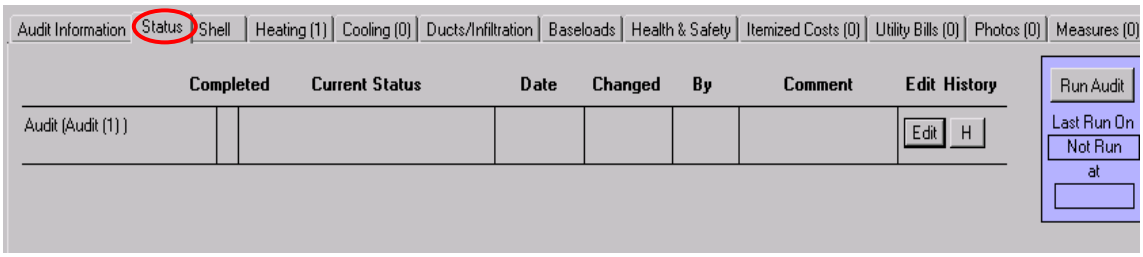
Enter the number of conditioned stories. Include a finished attic if it is heated or cooled. Include a basement if it is heated or cooled and the majority of its wall area is above-grade. Decimal entries such as 1.5 may be used for split level or half-story up- stairs. The value is used to compute the stack effect of infiltration.

Enter the number of square feet of floor area that is conditioned. If more area is heated than effectively cooled, enter the heated floor area. The value is total floor area, not footprint area.

This tab displays general information about the audit. This tab also has the navigation block used to view different audit records as well as the reporting block to view or print specific reports. Users select the Setup and Supply libraries to use for the audit as well as the weather region.

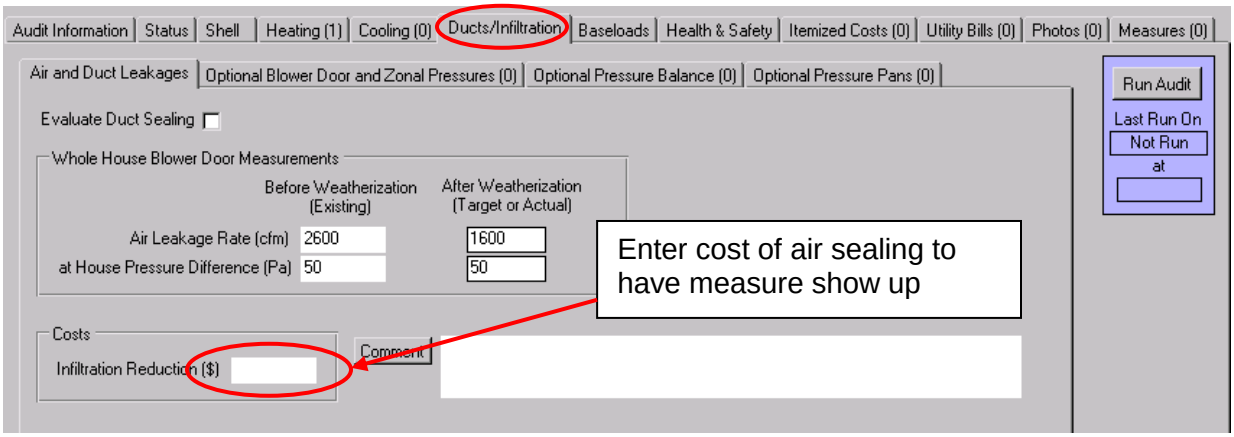
Tip: The audit information page is a good location to leave comments about the home and reasoning for not utilizing Pre-Wx Fuel consumption records.

4.2.2 Status



Use of the status tracking is optional. The status of the audit can be changed here or on the status tab of the client identification form. By selecting the history button it will show you the amount of runs associated with the audit.

4.3 Ducts and Infiltration



Note: Before Weatherization (Existing) and Infiltration Reduction ($) are required entries even though they are not outlined by a black box.

4.3.1 Evaluate Duct Sealing

When entering data to the MHEA audit, **do not check** the “Evaluate Duct Sealing” tab.

4.3.2 Whole House Blower Door Measurements

In the *Whole House Blower Door Measurements* box, enter the existing air leakage rate in CFMs in the Before Weatherization (existing) box and use 50 Pascals as the House Pressure Difference. Auditors should use the temperature adjusted “As Is” test from the Diagnostic Workbook modeling tab.

4.3.2.1 After Weatherization – Target or Actual

In the After Weatherization (Target or Actual), enter the estimated final CFM number at 50 Pascals. Enter the Auditor Estimated Final CFM50 number from the Diagnostic Workbook modeling tab.

4.3.2.2 Costs

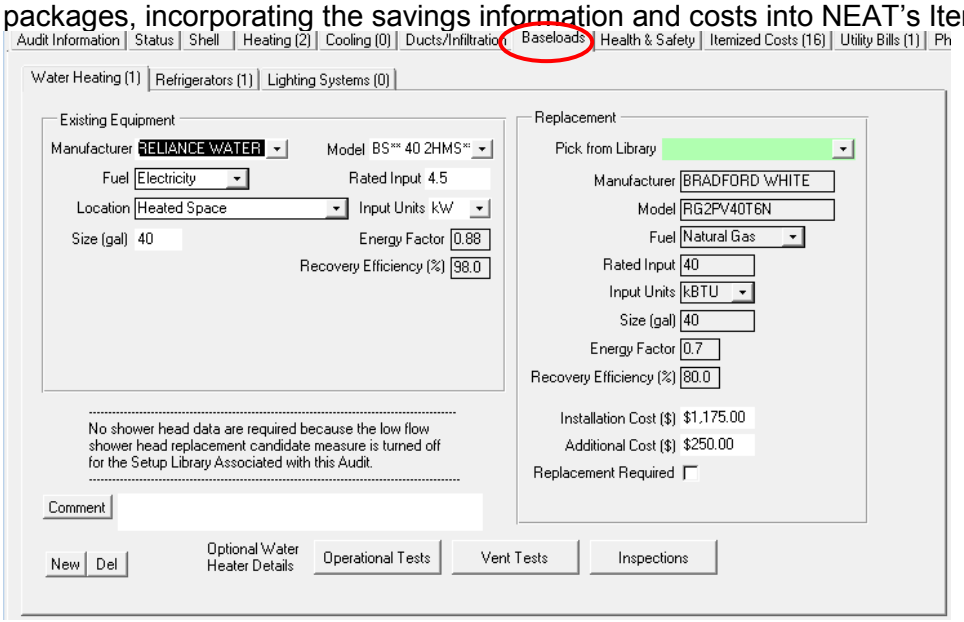
Enter the total Estimated Air Sealing Cost amount from the Diagnostic Workbook modeling tab. Auditors may adjust the cost as needed. If the building has a high pre-test CFM number, or sidewall insulation will contribute to air sealing results, the air sealing cost may be reduced. Complex work may increase air sealing costs. Enter comments whenever the Diagnostic Workbook estimate is adjusted.

Note: Infiltration Reduction is the only measure that is performed regardless of the measure SIR.

4.4 Baseloads

The term "baseload" refers to energy consumption from equipment or appliances whose usage is not directly affected by climatic conditions. In Wisconsin, the base load energy categories considered for reduction by weatherization are water heaters and refrigerators.

For 5-24 Unit Buildings use the 5-24 Unit Workbook to generate the savings for lighting packages, incorporating the savings information and costs into NEAT's Itemized Cost section.



4.4.1 Domestic Water Heating (DWH)

4.4.1.1 DWH Manufacturer - Optional

Enter the existing water heater manufacturer's name. Use this field either to enter a manufacturer or to search the look-up tables for a matching entry.

4.4.1.2 DWH Model - Optional

Enter the existing water heater's model number. Use the manufacturer field to enter any model or to search the tables for a matching entry.

4.4.1.3 DWH Fuel Type - Required

Select the fuel used by the existing and replacement water heaters from the three choices: Natural Gas; Electric; or Propane. The entry is required for all hot water measures. If the manufacture and model have been successfully chosen from the database, this field will auto populate.

4.4.1.4 DWH Location - Required

Three locations are available for the water heater. Due to an error in the Weatherization Assistant software, **only use** "Unintentionally Heated Space."

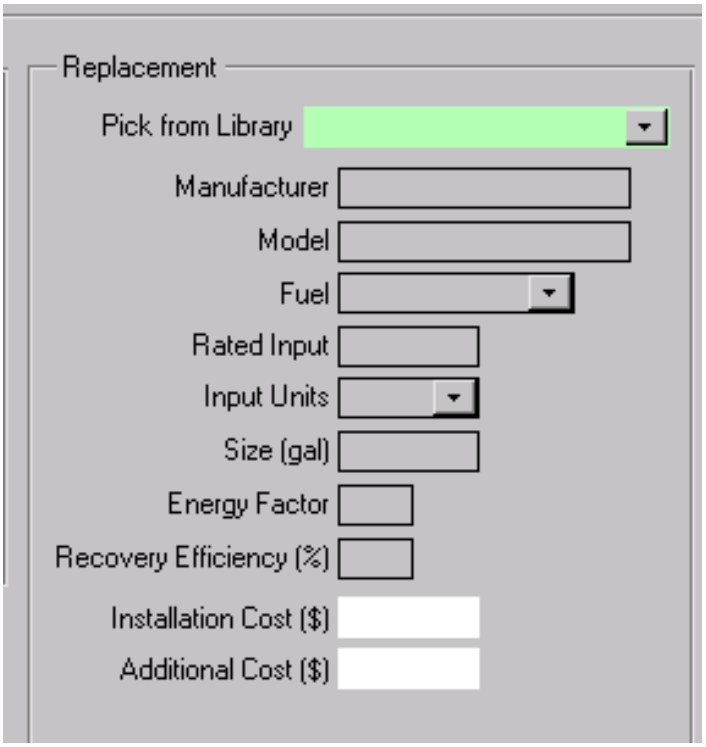
- Heated Space (purposefully heated by a heating system to maintain a desired temperature, usually utilizing a thermostat to control the space temperature. For example, a basement heated by supply registers or radiators in the space would be heated, as would a basement heated continuously by a space heater).
- Unconditioned Space (there are no sources of heat in the space other than conduction through walls, floors, and perhaps insulated ductwork).
- Unintentionally Heated Space (partially heated by a heat source in the space that adds heat unintentionally to the space. For example, a basement that is heated because furnace, boiler, or water heaters are located in the basement or because uninsulated ductwork runs through the basement).

4.4.1.5 DWH Tank Capacity – Required

Enter the standard rated tank capacity in gallons. If the manufacturer and model of the unit has been located in the database, it will automatically be entered. If the capacities have been entered for both the existing and replacement units and their values differ by more than 20%, the program will display a warning.

4.4.1.6 Replacement - Single Family Buildings and Mobile Homes

After the Hot Water Equipment portion of the supply library has been completed, users can select a replacement water heater from the pick from library drop down list that the audit will use to calculate an SIR. Please see picture below.



If the water heater has failed the H&S inspection, or the tank is leaking, users should check the Replacement Required and the Include in SIR check boxes. This will ensure that the replacement is selected by the audit

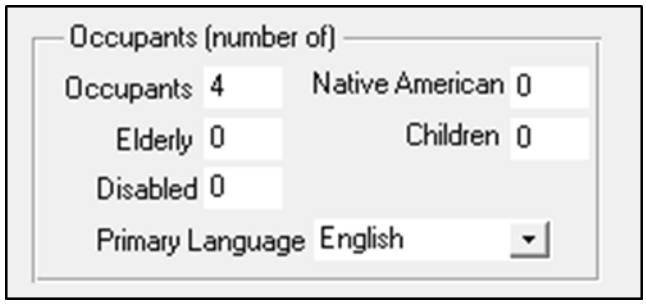
A measure SIR of less than 1 shall be reported as an H&S replacement and the cost of the water heater shall be included in the $1000 H&S threshold that requires all non-exempt H&S measures to be included in the SIR. A measure SIR that is greater than 1 shall be reported as an Energy Conservation Measure (ECM).

4.4.1.7 Replacement – 2 to 4 Unit Buildings

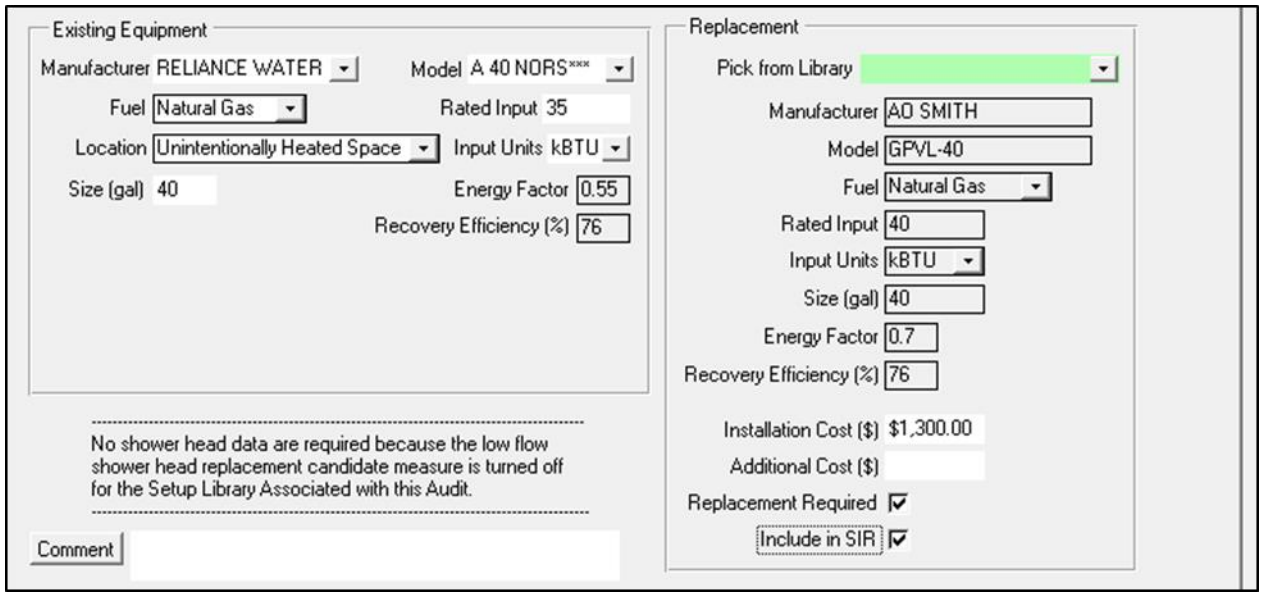
Modeling water heaters in 2 to 4-unit buildings will vary based on the location and number of water heaters in the building. If a single water heater serves all units in the building, then model the water heater in the Baseload Tab as shown in section 4.4.1.6 above. If there are multiple water heaters, each serving a single unit, model each water heater as an itemized cost following the steps below.

1. H&S replacements may be entered as an itemized cost measures included in the SIR at the full cost of each replacement. This modeling method will not provide any savings and will not contribute to the cumulative SIR. Use this method when additional savings from a H&S replacement are not needed to help keep the cumulative SIR at 1 or greater.
2. For all ECM replacements and H&S replacements where measure savings are needed to help keep the cumulative SIR at 1 or greater, follow steps 3-7 below.

3. WA considers only the occupant count in creating its estimates of water heater energy use and the cost-effectiveness of water heater replacements. The client Record for a multi-unit building normally includes every occupant in the entire building. In modeling a water heater that serves only one unit, the occupant count in the client record needs to be adjusted to include only that unit's residents. In the Client Record, enter the number of occupants in the first unit where the water heater may be replaced.



4. In the Baseload Tab, enter the existing water heater information and the replacement water heater information. Click both boxes for 'Replacement Required' and 'Include in SIR'.

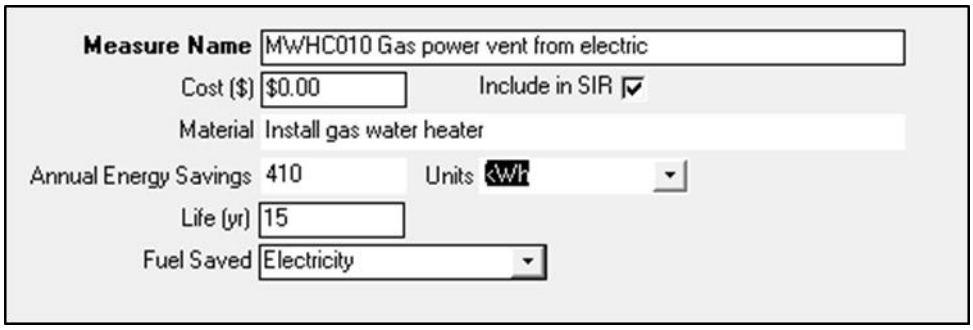


5. Run the audit to get savings results and the SIR for the replacement. If modeling a fuel switch, convert the savings as follows:
   a. Gas to Gas use the MMBtu
   b. Electric to Gas – Convert $ of savings to kWh: --- $ savings/.14
   c. Propane to NG – Convert $ of savings to MBTU: --- $ savings/1.65 X .091

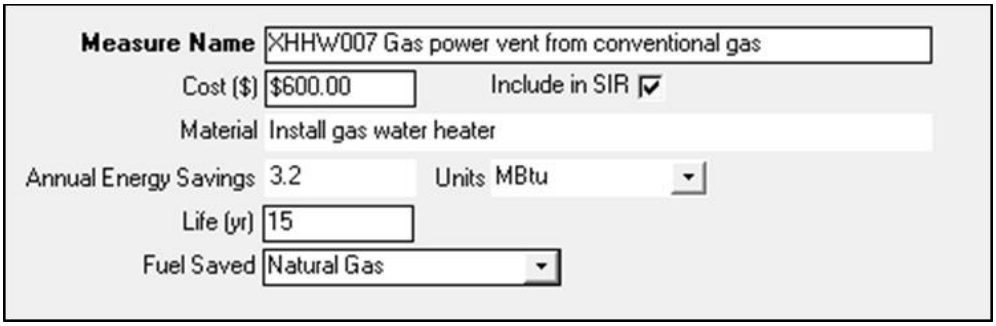
Annual Energy and Cost Savings

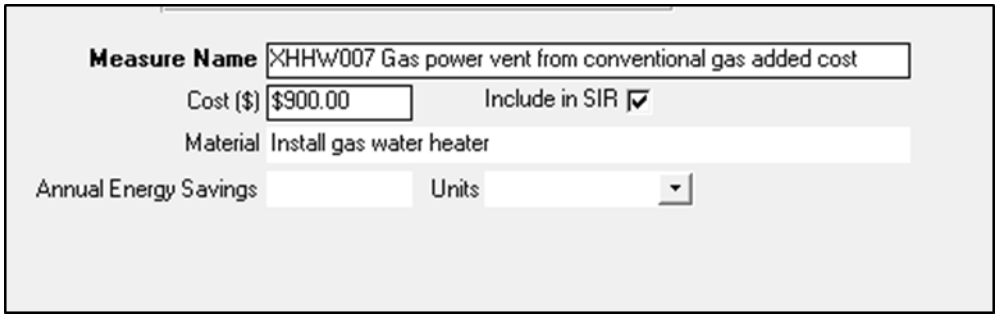
Index	Recommended Measure	Components	Heating (MMBtu)	Heating ($)	Cooling (kWh)	Cooling ($)	BaseLoad (kWh)	BaseLoad ($)	Total (MMBtu)
1	Infiltration Redctn		23.6	276	0	0	0	0	23.6
2	DWH Replacement		0.0	0	0	0	924	24	3.2

6. The estimated energy savings data is then used to create an Itemized Cost measure. If the SIR for the replacement is ≥ 1, enter in the information determined from the audit run as an itemized Energy Conservation Measure. Most often, this will be an electric to gas conversion. Use the existing fuel type as the fuel saved.



7. If the SIR for the replacement <1, enter in the information determined from the audit run as two itemized Health and Safety measures. For the 1st record enter cost as $100 and include as the Annual Energy Savings the data provided in Step 5. WA will create a measure that includes credit for the energy savings from the replacement. In the 2nd record, enter the cost as the remaining balance, and with no energy savings. The combined effect of the two measures will result in a SIR equal to that calculated by NEAT in Step 5. The total cost of the water heater shall be included in the $1000 H&S threshold.
   TIP: You can enter the extra costs for all water heaters replaced as H&S as one itemized costs.





8. Repeat steps 3 through 7 for each unit in the building with a water heater replacement.

9. After all possible replacements have been entered as itemized costs, delete the water heater record in the baseload tab of NEAT and enter the total number of occupants in the building in the client record.
10. OPTIONAL: It is feasible to create a “dummy” audit, with a client record and audit template that is used only for determining energy savings for water heater and refrigerator replacements. This may reduce the potential of introducing errors in the actual building audit. See Section 7.5 for more information.

4.4.1.8 Water Heater Replacement – Multi-Family Buildings (5 to 24 Units)

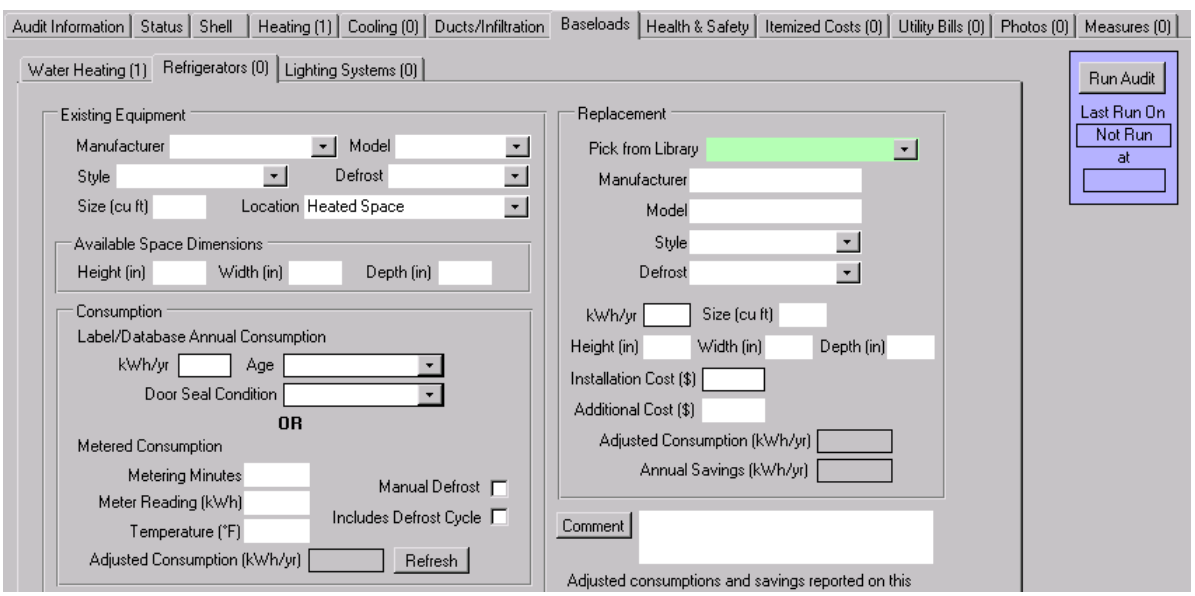
For 5-24 Unit Buildings, model water heater conversion or replacement as a measure or improvement with the energy audit, based on the criteria listed in the specifications. When needed to model multiple water heater replacements, use the 5-24 Unit Workbook to generate savings information. Incorporate the savings information and costs into NEAT’s Itemized Cost section. Building owners may opt to replace existing domestic hot water heating systems that do not meet a minimum 1.0 SIR test as a part of their contribution toward the weatherization of the building. The owner’s contribution shall be equal to or exceed the buy-down amount needed to reach an SIR of 1.0. See below for more detailed instructions regarding 5-24 Unit Buildings.

1) <u>Gas to gas replacements or system conversion:</u> Model direct-fired gas storage water heaters for replacement which are greater than 5 years old and have an Energy Factor (EF) of <.61 or Universal Energy Factor (UEF) <.58. Replace the water heating system if the replacement has a minimum 1.0 SIR when modeled with the energy audit. The replacement water heater shall be one of the following:
   a. Power-vented and have a minimum EF of .67/UEF of .65 (for 40 and 50 gallon units) or a thermal efficiency of 95 percent.
      i. 30 gallon water heaters shall have a minimum EF of .63/UEF of .60, and may be installed only when the unit cannot be upgraded to a 40 gallon unit.
   b. An indirect water heater working with a high-efficiency boiler system.
   c. A heat pump water heater with an EF of 2.0 or greater.
   d. One of the units listed above with a solar component. For solar water heaters modeled with the NEAT audit, use the itemized Cost section.
2) <u>Fuel switch water heater conversions</u>**:** Fuel switching replacement water heating systems from electric to gas or LP to natural gas is allowed when the total cost for fuel

switching the system is modeled with the energy audit, the measure meets a minimum 1.0 SIR, and the building owner agrees to the conversion. Building owners may opt pay part of the cost to replace existing water heating systems that do not meet a minimum 1.0 SIR test as a part of their contribution toward the weatherization of the building. The replacement system shall be properly sized and represent an increase in efficiency of at least 5 percent over the existing water heating system. The replacement shall be completed prior to the final inspection of the weatherization measures.

3) Electric to electric: Model the existing water heater system for replacement if the system is not properly sized, the water heater needs to be replaced based on safety concerns, or there is the potential to maximize energy efficiency. Replace the water heating system if the replacement has a minimum 1.0 SIR when modeled with the energy audit. The replacement water heater shall be one of the following:
   a. An electric storage water heater with a minimum thermal efficiency of 98 percent for commercial units or .95 EF/.93 UEF for individual units.
   b. A heat pump water heater with an EF of 2.0 or greater.
   c. One of the units listed above with a solar component. For solar water heaters, contact the Home Energy Plus Help Desk (heat@wisconsin.gov) for assistance in calculating the savings costs.

4.4.2 Refrigerators



NEAT and MHEA include a refrigerator replacement measure. In order to evaluate the potential savings obtained from replacing an existing refrigerator with a newer, more efficient unit, the program needs to know an estimate of the existing and new refrigerator's annual energy use, in kWh/yr. This data can be obtained in one of three ways:

1) A database containing many manufacturers' models of refrigerators data has been incorporated into the program. If the manufacturer and model are located in the look-up table provided, the required annual consumption will be entered automatically.

2) Refrigerators are sold with labels that list the estimated annual energy consumption in kWh/yr. If such an energy guide label is available for either the existing or new units (more likely for new units), it can be used as the source for this required input to the program.

3) Small meters exist which are capable of relatively easy monitoring of the consumption of a refrigerator. If using one of these meters, the program asks for the kWh consumed by the refrigerator during the monitoring period and the number of minutes monitored.

Additional inputs adjust the consumption data, when appropriate, for the ambient temperature of the space in which the refrigerator is located, the existing refrigerator's age, the condition of the door seals, and defrost cycles. The results of these adjustments, assuming the unit is in a heated space, are displayed in the un-editable "Adjusted Consumption" field at the bottom of the *Existing Equipment* block of data on the input form. For units in other than a heated space, insufficient information during the input prevents the adjustment based on space temperature.

Consumption data is also necessary for the replacement refrigerator. This data will be provided from the energy guide label on the replacement unit, or from values of pre-selected replacement units in your library of replacement refrigerators. This library is defined under the *Refrigerators* tab in the *Supply Library*.

4.4.2.1 Refrigerator Capacity

Enter the size of the existing unit in cubic feet. These entries are always optional. However, if entries for the existing and replacement units are not within 20%, the program will compare the entries and produce a warning.

4.4.2.2 Refrigerator Location

Select one of three locations for the refrigerator:

1) *Heated Space* (purposefully heated by a heating system to maintain a desired temperature, usually utilizing a thermostat to control the space temperature. For example, a basement heated by supply registers or radiators in the space would be heated, as would a basement heated continuously by a space heater);

2) *Unconditioned Space* (there are no sources of heat in the space other than conduction through walls, floors, and perhaps insulated ductwork);

3) *Unintentionally Heated* Space (partially heated by a heat source in the space that adds heat unintentionally to the space. For example, a basement that is heated because furnace, boiler, or water heaters are located in the basement or because uninsulated ductwork runs through the basement).

4.4.2.3 Available Space Dimensions − Optional

Enter the dimensions of the available space in inches, where the existing refrigerator is installed. These entries are always optional. However, if entered for both the existing and

replacement units, the program will compare the entries and produce a warning if the entries indicate a possible size problem related to the replacement.

4.4.2.4 Refrigerator kWh/yr Label – Required

(Unless using metered consumption data, then it is not required)
Enter the annual kWh/yr consumption listed on the energy guide label for the existing unit, if one exists. Use the look-up tables to identify the existing unit; this value (if listed in look-up tables) will be entered automatically.

4.4.2.5 Refrigerator Age − Required

(Unless using metered consumption data, then it is not required)
Select one of the categories describing the age of the existing unit:

- Less than 5 years
- 5 to 9 years
- 10 to 14 years
- 15 or more years

If the look-up tables are used to identify the existing unit and the data is available from the tables, this data will be entered automatically. Note, however, the age from the tables will be based on the first year the model was sold. If you know the existing model is newer than that indicated from the tables, change the entry.

4.4.2.6 Refrigerator Door Seal Condition − Required

(Unless using metered consumption data, then it is not required)
Enter the condition of the door seal on the existing refrigerator, the choices are:

- *Good,*
- *Fair-Some Wear*,
- and Poor-*Gaps Visible*

NEAT and MHEA will adjust table look-up and label values of annual consumption to reflect additional leakage through the door seals.

4.4.2.7 Refrigerator Metering Minutes

If you are using metered consumption data, enter the time period in minutes for which you metered the existing refrigerator. Metering should be performed for at least 180 minutes (3 hours). Attempt to prevent refrigerator door openings during the metering period. This entry is not required if the kWh/yr field has been used to provide the consumption data.

4.4.2.8 Refrigerator Energy Reading

Enter the metered consumption in kWh for the period specified by the Metering Minutes. This entry is not required if the kWh/yr field has been used to provide the consumption data.

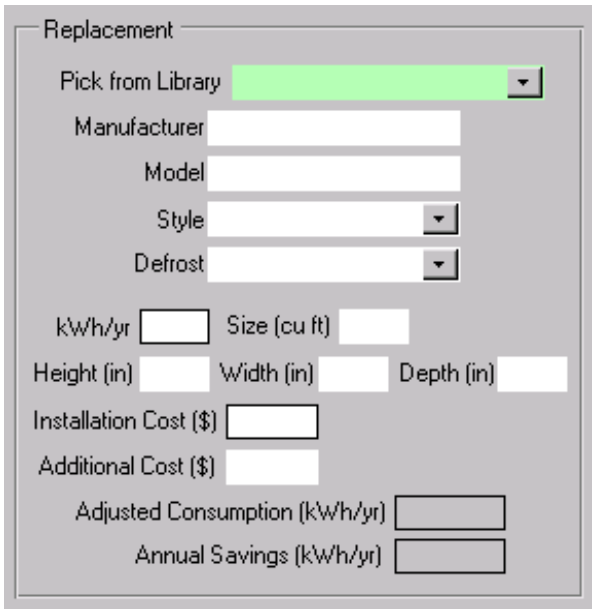
4.4.2.9 Refrigerator Ambient Temperature

Enter the metered ambient temperature around the refrigerator during the metering. This entry is not required if the kWh/yr field has been used to provide consumption data. The entry is used to adjust the metered refrigerator consumption of units whose location is other than a *Heated Space*.

4.4.2.10 Replacement – Single Family Homes and Mobile Homes

After the refrigerator tab in the supply library has been completed, users can select a replacement refrigerator that the audits will use to calculate an SIR.

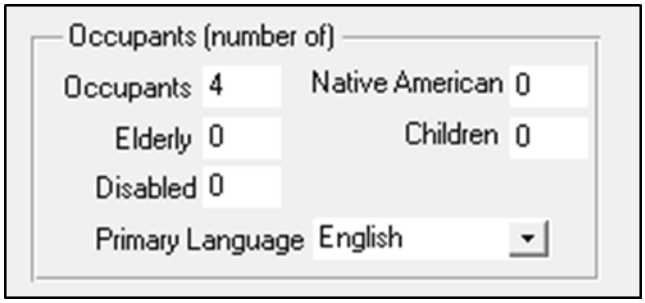
Remember to **click the Refresh button** on the screen after you have entered or changed the data for the existing refrigerator to adjust kWh consumption for a more accurate SIR calculation.



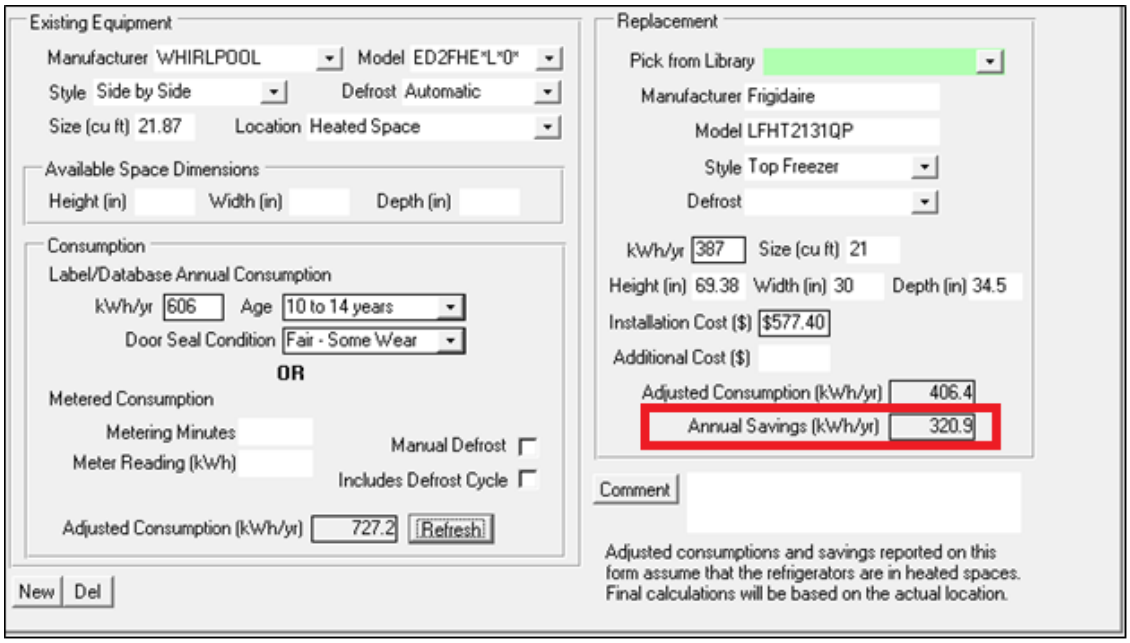
4.4.2.11 Replacement – 2 to 4 Unit Buildings

For 2-4 unit buildings, all refrigerators must be modeled as itemized cost measures. Obtain savings data by creating a “dummy” refrigerator replacement for each unit in the baseload tab. (This is similar to the procedure used in 4.4.1.7 above, to evaluate water heater replacement measures.) Follow the steps below to generate savings and model the replacements for each unit.

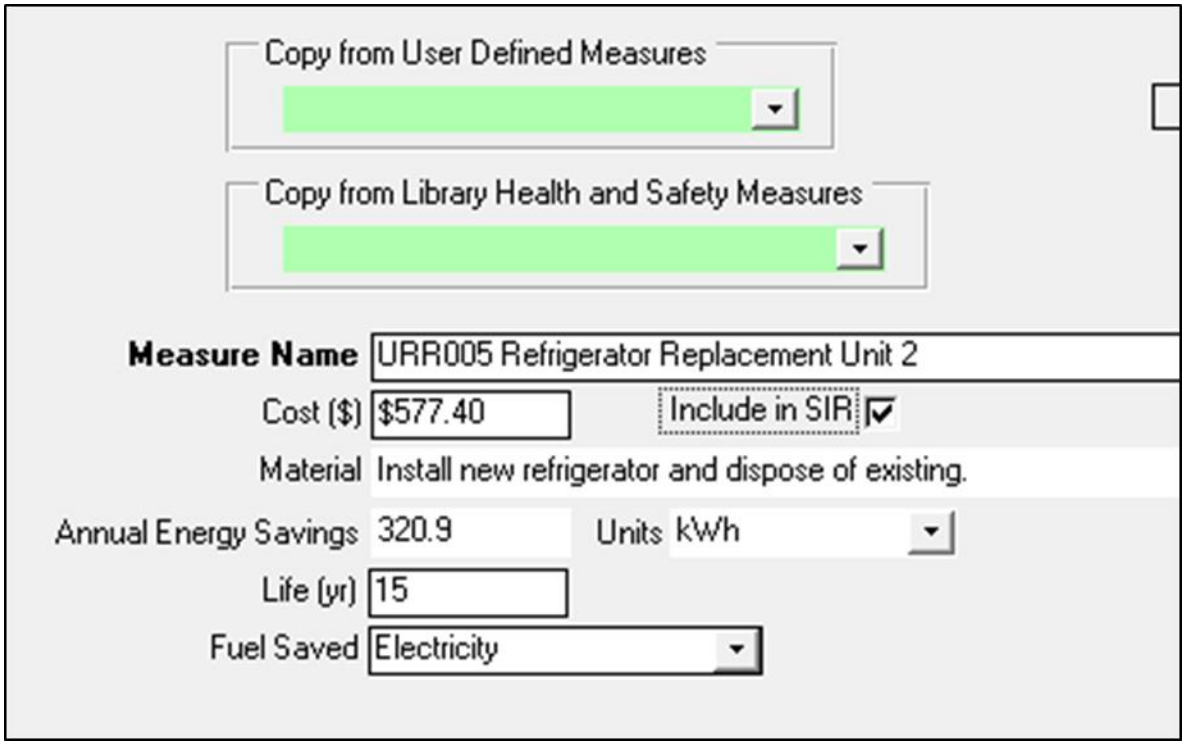
1. In the Client Record, change the number of occupants to match that in the unit where the refrigerator may be replaced. The client record must be updated with the correct unit occupant count for each refrigerator being considered for replacement.



2. In the baseload tab, enter the existing refrigerator information and the replacement refrigerator information. Remember to click on the refresh button and record the estimated Annual Savings.



3. In the Itemized Costs tab, select URR005 Refrigerator Replacement from User Defined Measures. Add clarifying text to end of description such as, “Unit 2” to indicate which refrigerator is being replaced. Enter replacement cost and Annual Energy Savings from baseload tab. Make sure units are kWh, Life (yr) is 15, and Fuel Saved is Electricity.



4. Repeat Steps 1 – 3 above for each unit.

5. After all possible replacements have been entered as itemized costs, delete the refrigerator record in the Baseload Tab and enter the total number of occupants in the building in the client record. If cost effective, the replacement measures will be selected by the audit.
6. OPTIONAL: You may create a “dummy” client record and audit template used only for determining baseload savings for water heater and refrigerator replacements to avoid introducing errors into the building audit. See Section 7.5 for more information.

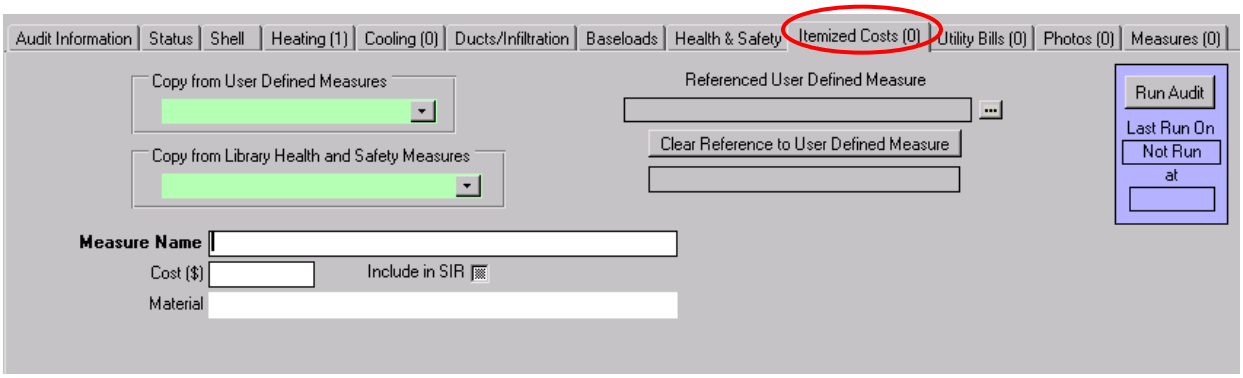
4.4.2.12 Replacement – Multi-Family Buildings (5 to 24 Units)

For 5-24 Unit Buildings, model all refrigerators with the energy audit. When needed, use the 5-24 Unit Workbook to generate savings information for multiple refrigerators. Incorporate the savings information and costs into NEAT’s Itemized Cost section. Replace refrigerators if the measure has an SIR greater than or equal to 1.0. Replacement refrigerators are limited to one per household. De-manufacture and properly dispose of pre-existing units.

If the owner has a list of refrigerators owned in all units, verify the accuracy of the list in the 25 percent sample of units audited. If no list exists, verify during the audit the make and model and age of every refrigerator to be replaced.

Remove, de-manufacture, and properly dispose of functioning secondary refrigerators with R-12 refrigerant listed on the label, whenever possible. Offer a $100 incentive for removal. Incentives may be paid for the removal of one unit per tenant household.

4.5 Itemized Costs



Entries on the *Itemized Cost* form allow evaluation of a wide variety of miscellaneous measures. Repair and Health and Safety (H&S) are available to select from the *Library Health and Safety Measures* dropdown list. Energy Conservation Measures are available to select from the *User Defined Measures* dropdown list. Savings for some ECMs such as Slab Exterior Foundation Insulation, Freezer Replacements, Electric to Fossil Fuel Heating System Conversions and other relevant measures are entered here to model for an SIR. Refer to modeling 2-4 Unit buildings for additional ECMs as itemized. All of these measures are entered in the User Defined Measures library in the Setup Library.

Select the measure from either the *User Defined Measures* dropdown list or the *Library Health and Safety Measures* dropdown list, and enter the total expected cost. If multiple quantities of an itemized cost measure are being installed in a building the total cost for all installations may be included in one measure, but in WisWAP the estimated and actual costs may need to be separated into multiple WisWAP entries depending on building type (see Chapter 9 WisWAP Reporting). Remember to click “new” before selecting subsequent entries. See Table 4.1 below for guidance on including itemized costs in the SIR. Uncheck “Include in SIR” for health and safety items when the total cost of H&S is less than $1000.00. **DO NOT** include the exempted measures listed below in calculating the $1000, and do not include them in the cumulative SIR.

Table 4.1: Itemized Costs Measures

Measure Type	Measure Name *("MH" = Mobile Home)*	Include In SIR?
Other	DIA120 Attic Prep - No Attic Insulation	Yes
Other	DIA130 Attic Prep - No Attic Insulation - MH	Yes
Building Insulation	DIFO020 Exterior Foundation Insulation (Slab)	Yes
HVAC Systems	JBM005 Automatic Fill Valve	Yes
HVAC Systems	JBM010 Compression Tank	Yes
HVAC Systems	JBM015 Electric Vent Damper	Yes
HVAC Systems	JBM020 Outdoor Reset	Yes
HVAC Systems	JBM025 Radiator New or Replacement	Yes
HVAC Systems	JBM030 Radiator Valves	Yes
HVAC Systems	JBM035 Backflow Preventer	Yes
HVAC Systems	JBM040 Modulating Aquastat	Yes
HVAC Systems	JBM045 Intermittent Ignition Device (IID)	Yes
HVAC Systems	JBM055 Zone Valves	Yes
HVAC Systems	JBM060 Boiler Distribution System Modifications	Yes
HVAC Systems	JHSM005 Clean and Tune	No
HVAC Systems	JHSM010 Disposable Filters	No
HVAC Systems	JHSM011 Cleanable Filters	No
HVAC Systems	JHSM015 Setback Thermostat	No
HVAC Systems	JHSM020 First Floor Ductwork	Yes
HVAC Systems	JHSM025 Second Floor Ductwork	Yes
HVAC Systems	JHSM030 Insulate Ducts	No
HVAC Systems	JHSM030 Insulate Ducts - MH	No
HVAC Systems	JHSM035 Seal Ducts	No
HVAC Systems	JHSM040 Clean and Tune - MH	No
HVAC Systems	JHSM045 Disposable Filters - MH	No
HVAC Systems	JHSM050 Cleanable Filters - MH	No
HVAC Systems	JHSM055 Setback Thermostat - MH	No
HVAC Systems	JHSM060 First Floor Ductwork - MH	Yes
HVAC Systems	JHSM065 Seal Ducts - MH	No
HVAC Systems	JHSR060 Electric Conversion	Yes

Measure Type	Measure Name *("MH" = Mobile Home)*	Include In SIR?
Baseloads	MWHC005 Gas power vent from conventional gas	Yes
Baseloads	MWHC010 Gas power vent from electric	Yes
Baseloads	MWHC035 Indirect Fired Water Heater	Yes
Baseloads	MWHT005 Flow Restrictors	No
Baseloads	MWHT010 Pipe Insulation	No
Baseloads	MWHT015 Reduce Temperature	No
Baseloads	MWHT020 Showerhead	No
Baseloads	MWHT025 Tank Insulation	No
Baseloads	MWHT030 Flow Restrictors - MH	No
Baseloads	MWHT035 Pipe Insulation - MH	No
Baseloads	MWHT040 Reduce Temperature- MH	No
Baseloads	MWHT045 Showerhead - MH	No
Baseloads	MWHT050 Tank Insulation - MH	No
Baseloads	PCFL005 CFL Bulbs	No
Baseloads	PCFL010 Torchiere Replacement	No
Baseloads	PCFL015 LED Exit Light	No
Baseloads	PCFL035 CFL Bulbs - MH	No
Baseloads	PCFL040 Torchiere Replacement - MH	No
Baseloads	PCFL055 LED Bulbs -MH	No
Baseloads	PCFL070 LED Bulbs	No
Baseloads	PCFL085 LED Can Light Insert	No
Baseloads	URR005 Refrigerator Replacement	Yes
Baseloads	URR010 Refrigerator Removal	No
Baseloads	URR015 Refrigerator Replacement - MH	Yes
Baseloads	URR020 Refrigerator Removal - MH	No
Baseloads	VFR005 Freezer Replacement	Yes
Baseloads	VFR010 Freezer Removal	No
Baseloads	VFR015 Freezer Replacement - MH	Yes
Baseloads	VFR020 Freezer Removal - MH	No
Health & Safety	XHAL005 CO Detector New or Replace	Yes if total H&S >$1,000
Health & Safety	XHAL010 Smoke Detector New or Replace	Yes if total H&S >$1,000
Health & Safety	XHAL020 Combo Smoke/CO Detector	Yes if total H&S >$1,000
Health & Safety	XHAL025 CO Detector New or Replace - MH	Yes if total H&S >$1,000
Health & Safety	XHAL030 Smoke Detector New or Replace - MH	Yes if total H&S >$1,000
Health & Safety	XHAL035 Combo Smoke/CO Detector - MH	Yes if total H&S >$1,000

Measure Type	Measure Name *("MH" = Mobile Home)*	Include In SIR?
Health & Safety	XHAP015 Appliance Repair or Replace	Yes if total H&S >$1,000
Health & Safety	XHAQ005 Worst Case Draft Test	No
Health & Safety	XHAQ006 Worst Case Depressurization w/o Draft	No
Health & Safety	XHAQ007 Chimney Liner	Yes if total H&S >$1,000
Health & Safety	XHAQ025 Dehumidifier New or Replace	Yes if total H&S >$1,000
Health & Safety	XHAQ035 Other Remediation Air Quality	Yes if total H&S >$1,000
Health & Safety	XHAQ040 Cook Stove Repair	Yes if total H&S >$1,000
Health & Safety	XHAQ045 Gas Leak Repair	No
Health & Safety	XHAQ050 Worst Case Draft Test - MH	No
Health & Safety	XHAQ055 Worst Case Depressurization w/o Draft - MH	No
Health & Safety	XHAQ060 Other Remediation Air Quality - MH	Yes if total H&S >$1,000
Health & Safety	XHAQ065 Gas Leak Repair - MH	No
Health & Safety	XHAR005 62.2 Exhaust Ventilation	No
Health & Safety	XHAR007 Local Exhaust Ventilation	No
Health & Safety	XHAR009 Venting Existing Exhaust	No
Health & Safety	XHAR010 Exhaust with Makeup Air	No
Health & Safety	XHAR013 Makeup Air	No
Health & Safety	XHAR015 Heat or Energy Recovery Ventilator	No
Health & Safety	XHAR020 62.2 Exhaust Ventilation - MH	No
Health & Safety	XHAR025 Local Exhaust Ventilation - MH	No
Health & Safety	XHAR030 Venting Existing Exhaust - MH	No
Health & Safety	XHAS005 Attic with Vermiculite	Yes if total H&S >$1,000
Health & Safety	XHAS010 Attic with Non-Vermiculite ACM	Yes if total H&S >$1,000
Health & Safety	XHAS015 Sidewalls with Vermiculite	Yes if total H&S >$1,000
Health & Safety	XHAS020 Sidewalls Slate/Stucco Siding	Yes if total H&S >$1,000
Health & Safety	XHAS025 HVAC/Distribution	Yes if total H&S >$1,000
Health & Safety	XHAS030 Miscellaneous ACM	Yes if total H&S >$1,000
Health & Safety	XHEL015 Upgrade or Repair Electric	Yes if total H&S >$1,000
Health & Safety	XHEL025 Upgrade or Repair Electric - MH	Yes if total H&S >$1,000

Measure Type	Measure Name *("MH" = Mobile Home)*	Include In SIR?
Health & Safety	XHHS005 Boiler Replace	Yes if total H&S >$1,000
Health & Safety	XHHS010 Boiler Repair	Yes if total H&S >$1,000
Health & Safety	XHHS015 Boiler Radiators, Repair or Replace	Yes if total H&S >$1,000
Health & Safety	XHHS020 Furnace Replace	Yes if total H&S >$1,000
Health & Safety	XHHS025 Furnace Repair	Yes if total H&S >$1,000
Health & Safety	XHHS030 Ducts Repair or Replace	Yes if total H&S >$1,000
Health & Safety	XHHS035 Space Heater Replace	Yes if total H&S >$1,000
Health & Safety	XHHS040 Space Heater Repair	Yes if total H&S >$1,000
Health & Safety	XHHS045 Wood Replace	Yes if total H&S >$1,000
Health & Safety	XHHS050 Wood Repair	Yes if total H&S >$1,000
Health & Safety	XHHS055 Electric Replace	Yes if total H&S >$1,000
Health & Safety	XHHS060 Electric Repair	Yes if total H&S >$1,000
Health & Safety	XHHS065 Furnace Replace - MH	Yes if total H&S >$1,000
Health & Safety	XHHS070 Furnace Repair - MH	Yes if total H&S >$1,000
Health & Safety	XHHS075 Ducts Repair or Replace - MH	Yes if total H&S >$1,000
Health & Safety	XHHW003 Electric to Electric Mobile Home .90	Yes if total H&S >$1,000
Health & Safety	XHHW004 Electric to Electric .94	Yes if total H&S >$1,000
Health & Safety	XHHW005 Water Heater Replace	Yes if total H&S >$1,000
Health & Safety	XHHW007 Gas power vent from conventional gas	Yes if total H&S >$1,000
Health & Safety	XHHW008 Gas power vent from electric	Yes if total H&S >$1,000
Health & Safety	XHHW010 Water Heater Repair	Yes if total H&S >$1,000
Health & Safety	XHHW015 Plumbing Repair or Replace	Yes if total H&S >$1,000
Health & Safety	XHHW020 Water Heater Replace - MH	Yes if total H&S >$1,000

Measure Type	Measure Name *("MH" = Mobile Home)*	Include In SIR?
Health & Safety	XHHW025 Water Heater Repair - MH	Yes if total H&S >$1,000
Health & Safety	XHHW030 Plumbing Repair or Replace - MH	Yes if total H&S >$1,000
Health & Safety	XHSS005 Chimney	Yes if total H&S >$1,000
Health & Safety	XHSS010 Floors	Yes if total H&S >$1,000
Health & Safety	XHSS015 Roof	Yes if total H&S >$1,000
Health & Safety	XHSS020 Walls	Yes if total H&S >$1,000
Health & Safety	XHSS030 Lead Paint Remediation	Yes if total H&S >$1,000
Health & Safety	XHSS035 Other Remediation Structure	Yes if total H&S >$1,000
Health & Safety	XHSS050 Floors - MH	Yes if total H&S >$1,000
Health & Safety	XHSS055 Other Remediation Structure - MH	Yes if total H&S >$1,000
General Repairs	ZRAQ005 Dryer Venting	Yes
General Repairs	ZRAQ030 Dryer Venting - MH	Yes
General Repairs	ZREL005 Upgrade or Repair Electric Service	Yes
General Repairs	ZREL015 Knob and Tube Replace Attic	Yes
General Repairs	ZREL020 Knob and Tube Replace Walls	Yes
General Repairs	ZREL025 Upgrade or Repair Electric Service - MH	Yes
General Repairs	ZRHS030 Thermostat Replacement - Non Programmable	Yes
General Repairs	ZRHS035 Fuel Switching	Yes
General Repairs	ZRHS040 Thermostat Replacement - Non Programmable - MH	Yes
General Repairs	ZRHS045 Fuel Switching - MH	Yes
General Repairs	ZRHW005 Water Heater Repair	Yes
General Repairs	ZRHW010 Plumbing Repair or Replace	Yes
General Repairs	ZRHW015 Water Heater Repair - MH	Yes
General Repairs	ZRHW020 Plumbing Repair or Replace - MH	Yes
General Repairs	ZRRS005 Chimney	Yes
General Repairs	ZRRS010 Floors	Yes
General Repairs	ZRRS015 Roof	Yes
General Repairs	ZRRS020 Walls	Yes
General Repairs	ZRRS025 Window and Door Frames	No
General Repairs	ZRRS030 Door Replacement R9	Yes
General Repairs	ZRRS035 Window Replacement Energy Star Rated	Yes
General Repairs	ZRRS036 Mobile Home Insider Storm	Yes

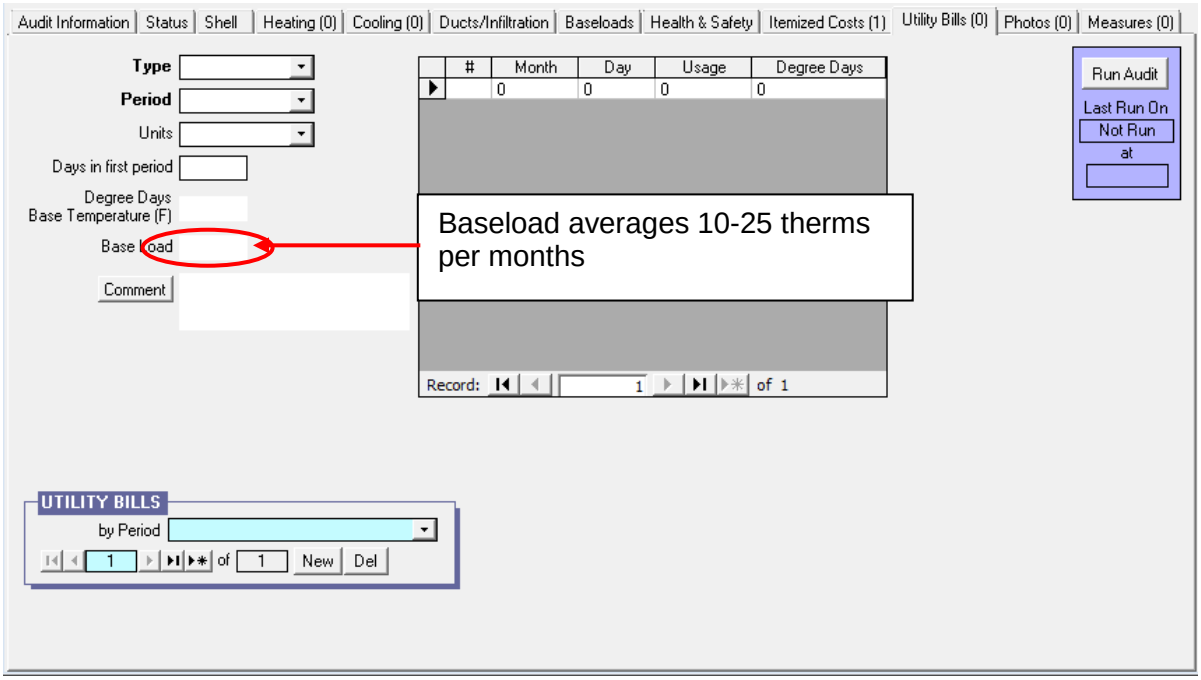
Measure Type	Measure Name *("MH" = Mobile Home)*	Include In SIR?
General Repairs	ZRRS040 Other Repair	Yes
General Repairs	ZRRS045 Ventilation - Soffit/Roof/Gable	Yes
General Repairs	ZRRS050 Floors - MH	Yes
General Repairs	ZRRS055 Roof - MH	Yes
General Repairs	ZRRS060 Walls - MH	Yes
General Repairs	ZRRS065 Door Replacement R5 - MH	Yes
General Repairs	ZRRS070 Window Replacement Energy Star Rated - MH	Yes
General Repairs	ZRRS075 Other Repair - MH	Yes
General Repairs	ZRRS080 Ventilation - Soffit/Roof/Gable - MH	Yes
General Repairs	ZRRS085 Major Pressure Boundary	Yes

4.6 Fuel Records/Utility Bills

Most of the time, the auditor has access to actual utility bills. A WA audit can model actual energy use prior to weatherization, to generate “adjusted” SIR values in place of the “default” values. Actual utility bills and “adjusted SIR” values shall be used whenever reliable bill data is available.

Actual utility bills and “Adjusted SIR” outputs are to be used for all audits, except when they are clearly not indicative of actual fuel use (see also Weatherization Program Manual Section 8.3.2.2 Modeling Buildings Using Fuel Consumption). Bulk fuel records are sometimes not reliable, especially when depending on occupants’ guesses about how much wood they used, or how much oil is in the tank each time they call for a delivery. A quality audit may ignore even metered fuel bills, when it is clear the occupant keeps their thermostat atypically low, or closes ducts in substantial areas of the house to cut their utility costs. In these cases, the audit “default” calculations are used to identify cost-effective measures and specify the job.

When space heating bills are entered, both NEAT and MHEA allow comparison of consumption predictions with pre-retrofit billing data. The SIR calculation will adjust the measure recommendations and savings to reflect actual energy consumption.



Note: When using "default" values, please add a comment on the Audit Information tab to explain why the audit is not using actual utility bills.

4.6.1 Entering Billing Data

Use the Therm Calculator that is found on the HE+ website to convert all fuel consumption to therms and to adjust for annual HDD variances. **TIP:** The Therm Calculator will show all data entry needs for the utility bill tab in the audit.

To enter billing data, use up to 12 months of utility bills. The Wisconsin Energy Fuel Information (WEFI) web service is a data validation function used by the Home Energy Plus WHEAP System to confirm direct pay electric or natural gas Class A utility account numbers. When a customer applies for Energy Assistance the WHEAP worker collects actual usage data from WEFI whenever possible. If the customer is using Natural Gas from a Class A utility, actual fuel records will be available in WisWAP, which will provide the monthly breakout of Therms and Cost.

When the customer receives an Energy Assistance benefit a certification letter is signed that includes the following language authorizing energy utilities and bulk fuel vendors to provide energy records: "I understand that by providing the account numbers for my household energy supplier(s) I am authorizing the energy provider(s) to provide details about the account and energy use to the Wisconsin Department of Administration for the purposes of eligibility determination of this and future applications, benefit determination, and program evaluation and analysis including before and after receiving any weatherization services." If the customer has discarded their bills, he or she may request consumption records from the local utility. WHEAP staff may also be able to assist in getting fuel records or the customer may sign an additional release granting authority to the weatherization agency to obtain the data; however, an additional release is not required if the utility or vendor is listed on the HE+ Application.

The billing data features work best with metered fuels, such as natural gas and electricity. Bulk fuels may require unit conversions, unless deliveries are relatively frequent and approximately the same amount of fuel remains in the tank at the time of each delivery. Use of billing data for bulk fuels can lead to substantial inaccuracy.

Billing periods entered into NEAT or MHEA must be consecutive. They may extend from one year into the next, but must span one year or less. The number of periods entered must be 12 or less. For example, entries can be:

1) One annual consumption (**Wisconsin preferred method to enter consumption**)
2) Twelve consecutive monthly readings
3) Any number of consecutive periods, 12 or less

For 5-24 Unit Buildings Fuel consumption documentation requirements are:

1) Master metered 5-24 unit buildings shall have heating fuel consumption records for the preceding 12 months submitted by the building owner as a part of the certification process.

2) Buildings with individual mechanical systems in each unit shall have the actual consumption records for each unit. Tenants not certified as Home Energy Plus eligible (free riders) will need to provide fuel consumption records to the building owner or the grantee.
    a. When fuel records are unavailable, free riders will need to sign a release to allow access to their utility records.

3) When fuel records are not available for individual units, use the Therm Calculator worksheet in the 5-24 Unit Workbook. This calculator will project the total building fuel consumption using a median consumption projection for units without actual data, based on heating costs or partial consumption data.

Tip: Use annual consumption when possible and enter actual Pre-Wx consumption period days as the billing period. This allows for fewer entries, and provides better accuracy for bulk fuel users.

4.6.1.1 Utility Bill Type

Select Heating as the major purpose for which the fuel entered is used. The space heating fuel may also supply non-heating or cooling end uses, such as cooking or domestic hot water heating. In these cases, you will have to enter an estimate of this "Base Load" in a subsequent field.

4.6.1.2 Utility Bill Period

Select that the data being entered pertains to a Pre-Retrofit or period. Only Pre-Retrofit data will be used for measure savings adjustments.

4.6.1.3 Utility Bill Units

Select the units of energy use data, either Therms or kWh, depending on the fuel source for the data being entered.

4.6.1.4 Days in first period

Enter the number of days included in the first billing period. Subsequent periods are assumed to be contiguous. Enter actual Pre-Wx consumption period days.

4.6.1.5 Base Temperature

The *Utility Bills Data Entry* screens provide an option for entering heating degree days (HDDs) for natural gas and electricity billing data. The degree-day information will not affect any adjustments to the measure savings. It allows comparison of degree-days used by NEAT and MHEA with those from the actual billing periods.

If degree-day information is entered, NEAT and MHEA require base temperatures for these HDD values. Assume a base temperature of 65°F for HDDs, unless a different base temperature is listed on the utility bill.

4.6.1.6 Base Load

Enter an estimate of the average base load consumption per month in the units chosen in “Units” above. The period consumption entered likely results from not only heating or cooling, but also from use of appliances, such as stoves, water heaters, or refrigerators. Billing analysis needs to separate this "base load" consumption from the heating and cooling consumption. This entry is an estimate of this base load consumption for an average 30-day month.

Do not enter the total/annual amount of baseload consumption.

4.6.1.7 Entering Multiple Utility Bills -- Utility Bill Entry Number

Number entries beginning with "1" and increase integrally for successive entries.

4.6.1.8 Utility Bill Month of Meter Reading

Enter the number of the month in which the meter reading corresponding to the billing period was taken (e.g. January is 1, February is 2, etc.). When modeling just one “bill” with annual consumption this number can be entered as “1”.

4.6.1.9 Utility Bill Day of Meter Reading

Enter the day of the month on which the meter reading corresponding to the billing period was taken. When modeling with annual consumption this number can be entered as “1”.

4.6.1.10 Usage During Metering Period

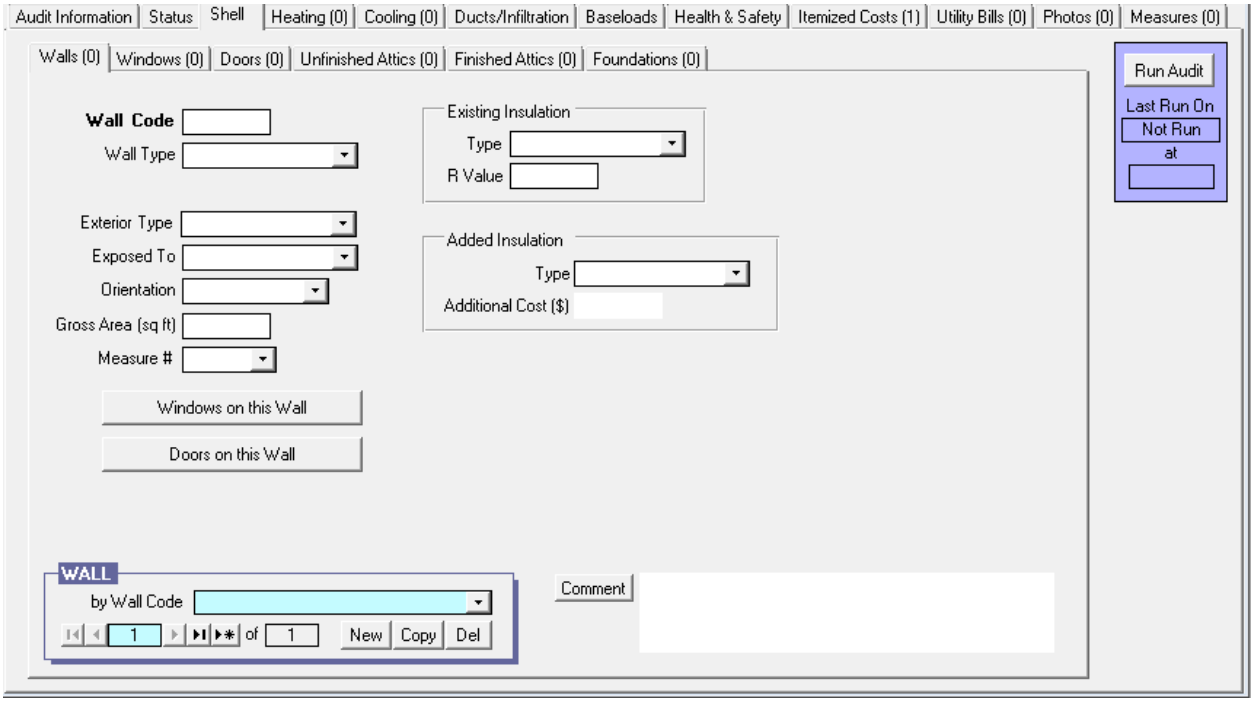
Enter the consumption during the billing period in units selected in the unit’s field on the form. When modeling with annual consumption enter the total therms used.

4.6.1.11 Degree Days During Metering Period

Enter the number of heating degree-days during the billing period. (Optional).

Chapter 5 NEAT/MHEA Shell Data Entry

5.0 Modeling the Building Shell



The shell tab contains sub tabs and forms used to describe the thermal envelope (or shell) of the home.

Note: Boxes outlined in black indicate a required entry field.

5.0.1 Walls

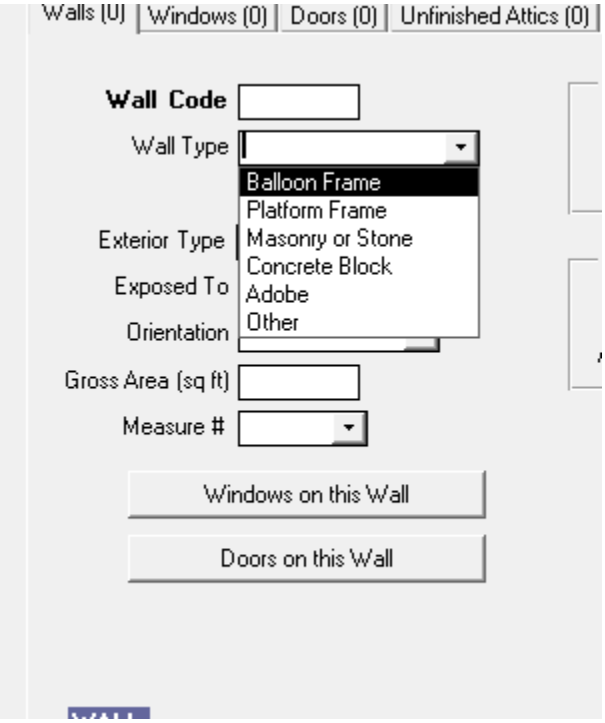
In NEAT, at least one wall in each cardinal direction is required to be described. To simplify input, combine multi-storied walls having the same orientation, insulation and construction type.

5.0.1.1 Wall Code – Required

Wall codes are abbreviated names used to identify house components for later identification. When selected, (push tab), the wall code is automatically entered as WL1 (Wall 1), WL2, and so on. It is recommended that auditors change the codes to accurately represent each wall section. Codes may contain up to twenty letters or numbers and are not case-sensitive, but it is suggested the length be kept to three to five characters.

Tip: Name the walls North, South, East and West to help identify them to crews as well for if questions arise during weatherization that would require the auditor to “re-look” at the original energy audit.

5.0.1.2 Wall Type − Required



Select the type of load-bearing structure of the wall. The choices are Balloon Frame, Platform Frame, Masonry or Stone, concrete Block, Adobe, and Other. NEAT does not differentiate between a balloon frame and platform frame structure. This distinction is for the benefit of you.

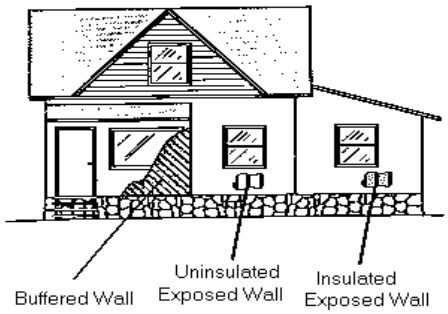
5.0.1.3 Stud Size − Required

Select size from drop down list. Default is 2X4. The choices are 2, 3, 4, 6 and 8. The material cost for insulating frame walls will be adjusted to reflect the available space in the wall cavity and determined by the stud size and any existing insulation.

5.0.1.4 Exterior Type − Required

Select the type of siding on the exterior wall. NEAT assumes a layer of wood sheathing under the siding. The choices are Wood, Metal, Stucco, Brick or Stone, None and Other.

5.0.1.5 Wall Exposure − Required



Describe the conditions seen by the outer surface of the wall. The surface can be "**Exposed**" to the outside air temperature, or "**Buffered**" by an unconditioned but enclosed space (such as a garage or porch). **Do not use the third option,** adjacent to an “Unconditioned Attic” space use “Buffered Wall” for this also

5.0.1.6 Wall Direction − Required

Select the closest cardinal compass direction the wall component faces:
(N) – North (S) – South (E) – East (W) – West

5.0.1.7 Gross Area − Required

Enter the total gross area of the exterior wall; include the square feet of the windows and doors. NEAT/MHEA will remove the square footage of the windows and doors for you. The entry must be in square feet and be greater than zero.

5.0.1.8 Wall Measure Number − Required

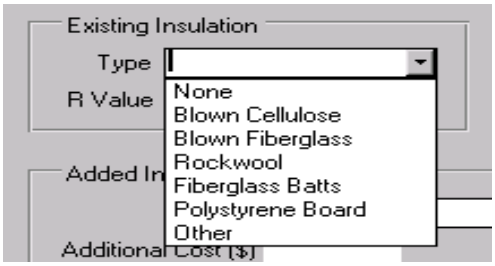
Give the same measure number to all wall segments that contain the same existing characteristics. WA will evaluate all these walls together to provide a single SIR for improvements. **Caution:** Walls with separate measure numbers are evaluated individually. In this case, only some (not all) wall sections may be selected by the audit as a recommended measure.

Tip: Enter insulation voids by creating a separate wall record to allow NEAT to calculate an SIR for treating all voids.

Tip: Walls with settled insulation should be modeled as two separate entries, one for the empty portion and one for the insulated portions. You may want to name these accordingly (i.e. east insulated, east uninsulated)

5.0.1.9 “Existing Insulation” Box

Type − Required



Select the type of insulation found in the wall, if any. The choices are None, Blown Cellulose, Blown Fiberglass, Rockwool, Fiberglass Batts, Polystyrene Board, and Other. Select "None" if walls are empty. If both cavity insulation and exterior sheathing insulation are present, enter the type that has the greatest R-value (you should also note this in the Comment field). Please comment on the reasoning to choose other.

Note: WA assumes most insulation is install only between the studs. If Polystyrene Board is selected and the wall type is Balloon or Platform Frame, NEAT assumes that the Polystyrene

Board and other insulation types are installed over the wall studs rather than between the studs as is assumed for the remaining insulation types.

5.0.1.10 R-value – Required

Enter the R-value of the insulation found in the wall. The default value displayed on the status bar assumes a 3-1/2 inch cavity and standard R-values per inch for the insulation type specified by the user in the previous entry. If both cavity insulation and exterior sheathing insulation are present, their total R-value combined should be entered for this field.

5.0.1.11 “Added Insulation” Box

Type − Required
Select blown cellulose, blown fiberglass, R19 batt or R11 batt if insulation. Select "None" if conditions prohibit insulating the wall and comment on the reasoning to choose none.

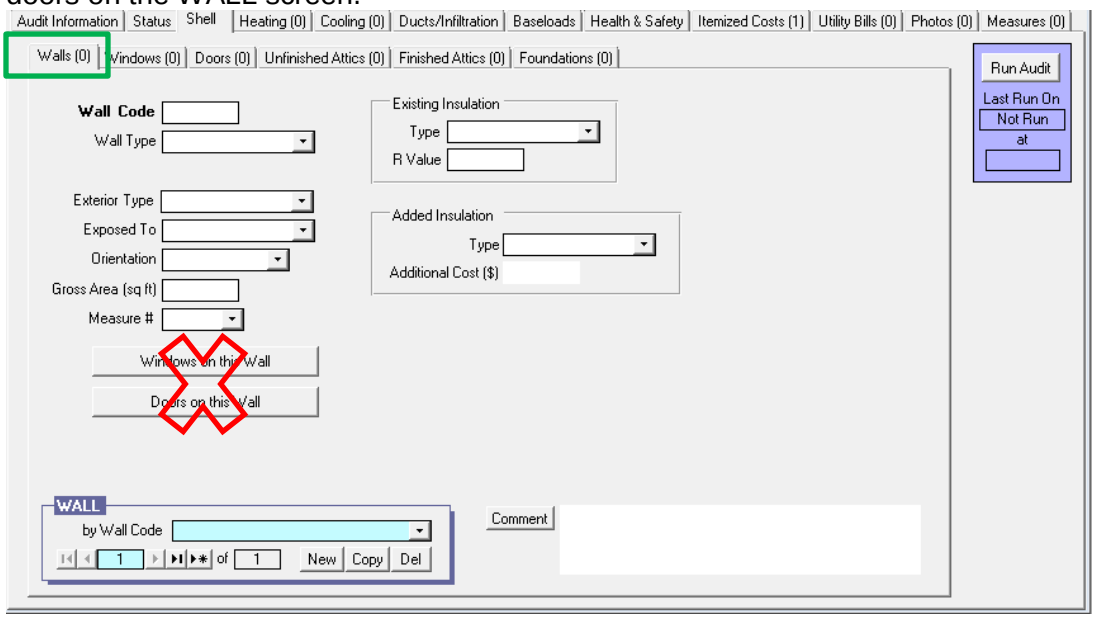
5.0.1.12 Additional Cost

The Set up Library includes an agency’s typical cost to insulate a square foot of sidewall. Where actual costs are likely to be different, enter additional costs associated with insulating a specific wall segment. Enter a negative cost where work is likely to be less expensive than average (for example, where balloon-framed walls can be blown entirely from the attic and no wall drilling is required). If an additional cost is entered, you should briefly explain the reason in the Comment field described below.

5.0.1.13 Comment

You may enter comments pertinent to the wall segment directly in the Comment field on the form, or you may enter them in the Comment Editor by selecting the “Comment” button to the left of the field.

The WALL screen has two buttons where an auditor can enter windows and doors. It is recommended to select the WINDOW tab and DOOR tab instead of entering windows and doors on the WALL screen.



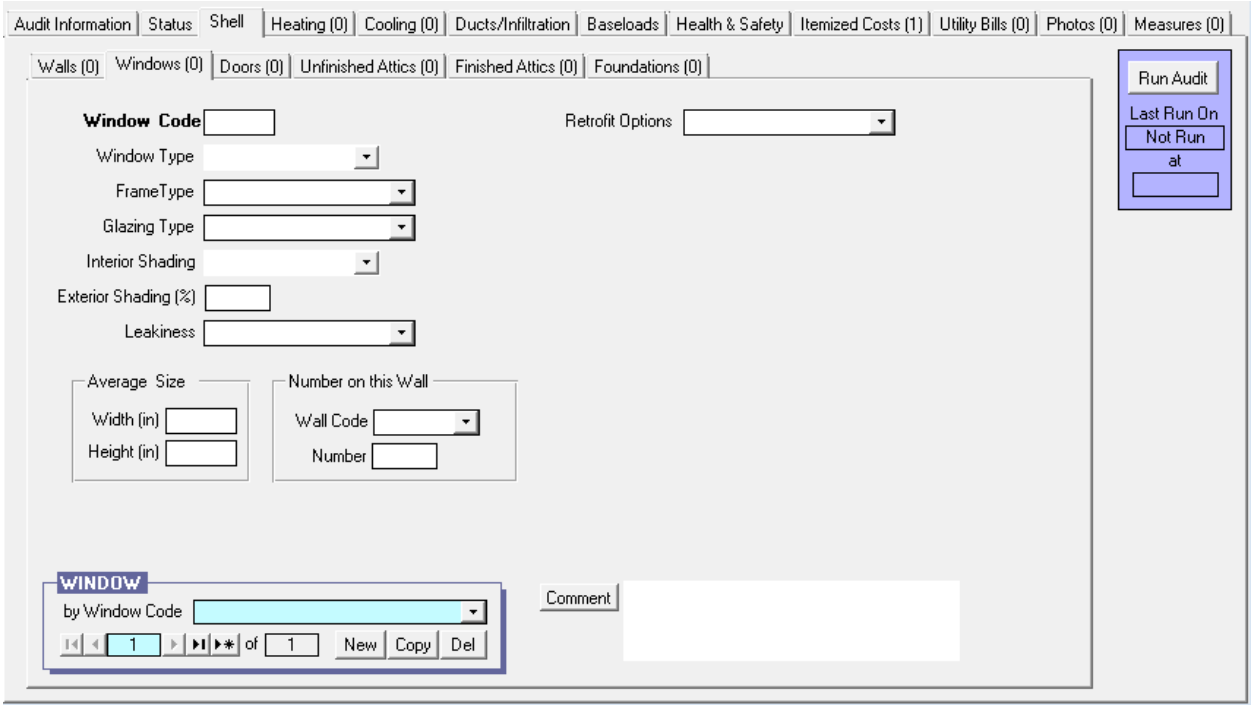
5.0.2 Windows

5.0.2.1 Window Code − Required

Window codes are abbreviated names specified by the user for later identification. They may contain up to twenty letters or numbers and are not case-sensitive. Usually three to five characters is adequate. The default window code when you hit tab is automatically entered as WN1 (Window 1). A total of 24 window descriptions may be entered.

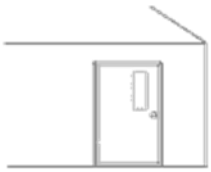
Tip: Use specific names and measurements if a window is going to be replaced or repaired.

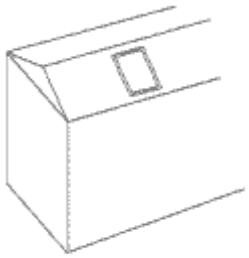
5.0.2.2 Window Type − Required



The window description is the type of window found. The window type choices are Jalousie, Awning, Slider, Fixed, Door Window, Sliding Glass Door, and Skylight. See detailed descriptions below for window types.

Jalousie	**Jalousie** windows are constructed of horizontal panes (about 6 inches wide) that open at the same angle when a crank near the bottom of the window is turned. Jalousie windows are always single pane. Often, very large gaps between the glass panes exit resulting in high infiltration rates through the window.

 Awning	**Awning** windows are hinged at the top or side of the window so that when opened (usually by turning a crank), the glass angles out from the home exterior. The glass either angles down or to the side, depending on where the window is hinged to the home.
 Vertical Slider	**Slider** windows usually have two panes of glass and either one or both panes slide past the other when the window is opened.
 Horizontal Slider	**Slider** windows usually have two panes of glass and either one or both panes slide past the other when the window is opened.
 Fixed	**Fixed** windows are sealed in the window frame and cannot be opened.
 Door	**Door** windows are sealed in the window frame of a door and cannot be opened.
 Sliding Glass	**Sliding glass doors** are large windows that extend to the floor and can be opened to enter or exit building

 Skylight	**Skylights** are glass or plastic windows in the ceiling of a home.

5.0.2.3 Frame Type − Required

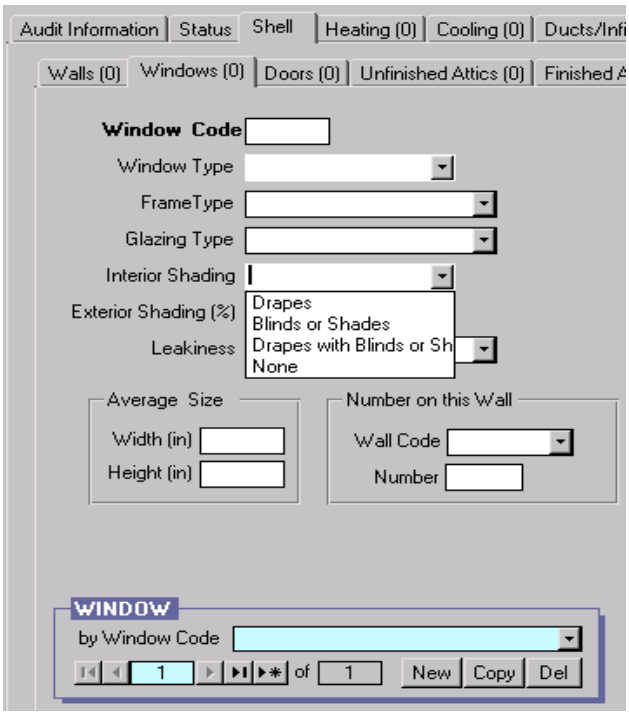
Select the correct window frame and sash construction materials. The choices are Wood or Vinyl, Metal, and Improved Metal. "Improved Metal" frames have a thermal break between the inside and outside framing members.

5.0.2.4 Glazing Type − Required

Select the window glazing type, depending on the number of panes of glass in the primary window, and the characteristics of any storm window that may cover the primary window. The choices are Single Pane, Single with Wood Storm, Single with Metal, Storm, Single with Bad Storm, Double Pane, and Double Pane Low-e.

Tip: NEAT treats a "Single with bad storm" as a single pane window without a storm.

5.0.2.5 Interior Shading − Optional



Interior shading can affect the insulating value of the window as well as the solar loads on the home. The options are Drapes, Blinds or Shades, Drapes with Blinds or Shades, and None. Interior shading devices affect the amount of heat gained or lost through windows. They slightly affect the window insulating value (U-value).

5.0.2.6 Percent Shaded − Required

Enter the approximate percentage of window area frequently shaded by eaves (typically 20%), porches (typically 100%), or other physical exterior barriers. Do not include the percent (%) sign. Default is 20%. Determine the percentage of shading that occurs during the winter. For example, deciduous trees lose their leaves in the winter, so their shading during that season may be minimal.

5.0.2.7 Window Leakiness − Required

Select the leakiness category that best describes the fit of this window description. The choices are Very Tight. Tight, Medium, Loose, and Very Loose. See examples of typical leakiness below.

Degrade the leakiness description one level if the windowpanes themselves are significantly loose in their mounting and/or 2 to 9 sq. in. of window is broken out. Degrade the leakiness two levels if 9 to 25 sq. in. of glass is missing. Specify the window to be Very Loose if more than 25 sq. in. of glass is missing in the window. .

Upgrade the leakiness description one level if a storm window in average or better condition is present.

Typical Leakiness

- Typical fixed window is Very Tight
- Typical casement is Very Tight
- Typical non-wood vertical slider is Tight
- Typical wood window in older homes is Medium
- Typical horizontal slider is Medium
- Typical jalousie window is Loose
- Typical awning and hopper windows are Very Tight
- Awning windows resembling jalousies are typically Medium

5.0.2.8 “Average Size” Box − Required

- Window Width and Height

  Enter the width and height (including the window frame) in inches of the window being described. NEAT will use these dimensions to estimate actual glazing area. NEAT will subtract this area from the gross wall area.

5.0.2.9 “Number on This Wall” Box − Entries Required

- Wall Code for Window

  Each window must be associated with the wall defined in the walls tab. The wall code dropdown box brings up a list of previously entered walls. This wall code entry is how NEAT subtracts the window areas from the appropriate gross wall area.

- Number of Windows

Enter the number of identical windows on the modeled wall that match the description given on the form.

5.0.2.10 Retrofit Options − Required

Select the kind of retrofit that is appropriate for this window record:

1) Evaluate All: The retrofit of this window is optional. The NEAT program will decide the most cost effective treatment option. Follow program protocols before selecting this option for possible replacement(s). Select this option only if the window(s) are located in the primary heating envelop and the window(s) have rotted or deteriorated frames or sashes.

2) Evaluate None: Select if window is not eligible for replacement

5.0.2.11 “Additional Cost” Box − Not required

Enter additional costs if needed. Typical additional costs would be extra framing or labor needed to install the window. Do not enter the cost of the window in this cell.

5.0.2.12 Comment

You may enter comments pertinent to the window directly in the Comment field on the form, or you may enter them in the Comment Editor by selecting the “Comment” button to the left of the field.

Select COPY in the WINDOW box in the lower left hand corner of the WINDOW screen to add another window. The next sequential window code will appear, and data from the previous window will populate the fields. This will reduce data entry, as duplicate fields, such as window type, will already be populated. Remember to update “Window code” and other applicable cells.

5.0.3 Doors

Each door must be associated with a previously defined wall. A maximum of 10 doors can be entered per house (for all walls).

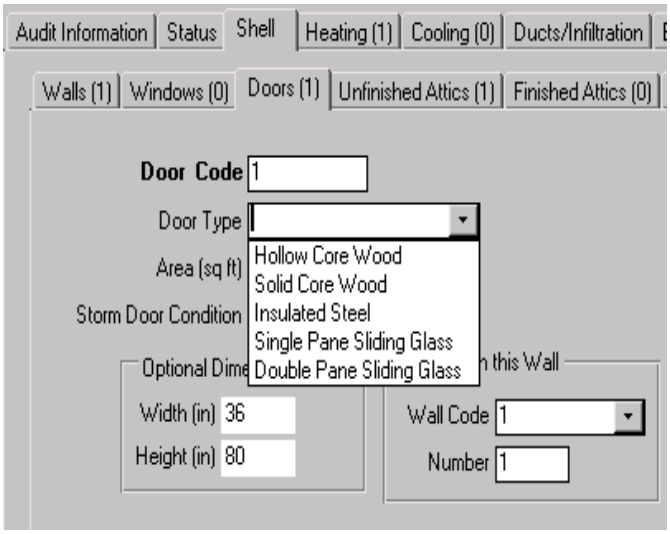
Storm or replacement doors are not evaluated in NEAT. They are normally not cost-effective measures, based on heat conduction savings. **Replacement doors may only be modeled as a repair in Wisconsin’s weatherization program.**

NEAT subtracts door area from the wall area and figures heat loss from the wall and door separately in cost calculations for wall insulation.

5.0.3.1 Door Code − Required

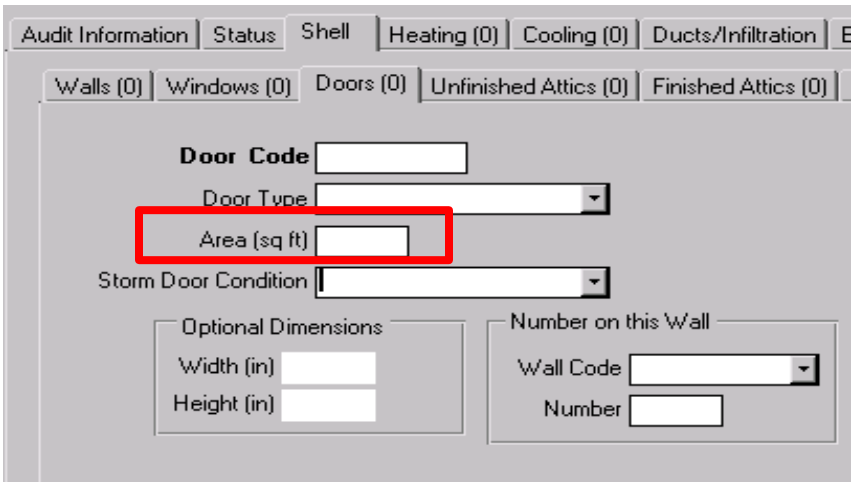
Door codes are abbreviated names specified by the auditor to identify specific house components for later identification. Auditors can change the codes if desired. They may contain up to twenty letters or numbers and are not case-sensitive, but three to five characters are usually enough. When selected, "push tab" is the door code is automatically entered as DR1 (Door 1).
Tip: Name the doors in accordance with their location.

5.0.3.2 Door Type − Required



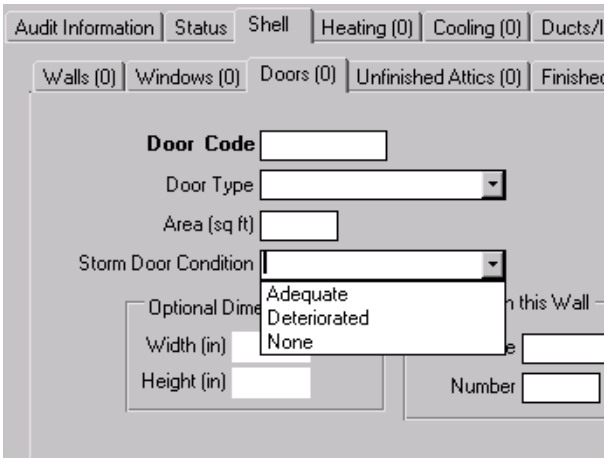
Select one of the five door types displayed. The choices are Hollow Core, Wood, Solid Core, Insulated Steel, Single Pane Sliding Glass, and Double Pane Sliding Glass. For a door with glazing, you will usually enter the door on the Doors form and the glazing on the Windows Form, although in some cases you may want to enter it just as a door or a window depending on which has the greatest fraction area.

5.0.3.3 Area Tab − Required



Enter the area, in square feet, of the individual door. If the number of doors indicated is greater than one, NEAT will compute a total door area as the area given here times the number of doors. Default is 20 square feet for a 36” x 80” door. A 32” x 80” door is 17.78 square feet. The quick formula to calculate a 32”x80” door is 32x80/144=17.78

5.0.3.4 Storm Door Condition − Required



Select one of the three choices for the condition of the storm door. The choices are Adequate, Deteriorated, and None. NEAT treats "Deteriorated" and "None" as the same.

5.0.3.5 Leakiness

Provide an estimate of how leaky the door is. The choices are Tight, Medium, and Loose. Typical characteristics of these three categories of leakiness are listed below

Tight: Doors will have the door and frame squared, no warping, functioning weather stripping in good condition around the door, a good seal at the threshold, no holes or structural damage, and latches that keep the door securely shut. If windows exist in the door, they will be fixed and well-sealed

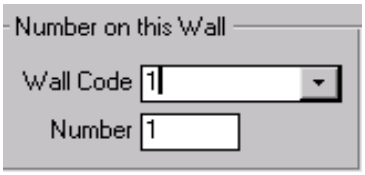
Medium: Doors will have some characteristics of loose doors, but retain substantial integrity, However, they would likely benefit from air sealing efforts

Loose: Doors will exhibit many of the following problems, door and/or frame out of square, warping, weather stripping missing or severely damaged no seal at the threshold, holes or significant structural damage, and latches that do not keep the door securely shut.

5.0.3.6 “Optional Dimensions” Box

Record the width and height, in inches, of door openings. NEAT does not use these measurements in any of its calculations. It is simply for documentation purposes for the auditor.

5.0.3.7 “Numbers on this Wall” box − Entries required



The wall code dropdown displays a list of available walls that have been defined in the walls tab, select the matching wall code. This is how NEAT subtracts the door area from the appropriate gross wall area. Enter the number of identical doors that match the description given on the form; the default is 1.

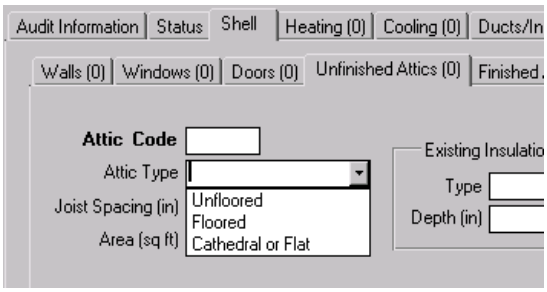
5.0.4 Unfinished Attic Areas

A maximum of seven unfinished attic areas may be entered.

5.0.4.1 Attic Codes − Required

Attic codes are abbreviated names specified by the user to identify specific house components for later identification. When the *Attic Code* button is selected, it will automatically create the code A1 (Attic 1). It is recommended that auditors choose to use a different identifier of up to twenty letters or numbers for easier identification by crews. Example: “main attic.”

5.0.4.2 Attic Floor Type − Required



Select one of the three choices, the choices are Unfloored, Floored, and Cathedral or Flat. NEAT does not treat "Unfloored" and "Floored" attics differently. This information is for the auditors benefit. An *Added Cost* may be associated with insulating "Floored" segments.

Tip: Model short slopes/slants as roof rafters under finished attics, not as cathedral.

Tip: Attics that are floored that can have insulation added above the floor shall be modeled as one measure. Do not separate these two out.

Tip: Shed style additions shall be modeled as cathedral/flat style attics based upon construction characteristics.

Tip: Top (collar beam) and side (kneewall/outer ceiling joist) attics in a 1 ½ story house should be modeled under finished attics.

5.0.4.3 Joist Space − Required

The default value is 24”, but many houses have joists 16” apart.

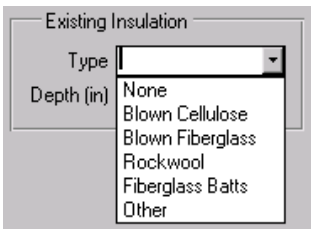
5.0.4.4 Area − Required

Enter the area in square feet of the ceiling or attic floor that borders the conditioned space. This value must be greater than 0. For "Cathedral" ceilings, enter the actual area of the sloped ceiling, which will require measuring the width and the lowest point to the highest point of the cathedral ceiling to get the actual area.

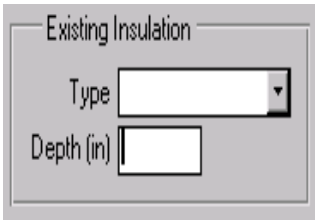
5.0.4.5 Roof Color

Enter the color of the roof. The two choices are white, Reflective or Shaded, and Normal or Weathered. Roofs completely shaded by trees in the summer should be categorized as white or reflective roof regardless of their finish.

5.0.4.6 “Existing Insulation” Box − Required entries



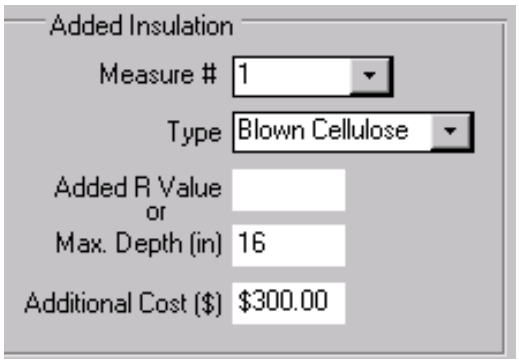
Select the type of insulation found in the attic area, if any. The choices are None, Blown Cellulose, Blown fiberglass, Rockwool, Fiberglass Batts, and Other. Select "None" if none exists. If “None” is selected, the *Existing Insulation Depth* field automatically disappears.



Enter the effective depth of insulation found in the attic taking into account insulation gaps and other construction defects that affect the overall R-Value of the existing insulation. Ignore compression around the eaves. The “depth” field disappears if "None" is chosen for the *Existing Insulation Type*. If insulation type is selected and no entry is made in the field, a default thickness equaling R-19 will automatically be entered.

Tip: If multiple types of insulation are present in the same attic, select “Other” as the insulation type and enter the average R-Value into the “Depth” field, not inches. It is useful to add a comment about the insulation types found and their estimated thicknesses.

5.0.4.7 Added Insulation Box



- Measure Number − Required

Use one measure number for all attic segments grouped with the same characteristics together in computing a single SIR when insulating.

Attic areas with additional installation costs, or having different levels of existing insulation, or which have maximum depth restrictions or specified added R-value should be given different measure numbers.

Note: If multiple attics are being modeled under the same measure number, consider adding additional costs to reflect the multiple attic accesses that may need work. NEAT assumes a single attic access with each measure number.

- Type − Required

Select the type of insulation to add to the attic area. The choices are None, Blown Cellulose, Blown Fiberglass, Cellulose Dense pack, Fiberglass Dense pack, Fiberglass Batts, and 2-Pt Foam. Select "None" if conditions prohibit insulating the area (comment on reasons why none selected was modeled).

Tip: When modeling to dense pack a floored attic, select “Cellulose Dense pack” as the insulation type.

- Added R-value – Do not select this, as you are not allowing NEAT to select the most cost effective level of insulation to install. Either the cavity should be packed full, or left alone if it isn’t cost-effective to fill it. Selecting “added R” over-rides this function, and evaluates only the single measure selected.

- Insulation Maximum Depth − Optional as needed

Enter the total (existing plus added insulation) that can exist in the space. If no restriction exists, leave the field blank. For *"Floored" Attic Types*, enter the distance between the ceiling board and the attic floor (normally the joist height). NEAT will consider all standard levels fitting into the space remaining, as well as completely filling the space.

- Additional Cost for Attic Insulation

  Enter any additional costs not normally associated with installation of attic insulation. The value is a lumped dollar amount, not per square foot. The amount will be added to the default cost. An example is H&S asbestos safe work practices costs. The additional cost may also be negative for example when there is no access work to be completed.

All repairs related to attic measure(s) shall be modeled in the Itemized Cost tab instead and included it in the SIR.

5.0.4.8 Comment

You may enter comments pertinent to the attic segment directly in the Comment field on the form, or you may enter them in the Comment Editor by selecting the “Comment” button to the left of the field.

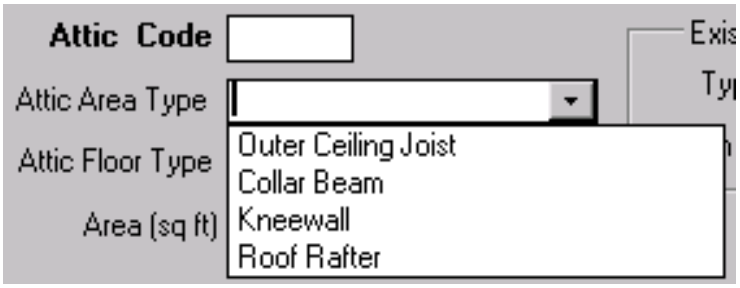
5.0.5 Finished Attics

The entries on the *Finished Attic tab* are similar to those for the *Unfinished Attic* tab. Four types of finished attic component can be described in NEAT: outer ceiling joist, collar beam, knee wall, and roof rafter. You are allowed to enter as many as 16 finished attic components in any combination of the four types.

5.0.5.1 Attic Codes − Required

Attic codes are abbreviated names specified by the user to identify specific house components for later identification. When the Attic Code button is selected, it will automatically create the code FA1 (finished Attic 1). It is recommended that auditors choose to use a different identifier (Collar Beam, Roof Rafter, Outer Ceiling Joist, and Kneewall) of up to twenty letters or numbers for easier identification by crews.

5.0.5.2 Finished Attic Area Type



The entries on the *Finished Attic* tab are similar to those for the unfinished attic. Select the Finished Attic Area Type from the drop down: Outer Ceiling Joist, Collar Beam, Kneewall, and Roof Rafter.

5.0.5.3 Attic Floor Type − Required

Select one of the two choices, floored or unfloored. NEAT does not treat "Unfloored" and "Floored" attics differently. This information is for the auditors benefit. An "Added Cost” may be associated with insulating "Floored" segments to take into account the additional labor needed for drilling holes, removing boards, etc. Enter restrictions to the total depth of insulation that can exist in a "Floored" segment in the *Added Insulation Max. Depth* in field.

5.0.5.4 Area − Required

Enter the area in square feet of the attic segment that borders the conditioned space. For "Roof Rafter" segments, enter the actual area of the sloped ceiling.

5.0.5.5 “Existing Insulation” Box – Required entries

- Type - Select the type of insulation found in the attic area, if any. Select "None" if none exists.

- Enter the average depth of insulation found in the attic. Ignore compression around the eaves. This field disappears if "None" is chosen for the *Existing Insulation Type*. If insulation type is selected, and no entry is made in the field a default thickness equaling R-19 will automatically be entered. Enter a depth to match the selected insulation to match the effective overall R-value if multiple types of insulation are present.

5.0.5.6 “Added Insulation” Box

- Measure Number - Required

- Type − Required

Select the type of insulation to be added to the attic area. The choices are for Outer Ceiling Joist, Roof Rafter, and Collar Beam: None, Cellulose blown, Fiberglass blown, Cellulose Dense pack, Fiberglass Dense pack, Fiberglass Batt, 2-pt foam. For Kneewall the choices are: R-11 Fiberglass Batt, R-19 Fiberglass Batt, R-11 Cellulose enclosed, R-19 Cellulose enclosed, R-11 2-pt, and R-19 2-pt. Select "None" if conditions prohibit insulating the area.

Tip: Select Cellulose Dense pack if dense packing a floored attic or roof rafters.

Added R-value – Do not select this, as you are not allowing NEAT to select the most cost effective level of insulation to install. option. Either the cavity should be packed full, or left alone if it isn’t cost-effective to fill it. Selecting “added R” over-rides this function, and evaluates only the single measure selected.

- Insulation Maximum Depth

Complete this field only if a restriction to the amount of insulation that can be entered such as in a floored attic. Always enter a depth for roof rafters. Enter the total (existing plus added insulation) that can exist in the space. For *"Floored" Attic Types*, enter the distance between the ceiling board and the attic floor (normally the joist height). NEAT will consider all standard levels fitting into the space remaining, as well as completely filling the space.

- Additional Cost for Attic Insulation

Enter any additional costs associated with installation of attic insulation. The value is a lumped dollar amount, not per square foot. An example is H&S asbestos costs. The additional cost may be negative for example when there is no access work to be completed.

All repairs shall be separated out and identified in the itemized cost tab.

5.0.5.7 Comment

You may enter comments pertinent to the attic segment directly in the Comment field on the form, or you may enter them in the Comment Editor by selecting the “Comment” button to the left of the field.

Note the following items regarding the finished attic tab:

- *Attic Floor Type* is suppressed for the knee wall or roof rafter attic area types since these components cannot be floored or un-floored.

- *No Measure Number* is requested for the knee wall attic area type. Knee walls are not grouped together in NEAT, but are evaluated and ranked separately.

- A selection of "None" in “Added Insulation” for this field will prevent consideration of insulation for this component.

- It is recommended to NOT group finished attic sections because an insulation depth restriction will be applied to all segments grouped together.

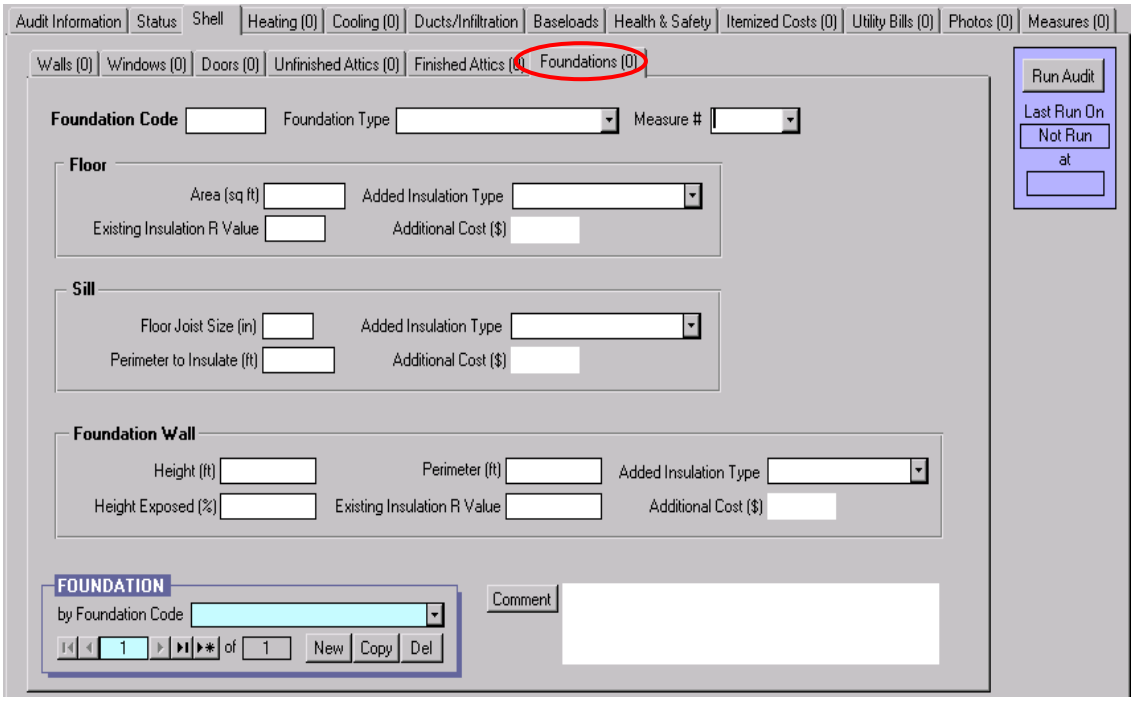
- If "None" is selected for the type for either the existing or added insulation, the corresponding depth entry will disappear.

Select “Copy” in the Attics box in the lower left hand corner of the shell screen to add another attic area. Attic Code (A2) will appear, and data from the previous attic will populate the fields. This will reduce data entry tasks as duplicate fields such as attic type, will be populated.

5.0.6 Foundations

Foundation spaces include basements (finished and unfinished), crawl spaces, slab on grade, and floors exposed to unheated spaces.

Note: NEAT will never recommend both floor insulation and sill and/or wall insulation for the same foundation.



5.0.6.1 Foundation Codes

Foundation codes are abbreviated names specified by the user to identify specific house components for later identification. When the Foundation Code button is selected, it will automatically create the code F1 (Foundation 1). Auditors can choose to use a different identifier to identify how the foundation area relates to the house. It is recommended that auditors choose to use a different identifier of up to twenty letters or numbers for easier identification by crews.

5.0.6.2 Foundation Type

Select from one of the seven choices:

- Conditioned: The space is purposefully heated (or more rarely cooled) by a heating system to maintain a temperature at or near the rest of the dwelling (example being a basement heated by supply registers or radiators in the space would be conditioned, as would a basement heated continuously by a space heater. Space has thermostat control.

- Non-Conditioned: There are no sources of heat in the space other than conduction through walls, floors, and perhaps <u>insulated</u> ductwork.

- Vented Non-Conditioned: Same as Non-Conditioned and vented directly to the outdoors.

- Unintentionally Conditioned: There is a heat source in the space that adds heat unintentionally to the space so that the temperature of the space is maintained above the outside temperature or ground temperature. (Example a basement that is heated

because a furnace or water heater is located in the basement or because uninsulated ductwork runs through the basement).

- Uninsulated Slab: On grade.
- Insulated Slab: On Grade.
- Exposed Floor: Overhangs, garage ceilings, and a home built on stilts or using pier and beam construction such that ambient air can freely flow beneath the house.

5.0.6.3 Foundation Measure Number

Group all similar foundation spaces together when computing a single SIR. Give separate measure numbers to spaces with different existing levels of insulation or where costs of insulating differ.

5.0.6.4 "Floor" Box

Depending on your foundation type, the remaining fields will vary. Any choice, other than *Uninsulated* or *Insulated Slab*, will display the following "Floor" Box, asking for the following information:

- **Area − Required**

  Enter the area in square feet of the floor directly above the foundation space. For slab-on-grade, enter the area of the slab floor in the living space. Entries must be greater than zero.

- **Existing Insulation R-value – Required**

  Enter the R-value of the existing insulation in the floor over the basement or crawl space. The default is zero, uninsulated.

- **Added Insulation Type – Required**

  Select the type of insulation you plan to model, the choices are, None, Fiberglass Batt, Cellulose Dense pack, Fiberglass Dense pack, 2-pt foam, R-10 Polystyrene Board, and R-7 Polystyrene Board. Select "None" if the floor should not be insulated.

- **Additional Cost for Insulation – Optional – As needed**

  Enter any additional costs associated with insulating the foundation space. The value is a lumped dollar amount, not per square foot. The amount will be added to the cost computed from the floor area and cost per square foot. Examples of additional costs could be material and labor costs associated with freeze protecting water pipes in floors.

Use exposed floor to model area under bump out windows or cantilevered floor sections.

The ceiling of a tuck under garage is modeled as an exposed floor area.

5.0.6.5 "Sill" Box

If the foundation type is anything other than insulated or uninsulated slab on grade, a data box for "Sill" insulation will be present.

- **Floor Joist Size − Required**

  Enter the actual size of the floor joists in units of inches.

- **Added Insulation Type – Required**

  Select the type of insulation you plan to model, the choices are, None, R-19 Fiberglass batts, R-11 Fiberglass batts, R-19 2-pt foam, R-12 2-pt foam, and R-10 Polystyrene Board. Select "None" if the box sill cannot be insulated.

  Tip: Model several options to provide the maximum SIR.

- **Perimeter to Insulate − Required**

  Enter the length, in feet, of the floor perimeter bordering the outdoors that is not insulated. If you can't insulate due to being filled with block, bricks or other reason, enter the length that is not insulated and select none for added insulation. Do not include the perimeter that borders another foundation space.

  Enter 0 if the entire perimeter is insulated.

- **Additional Cost for Insulation – As needed**

  Enter any additional costs associated with insulating the foundation space. Separate entries are provided for the floor and wall insulation options, provided each are being evaluated. The value is a lumped dollar amount, not per square foot.

5.0.6.6 "Foundation Wall "Box

When conditioned, unconditioned, vented conditioned or unintentionally conditioned are chosen, a "Foundation Wall" box is present. Complete the fields in this box.

- **Total Wall Height − Required**

  Enter the actual height, in feet, of the basement or crawl space wall. Estimate an average if the height is not uniform. The entry must be greater than zero. Include the height of the box sill to ensure continual insulation from sub-floor to ground for interior foundation in crawlspaces. If the wall height entered is less than two feet, NEAT will not evaluate the installation of floor, sill, or foundation wall insulation for the space because of access concerns.

  Exception: When modeling for exterior foundation insulation, the exterior height of the foundation plus the 6" below grade shall be entered as the foundation height.

- **Wall Height exposed − Required**

  Estimate the amount of wall exposed to the outside. For example, if the wall height in the foundation is 6 feet, and there is approximately 2 feet exposed outside, the exposure is 33%.

- **Foundation Perimeter − Required**

  Enter the length, in feet, of the floor perimeter bordering the outdoors. Do not include the perimeter that borders another foundation space. The value must be greater than zero. The default is the perimeter of a square with area given in the *Floor Area* field. The value is used with the wall height to determine the space's wall area bordering the outside or ground.

- **Foundation Wall Existing Insulation R-value − Required**

  Enter the R-value of insulation currently on the crawl space or basement wall. NEAT assumes this coverage is uniform. If only part of the wall is insulated, either (1) adjust the perimeter to subtract out the insulated portion and enter zero, or (2) enter an area-weighted average R-value. Entry is optional with default zero.

  Note: Typical foundation walls have an R-value of 1 even when not insulated.

- **Additional Insulation – Required**

  Select the type of insulation you plan to model, the choices are, None, R-7 Thermax Board, R-19 Fiberglass Batt, R-11 Fiberglass Batt, R-19 2-pt foam, R-12 2-pt foam, and R-5 Exterior foam board. Select “None” if the foundation will not be insulated.

- **Additional Cost for Insulation – Optional, as Needed**

  Enter any additional costs associated with insulating the foundation space. The value is a lumped dollar amount, not per square foot.

5.0.6.8 Insulated or Uninsulated Slab on Grade Foundations:

If the foundation is either insulated or uninsulated slab on grade, only the area of the slab and the perimeter measurements are required. Exterior foundation insulation for uninsulated slabs is modeled using the itemized cost tab and the energy savings formula provided in that tab.

5.0.6.9 Comment

You may enter comments pertinent to the foundation segment directly in the Comment field on the form, or you may enter them in the Comment Editor by selecting the “Comment” button to the left of the field.

5.1 Modeling the 5-24 Unit Building Shell

Buildings with 5 to 24 units are modeled using the NEAT audit. In most cases, the entire building exterior shell will be modeled as one heated space. The units are all modeled together for cumulative measures and average conditions. In special cases, (condos and townhouses) NEAT modeling may include separate audits for each unit. This is contingent on the building design. As noted above, regardless of the audit strategy, actual data from a representative sample of 25 percent of a building’s units is required. Additional Wisconsin policy requirements are:

1) The 5-24 Setup Library is adjusted to show all measures that have an SIR > 0.5, to show measures that might be completed if the owner is willing to buy down the cost. Owner buy downs are not allowed in buildings with fewer than five units.

2) Model the full cost of all measures, even if the owner may be paying part of the cost. Job cost reduction funds shall **not** be used to reduce the cost of a measure in Weatherization Assistant. Calculations regarding buy downs and actual agency costs for measures will be completed and documented in the 5-24 Unit Workbook.

3) Actual fuel records or Therm Calculator projections shall be used in conjunction with the energy audit.

4) Use the 5-24 Unit Workbook, available on the T&TA site at https://homeenergyplus.weccusa.org/ under the Technical Assistance tab, to generate savings information for multiple measures. The savings information and costs shall be incorporated into NEAT's Itemized Cost section to evaluate multiple measures.

5) Single measures or measures not addressed in the 5-24 Unit Workbook shall be modeled in the appropriate NEAT tab.

6) Detailed instructions for modeling 5-24 unit buildings using Weatherization Assistant software are posted on the Home Energy Plus website under Multifamily Resources (5+):
    a. http://homeenergyplus.wi.gov/category.asp?linkcatid=494&linkid=122&locid=25

5.1.1 Ceiling or Attic Areas

Model all ceiling/attic spaces for insulation up to as instructed in sections 5.0.4 and 5.0.5. Specify the level of insulation the energy audit selects that has an SIR greater than or equal to 1.0. Consider adjusting the effective R-value of the existing insulation based on the number/size of gaps in the insulation coverage. Seal applicable key junctures and bypasses prior to insulating. Incorporate related repair cost into the ceiling/attic insulation costs.

5.1.2 Sidewall Insulation

Model all uninsulated exterior walls of heated spaces to the maximum structurally allowable as instructed in 5.0.1. Install insulation if the SIR is greater than or equal to 1.0. Incorporate related repair cost into the sidewall insulation costs.

5.1.3 Foundation Insulation

Model foundation walls or floors that define the heating envelope, including the exterior walls of unintentionally conditioned crawlspaces, sill boxes, and slab-on-grade assemblies, for insulation with an energy audit as instructed in section 5.0.6. Start with modeling the maximum R-value the energy audit allows, based on structural capacity. Install the R-value that generates the highest SIR greater than 1.0, or provides the best R-value within the package of improvements. Install insulation only if the SIR is greater than or equal to 1.0. Incorporate related repair cost into the foundation insulation costs.

5.1.4 Window Replacement

Model windows that meet the replacement criteria as an improvement as instructed in section 5.0.2. Replacement windows shall meet ENERGY STAR® standards. Replace the window as an ECM if the SIR is greater than or equal to 1.0. Building owners may opt to replace existing windows that do not meet a minimum 1.0 SIR test as a part of their contribution toward the weatherization of the building. The owner's contribution shall be equal to or exceed the buy-down amount needed to generate an SIR equal to or greater than 1.0.

5.1.5 Door Replacement

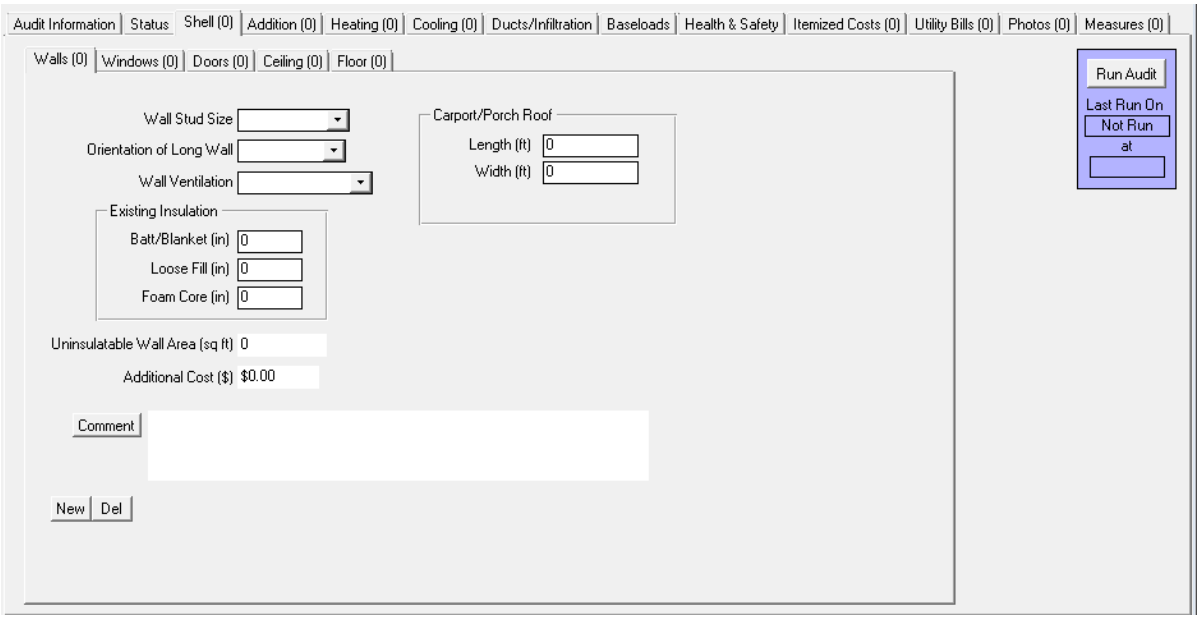
Model doors that are deteriorated beyond repair for replacement as an improvement or a repair as instructed in section 5.0.3. Doors may be replaced within the entire improvement package or when the building has a cumulative SIR equal to or greater than 1.0.

5.2 Modeling Manufactured Homes in the MHEA Shell Tab - Including Additions

This tab contains sub tabs and forms used to describe the thermal envelope (or shell) of a mobile or manufactured home.

MHEA also provides an "additions" tab to enter information about one addition to the manufactured home. An addition is part of the living space, conditioned by the heating and cooling systems servicing the remainder of the manufactured home. If the addition is separated from the manufactured home (e.g., by closing the door to an entrance vestibule), it should not be included in the energy audit.

If more than one addition is present, it may be best to utilize NEAT to model the home. See the Wx Program Manual for details to guide the best way to model unusual configurations.



Note: Boxes outlined in black indicate a required field.

5.2.1 Walls

MHEA assumes that the house is rectangular in shape and the walls of the manufactured home are all of the same construction type; therefore, there is only a single wall information screen. Remember that any additions to the home are treated separately on the Additions tab.

5.2.1.1 Wall Stud Size − Required

The wall stud is the wood framing between the interior and exterior manufactured home walls. The choices are 2, 3, 4, and 6. Manufactured homes are typically constructed using standard wood framing. MHEA uses this information to calculate the wall R-value and the volume of the wall cavity available for added insulation.

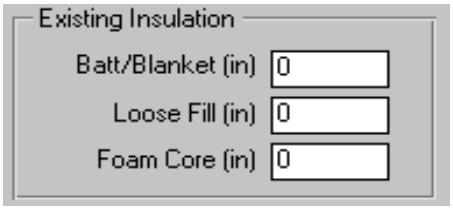
5.2.1.2 Orientation of Long Wall of Home − Required

Select the cardinal direction of one of the long walls. A good rule of thumb is to select the wall on which the main entrance is located. MHEA uses this information to calculate solar loads on the home.

5.2.1.3 Wall Ventilation − Required

Indicate whether the walls are vented or not vented. A manufactured home wall may be intentionally or unintentionally ventilated. An intentionally ventilated manufactured home may have corrugated metal siding open at the bottom to provide space for air to flow between the exterior and interior wall materials. MHEA degrades the wall R-value for ventilated walls.

5.2.1.4 Existing Insulation Box



Insulation Type/Thickness – Required
MHEA assumes that exterior walls of the manufactured home may have Batt/Blanket, Loose Fill, or Foam Core insulation. Enter the thickness of existing insulation in inches. If a thickness of 0 inches is entered, MHEA assumes that type of insulation does not exist.

MHEA uses this information to calculate the wall R-value and to calculate the volume in the wall section that is available for additional insulation.

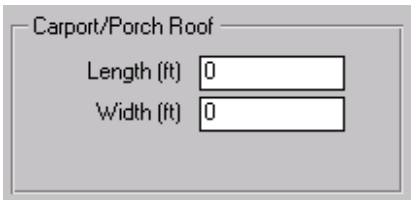
5.2.1.5 Uninsulatable Area (ft2) – Not Required

Enter the gross area of the wall in square feet that is not accessible for insulating, taking into account that it is rarely possible to insulate manufactured home walls from the interior. MHEAaccounts for wall studs and framing around windows and doors. An example of an uninsulatable wall is a wall segment between an attached unconditioned space and the home.

5.2.1.6 Added Insulation Cost – Not Required

Enter any additional costs not normally associated with installation of wall insulation. The value to be entered is a lumped dollar amount, not per square foot. The default is zero.

5.2.1.7 Carport/Porch Roof Box – Required

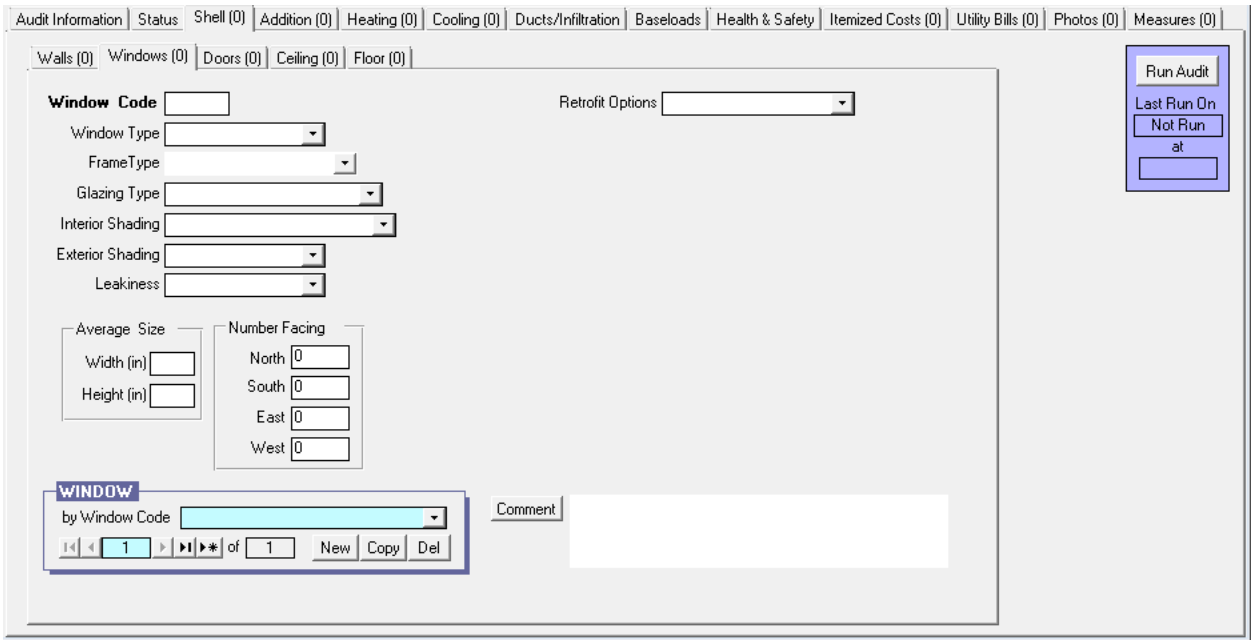


A carport/porch roof is a shelter with no walls that extends out from one wall of the manufactured home. Indicate the length along the mobile home (in feet) and width out from the mobile home (in feet) of this carport/porch roof. If no carport/porch roof exists, enter a length and width of zero feet. Often, this shelter is used to park a car or shade an outdoor sitting area. as well as unheated additions should be entered here too.

5.2.1.8 Comment

You may enter comments pertinent to the walls directly in the Comment field on the form, or you may enter them in the Comment Editor by selecting the “comment” button to the left of the field.

5.2.2 Windows



The *Window* form under MHEA’s Shell tab is used to enter information all the windows installed in the main portion of the manufactured home. A total of 24 windows descriptions may be entered. Windows of the same type and size can be entered on a single record regardless of their orientation. Indicate in the *Number Facing* fields how many windows having the same description face each of the cardinal directions.

5.2.2.1 Window Code − Required

Window Codes are abbreviated names specified by the user to identify specific window descriptions for later identification. They may be used to link components on a floor plan drawn by the auditor to those entered into MHEA. They commonly contain three to five letters or numbers and are not case sensitive.

Tip: Use specific names if a window is going to be replaced or repaired.

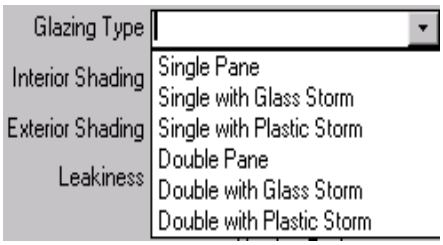
5.2.2.2 Window Type – Required

The window description is the type of window found. The choices are Jalousie, Awning, Slider, Fixed, Door Window, Sliding Glass Door, and Skylight. See section 5.0.2.2 for detailed descriptions of each window.

5.2.2.3 Window Frame Type – Optional

Select the correct window frame and sash construction materials. The choices are Wood or Vinyl, Metal, and Improved Metal (i.e., metal frame with a thermal break).

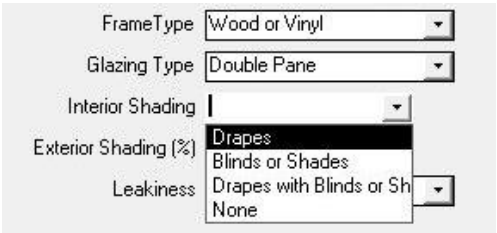
5.2.2.4 Window Glazing Type − Required



Select the glazing type depending on the number of panes of glass in the primary window and the characteristics of any storm window that may cover the primary window. MHEA energy calculations take into account that the storm window (second, removable pane) is typically installed on the interior side of the window. If the existing storm window is on the exterior side of the window, the window should be considered as not having a storm window.

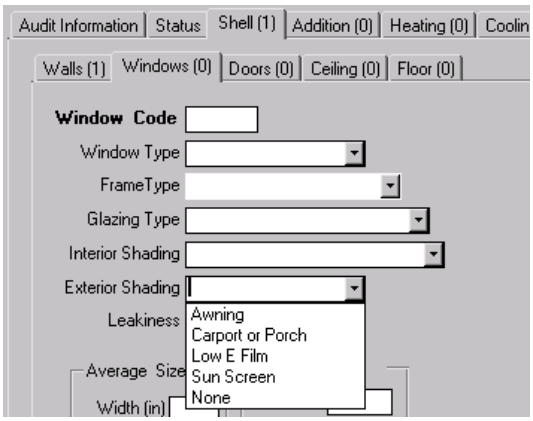
- **Single Pane:** windows have one plate of glass in the window frame.
- **Single with Glass Storm** window have a single pane of window glass with a second (usually removable) single pane of glass installed at one inch or so from the windowpane.
- **Single with Plastic Storm:** have a single pane of window glass with a second (usually removable) single pane or sheet of plastic installed at one inch or so from the windowpane.
- **Double Pane:** windows have two plates of glass in the window frame.
- **Double with Glass Storm:** window is two panes of window glass with an additional (usually removable) single pane of glass installed at one inch or so from the windowpane.
- **Double with Plastic Storm:** window is two panes of window glass with an additional (usually removable) single pane or sheet of plastic installed at the one-inch or so from the

5.2.2.5 Interior Shading − Required



Select the interior window covering that are present which, when closed, prevent sunlight from entering the home and also slightly increase the insulating value of the window. The options are Drapes, Blinds or Shades, Drapes with Blinds or Shades, and None. Interior shading affects both the insulating value of the window/window shading combination as well as the solar loads on the home. Indicate drapes with shades if the occupant has both on the window. Interior shading devices affect the amount of heat gained or lost through windows. If there is no interior window shading, select "None".

5.2.2.6 Exterior Shading – Required



Select the type of exterior window shading present outside the window and which reduces the sunlight striking the window. The choices are Awning, Carport or Porch, Low-e Fil, Sunscreen, and None. Exterior shading reduces the solar load on the mobile home. Low E film is a reflective film applied to the exterior surface of glass windowpanes by the window manufacturer. A sun screen is a mesh screen that is installed or hung on the exterior side of a window. An awning is mounted above a window and extends out from the exterior of the home. A carport/porch roof is a shelter that has no walls and extends out from one wall of the manufactured home.

If there is no exterior window shading, select "None".

5.2.2.7 Window Leakiness

Select the leakiness category that best describes how leaky the window is. The choices are Very Tight, Tight, Medium, Loose, and Very Loose.

Degrade the leakiness description one level if the windowpanes themselves have become significantly loose in their mounting and/or 2 to 9 sq. in. of glass is missing. Degrade the leakiness two levels if 9 to 25 sq. in of glass is missing. Specify the window to be Very Loose if more than 25 sq. in of glass is missing.

Upgrade the leakiness description one level if a storm window in average or better condition is present.

Typical Leakiness:

- Typical fixed window is Very Tight
- Typical casement is Very Tight
- Typical non-wood vertical slider is Tight
- Typical wood window in older homes is Medium
- Typical horizontal slider is Medium
- Typical jalousie window is Loose
- Typical awning and hopper windows are Very Tight
- Awning windows resembling jalousies is typically medium

5.2.2.8 Average Size

Enter the width and height of the windows (including the window frame) in units of inches being described.

5.2.2.9 Number of Windows Facing Each Orientation

Indicate the number of windows on each wall facing the closest cardinal direction of the manufactured home that fit the description shown on the form. Do not enter information about windows on the portion of a wall shared with an addition.

5.2.2.10 Retrofit Options

Select the kind of retrofit that is appropriate for this window record. The choices are:

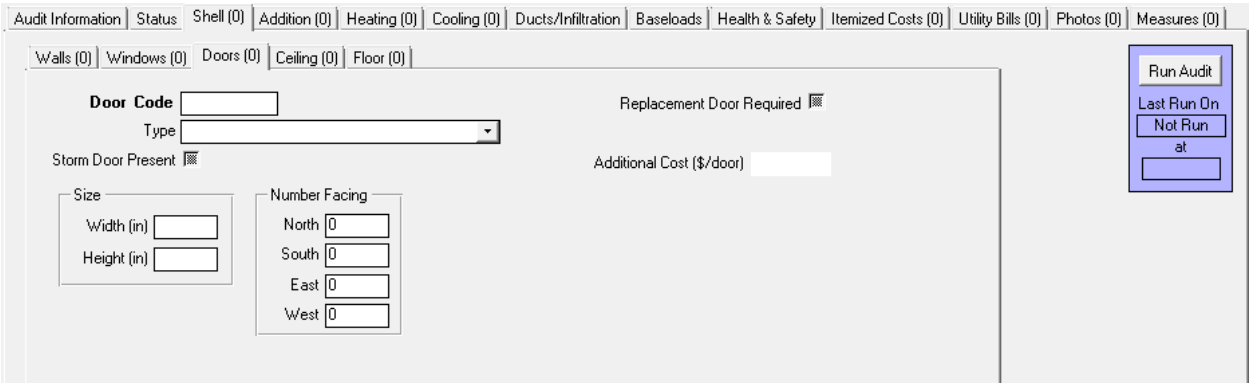
- Evaluate All: The retrofit of this window is optional. MHEA will decide the most cost effected treatment option. Use this option to model for insider storm windows or replacement windows.

- Evaluate None: None of the above retrofits will be considered for this window description. Select this option unless insider storm windows are a possible option.

When “evaluate all” is selected, a second box opens to allow for entry of additional costs.

Select “Copy” button in the lower left hand corner of the Shell screen to add another window. Window Code (WN1−2) will appear, and data from the previous window will populate the fields. This will reduce data entry as duplicate fields such as shading will already be selected.

5.2.3 Doors



Describe door types, sizes, and orientation. MHEA subtracts door area from the wall area and figures heat loss from the wall and door separately. A total of ten door descriptions may be entered.

5.2.3.1 Door Code − Required

Door Codes are abbreviated names specified by the user to identify specific door descriptions for later identification in MHEA reports. They typically contain three to five letters or numbers and are not case-sensitive.

5.2.3.2 Door Type − Required

Indicate the type of door found in the manufactured home, the choices and descriptions are listed below:

- **Hollow Core Wood** − constructed of two lightweight panels of wood.
- **Solid Core Wood** − constructed of a solid piece of wood.
- **Standard Manufactured Home Door** − constructed of a metal, vinyl, or a fiberglass skin with a solid insulating core (such as polyurethane).

5.2.3.3 Storm Door Present – Check Box

Indicate whether a storm door exists.

5.2.3.4 Average Size − Required

Enter the width and the height of the door opening in the units of inches.

5.2.3.5 Number of Doors Facing Each Orientation − Required

Indicate the number of doors on each wall of the manufactured home facing the closest cardinal direction. Do not enter information about doors on the portion of a wall shared with an addition. MHEA assumes all door descriptions are exposed to the outside.

5.2.3.6 Replacement Door Required − Do not check this box

If this box is checked, MHEA will consider the replacement mandatory and recommend it whether the SIR is greater than the minimum acceptable value. In Wisconsin, door replacements **must** be considered a repair item as an itemized cost.

5.2.3.7 Include Cost in SIR − Check Box − Not Required

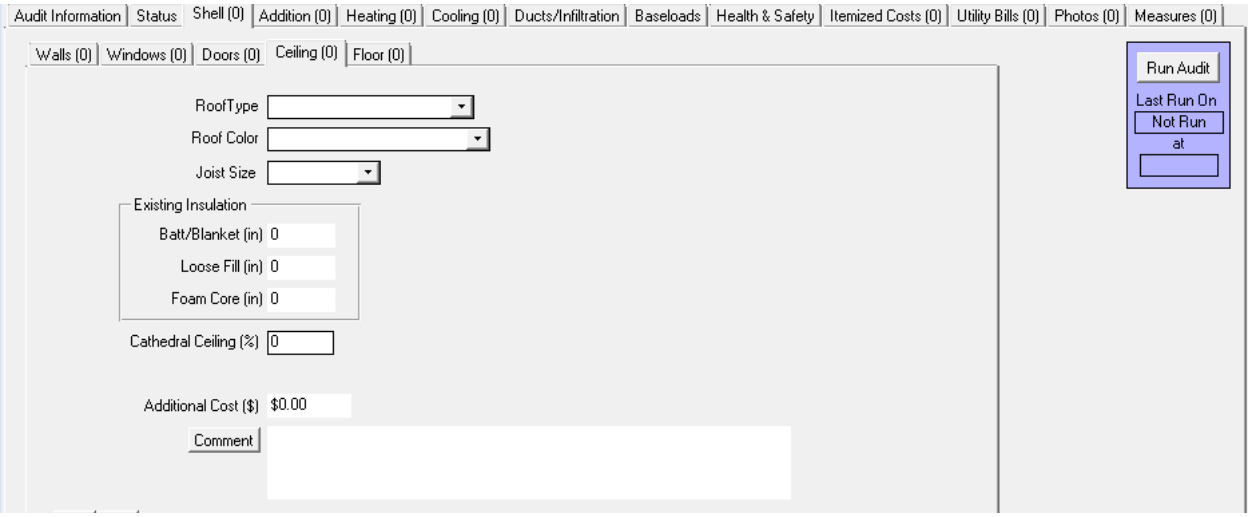
Because door replacements must be considered a repair item in Wisconsin's weatherization program, **this check box should not be selected**.

5.2.3.8 Comment

You may enter comments pertinent to the door directly in the Comment field on the form, or you may enter them in the Comment Editor by selecting the "Comment" button to the left of the field.

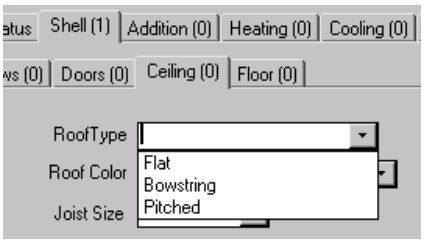
Select "Copy" button in the lower left hand corner of the *Shell* screen to add another door. Door Code (D2) will appear, and data from the previous door will populate the fields. This will reduce data entry as duplicate fields such as door type will already be selected.

5.2.4 Ceilings



Enter information describing the roof/ceiling section of the manufactured home.

5.2.4.1 Roof Type − Required



Based on the roof type selected, MHEA will calculate the volume of the roof/ceiling section. The choices and descriptions are listed below.

- **Flat** roofs have an interior surface (ceiling) and an exterior surface (roof) attached directly to either side of the wood framing, similar to wall construction. MHEA assumes 2 x 6 framing separates the ceiling and roof.

Roof/Ceiling Joist Size will appear as a required entry if the auditor selects a flat roof option. The roof/ceiling joist is the wood framing that supports the interior ceiling and the exterior roof. Indicate the dimensions of the roof/ceiling joists. MHEA needs this information to calculate the roof/ceiling R-value and the volume addition roof/ceiling section.

- **Bowstring** roofs have a lightweight exterior roofing material (usually aluminum) that is stretched over the roof frame structure. The roof has a slight curve with the highest point in the middle of the home width. MHEA uses the home width and your input for *Height of Roof* at the center to calculate the volume of a bowstring roof section.

Height of Bowstring Roof
If *Bowstring Roof* is selected, enter the maximum height in units of inches of the roof above the ceiling, disregarding any existing insulation. This assists MHEA in determining the available space for additional insulation.

- **Pitched** roofs are sloped to a higher peak point. When viewing the home width from the outdoors, the roof line creates a triangle. Pitched roofs are also often shingled, unlike flat and bowstring roofs. MHEA uses the width of the home and the assumed value for the roof pitch to calculate the volume of a pitched roof section.

Added Insulation in Pitched Roof
For Pitched roofs, enter the number of inches of insulation to be added to the existing insulation (if any). Unlike NEAT, MHEA does not consider various insulation measures, to report out the measure with an SIR > 1 that is the most cost-effective measure. If the specified level is not cost-effective, MHEA will not recommend the ceiling insulation measure. Try running MHEA again, using a lesser level of insulation to see if cost-effectiveness for the measure can be established.

NOTE: In some cases, the pitched roof is a second roof constructed over the original manufactured home roof. Enter construction information describing the original manufactured home roof, since it is under this roof that insulation may be added. Enter only the roof color of the second (exterior) roof.

MHEA will not consider adding more than 12 inches. Entering 0 will prevent roof insulation from being considered.

5.2.4.2 Roof Color − Required

Enter the color of the roof; the two choices are White, Reflective of Shaded, and Normal or Weathered. Choose *White* or *Reflective* if the roof appears white or shiny metallic is clean, has little or no discoloration due to weathering. Roofs completely shaded by trees in the summer should be categorized as White or Reflective regardless of their finish. The majority of roofs will be classified as Normal or Weathered.

5.2.4.3 Existing Insulation Box − Required

Enter the amount of existing Batt/Blanket, Loose Fill, or foam Core insulation. Enter the thickness of existing insulation by type in inches measured at the center of the roof/ceiling section. Enter 0 or leave the field blank for insulation types that do not exist.

MHEA uses this information to calculate the roof/ceiling section R-value and to calculate the volume in the roof/ceiling cavity for flat and bowstring roofs that is available for additional insulation. Depth should be based on performance rather than nominal thickness. For example, a 6” batt with 10% gaps or voids should be de-rated to 5 or 5 ½ ".

5.2.4.4 Percent Cathedral Ceiling – Required

Enter the approximate percent of floor area that lies beneath a cathedral ceiling. A Cathedral ceiling is a sloped or vaulted ceiling where the ceiling and roof planes are parallel. For example, if a cathedral ceiling is above the living room and the living room floor area is about one third the total home floor area, the percent cathedral ceiling is about 33%.

Note: If the roof type selected is flat or pitched and the percent of the cathedral ceiling is greater than 0, the Step Wall Orientation field will appear. Some manufactured home ceilings slope up to the top of a short wall. This short wall then steps vertically down to the average home height. Select the closest cardinal direction that the step wall faces. Enter no step wall if a step wall does not exist.

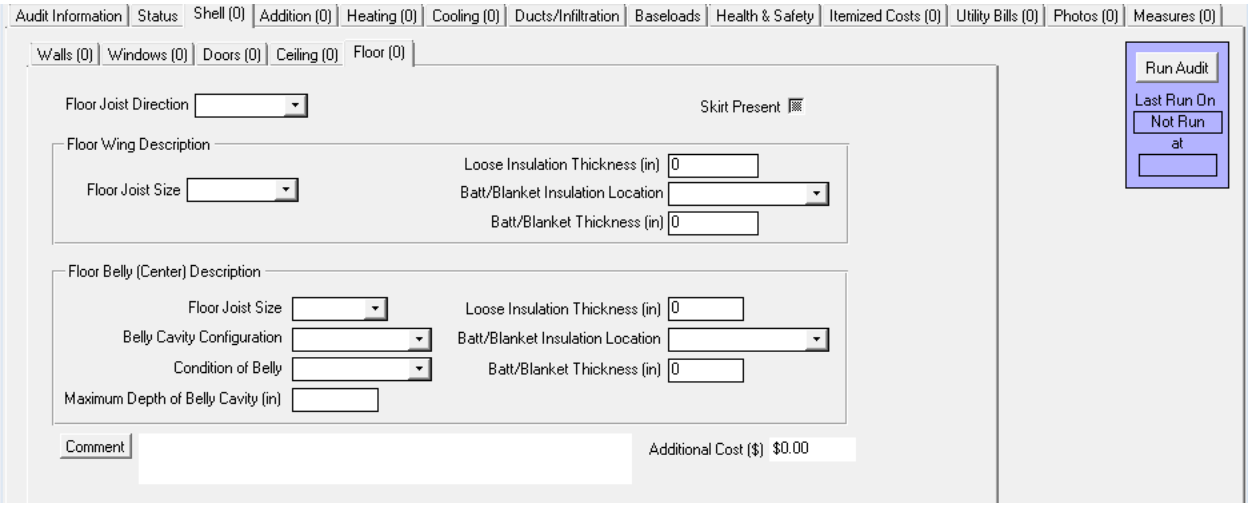
5.2.4.5 Additional Ceiling Installation Cost – As Needed

Enter any additional costs not normally associated with installation of ceiling insulation. The value is a lumped dollar amount, not per square foot. Installing an attic access is an example of work requiring additional cost. The default is zero.

5.2.4.6 Comment

You may enter comments pertinent to the roof/ceiling section directly in the Comment field on the form, or you may enter them in the Comment Editor by selecting the “Comment” button to the left of the field.

5.2.5 Floors



The *Floor* input screen contains information about the manufactured home floor/belly section. The Floor form is divided into four sections: a general description, floor wing description, floor belly (center) description, and the Comment and Additional Cost fields.

5.2.5.1 Floor Joist Direction − Required

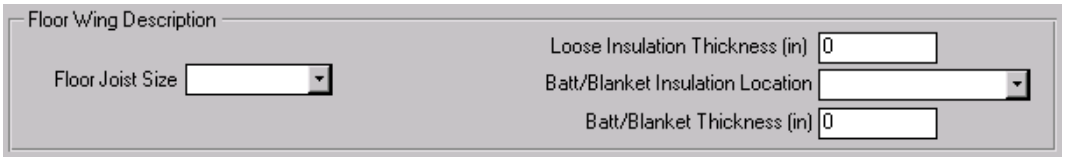
The floor joist is the wood framing that supports the interior floor. Enter the direction the floor joists are installed. The choices are Lengthwise and Widthwise. The floor joist direction is needed to calculate more accurately the volume of the belly section, and indicates where a central air supply duct is located (between joists or below joists), and the R-value of the floor.

- **Lengthwise** floor joists are installed parallel to the long dimension (length) of the home.
- **Width-wise** floor joists are installed parallel to the short dimension (width) of the home.

5.2.5.2 Skirt Present Check Box − Required

Indicate whether a skirt exists around the exterior of the home. The skirt must be solid and intact, not simply a decorative lattice. If skirting exists, MHEA adjusts the exterior R-value to account for the absence of wind when the total R-value of the floor/belly section is calculated.

5.2.5.3 Floor Wing Description Box – Required



Floor Joist Size
Indicate the dimensions of the floor joists in the wing sections. The choices are 4, 6, and 8. Sometimes the floor joist size is different in the wing section that in the belly section. MHEA needs this information to calculate the floor R-vale and the volume of the floor/belly section.

Insulation Type/Thickness
Enter the amount of existing batt\blanket and loose-fill insulation. If a thickness of 0 inches is entered, MHEA assumes that insulation of that type is not present. MHEA uses the existing insulation thickness to calculate the floor/belly R-value and to calculate the volume in the floor/belly section that is available for additional insulation. Depth should be based on performance rather than minimal thickness. For example, an older 2" batt could be de-rated to 1 ½ "if not in ideal condition.

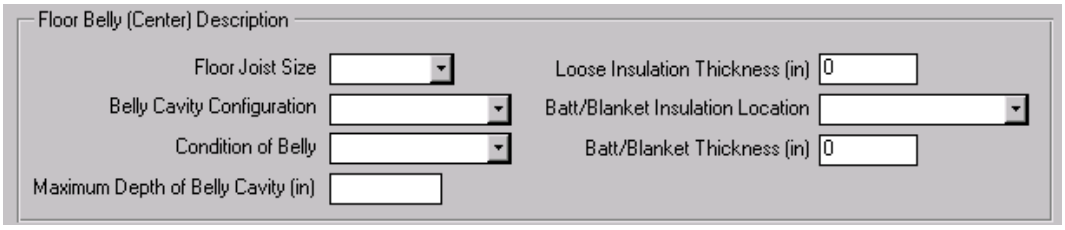
Batt/Blanket Insulation Location
Indicate where the batt/blanket insulation is located in the wing sections. The choices and descriptions are listed below.

- **Attached to Flooring:** refers to the case if the batt/blanket insulation is attached to the underside of the flooring.

- **Between Joists:** refers to the case if the insulation lies between but at the bottom of the joists, leaving the potential for an air space between the top of the insulation and the flooring.

- **Attached to Joist:** refers to the case if the insulation is attached to the underside of the floor joists.

5.2.5.4 Floor Belly Description Box – Required



- **Floor Joist Size**
  Indicate the dimensions of the floor joists in the belly sections. MHEA needs this information to calculate the floor R-value and the volume of the floor/belly section. The choices are 4, 6, and 8. Sometimes the floor joist size is different in the wing section that in the belly section. MHEA needs this information to calculate the floor R-vale and the volume of the floor/belly section.

- **Belly Cavity Configuration**
  Enter the configuration of the belly center cavity. The belly cavity is the deep section that runs the length of the home and usually houses the main supply air duct. The choices and descriptions are listed below.

Square: refers to the case if the cavity configuration has vertical sides and a horizontal base. (Usually, the main iron support beams act as the vertical sides).

Rounded: refers to the case if the belly wrap is draped in the middle portion of the home. Usually, the wrap is draped between the main iron support beams of the home.

Flat: refers to the case if the belly cavity configuration is one in which there is no center belly section lower than the belly wing section. This type of belly is often found on homes where the main air supply duct is located between lengthwise floor joists or where the main supply air duct is located in the roof section.

- **Condition of Belly**
  By observation, enter the condition of the existing belly wrap. The choices and descriptions are listed below.

  Good: A belly in good condition does not have any tears, holes, or other openings and is tightly attached around its entire perimeter.

  Average: An average belly wrap condition has some small tears, holes, or other openings in the belly wrap or may not be well attached at its perimeter.

  Poor: A belly wrap with large tears, holes, or other openings or which is not well attached at its perimeter.
  MHEA needs the belly wrap condition to calculate the effectiveness of existing insulation in the floor/belly section.

  NOTE: If the belly is in other than good condition and it is anticipated the belly will need insulation, include as "Additional Cost" the cost of repairing the belly with insulating type materials. Or, include this cost as an "Itemized Cost" and it will not be associated with the belly insulation measures.

- **Maximum Depth of Belly Cavity (in.)**
  Enter the maximum depth of the belly (in inches) as measured from the underside of the flooring to the lowest part of the belly, disregarding any existing insulation.

- **Insulation Type/Thickness**
  Enter the amount of existing batt\blanket and loose-fill insulation. When a thickness of 0 inches is entered, MHEA assumes that insulation of that type is not present. MHEA uses the existing insulation thickness to calculate the floor/belly R-value and to calculate the volume in the floor/belly section that is available for additional insulation. Depth should be based on performance rather than nominal thickness. For example, an older 2” batt should be de-rated to 1 ½" if not in ideal condition.

5.2.5.5 Added Floor Insulation Cost – As Needed

Enter any additional costs not normally associated with installation of belly insulation. The value is a lumped dollar amount, not per square foot. The default is zero. Additional cost of repairing the belly wrap material shall in the itemized cost tab be entered if the condition of the material needs to be improved prior to any blown insulation measure for the floor.

Note: If insulating materials are used for repairing the belly, model the costs here and if floor insulation has an SIR of 1 or greater, then the measure can be reported as floor insulation and not a repair.

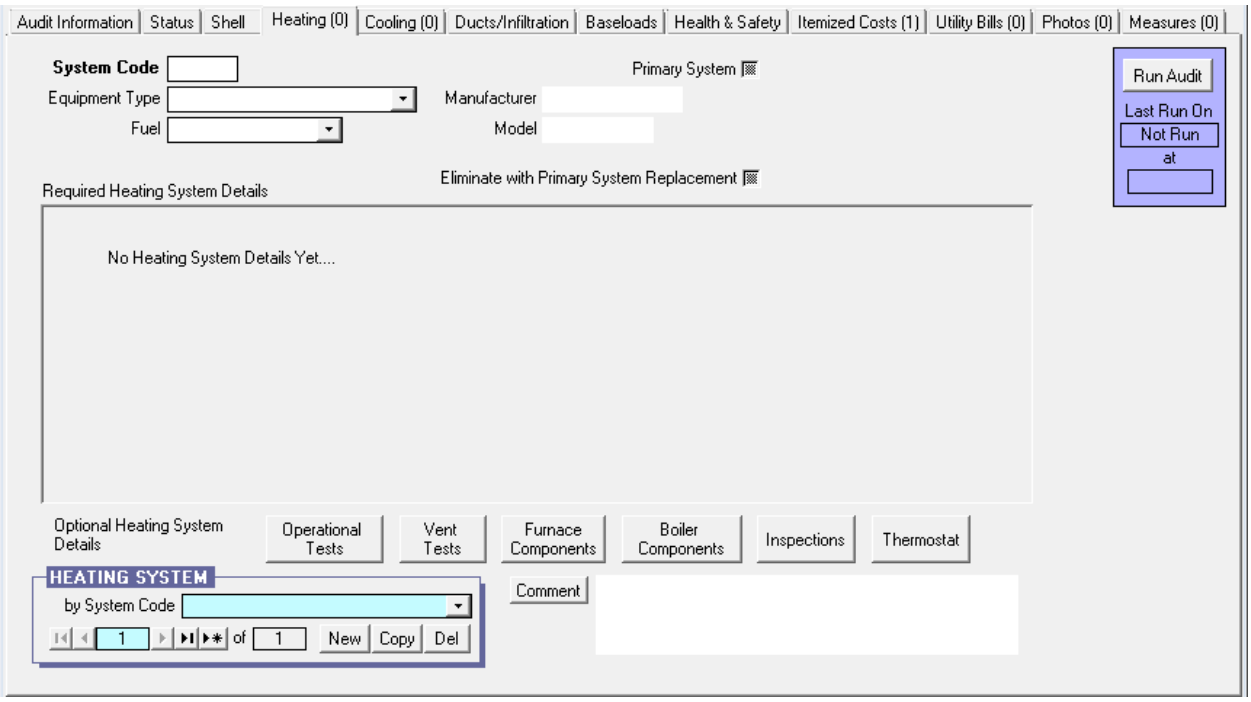
Chapter 6 NEAT/MHEA Heating System Data Entry

6.0 NEAT Heating Systems

This form is used to enter information about the heating system(s) for the house. Enter as many systems as are present. NEAT will only model replacement of the "Primary" system (assumed to supply the majority of the heat). Secondary systems will be considered for replacement only when replacement of the primary system will lead to removal/elimination of the secondary system.

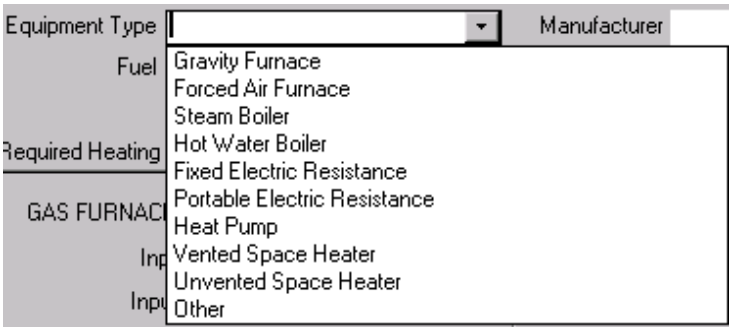
When the primary heating system is inoperative,do not as having a value of 0 for either the Steady-State Efficiency (SSE) or Heat Supplied. Enter data showing the existing heating equipment as supplying the amount of heat as it was intended to supply. Enter an efficiency value that is typical, but at the lowest end of the possible range, for equipment of its type.

6.0.1 Heating System Code − Required



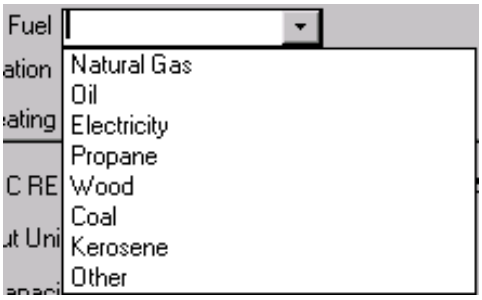
Heating System codes are abbreviated names specified by the user to identify specific components for later identification. System codes should be three to five characters in length. All heating system codes must be unique for a given Job. When the *Heating System Code* button is selected it will automatically create the code HS1, (heating system 1). If multiple heating systems are in a home, it is recommended to identify each heating system with its own unique code.

6.0.2 Heating System Equipment Type − Required



Select the type of equipment from the list shown above that best describes the heating system. Secondary systems may be described on subsequent heating system forms. The *System Details* form will vary slightly depending on the system type selected here.

6.0.3 Heating System Fuel Type – Required



Choose the fuel type consumed from the list shown to the left by the heating system being described. When the *Fuel Type* is entered, the System Details form will appear and will vary depending on the fuel selected as indicated below.

Fuel Type	System Details
Natural Gas	Gas Furnace Details
Oil	Oil Furnace Details
Propane (LPG)	Gas Furnace Details
Electricity	Electric Resistance Details Form Required
Wood	Space Heater Details
Coal	Space Heater Details
Kerosene	Space Heater Details
Other	Depends on Equipment Type

Tip: The “Other” fuel type tab is set up primarily to simplify data entry for wood pellet appliances.

6.0.4 Heating System Location − Required

Choose one of three locations for the heating system:

1) Heated space (purposefully heated by a heating system to maintain a desired temperature, usually utilizing a thermostat to control the space temperature. For example, a basement heated by supply registers or radiators in the space would be heated, as would a basement heated continuously by a space heater).

2) Unconditioned space (there are no sources of heat in the space other than conduction through walls, floors, and perhaps insulated ductwork).

3) Unintentionally heated space (partially heated by a heat source in the space that adds heat unintentionally to the space. For example, a basement that is heated because furnace, boiler, or water heaters are located in the basement or because uninsulated ductwork runs through the basement).

6.0.5 Percent of Heat Supplied − Required

Enter the estimate of the percent of total floor space heated by this system. If multiple heating systems all heat the same space, estimate and enter the percentage that each heating system delivers to the building. The sum of the percentages for all heating systems described must be 100%.

6.0.6 Primary Heating System − Check Box

NEAT supports only one primary heating system per house. Heating retrofits will apply only to the primary system. If this box is left unchecked, the system is assumed to be a secondary system, unless it is the only system described. Checking the primary system box for any heating system will automatically uncheck the box for any other systems entered.

The primary system should be what is listed on the customer's WHEAP application and referral. If the actual primary heating system is not as what is listed on the customer's application and referral, contact the local WHEAP agency prior to starting weatherization work. If the primary heating fuel mis-match is unable to be resolved at the local level, submit the question or issue to the HE+ Help Desk.

6.0.7 Eliminate with Primary System Replacement − Check Box

Secondary heating systems are modeled the same as the primary system, except that this checkbox is available for secondary systems only. Leave it unchecked if the intent is to leave the secondary system in place. Use this checkbox to identify any secondary system that will be eliminated by replacing the primary system. Then, the heat supplied by any secondary heating system will, post-weatherization, be added to the load assumed to be supplied by the replacement primary system.

If the secondary system is to be eliminated, all costs associated with the elimination of the secondary heating system must be included with the cost of replacing the primary heating system. If the combination of the primary replacement and secondary system elimination is selected as an ECM, proceed with work.

If the combination is not selected as an ECM, uncheck the box for elimination of the secondary system. The reduction in costs may be sufficient to raise the SIR on primary system replacement above 1, but the cost-effectiveness calculation for the primary system is usually reduced, because NEAT will calculate that the new system is getting less use. If this does turn out to be the only way to get an acceptable SIR on the primary system replacement, consider leaving the secondary heating system in place and counselling the occupant not to use it.

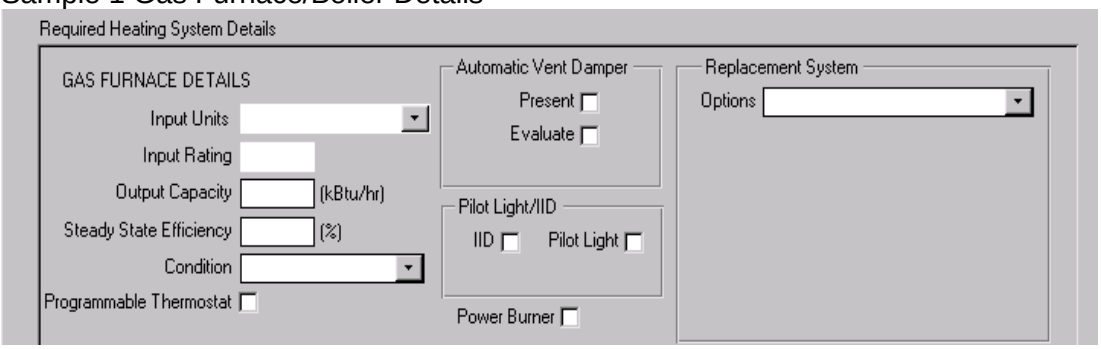
If the combination of replacing the primary system and eliminating the secondary is not selected as an ECM, the full cost may be modeled as an H&S heating system replacement with proper documentation. If the cumulative SIR is ≥1.0, then proceed with work. If cumulative SIR is <1.0, model only the cost of the primary system replacement as a H&S measure and leave the secondary system in place.

6.0.8 Manufacturer Name and Heating System Model − Optional

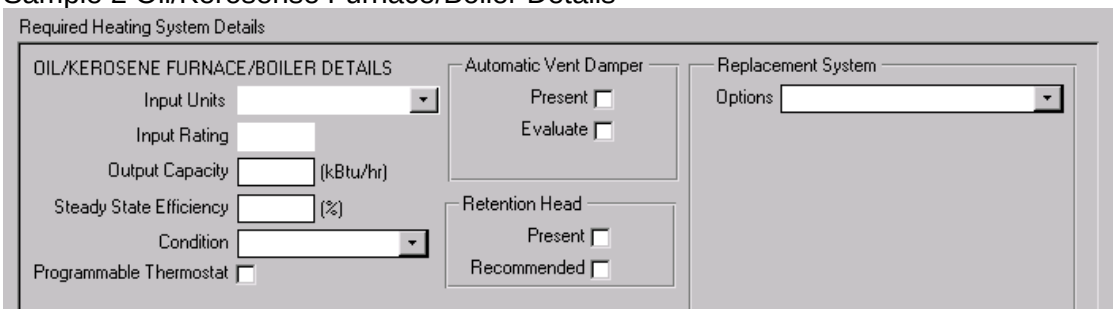
6.0.9 Heating System Details − Required

Depending on the heating system type and the heating system fuel selections, one of several *Furnace System Details* boxes will appear. (See below). Complete the information requested in the *Heating System Details* box that appears after audit information is entered. See Samples below − Choose option accordingly.

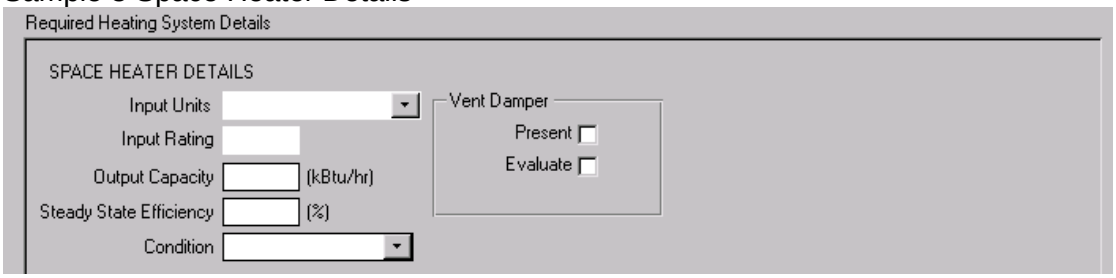
Sample 1 Gas Furnace/Boiler Details



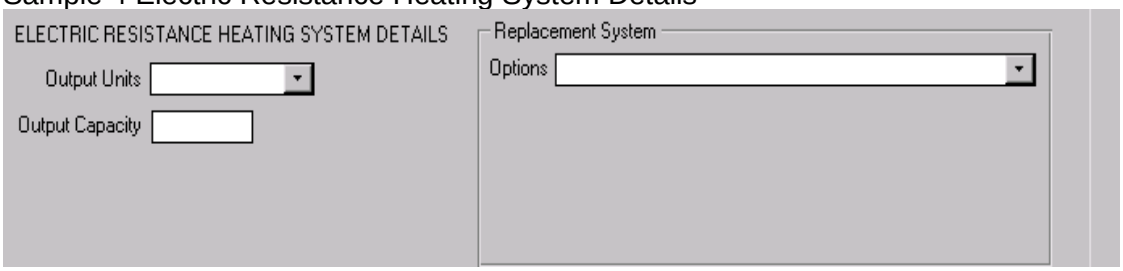
Sample 2 Oil/Kerosense Furnace/Boiler Details



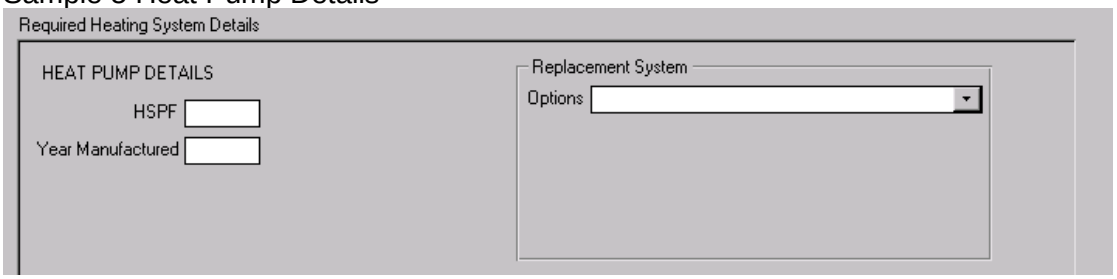
Sample 3 Space Heater Details



Sample 4 Electric Resistance Heating System Details



Sample 5 Heat Pump Details



The items below appear on some or all of the heating system details screens. Enter information as needed.

6.0.9.1 Input Units − Required

Indicate the units for the *Input Rating* entry that follows. The choices are No Input, kBtu per Hour, Gallons per Hour, Lbs. per Hour, and Cubic Centimeters per Minute. Then enter the actual value of the input rating in the Input Rating field. The input rating can be measured, or taken directly from the nameplate of the heating system. If an *Input Rating* is not available for the system being described, select "No Input" for this field and the *Input Rating* field will disappear. The *Input Rating* is used only with the *Output Capacity* to provide a default heating system *Steady State Efficiency percentage*. If the steady-state efficiency of the heating system will be measured by performing a flue-gas analysis or if the steady-state efficiency will be obtained by some other means, then, there is no need to obtain an input rating and the "No Input" menu item should be selected.

6.0.9.2 Output Capacity − Required

Enter the output of the heating system in units of kBtu/hr. The value can be measured, taken directly from the nameplate of the heating system, or approximated. If a value for *Input Rating* is entered, it will be used with the *Output Capacity* to provide a default *Steady State Efficiency*. The default for Output Capacity is based on system type. If steady state efficiency and an Input Rating have been entered, the Output Capacity is calculated by “tabbing” on this empty cell.

6.0.9.3 Steady State Efficiency − Required

Enter the measured or estimated (if furnace is inoperable at time of audit) steady-state efficiency of the heating system. If *Input Rating* has been entered, the default value will be derived from it and the value of *Output Capacity*. Otherwise, the default is based on system type. This parameter affects the savings of most envelope measures and should be as accurate

as possible. It is not recommended to replace a heating system based on anything but a measured efficiency.

High Efficiency Gas: Add 3 points to the tested SSE for all Category IV units to better calculate the AFUE value to be entered in WA. Example: Tested SSE = 91.4 percent; enter 94.4 percent.

6.0.9.4 General Condition − Required

Select one of three choices to describe the current condition of the heating system. The choices are Good, Fair, Poor (but working).

6.0.9.5 Programmable Thermostat − Check box

Indicate whether the existing thermostat control allows automatic setback of the heating set point. The presence of a programmable thermostat will affect the annual consumption computed by NEAT and prevent the measure from being evaluated.

6.0.9.6 Vent Damper Present

Indicate whether the heating system flue is equipped with an automatic vent damper. Presence of an existing automatic vent damper will prevent installation of one from being evaluated.

6.0.9.7 Pilot Light Present

Indicate whether the heating system uses a pilot light.

6.0.9.8 System Retrofit Options

This entry tells NEAT about the status of the primary heating system and how it should be evaluated relating to replacement or switching fuels.

The following options are available:

- **Evaluate All** - **<u>Always Select This Option</u>** Evaluate all heating systems for replacement (standard and high efficiency). Replacement system efficiencies and costs for both standard and high-efficiency replacements will be requested in subsequent fields.

- **Evaluate None** – **Do Not Select This Option**

6.0.9.9 Replacement System AFUE

Enter the AFUE (Annual Fuel Utilization Efficiency) for the replacement unit. Entries will be required for either or both the standard and high-efficiency units, depending on the choice made for *System Retrofit Options*. The actual AFUE should be entered from agency procurement document for replacement equipment.

Note: Standard efficiency unit entries are solely because Weatherization Assistant will not execute the audit or calculate SIR values unless these boxes have data. Do not install standard efficiency heating systems as part of the WAP program.

6.0.9.10 Estimated Replacement Labor and Material Costs

Enter the labor and material costs associated with replacing the primary heating system. Default values are those specified in the *Setup Library*. Entries are displayed for either or both the standard and high-efficiency units, depending on the choice made for *System Retrofit Options*. NEAT adds the labor and material costs in computing the SIR and reporting costs. Thus, the total cost (labor plus material) may be entered in either field, with $0.00 entered for the other of the two fields, with no adverse consequences. Do not enter $0.00 in both Labor and Material Cost fields for either replacement unit. The labor and material costs should be entered from agency procurement contracts for replacement equipment.

6.0.9.11 Heat pump HSPF

If a heat pump is the primary system, the default value of 6.5 may be used.

Optional Heating System Details: Wisconsin Auditors do not use these tabs.

6.1 Fuel Switching/Conversion of Heating Systems

6.1.1 Fuel Switching/Conversion of Heating Systems Audit Procedures

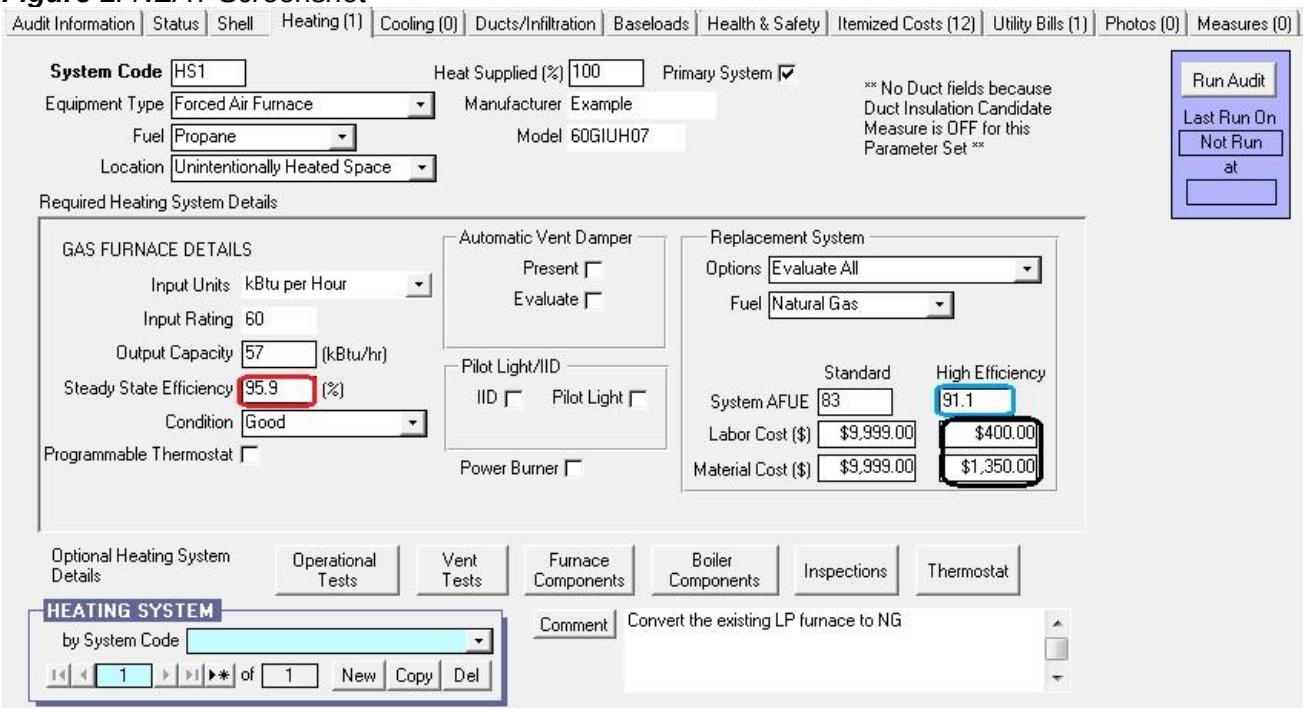
1) Model the replacement heating system in the Heating System tab as an Energy Conservation Measure (ECM). All costs associated with the heating system replacement, including emptying, disposing and/or moving existing fuel tank, shall be included in the modeled replacement costs for the evaluation of the SIR. If the gas lateral installation exceeds the maximum footage covered by the utility the cost of the additional footage can be modeled with the replacement cost. If the SIR for both the measure and the job are 1.0 or greater, then the fuel switch of primary heating system is allowed.

2) Model a water heater conversion as an ECM. Fuel switching replacement water heating systems from electric to gas, oil to gas or LP to natural gas is allowed when the total cost for fuel switching the system is modeled with the energy audit, the measure meets a minimum 1.0 SIR, and the building owner agrees to the conversion.

3) Model and replace existing oil heating system to natural gas following the policies and protocols in the Weatherization Program Manual.

4) Model conversion of existing LP heating systems to natural gas following the protocol below when the existing heating system is not to be replaced (see page 3, Figure 1):
    a. Under GAS FURNACE DETAILS (red outlined box below), enter the **actual** measured SSE (do **not** add 3%).
    b. In the Replacement System Section under High Efficiency (blue outlined box), enter the measured SSE x 0.95.
    c. In the Replacement System Section under Labor and Material Cost (**black outlined boxes**), enter **all** conversion costs including gas line and interior piping modifications. There should not be any cost in the Itemized Cost category for fuel switching; the itemized measure is for reporting purposes only.

***Figure 1**: NEAT Screenshot*



6.1.2 Electric to Fossil Fuels

1) Complete the Fuel Switch Calculator. This is located on the HE+ Website at: (http://homeenergyplus.weccusa.org/workbooksandcalculators). Actual Pre-Wx monthly electric consumption must be entered.

2) Enter savings results from the Fuel Switch calculator in NEAT audit as an Itemized Cost measure, checking "include in SIR." IF selected as cost-effective by NEAT, the conversion can be completed.

3) Enter information into the heating system tab using the replacement system if selected by NEAT. This will more accurately reflect the cost-effectiveness (usually, lower SIR) of other measures, because the heating system conversion is selected first before interaction with other possible measures.

6.2 5-24 Unit Heating Systems

Model heating systems as instructed in section 6.0 for replacement with an energy audit under the conditions listed below. The combustion efficiency of heating systems shall be measured. The annual efficiency shall be entered into the energy audit. Fuel switching replacement heating systems from oil, LP, or electric (furnace only) to natural gas is allowed when the total cost for fuel switching the system is modeled with an energy audit (or an SIR calculator) and the measure has an SIR of at least 1.0. The replacement of both primary and secondary heating systems is allowable as long as each replacement meets a minimum SIR of 1.0.

Building owners may opt to replace existing heating systems that do not meet a minimum 1.0 SIR test as a part of their contribution toward the weatherization of the building. Miscellaneous heating system repair measures that are required for the heating system to function properly shall be incorporated with the cost of the heating system replacement. The owner's contribution shall be equal to or exceed the buy-down amount to generate an SIR equal to or greater than 1.0. Note: as stated in the General Policy and Specifications, the buy-down of measures shall not result in other cost-effective measures being dropped from the improvement package. All measures that were cost-effective after the initial energy audit is conducted shall remain on the list of measures to be completed at the property.

1) Gas Heating Systems - Natural Draft: Model all gas-fired heating systems for replacement. Inspect fan-assisted systems for potential safety issues and model for replacement if safety issues cannot be repaired.

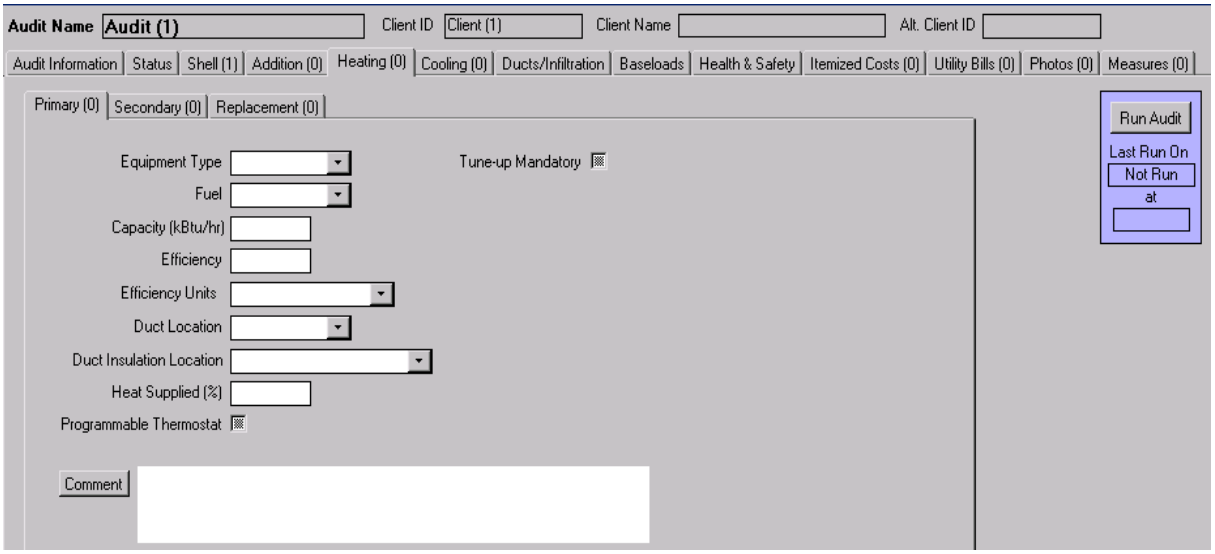
2) Gas Heating Systems - Sealed Combustion: Inspect systems for potential safety issues and model for replacement if safety issues cannot be repaired.

3) Oil Heating Systems: Model for replacement if the existing system is 10 years or greater in age. Inspect systems less than 10 years old for potential safety issues and model for replacement if safety issues cannot be repaired.

4) Space Heaters: Model for replacement if the existing space heater is 10 years or greater in age. If necessary, use the 5-24 Unit Workbook to generate savings information for multiple space heaters, incorporating the savings information and costs into NEAT's Itemized Cost section. Include all of the costs associated with the fuel switch in the replacement costs. Inspect systems less than 10 years old for potential safety issues and model for replacement if safety issues cannot be repaired.

5) Electric Furnace Conversion: Model for replacement with gas furnace with the energy audit or the Electric Heating System Conversion Calculator. Model conversion to a hydronic (boiler-driven) fan coil unit with TREAT. Include all of the costs associated with the fuel switch in the replacement costs. Inspect all units that will not be replaced for potential energy conservation measures and safety issues.

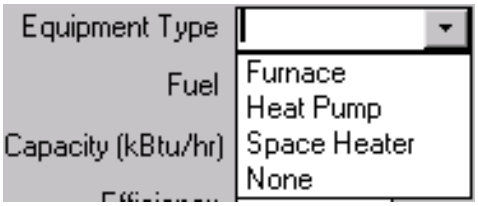
6.3 MHEA Data Entry – Heating



6.3.1 Primary Heating System

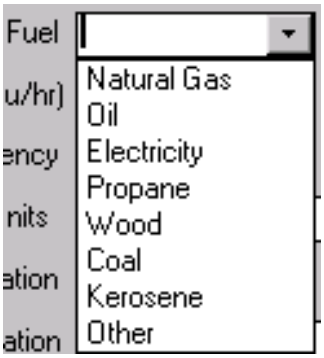
The primary system is the system that supplies the majority of the heat to the home and on which MHEA will consider installing energy efficiency measures. You must describe an existing primary heating system before MHEA will execute.

6.3.2 Equipment Type – Entry Required



Select what type of heating system in in the home. The choices are Furnace, Heat Pump, Space Heater, and None.

6.3.3 Fuel Type – Entry Required



Select the fuel type associated with the primary heating system. The choices are Natural Gas, Oil, Electricity, Propane, Wood, Coal, Kerosene, and Other. Heat pumps are automatically considered electric.

6.3.4 Capacity

Enter the rated input capacity in kBtu/h for natural gas, electric, propane, oil, kerosene furnaces and space heaters. The capacity can often be obtained directly from the nameplate of the heating system or from an inspection of nozzle sizes, etc. If this information is not available, the output capacity can be approximated or, in rare cases, measured. Enter the rated output capacity for heat pumps. Capacity input for coal and wood systems is not required.

6.3.5 Efficiency

Enter the measured heating efficiency of the primary heating system. The heating efficiency is the fraction of heat supplied to the living space by the equipment after fuel is consumed to produce the heat. Enter the SSE if tested using a combustion analyzer.

High Efficiency Gas: Add 3 points to the tested SSE for all Category IV units to better calculate the AFUE value to be entered in WA. Example: Tested SSE = 91.4 percent; enter 94.4 percent.

An electric furnace or un-vented space heater is 100% efficient as long as it is located in the living space of the manufactured home. De-rate an electric furnace located in a closet with an exterior access by as much as 10% depending on the leakiness of the closet.

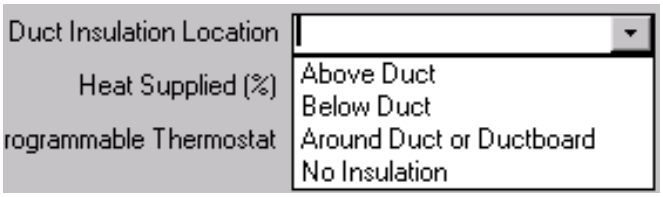
6.3.6 Heating System Efficiency Units

Select the unit of efficiency entered in the *Equipment Efficiency field*: *Steady State* will be the common selection. Coefficient of Performance (COP) and Heating Season Performance Factor (HSPF) are used in rating heat pump equipment. See glossary for definitions of the various efficiency ratings.

6.3.7 Heating Duct Location

Select the location of the main supply air duct for the heating system. The choices are Floor, Ceiling, and None. Usually, manufactured homes have a single duct that runs along the center of the home, or two ducts, each running along the length of the home and connected by a cross-over duct. Indicate if the main supply duct is located under the floor or above the ceiling. In some cases, no main supply air duct exists. Enter “none” if the supply air duct has been disconnected from the central heating system and there are no plans to reconnect it

6.3.8 Heating Duct Insulation Location



Tip: Pick “Around Duct or Duct board” if any insulation is present.

6.3.9 Percent of Total Heat Supplied (%)

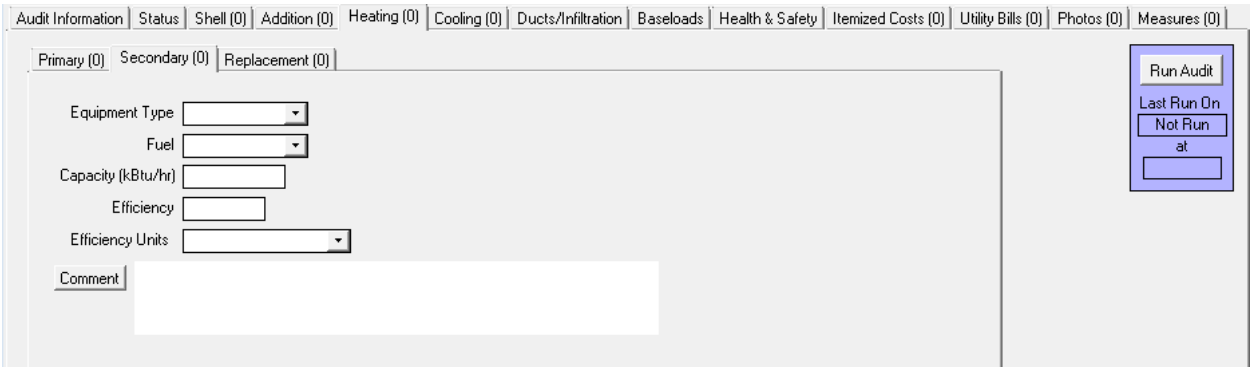
If there are two heating systems in the home, estimate the amount of heat supplied by the primary heating system. Enter this value as a percent of the total heat supplied by both heating

systems. If no entry is made, MHEA assumes that the primary system supplies 100% of the required heat.

6.3.10 Programmable Thermostat Installed?

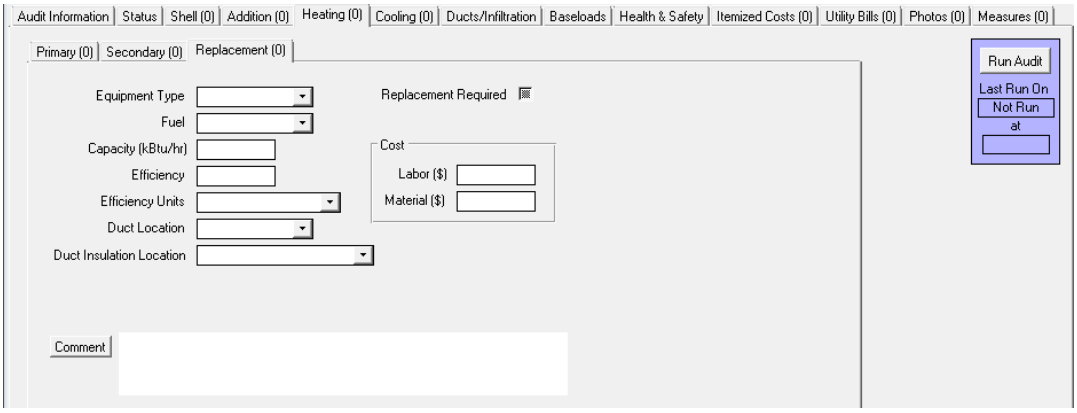
Indicate whether the thermostat is programmable. A programmable thermostat will affect the annual consumption computed by MHEA.

6.3.11 Secondary Heating System



Once data for the primary system is completed, a secondary system can be added if the primary system does not provide 100 percent of the heat. Inputs present on the *Secondary Heating Equipment* form are identical to entries on the *Primary Heating Equipment* form. Required entries include *Equipment Type*, Fuel Type, and *Capacity*. An optional *Comment* field also exists.

6.3.12 Replacement Heating System



Note: In Wisconsin, replacement information must be added for fossil fuel systems.

Click the tab labeled “Replacement” to access the *Replacement Heating Equipment* description form. The form is similar to the *Primary Heating Equipment* form. Specify the equipment to be installed if replacement is part of the retrofit package**. DO NOT** check the replacement required check box.

6.3.13 Capacity

Enter the heating system capacity in kBtu/h of the replacement heating system to be installed.

6.3.14 Heating System Efficiency Units

Select the unit of efficiency entered in the *Equipment Efficiency* field: *AFUE* should be selected. The AFUE rating that is to be entered should be obtained from agency procurement documents. *COP* and *HSPF* are used in rating heat pump equipment and are not common in Wisconsin. See the glossary for definitions of these efficiency ratings.

6.3.15 Labor and Material Costs

Enter the Labor and Material cost associated with replacing the primary heating system. MHEA adds the labor and equipment costs in computing the SIR and reporting costs. Thus, the total cost (labor plus equipment) may be entered in either field, with $0.00 entered for the other of the two fields, with no adverse consequences. Do not enter $0.00 in both Labor and Material Cost fields for either replacement unit. The labor and material costs that are to be entered should be obtained from agency procurement documents.

Chapter 7 Wisconsin Protocols and Specific Modeling Procedures

7.0 Audits

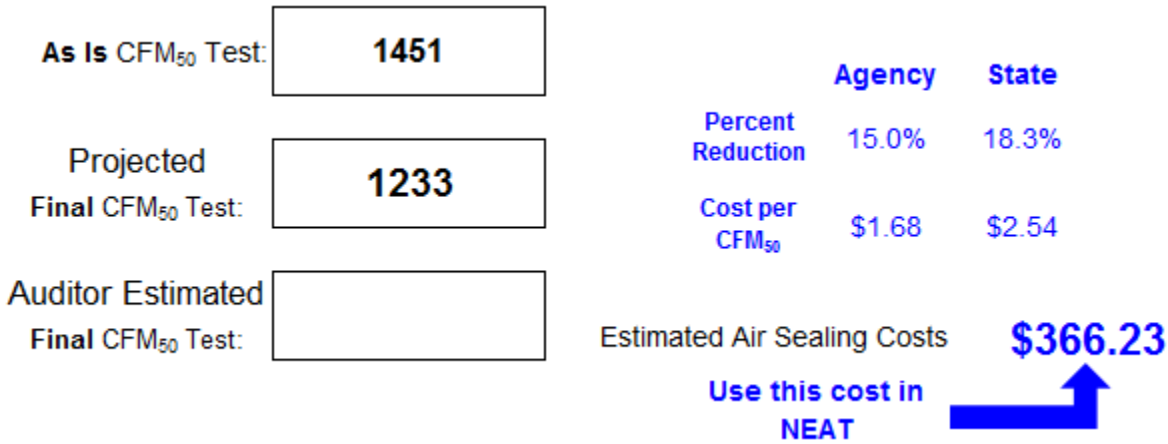
Wisconsin requires an energy audit for every unit to be weatherized, with the exception of Mobile Homes which primary heat source is Natural Gas, these homes are treated by use of the Mobile Home Measures List. Wisconsin uses the Weatherization Assistant Energy Audit software to determine what measures are completed on dwelling units.

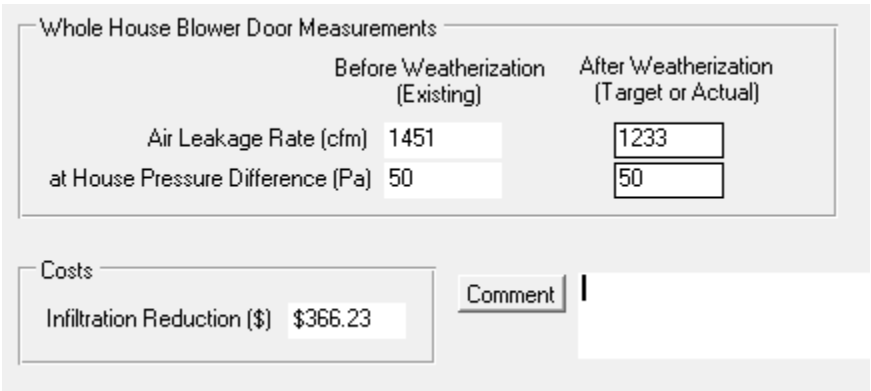
- For bulk fuel manufactured homes utilize MHEA. Exceptions: When the building has more characteristics of a site built home use NEAT. MHEA will only model one addition, so a manufactured home with multiple heated additions will require use of NEAT. A manufactured home on a full heated basement is best run in NEAT.

- For 1-4 Unit Buildings and 5-24 Unit Buildings, use NEAT.

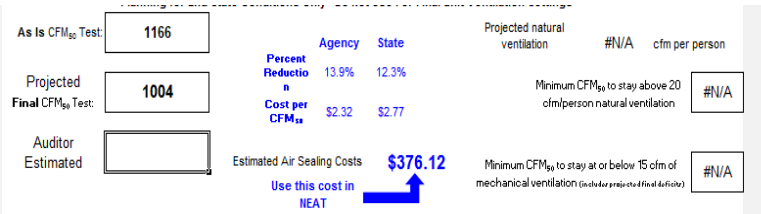
7.1 Ducts and Infiltration

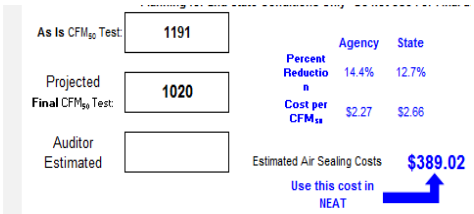
The appropriate Diagnostic Workbook has a tool to estimate air sealing results and costs. For single family, mobile homes, and 2-4 unit buildings that are blower door-tested as a single zone building and are modeled in a single audit, use the temperature adjusted auditor measured "As Is CFM_{50}" as the Before Weatherization Whole House Blower Door Measurement. Use either the Projected or the Auditor Estimated Final CFM_{50}as the After Weatherization Whole House Blower Door Measurement. All values should be taken from the modeling tab of the diagnostic workbook. Enter the calculated estimated air sealing cost for the Infiltration Reduction ($)





For 2-4 unit buildings that are blower door-tested and modeled as individual audits, use the temperature adjusted auditor measured As Is CFM_{50} as the Before Weatherization Whole House Blower Door Measurement. Use either the Projected or the Auditor Estimated Final CFM_{50}as the After Weatherization Whole House Blower Door Measurement. All values should be taken from the modeling tab of the diagnostic workbook. Enter the calculated estimated air sealing cost for the Infiltration Reduction ($). Use data from the corresponding unit in each audit.





For 2-4 unit buildings that are tested as units and are modeled in a single audit or 2-4 unit buildings that are tested as a building and are modeled in individual audits, contact the Help Desk for assistance.

If not possible to complete a blower door test on a 5-24 unit building, estimate the Before and After weatherization air leakage in the building by taking the square footage of the building surface above grade by a leakiness factor using the chart below as a guide for estimating the CFM_{50}.

Building Tightness Projections: 5+ Unit Buildings
(all measurements are CFM/square foot above grade)

		Post WX	
Building Type	**Pre-WX**	**Average**	**Very Tight**
Wood Frame		(25% Reduction)	(35% Reduction)
Average	1.00	0.75	0.66
Leaky	1.25	0.9	0.8
Very Leaky	1.5	1.1	0.9
Masonry	0.66	0.5	0.4

7.2 2-4 Unit Building: Single Audit

Create a single client record and include contact information for each unit. Enter the total number of occupants in the building.

Create a new NEAT audit and enter shell data using the entire building dimensions and insulation levels for each of the shell components. Common area, entries or hallways are

included with the dimensions as well as all doors and windows. Follow the directions in section 7.1 to enter Infiltration data.

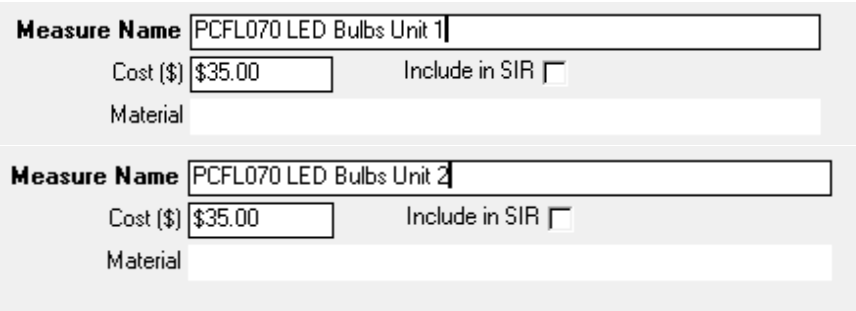
Enter details for each of the heating systems in the building, marking the first one entered as the primary. If the entire building is heated by electricity, you may combine all the systems as a single heating system. Remember to enter portable electric space heaters when present in any of the units.
Assign the appropriate % of heat supplied for each heating system (a single system would be 100%). Use fuel records when available to estimate percentages.

Tip: In an upper/lower duplex, typically the lower unit heating system supplies 60 percent of the building's space heat, and the upper supplies 40 percent.

If there is a single water heater that serves all occupants of the building, enter information in the baseload tab about the existing water heater and the replacement water heater, if considering water heater replacement as a measure. If there are multiple water heaters, do not enter any information on the baseload tab. Follow the directions in section 4.4.1.7 to enter possible replacements as itemized cost measures.

Do not enter any information on the baseload tab for refrigerators. Follow the directions in section 4.4.2.11 to enter possible replacements as itemized cost measures.

Add Itemized costs for all additional measures to be completed in the building. Select the measure from one of the *Itemized Cost* lists, and enter the actual expected cost. Remember to click new before selecting subsequent entries. When completing the same measure for more than one unit, add the unit number to the end of the measure description. Use 'copy' to add another version of the same measure.



Refer to the table in Section 4.5 to determine if selected measures are included in the SIR or not. Uncheck "Include in SIR" for health and safety items when the total cost of H&S is less than $1000 per unit ($2000 for a duplex). **DO NOT** include the exempted measures listed in Table 4.1 calculating the $1000 nor include them in the SIR.

Run the audit and proceed with the project if the cumulative SIR is ≥ 1.0 installing all ECMs selected by the audit. Water heaters and refrigerators may be selected as individual ECMs when entered as itemized costs.

7.2.1 Modeling for Multiple Heating System Replacements

If there is a single primary heating system for the building and secondary heating system(s) in unit(s) that can be eliminated with the primary replacement, follow the directions in section 6.0.8 for modeling.

If there is a primary heating system for each unit and a replacement can be considered as an ECM, run the audit multiple times. For each run, identify each unit's heating system as the primary system. After the initial audit run as described in section 7.1 is complete, identify if the heating system for unit 1 is selected as an ECM or not. If it is selected as a cost-effective ECM, write down the MBtu savings. If there is a fuel switch, write down the $ saved.

Annual Energy and Cost Savings

Index	Recommended Measure	Components	Heating (MMBtu)	Heating ($)	Cooling (kWh)	Cooling ($)	BaseLoad (kWh)	BaseLoad ($)	Total (MMBtu)
1	Infiltration Redctn		2.0	15	0	0	0	0	2.0
2	Attic Ins. R-38	attic	74.2	572	0	0	0	0	74.2
3	High Eff Furnace	Unit 1	14.0	108	0	0	0	0	14.0
4	Sillbox Ins.	basement	2.7	21	0	0	0	0	2.7

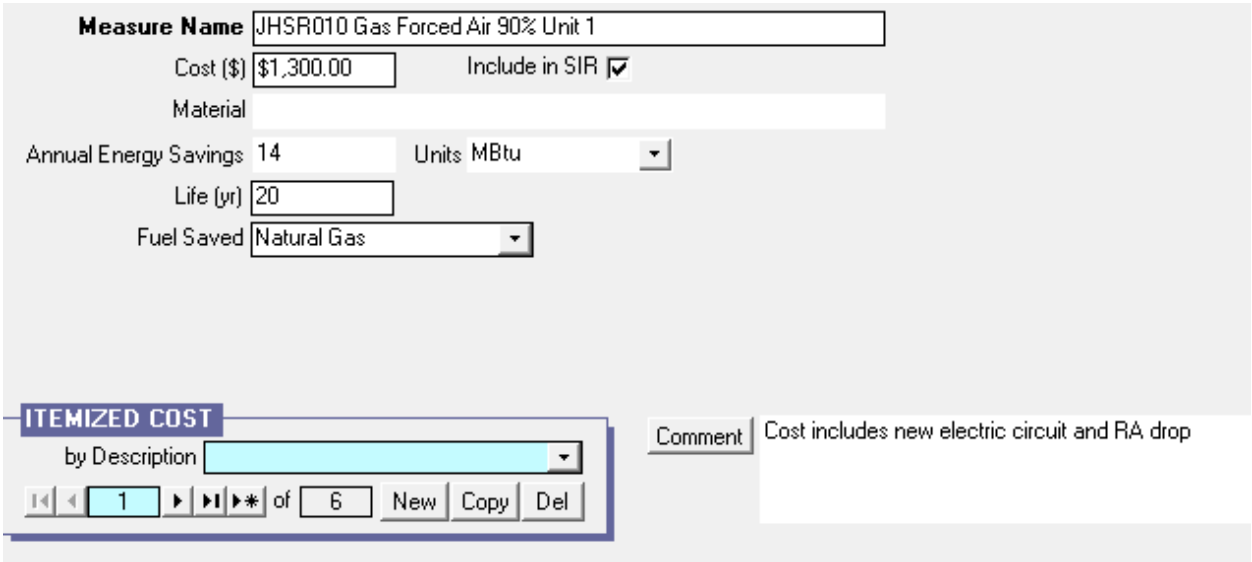
Close the Recommended Measures report and go to Unit 2 Heating System and enter a check mark to identify it as the Primary heating system. Enter the AFUE and costs for replacement. Execute the audit and review the report, noting if the heating system for unit 2 is selected as an ECM or not. If selected, write down the MBtu savings. If there is a fuel switch, write down the $ saved.

Annual Energy and Cost Savings

Index	Recommended Measure	Components	Heating (MMBtu)	Heating ($)	Cooling (kWh)	Cooling ($)	BaseLoad (kWh)	BaseLoad ($)	Total (MMBtu)
1	Infiltration Redctn		1.9	14	0	0	0	0	1.9
2	Attic Ins. R-38	attic	69.1	533	0	0	0	0	69.1
3	High Eff Furnace	Unit 2	12.6	97	0	0	0	0	12.6
4	Sillbox Ins.	basement	2.6	20	0	0	0	0	2.6

Repeat the process for unit 3 and unit 4 as needed. After all runs are completed, identify the heating system with the lowest savings (or the only one that is selected as an ECM) and check that system as the primary. If no replacements are selected, it does not matter which one is checked as primary.

For the remaining selected ECM replacements, enter each as an itemized cost measure with the savings calculated and noted above. Enter the total cost of the replacement including incidental costs.



After completion of an audit using this procedure, send a .wdz file to the Help Desk along with the Therm Calculator to confirm that the data entry and model output is accurate.

7.3 OPTIONAL: 2-4 Unit Buildings: Separate Unit Audits

There may be instances where a single audit for a building does not work well and an exception can be made to run an audit for each unit of a 2-4 unit building.

1) Create a client record for each unit in the building. Run an audit for each unit and assign sections of the building shell to each unit.
2) For a 2-story duplex, assign the foundation to the lower unit of the building and the entire attic to the upper unit. Enter shared ceiling/floor as an attic for the lower unit with an effective R value of 100 and as a floor over a conditioned foundation space for the upper unit with an R value of 38. Assign walls to each unit, upper walls with upper unit.
3) For a side by side duplex, assign attic, walls, foundation to each side. Model the shared wall between the two units in both audits with an effective R value of 38.
4) Run separate blower door test for each unit to be entered in the audit

7.4 Replacing Multiple Space Heaters with a Forced Air or Boiler System

1) Pick one space heater as the primary heating system. Add the total costs of the replacement, including distribution system, as the cost of the replacement. Enter comments to explain the work involved.

2) Add the second and all additional space heaters as secondary systems assigning each a percentage of the total heat supplied. Check box for “Eliminate with Replacement of Primary Heating System.”

3) If the primary replacement and eliminating all secondary systems does not call up as an ECM, there are two alternate paths:

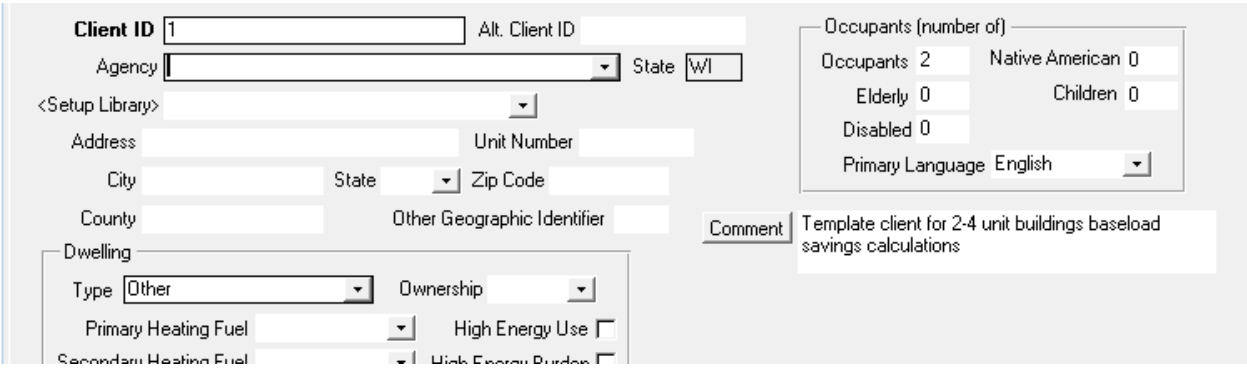
   a. The primary replacement and eliminating all secondary systems can be modeled as an H&S Furnace Replacement. The cumulative SIR must be above 1.0 in order for the installation of a new system with distribution to be completed.
   b. Model for the replacement of just the primary space heater and one of the multiple secondary space heaters, leaving the other secondary systems in place and in use. Enter a lower cost of replacement to reflect less cost for installing new distribution.

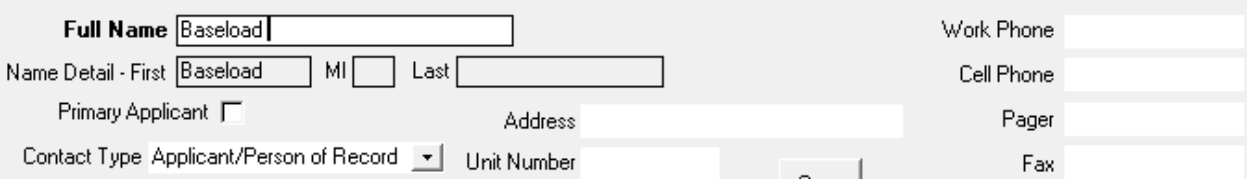
The replacement selection will default to a Standard Efficiency . Enter high efficiency numbers for the primary replacement – either forced air or boiler – and run the audit to see if the high efficiency replacement has a SIR ≥ 1.

7.5 Client Record and Audit for Baseload Savings Calculations

For 2-4 Unit Buildings, a template audit can be created to use for the sole purpose of calculating baseload savings. This may help to avoid using the incorrect number of occupants in the building audit and not having baseload data entry records.

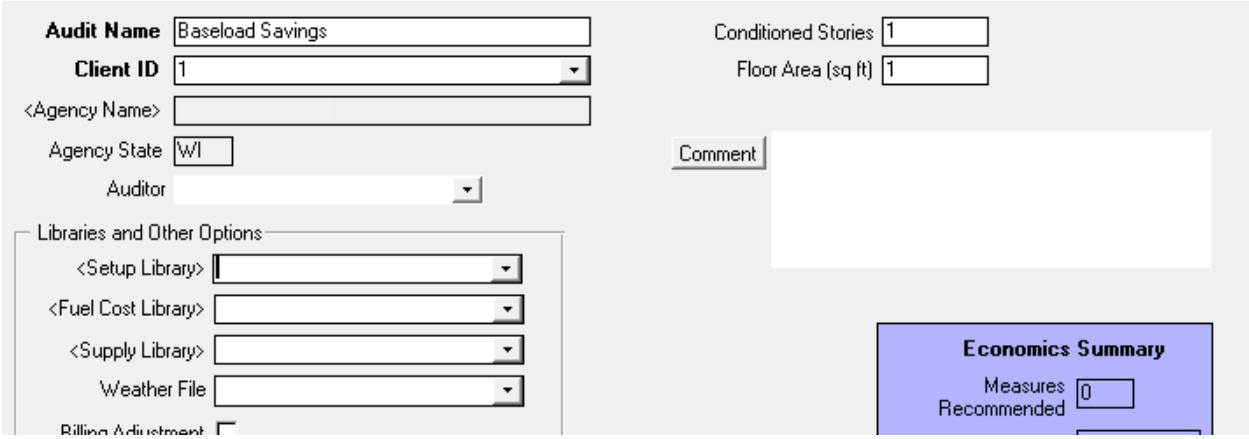
To create the audit, a client record is created that is also used to change the number of occupants for each unit. Use the number “1” as the client ID to easily find the record in the agency database. Select “other” as the type of dwelling and the most common occupant count. Add a comment to describe purpose of this “dummy” client record. The name “Baseload” can be entered as the dwelling contact for this client record.



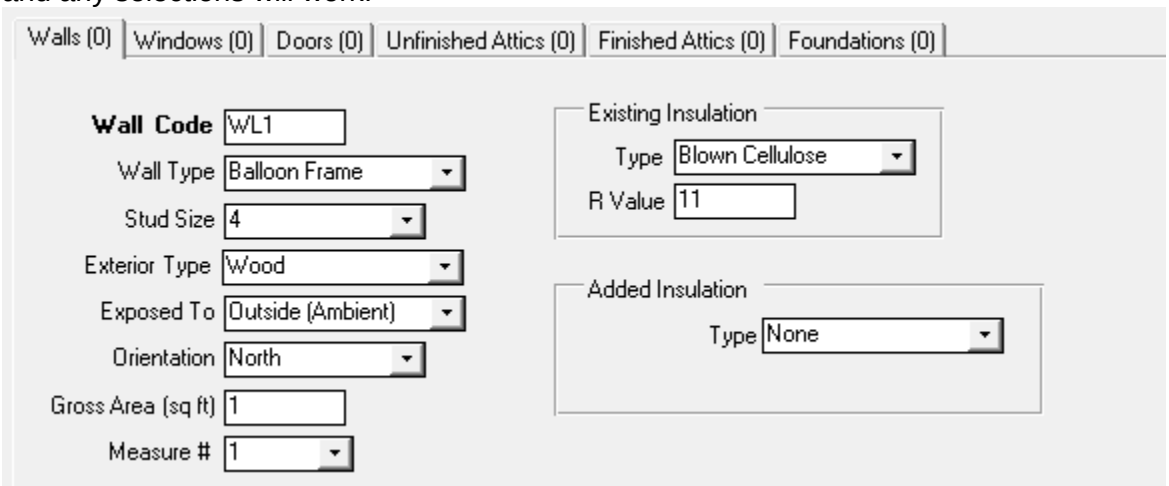


Create a new audit for this client to enter a minimal amount of data just to allow the software to execute the audit. Use Baseload Savings for the audit name and enter data in all required cells.

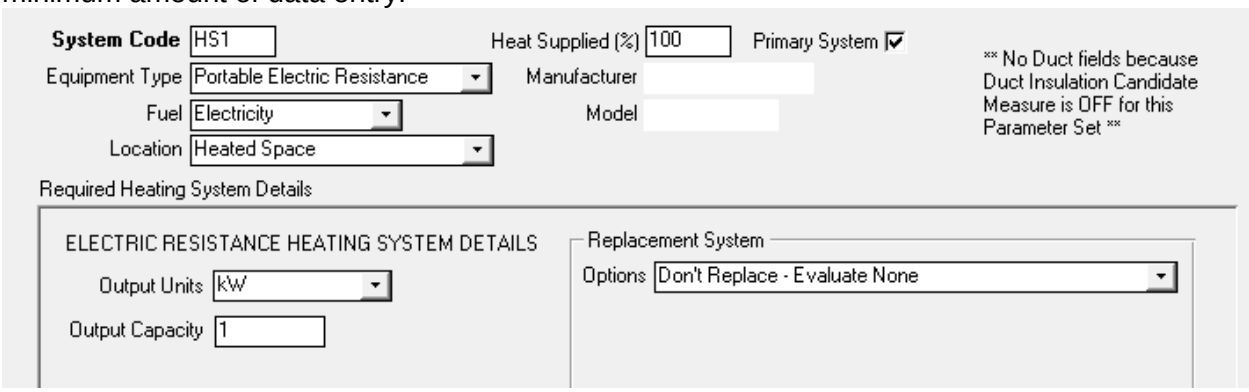
You will get errors that vales are unreasonable, just click that it is ok. Select the current year Library and Other Options.



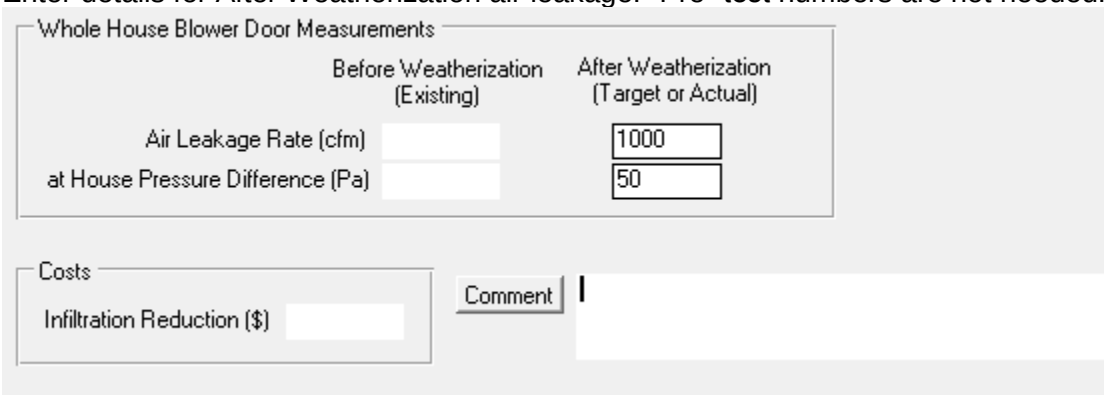
Only one wall record is required for shell information. Details about the wall are not important and any selections will work.



Enter details for a heating system. Using electric as the existing system will require the minimum amount of data entry.



Enter details for After Weatherization air leakage. “Pre” test numbers are not needed.



At this point, run the audit to verify that enough data entry has been completed for the audit to execute. The output report will have no measures. Your template is now ready to use for calculating savings of water heater and refrigerator measures.

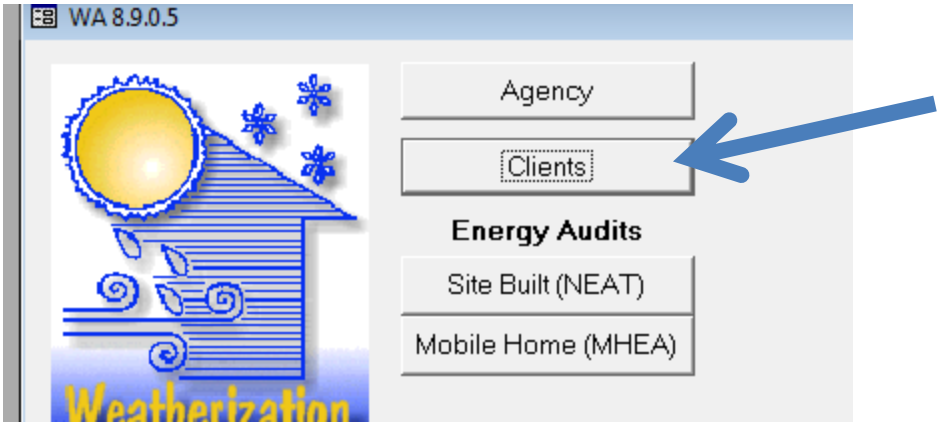
Pre/Post Retrofit Energy and Loads

	Pre Retrofit		Post Retrofit	
	Heating	Cooling	Heating	Cooling
Annual load (MBtu/yr)	5.4	0.5	5.4	0.5
Annual Energy (MBtu/yr)	5.4	0.0	5.4	0.0
Heat loss/gain (kBtu/hr)	3.5	2.0	3.5	2.0
Output required (kBtu/hr)(ton)	3.5	0.2	3.5	0.2

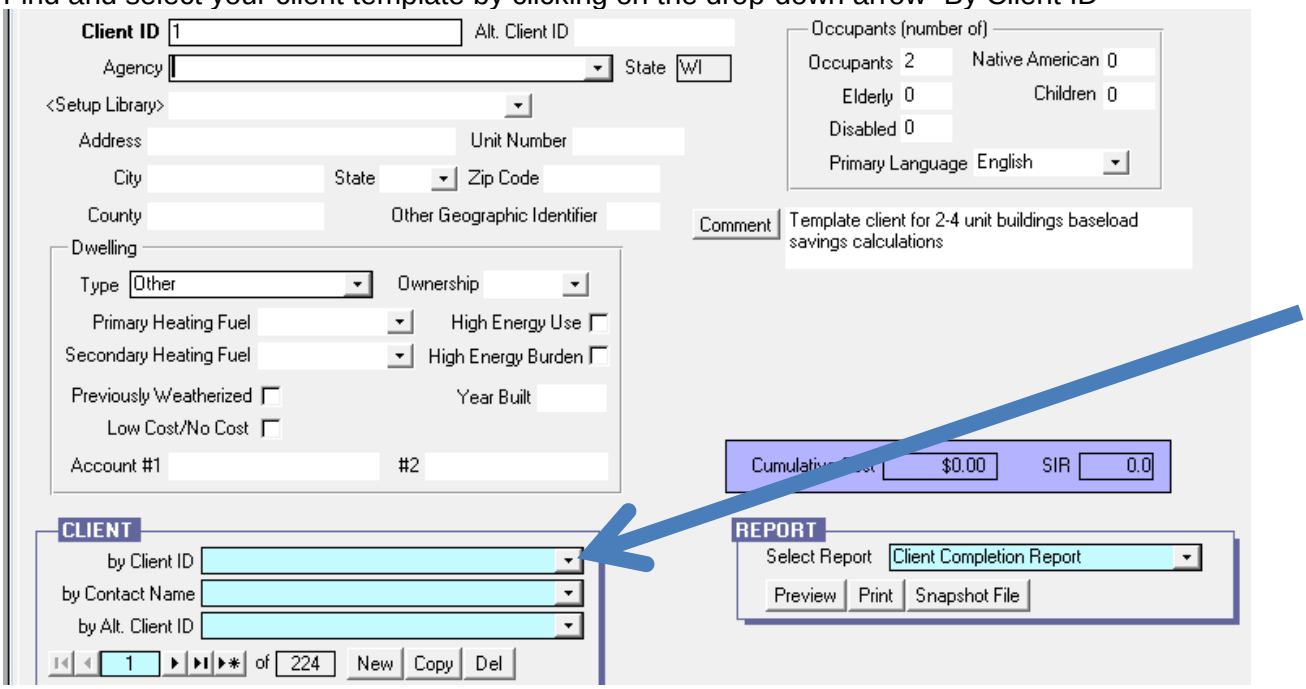
Approximate Component Contributions to Peak HEATING Load

Component Type	Component Name	Area or Volume (Inf)	Pre Retrofit Load (Btu/h)	Post Retrofit Load (BTU/h)
Wall	WL1	1	8.0	8.0
Infiltration	Inf	8	3500.2	3500.2
Total heat loss	Tot	0	3508.2	3508.2
Duct loss	Duct	0	0.0	0.0
Output required	Output	0	3508.2	3508.2

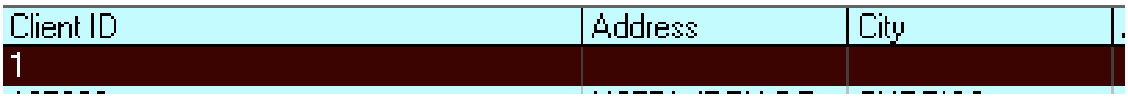
To use the baseload calculations template, open the client record and adjust the occupant count as needed. From the main screen, open “Clients” not “Site Built (NEAT).”



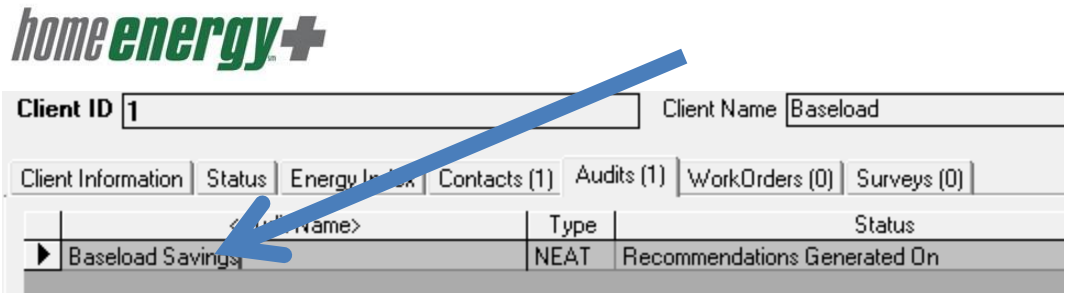
Find and select your client template by clicking on the drop-down arrow “By Client ID”



If you identified it as Client 1, it will appear at the top of the list that pops up.



Go to the audit tab, and open the template audit by double-clicking on the audit name.



Follow directions as described in sections 4.4.1.7 and 4.4.2.11 to determine the savings for baseload replacements. Record savings results to enter as itemized costs measures in the building audit that you are going to complete.

To edit the occupant count, close the audit and open the "client information" tab. After editing the occupant count, open the audit again and edit baseload measures as needed.

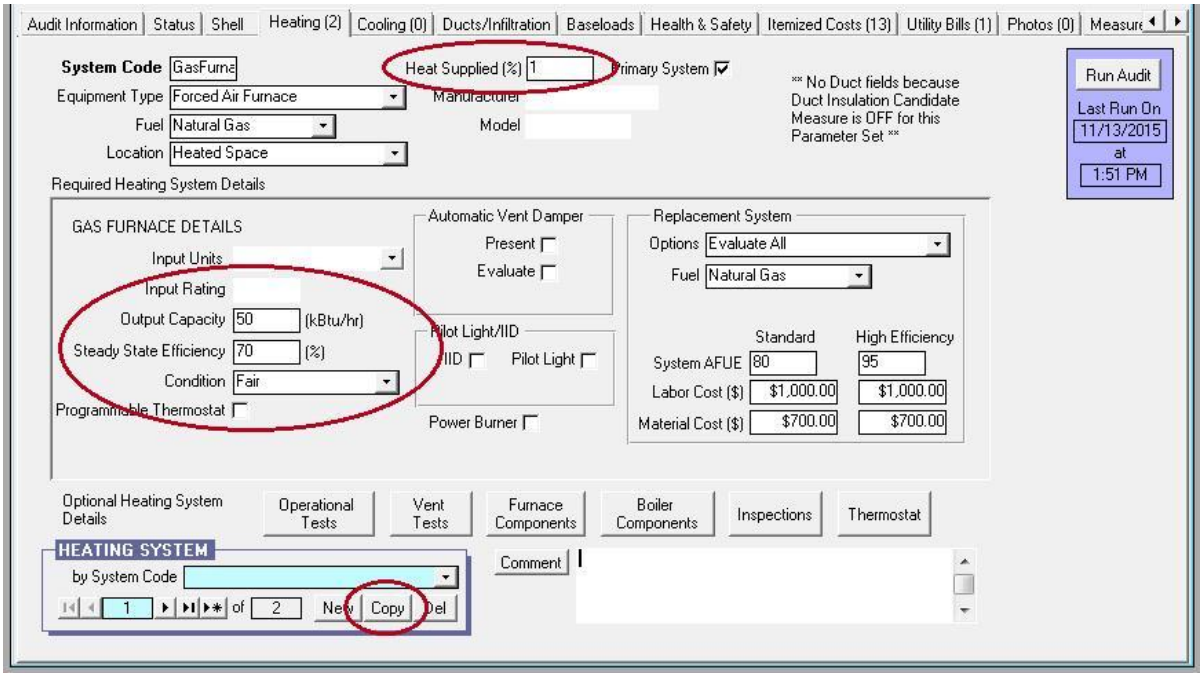
TIP: Save the most common replacement refrigerator and water heater in the audit template.

TIP: Save the details and results for the more common replacements to use in future audits.

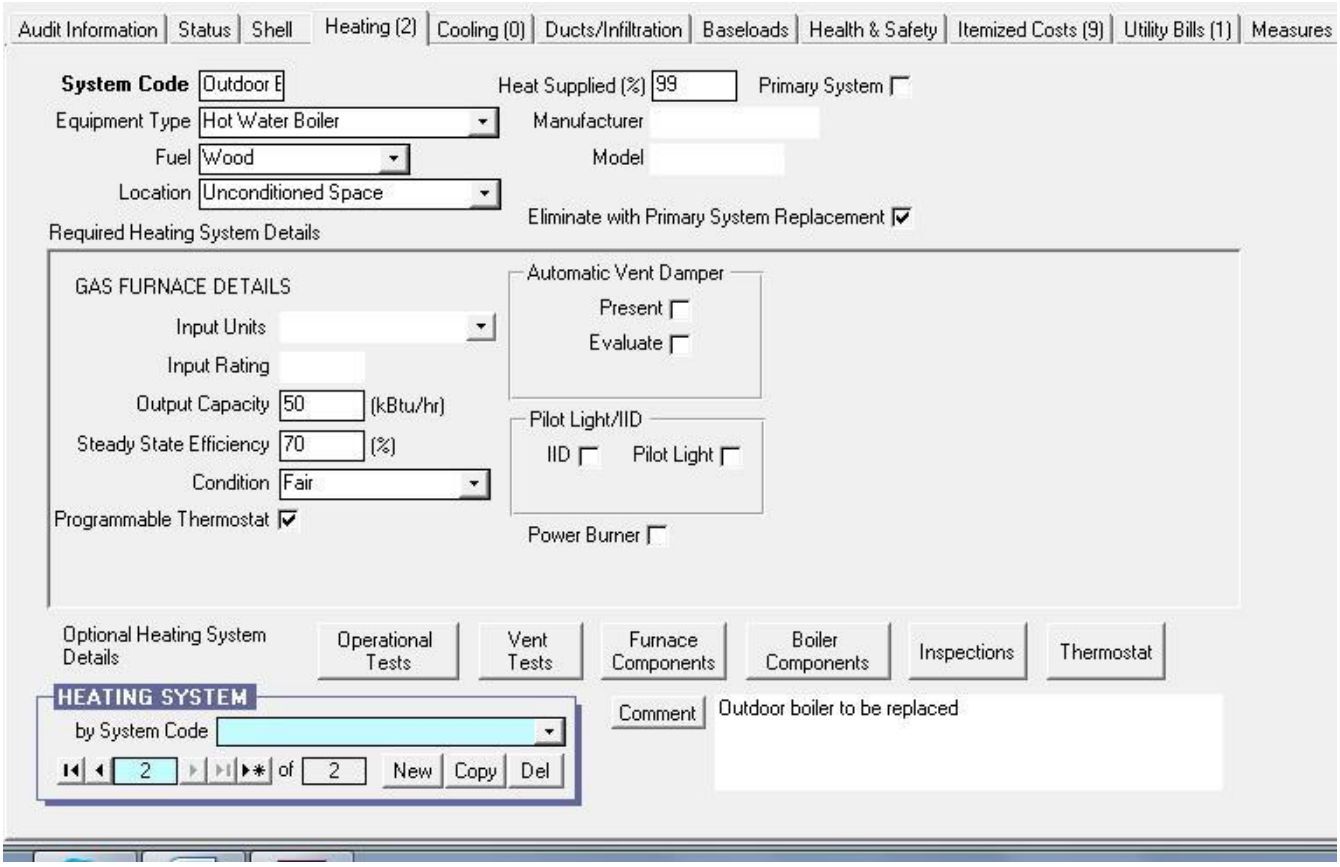
7.6 Modeling Conversion from Wood, Coal or Other to Gas

NEAT will not model for the replacement of a primary heating system fueled by wood or coal with anything but another system using the same fuel. So, it is not possible to directly model replacement of a primary wood furnace with a propane or natural gas furnace. However, NEAT will analyze the savings from eliminating a *secondary* system fired by wood, coal or other fuels. Work around this limitation by modeling the proposed replacement system as if it were an existing primary system, but supplying only one percent of the space heating load. Then model the existing wood, coal or other unit as a "secondary" system that is supplying 99 percent of the space heating load. This allows modeling replacement of both units with a single propane or natural gas heating system. Note: WI has assigned the "other" fuel category to be associated with wood pellets.

1. <u>Model the intended replacement system as the primary system,</u> with the following differences:
    a) *Heat Supplied (%):* Enter "1". (This effectively treats the system as a placeholder.)
    b) *Steady State Efficiency (%)*: Enter the estimated SSE for the existing wood, coal or other system.
    c) *Input Units/Rating, Output Capacity, Condition*: Enter the specs from the existing wood, coal or other system.
2. In the Replacement System section, enter the estimated cost and AFUE for the proposed replacement.



3. Model the existing wood, coal or other system as if it were an existing secondary system. To do this, copy the primary system by clicking the Copy button at the lower left of the 'Heating' tab. Then, make these changes:
    a) *System Code:* Rename the system to identify its actual type
    b) *Fuel:* Select "Wood", "Coal" or "Other".
    c) *Heat Supplied (%):* Enter "99". This models the home with the wood, coal or other system providing essentially all the heat, using default costs for wood as the space heating fuel.
4. *Primary System:* Uncheck the box. (Unchecking the box triggers the appearance of the *Eliminate with Primary System Replacement* check-box.)
5. *Eliminate with Primary System Replacement:* Check this box.
6. *Equipment Type, Location:* Choose options that best describe the existing wood, coal or "other" system.



7. When the audit executes, NEAT will evaluate the home as if the propane or natural gas replacement system is being installed into a home that is essentially heated 100% with the fuel you are trying to eliminate.

Chapter 8 Reports

8.0 Input Reports

The Weatherization Assistant will produce a report for both NEAT and MHEA showing the input information entered into NEAT or MHEA by the auditor. This can be used as a resource for auditors and quality assurance if they want to check their entries for accuracy.

8.1 Output Reports – Recommended Measures

The Weatherization Assistant software produces an output report for both NEAT and MHEA that lists measures recommended as a result of the auditor's input. The output report can be run as many times as needed, if inputs need to be updated or changed.

In the *Energy Saving Measure Economics* section, measures will be listed in the following order:

1) Health and Safety Measures > $1,000 (are to be included in SIR). This contributes to the cumulative cost, but no savings are related to the measures.

2) Repair Measures (all are to be included in SIR). Again, no savings are related to these measures.

3) Forced Energy Conservation Measures (ECMs) − For example, required water heater replacements.

4) All other ECMs in descending order of their SIR.

5) All other ECMs selected as itemized costs.

6) Health and Safety measures <$1,000 in Itemized costs. These measures do not contribute to cumulative savings or cost so have no impact on the cumulative SIR. They are listed with an SIR = 0.0 and cumulative SIR = 0.0.

Users will need to look above the Health and Safety Items < $1000 to get the real cumulative SIR for the job.

The Recommended Measures must be installed using the selected R-Value and/or materials as appropriate.

For 5-24 Unit Buildings

1) Building owner contributions may be used to the cover the cost (or portion of the cost) of any weatherization measure allowed by the State of Wisconsin that does not meet a minimum 1.0 SIR test as a part of their contribution toward the weatherization of the building, under the following conditions:

a. The owner's contribution shall be equal to or exceed the buy-down amount needed to generate an SIR greater than or equal to 1.0.
b. The owner's contribution shall be at least 15 percent of the total cost of measures performed when the heat is master-metered.
c. The buy-down of measures shall not result in other cost-effective measures being dropped from the improvement package. All measures that were cost-effective after the initial energy audit is conducted shall remain on the list of measures to be completed at the property.
d. The cumulative SIR of the building's measures package shall be greater than or equal to 1.0.
e. There shall be documentation in the building/customer file of the energy audit, including measures that will be completed which have an initial SIR of less than 1.0.

8.2 Output Report - Energy Saving Measure Economics

Recommended measures are listed in the order selected by the Weatherization Assistant software. In Wisconsin, all measures that appear in the *Energy Saving Measure Economics* section of the output report with a cumulative Savings to Investment Ratio (SIR) equal to or greater than one (≥1) must be included on the work order. ECM measures with a Measure SIR<1 cannot be included on the work order (Infiltration Reduction is an exception to this).

The *Energy Saving Measure Economics* portion of the output report estimates the savings dollars per year of each measure selected, as well as the cumulative savings per year of all measures. Energy Saving Measure Economics (Adjusted)-Required unless exceptions met.

Whenever possible, the energy audit should be based on actual utility bills. (See Section 4.6). When utility bills are available, the values reported for "Energy Saving Measure Economics (Adjusted)" are those used to evaluate the job and select measures to be installed.

Energy Saving Measure Economics (Adjusted)

Index	Recommended Measure	Components	Measure Savings ($/yr)	Measure Cost ($)	Measure SIR	Cumulative Cost ($)	Cumulative SIR
1	Infiltration Redctn		74	1000	0.7	1000	0.7
2	DWH Replacement		412	1300	3.9	2300	2.5
3	Fill Ceiling Cavity	FA4	32	165	3.3	2465	2.6
4	High Eff Furnace	HS1	156	1385	1.9	3850	2.3
5	Attic Ins. R-38	FA2	16	221	1.3	4072	2.3
6	Attic Ins. R-30	FA1	73	1034	1.2	5105	2.1

Use this section (page 2 of the Output Report) if billing/ utility data is entered. It will appear on the *Recommended Measures* report only when utility costs are entered into the audit. In most audits, entering the utility usage will alter the recommended measures list as shown above.

Chapter 9 WisWAP Reporting

See Appendix B of the Weatherization Program Manual for guidance on reporting measures in WisWAP. The Manual is available on the Home Energy Plus WisWAP Grantee Information page under the heading Weatherization Program Manual.

9.1 Reporting 2-4 Unit Buildings in WisWAP

When one WA audit is run on a 2-4 unit building, some measures that are bundled together in the audit will need to be reported separately in the WisWAP jobs associated to the units.

The following measures shall be invoiced in a common area. The intent of reporting in a common area rather than a unit is to capture any costs and associated savings that would be shared by the residents and not direct-billed by the utility to the household occupying the unit. After job completion, the total measure cost will be split evenly between units for reporting (e.g., Average Unit Cost).

- ABD045 Air Sealing
    - If multiple blower door tests are run in the building (e.g., one in each unit) add the results together and enter the total As Is CFM50 Test and CFM50 Reduction amounts in the common WisWAP measure. If multiple tests were done enter the number (“3 tests”) in the comment field.
- Heating System Repair/Replacement, if one system is serving all units in building
    - If each unit has its own furnace or heating system multiple measures should be created (one for each unit)
- Water Heater Repair/Replacement, if one heater is serving all units in building
    - If each unit has its own water heater multiple measures should be created (one for each unit)
- Lighting measures installed in hallways or exterior of hallways that are on a shared meter
- Shell measures completed on a shared hallway or entrance
- Insulation measures only if the square footage is not easily divisible between units
- Windows, repairs (including doors) or health and safety measures completed in common areas

All other measures should be invoiced to the unit in which they were installed. Itemized cost measures installed in more than one unit may be bundled in NEAT, but will be split between units in WisWAP. For example, in a three-unit building where one audit was run on the whole building and two local exhaust fans are being installed in units 1 and 2:

- In NEAT, the auditor enters one itemized cost measure with the total estimated cost for both fan installations. A comment is recommended noting the two units that will receive fans.
- In WisWAP two measures are created, one for each unit where a fan is installed.

Appendix A: Glossary

AFUE (Annual Fuel Utilization Efficiency) − A measurement of the seasonal energy efficiency of fossil fuel heating equipment. It is the annual output energy of the equipment divided by its annual input energy, expressed in consistent units (i.e. Btu-out per Btu-in) as a percentage. AFUE includes input energy required by the pilot light but does not include electrical energy for fans or pumps.

Audit − The process of identifying energy conservation opportunities in houses. As used here, NEAT/MHEA audit means a computer selection technique which optimizes the Saving-to-Investment Ratio of selected energy conservation measures.

Auditor − A person who performs an energy audit.

Balance point − For heating, the balance point is the outside temperature above which no heating is needed. For cooling, the balance point is the outside temperature below which no cooling is needed.

Band joist − A horizontal framing member resting on top of a framed wall that separates stories in a building.

Baseload − The energy required to operate the domestic hot water heater, lights, cooking, clothes washing, and other household appliances that are used throughout the year.

Base temperature − Base temperature is the outdoor temperature below which heating or above which cooling systems are used. Assume a base temperature of 65°F for heating degree-days (HDD's) and 78°F for cooling degree-days (CDD's), unless a different base temperature is listed on the utility bill.

Belly − The underside of a manufactured home consisting of a rodent barrier, floor trusses, and insulation.

Bowstring − Wood roof trusses in the shape of a bow which support the weight of the roof in a mobile home.

British thermal unit (Btu) − The quantity of heat required to raise one pound of water one degree Fahrenheit.

Buffered − A wall which is protected by an unconditioned, attached enclosure − like a garage or an enclosed porch.

Building description − Information used to describe the house to NEAT.

CCF − One hundred cubic feet (usually natural gas)

CCM − Cubic centimeter per minute. Refers to fluid flow.

Ceiling joist − The horizontal wood framing member that holds up the ceiling (see outer ceiling joist).

CFM − Cubic feet per minute.

Collar beam − A horizontal piece of lumber that ties the rafters together near the peak of the roof, and forms the ceiling for a section of finished attic.

Combustion tester − A device used to analyze the steady − state efficiency of combustion heating units.

Component − A segment of a building normally described by a single line within the NEAT building description data input, having sufficiently uniform construction and orientation to be considered as a single unit (for example, a portion of a house's exterior walls facing the same direction with similar construction and retrofit potential).

Conditioned − Intentionally heated or cooled areas of the home.

Cooling degree day (CDD) − During a 24 hour period, each degree that the average daily temperature is above the base temperature (usually 78°F) constitutes one cooling degree day unit.

COP (Coefficient of Performance) − A measurement of the instantaneous efficiency of heating or cooling equipment. It represents the steady-state rate of energy output of the equipment divided by the steady-state rate of energy input to the equipment.

Cost effective − Having an acceptable Savings−to−Investment Ratio

Crawl space- A type of basement in which one cannot stand up: the height may be as little as a foot, and the surface is often soil. Crawl spaces often provide access to pipes, substructures and other areas that may be difficult to access otherwise. A crawlspace cannot be used as living space, but can be used as storage

Datasheet view − A format of data entry similar to a spreadsheet. All field for a given item of required information from all records of a given component type are in the same column in the spreadsheet. Horizontal scrolling may be necessary to view all data items associated with a given record.

Draft diverter − A device located in exhaust pipes, used to prevent outside air from flowing into the pipe.

Electric Damper − See "vent damper"

ECM – Energy Conservation Measure

Energy Consumption − Energy consumption is the energy used by the occupants of a home. This energy is either electricity supplied by a utility or by fuel that is burned in the home (i.e., natural gas, wood, etc.). It includes energy consumed to heat and cool homes, cook, heat water, power lights, and other uses.

Energy cost escalation rate − The energy cost escalation rate is the federal government's best guess of how much energy costs will increase above the rate of inflation from one year to another.

Energy efficiency ratio (EER) − A measurement of energy efficiency for room air conditioners. The EER is computed by dividing cooling capacity − measured in British Thermal Units per hour (Btu/h) − by the watts of power used. This is a steady − state efficiency.

Envelope − The physical boundary of a building (i.e., wall roof) which encloses the interior space.

Exposed − In the context of NEAT/MHEA "exposed," means that a building component is in direct contact with the outside air.

Flame Retention Head Oil Burner (FRHOB) − A modern, improved efficiency oil burner that burns the oil more completely through enhanced mixing of the oil particles with air.

Floor joist − The framing members (often 2 x 8 lumber) which support the floor.

Form view − A format of data entry which allows edits to be seen and made to the information for a particular record. Data entry controls may be arranged or grouped in ways that contribute to your understanding of the information requested.

Form − In NEAT/MHEA, a computer screen containing information entered by the user describing a particular component of a house, such as a wall or furnace.

Heating Degree Day (HDD) − During a 24 hour period, each degree that the average daily temperature is below the base temperature (usually 65°F) constitutes one heating degree day unit.

HSPF (Heating Season Performance Factor) − A measurement of the seasonal efficiency of an electric heat pump using a standard heating load and outdoor climate profile over a standard heating season. It represents the total seasonal heating output in Btu's divided by the total seasonal electric power input in watt-hours (Wh). Units are Btu/Wh. Typical values range from 5.0 to 10.0.

Infiltration − Air leakage in or out of a building under natural conditions rather than under artificial pressurization by a blower door.

Input rating − A theoretical rate of a fuel's available energy a furnace, boiler or space heater is capable of receiving (kBtu/hour, gal/hour, lb. /hour, ccm).

Interior shading devices − Interior shading devices are interior window coverings that prevent sunlight from entering a manufactured home. Drapes are heavy curtains that hang in loose folds over the window. Blinds or shades are lightweight window coverings that hang flat over the window. Both venetian blinds and roller shades are in this category.

Intermittent ignition device (IID) − A device that automatically ignites the gas burner on a gas heater only when the thermostat calls for heat, thus saving the energy that a continuous pilot light consumes.

Job Identifier − A string of 50 or less typed characters entered on the *General Information* screen that uniquely identifies a building description (house) to users and the computer. It may include symbols and spaces.

Joist − A horizontal, wooden framing member supporting a floor or ceiling.

Kilowatt – hour (kWh) − A unit of energy (usually in reference to electricity).

Knee wall − A short wall that separates the unconditioned part of a finished attic from the conditioned part. The knee wall borders the floor and sloping ceiling.

Low E window − A multi−pane window with a metalized coating on one of the interior surfaces. Low E windows save energy during the winter by reflecting heat rays originating in the house back indoors. During the summer, low E windows reflect solar heat outdoors. Low E windows have a higher R-value than standard windows.

Manufactured home − A manufactured home is constructed in a factory and has a permanent chassis as part of the frame so that it can be moved. Manufactured homes are constructed either as one unit (usually less than 20 feet wide) or as two long units (each unit is usually less than 20 feet wide) that are attached at the center after the two parts have been moved separately to the site the home will occupy.

Measure number − Measure numbers group together building parts which will have the same energy treatment. Assign the same measure number to a group of components of the same type, which should be considered together when determining the SIR for retrofitting the components.

Measures − Energy conservation projects under consideration for a house.

MHEA − Acronym for Manufactured Home Energy Audit.

NEAT − Acronym for National Energy Audit Tool.

Outer ceiling joist − The portion of the ceiling joist extending from knee wall to roof rafter.

Output capacity − The rate of actual heat delivered by the heating device after flue losses and combustion inefficiencies are considered (in kBtu/h).

Pascal − A unit of pressure (kilogram−per−square meter).

Retention head − See "flame retention head oil burner" (FRHOB).

Retrofit − The process of improving the efficiency of a system, such as adding insulation to the walls of a house.

Rim joist − A horizontal framing member resting on top of the foundation

Roof rafter − A sloping wooden framing member supporting the roof.

Savings − to − investment ratio (SIR) − A ratio of the lifetime savings−to−initial investment. The SIR calculates the "present value" of dollars advised by an energy conservation measure, by adjusting the future savings to reflect energy cost escalation rates and discount rates. A SIR indicates that the investment will pay for itself over the lifetime of the measure. A SIR greater than one indicates an earlier recovery of initial investment.

SEER − Acronym for Seasonal Energy Efficiency Ratio.

Setup − Accessed by selecting "Setup" on NEAT's introduction screen. "Setup" contains material cost data, fuel prices, key parameters and weather data.

Sheathing − The rigid exterior covering over wall studs in the exterior walls of wood−frame houses. Plywood and asphalt−impregnated fiberboard are common sheathing materials.

Sill box − The area bounded on three sides by the rim joist, sill plate and sole plate.

Slab−on−grade − A concrete foundation resting on a surface even with level ground.

Steady State Efficiency − This is the instantaneous useful output of the heating system (disregarding any losses in the distribution system) divided by the input power. The value is expressed as a percentage.

Stud − A vertical framing member that is the structure of the wall of a wood frame home.

Therm − A unit of energy. One therm equals 29.3 kilowatt−hours.

Unconditioned space − An area within the house's envelope which is not intentionally heated or cooled.

Vent damper − A device that conserves energy by closing part or the entire flue when a heater is not burning fuel. Vent dampers prevent heated air from escaping up the flue while the heater is not operating.

Ventilated wall − A manufactured home wall which has space for airflow between the exterior and interior wall materials. The insulation in a ventilated wall will often be excessively dirty.

Wall code − The letter/number system used to identify each exterior wall on the floor plan. Analogous codes exist for windows, doors, attics, subspaces and air conditioners.

Window frame − The sides, tip, and sill of the window which forms a box around all the window components.

Window sash − The part of the window that surrounds and supports the glass.