# EA-QUIP

**E**nergy **A**udit using **Qu**eens **I**nformation **P**ackage

# USER MANUAL

## EA-QUIP ONLINE

Manual Version 2.0
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# 1. Introduction

## 1.1. General Description

**E**nergy **A**udit using **Qu**eens **I**nformation **P**ackage (**EA-Quip**) is a Web-based User-friendly program which analyzes energy use and energy conservation opportunities in multi-family residential buildings. EA-Quip couples the state-of-the-art automated generation of retrofits with interactive data entry and reporting screens.

## 1.2. References

The first version of **EA-Quip** (Dos version) was an adaptation from the Computerized, Instrumented, Residential Audit (CIRA). The original calculation engine of EA-Quip, was preserved and converted to Visual Basic 6.0 and MS-Access database. It has since been converted to work in a web-based format.

## 1.3. Overview

EA-Quip allows the User to describe a building using a list of questions with default answers and permits the User to enter supplementary parameters. Based on the data entries and parameters, EA-Quip calculates annual loads and energy consumption of the building in its current conditions, identifies applicable retrofits, their cost for each component and their effect on building load, internal gain, and other factors. EA-Quip estimates the savings from each retrofit and adjusts the savings to fit energy consumption and produces work scope with interaction between generated retrofits. Interest and inflation rates are incorporated in the calculations.

## 1.4. Input Screens and Parameters

EA-Quip is designed to facilitate the process of entering the appropriate building data into the computer.

Upon creating a new building, a User will have the option of entering the building information as well as energy parameters. The 14 components at the right of the screen are used as follows:

1. **Bldg Info:** allows input of general building information, such as building address, Owner, contact numbers, etc.

2. **Fuel Data:** to enter heating fuel information, such as the schedule of fuel delivery, units, city and heating reference temperature. The Fuel Data screen calculates Billing Summary and Actual Yearly Usage based on available data. Total Usage, Monthly Base and Heating Degree Days calculated on the Fuel

Data screen are transferred as defaults to appropriate fields onto the Economic and Fuel Data Entry Screen, which can be overwritten. Fuel Data can be entered directly in the grid or can be imported in bulk via an Excel .CSV spreadsheet using the CSV Import button on the Fuel Data page. Fuel Data can be exported to an Excel .CSV spreadsheet via CSV Export functionality.

The rest of the sections (Gen, Infil, Econ/Fuel, etc) facilitate for viewing and maintaining information about 12 building components. Each of the components data entry screens present a set of "default" answers for a typical building, so the User is required to enter only specific information that distinguishes the particular building. The User can access Help files by pointing and clicking on the Help section in the upper right-hand section of the screen. User has access to typical value ranges and default values by pointing to the entry box. Sub-components of multi-component entries can be dynamically added and removed.

Information on Data Entry screens can either be typed in or selected from list boxes. EA-Quip provides dynamic defaults -- questions/answers that depend on the answers to one or more of the previous questions.

## 1.5. Calculation Engine

EA-Quip is able to recommend the most desirable energy-saving combination of retrofits. This is accomplished in two stages: the selection of retrofits and their economic optimization.

EA-Quip scans an extensive list of retrofit options, comparing their respective costs and figures of thermal merit. EA-Quip considers only those items appropriate to the structure in question, whether or not they are cost-effective; for example, cellulose insulation will only appear as an option if the User has noted that the building has cavity walls. It will not be listed as an option for solid masonry walls. Sliding storms is only an option for double-hung windows, not for casement windows, etc.

The energy savings it would generate if taken alone rates each applicable retrofit. Only the retrofits with individual savings-to-investment ratio (S.I.R) above 0.1 are selected.

**EA-Quip fully analyzes the effects due to the interaction between multiple retrofits**. The software sorts the retrofits in increasing order based on the most cost-effective retrofits that will generate the greatest first-year paybacks. EA-Quip calculates the energy consumption generated by the first retrofit on the list. Each remaining retrofit on the list is re-rated by calculating a new savings-to-cost ratio given the savings generated by the previous retrofits. The final retrofit list (system recommended retrofits) is sorted in decreasing order of S.I.Rs. Retrofits with an S.I.R rating higher than 1.0, based on the interactive features, appear in bold in the investment analysis report.

## 1.6. Reports

The resulting data from EA-Quip calculations can be viewed and printed. Each report can be printed by clicking File → Print in your browser. Each report can also be exported in MS-Word format.

EA-Quip generates the following printable reports that can be accessed via the Reports menu option:

1. Building Information – summarizes the data entered on Building Information data entry screen.
2. Building Data – summarizes the data entered for each component on the data entry screens.
3. Energy Analysis of Existing Conditions – summarizes existing conditions of the building.
4. Energy Saving report - presents a retrofit list with individual savings percentages.
5. Savings And Cost Analysis - presents building energy factor and a retrofit list with individual first year savings and associated investment costs.
6. Investment Analysis - displays retrofits sorted by decreasing savings to investment ration (S.I.R.).
7. Building Modeling - presents the building current usage model for each month of the year. The building modeling table is accessible by the reports section or directly by clicking the "Building Modeling" section of your toolbar. The Building Modeling Chart can be generated by clicking the "Display Chart" button on the bottom of the Building Modeling Report (this can only be done in the Building Modeling screen accessed via the toolbar).
8. Scope Of Work - presents a list of system-generated retrofits with an option to narrow down the retrofit selection based on the User's choices. A report can be generated based on both User-selected retrofits and system recommended retrofits. EA-Quip recalculates measurements based on User selection.
9. WAP Scope Of Work - allows the User to generate a scope of work in a format developed specifically for the Weatherization Assistance Program. Each of the retrofits must be assigned to a Category, may be given an alternate description, and a comment. A User may add custom descriptions, assign them to a category and enter Estimated Cost and First Year Savings. A report can be generated combining System and User measure descriptions.
10. Retrofit Costs – summarizes retrofit costs used for the analysis. Retrofit costs are saved and unique to each building.

11. Auto Check Report – provides QC overview to ensure that data entered and calculated is within typical ranges. Provides the User with an opportunity to verify inputs and make comments for any fields which might be outside of the typical parameters.

## 1.7. Help

EA-Quip provides on-screen Help. The Help section can be accessed by clicking the Help button on the upper right-hand side of your screen.

## 1.8. Features

Among the features of EA-Quip data entry screens are:

- User-friendliness: EA-Quip does the work by asking about building specifications; User simply answers the questions displayed on screen with very few computations required.
- Helpfulness: User is presented with a "default" set of answers for a typical building, so User has to enter only the specific information that distinguishes the particular building.
- Multiple Choice: User does not need to remember the possible answers; clicking on down arrow displays a list of options in multiple-choice style.

Distinctive Features:

- The required questions are presented in bold typeface; the "default-able" questions are shown in regular typeface.
- Two types of input questions are used in the EA-Quip data entry screens: multiple choice and numerical data questions. Quantitative answer fields are equipped with appropriate boundaries applicable to the specific question and can be viewed by holding the pointer over the answer area.
- EA-Quip issues a warning if supplied answers fall outside of suggested ranges.
- EA-Quip also uses questions that appear or disappear as a result of a piece of information from a previous question.

Additional Information:

- Comments can be added to every component or sub-component.
- A warning is issued if the data entry screen is left without saving the data first.

## 1.9. Opening EA-Quip Application

1. Log-in to the URL www.ea-quip.com.
2. Enter user ID and password as provided in your registration email.
3. You can change your password once you login in the Edit Profile section.

# 2. Starting a Project

## 2.1 Building Components

EA-Quip uses 12 components to describe a building: General, Infiltration, Economics & Fuel, Heating System, Control & Distribution, Appliances, Lighting, Walls, Windows, Doors, Roof and Base. A button for every component, along with buttons for Building Info and Fuel data, are located at the right of your screen and can also be access by selecting "Single Entry Components" and "Multiple Entry Components".

The menu item on the right of your screen will go from black to grey and will change from Yes to No if data for that component has been saved, providing a quick view on completed components. A newly created audit has all buttons as bold black and will say No.

## 2.2 Retrofit Costs

Retrofit Costs can be accessed via the Retrofit Costs link on your toolbar.

Retrofit Costs screen consists of a drop-down box containing Building Components and table with Retrofit Description, Existing Conditions, Units, Fixed Cost and Cost per Unit, and the Expected Service Life of the Measure.

To view/change Retrofit Costs for a Component, select Component from a drop down box. Retrofit Costs table will be populated with Retrofit information for that component. User may edit only the Cost columns by entering directly into cells. Cost Per Unit and/or Total Installed Cost can be entered for each retrofit. Double-click on the Cost Per Unit cell and enter Labor Cost and Material Cost separately to come-up with Cost Per Unit.

Every component retrofit cost and service life can be edited. Modified information is saved per building.

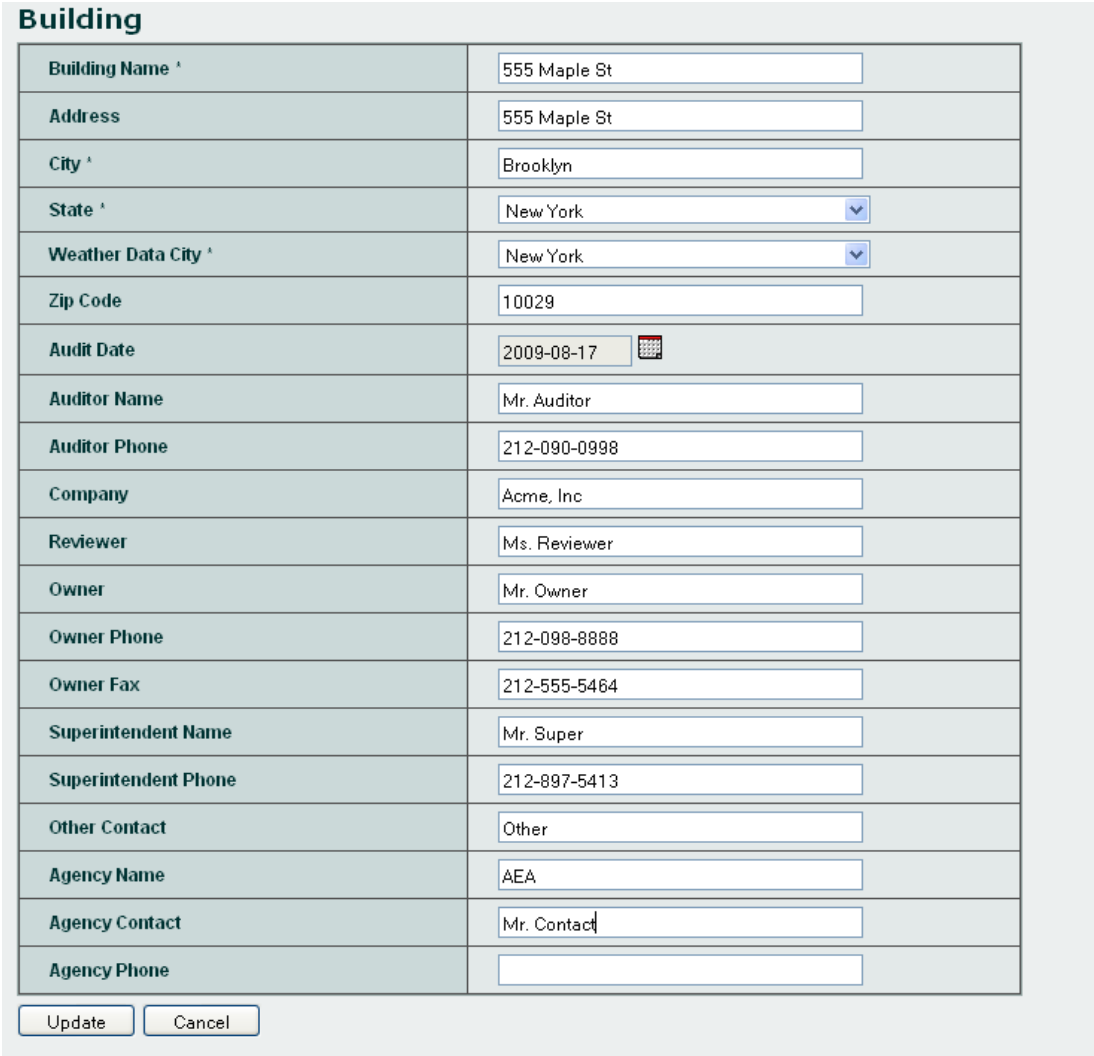
Retrofits costs are inherited from the default retrofit cost set by your organization.

## 2.3 Data Entry Screens

EA-Quip is designed to facilitate the process of entering the appropriate building data into the computer in an intuitive and User-friendly fashion.

### 2.3.1 Building Information

Building Information screen facilitates the entry of information regarding auditing firm, building's Owner, Superintendent and Agency.




**Address, City, State, Zip Code** is the building address.

**Weather Data City**: The city for which historical and current weather data is selected. Choose the weather data city nearest to your building's location. The weather data city must reside within the same state as the building.

**Audit Date** is the date the field visit was performed.

**Auditor** is the person conducting the audit. Enter first and last name of the person.

**Company** is the name of the auditing firm.

**Owner, Owner Phone, Owner Fax** is for entering first and last name of the building's Owner, Owner's phone and fax numbers.

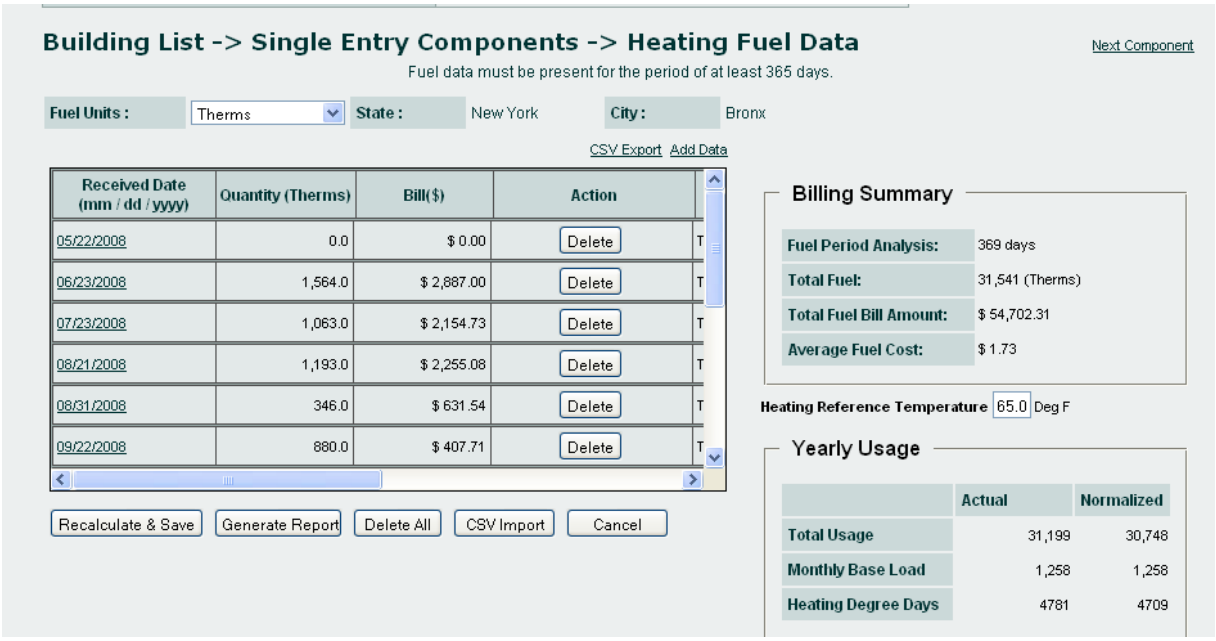
**Super, Super Phone** is for entering first and last name of the building's Super and Super's phone number.

**Agency Name, Agency Number and Agency Contact** are spaces that allow the User to enter the name of the agency and contract information for which the audit is performed.

The following fields are required: Building Name, City, State, and Weather Data City

## 2.3.2 Fuel Data

Heating Fuel Data facilitates the entry of heating fuel information, such as the schedule of fuel delivery, fuel units, state, city and heating reference temperature. Fuel Data screen calculates Billing Summary and Actual Yearly Usage based on the available data Total Usage, Monthly Base and Heating Degree Days, which are calculated on the Fuel Data screen and are transferred as defaults to appropriate fields onto Economic and Fuel Data Entry Screen, however, they can be overwritten. Fuel Data can be entered directly in the grid or can be imported in bulk via an Excel .CSV spreadsheet using the CSV Import button on the Fuel Data page. Fuel Data can be exported to an Excel .CSV spreadsheet via CSV Export link.



## Import/Export to/from Excel

Fuel Data can be imported via an Excel .CSV file.

To import data from Excel:

1. Click on CSV Import.
2. Locate the file to import from.

To export EA-Quip data to Excel:

1. Click on CSV Export link.
2. The data will be transferred onto an Excel .CSV spreadsheet.

Excel format for Fuel Data:

- No title row
- 1st column - Date (MM/DD/YYYY)
- 2nd column - Fuel Quantity (first value must be 0, no commas)
- 3rd column - Bill Amount (first value must be 0, no commas or $ signs)

| | | |
|---|---|---|
| 07/13/2000 | 0 | 0 |
| 08/15/2000 | 1289 | 430 |
| 09/17/2000 | 1134 | 402 |

*Notes:*

*>Make sure to save Excel file as a .CSV (comma delimited) file before importing.*

*>Ensure there are no commas in the data*

*>Ensure there is at least 365 days worth of data*

To enter fuel delivery schedule into the grid, type in the delivery date in the first column, quantity in the second column, and cost in the third column of the grid. First date's quantity and amount should be zeros. The dates are arranged in increasing chronological order after the fuel data is saved. The grid may be edited

by typing directly into the cells. Rows may be added/deleted by using Add/Delete buttons. By clicking Add Data, an empty row is added to the end of the spreadsheet. Delete command deletes highlighted row. Date must be entered in a date format mm/dd/yyyy.

To import fuel data schedule, click .CSV Import, locate the spreadsheet and click OK. The imported data will override the entries on the screen. It is recommended to save fuel delivery records in a spreadsheet by using .CSV Import. Export function can also be used to share fuel data schedule between computers or email to another person.

**Heating Reference Temperature** is 65 Deg F by default and may be overwritten.

**Billing Summary** presents a summary of fuel data for the entire period entered by the User.

**Fuel Period Analysis** is the total number of days entered in the grid.

**Total Fuel** is the total fuel quantity entered in the grid.

**Total Bill Amount is** the total amount entered in the grid**.**

**Average Fuel Cost** is the total bill amount divided by fuel data analysis period. Average Fuel Cost is automatically copied to Fuel Cost on Economic & Fuel screen when the recalculate/save button is clicked.

**Yearly Usage** interprets fuel data on a yearly basis.

**Total Usage** is computed for 365 days based on the total period analysis.

**Monthly Base Load** is calculated using regression analysis and variable base degree-day method.

**Actual Usage** interprets baseload and heating load with recorded Heating Degree Day.

**Normalized Usage** computes heating load based on 30-year average Heating Degree Day for the selected city.

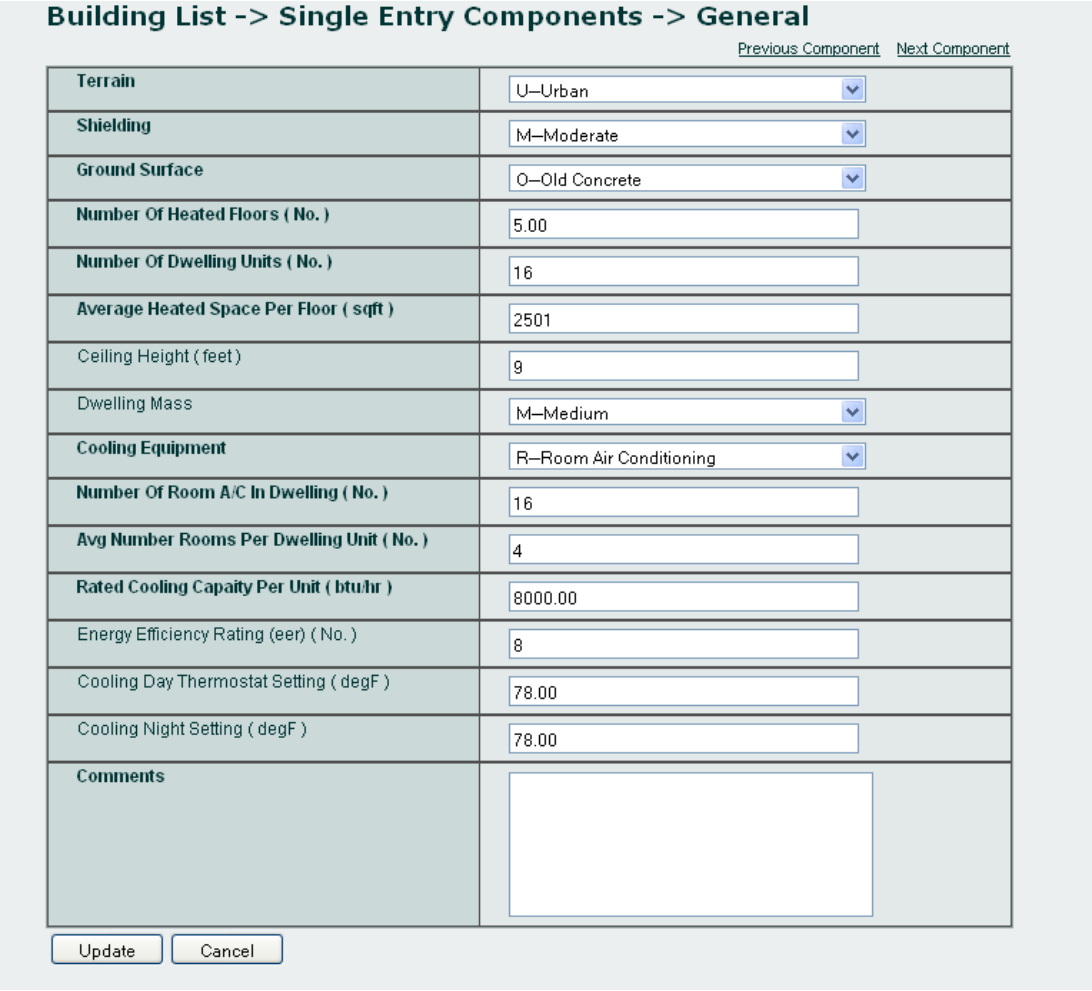
**Heating Degree Days** is the sum of difference between **Heating Reference Temperature** and daily-recorded temperature for each day of the fuel data schedule.

**Total Usage, Monthly Base Load, Heating Degree Days, and Average fuel cost** are automatically copied to corresponding Economic & Fuel screen upon pressing Save/Recalculate. These values are default values.

To create Fuel Data report that can be printed or exported into html/txt format, click **Generate Report**.

## 2.3.3 General

Click on the Gen button on the right of the screen.




**Terrain** describes the size and occurrence of obstructions found within three miles of the building. Answer is used to adjust the standard values for air infiltration to fit the location.

Available choices:

D Center of large city
W Ocean or other body of water with at least 3 miles of unrestricted expanse
O Flat terrain with some isolated obstacles (e.g., buildings or trees well separated from each other)
S Rural areas with low buildings & trees
U Urban, industrial or forest areas

**Shielding** describes by how much a building is shielded by objects in the immediate vicinity (within a few building heights). Answer is used to adjust the standard values for air infiltration to fit building location.

Available choices:

N No obstructions or local shielding whatsoever
L Light local shielding with few obstructions (e.g. a few trees, or a small shed)
M Moderate local shielding, some obstructions within two building heights (e.g. a thick hedge or a solid fence, or one neighboring building)
H Heavy shielding, obstructions around most of perimeter (e.g. buildings or trees within 30ft in most directions; typical suburban shielding)
V Very heavy shielding, large obstructions surrounding perimeter within 2 building heights.

**Ground Surface** is used to calculate the value for Ground Reflectance, that is, how much of the sunlight that strikes the ground around the building is bounced back toward the windows and walls.

**Number Of Heated Floors** is the number of living spaces from the level of the exterior grade to the top. This data is used to calculate the infiltration caused by stack effect.

**Number Of Building Units** is the number of apartments or separate living units in the building. It is used in several calculations for reporting matters.

**Average Heated Space Per Floor** is the area of one floor of the typical heated (or cooled) living space in the building. For instance, a building with three 1000-sqft apartments on each floor would have an **Average Heated Space Per Floor** of 3 x 1000 = 3000 sq ft. Public spaces in apartment buildings should be included only if they are heated.

**Ceiling height** is the floor-to-ceiling height for the typical living space in the building. This is necessary in order to calculate both the volume of the building and the infiltration rate for the building.

**Dwelling Mass** is related to the weight of the building that can store heat. The greater the mass, the more sluggishly the building behaves, i.e. the longer it takes for the building to heat up or cool down.

Available choices:

Heavy Concrete structures with massive walls
Medium Light concrete structures or concrete structures where masonry is shielded by paneling or rugs

Light Wood-frame construction.

**Cooling Equipment:** usually one central unit, or room air conditioners or a heat pump. In forced air installations, the cooling coil is in the air stream near the fan, and the compressor is in a separate box outdoors. Select one type of cooling equipment.

**Number of Room AC unit in dwelling:** enter the total number of room AC units in the building. This option will be unavailable if the User has previously entered that there is no cooling equipment for the building.

**Average number of rooms per dwelling unit:** Compute the total number of rooms: living rooms, bedrooms, kitchens but not bathrooms in the building. Enter this value divided by the number of apartments in the entry box.

**Rated Cooling Capacity Per Unit:** the amount of heat (both sensible and latent) that an air conditioner can remove from the building per hour at ARI rated conditions. If Room AC units are selected as cooling equipment, enter the average Rated Cooling Capacity per unit **and not** the total building Cooling Capacity. The total capacity is generally listed on a label on the air conditioner either in Btu/h (Btu per hour), M Btu/h (thousands of Btu's per hour) or tons (one ton = 12,000 Btu/h). For an evaporative cooler, the **Rated Cooling Capacity Per Unit** is the electrical input for which the cooler is rated. It should be on the nameplate, or use the default.

**Energy Efficiency Ratio (EER):** the ratio of output capacity in Btu's per hour and INPUT energy in watts. Sometimes, the label will give the Coefficient of Performance, or COP. To obtain the EER, multiply the COP by 3.414. There is no available field measurement for the EER. Take label information or use the default.

**Cooling Day/Night Thermostat Setting:** the cooling season average temperature set on the dial. Day and night settings can be different. If you turn the cooling off at night, enter the highest permitted temperature as the night setting.

### 2.3.4 Infiltration

Click on the Infil button on the bottom of the screen.

**Infiltration Measured:** the type of infiltration measurement, if any. If a Minneapolis blower door was used, choosing Blower Door measurement will allow entering the measurements from the blower door and computing the flow through the blower door. If the "effective leakage area" or the air changes per hour were measured or estimated, they can be entered directly.

If Blower door measurement for the type of infiltration measurement is selected and Minneapolis blower door is used, User may enter the type of blower door (Model 2 or Model 3), whether the tests were pressurization or depressurization tests, and the inside and outside temperatures at the time of the tests. User may also enter whether a low-flow plate for a Model 2 door, or low-flow rings in the case of the Model 3 door, were in place and, if so, which holes or rings were used.

User may then enter the number of the test (1, 2, 3, etc.) and the house pressure and fan pressure for each one. Each time the resulting airflow is computed and shown, this data is stored for subsequent display and calculation.
These results are used to provide the infiltration level, which EA-Quip assumes in starting its retrofit calculations.

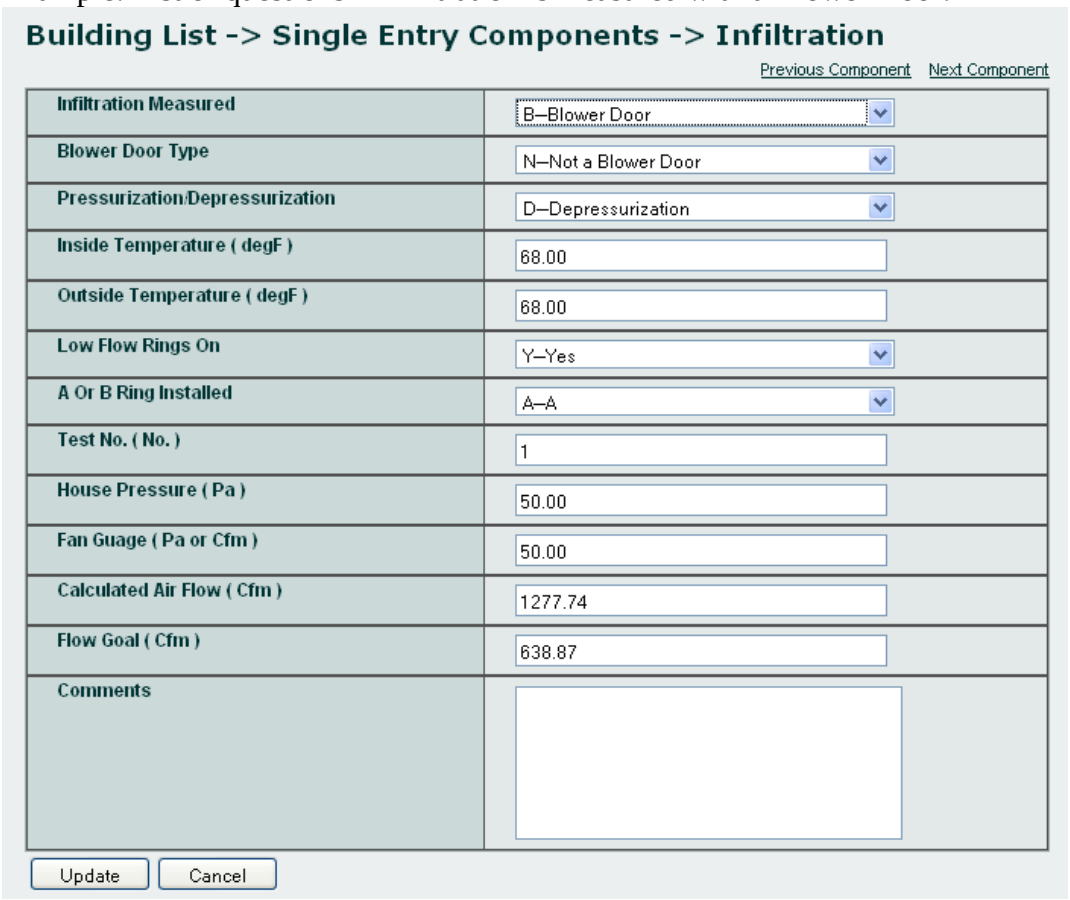
**Mechanical Ventilation:** means any fans that provide ventilation (in addition to naturally occurring air infiltration) to the heated portions of the building. Included are kitchen fans, whole-house fans or regular fresh-air systems with special air intakes and/or exhausts. Enter the monthly average number of cubic feet per minute of air brought into the house by the fans (a 200 cfm kitchen fan that is used only once a month can be neglected).

**Exhaust** (air taken out of the house) and **Supply** (air brought into the house) rates can be different, and so can **Summer** and **Winter** rates. If the system only supplies intake air and relies on cracks or vents for exhaust, enter only the **Supply** flow rate and enter zero for the **Exhaust** flow rate. The opposite applies for **Exhaust** systems.

**Measured Total Leakage Area:** the sum of roof leakage that occurs through the roof, floor leakage that occurs through the floor into an unheated basement or crawlspace, and wall leakage that occurs through the walls, windows, and doors. Measured Total Leakage Area is usually measured using a blower door. If it is entered here, it should be entered as an effective Leakage Area, the form

developed at Lawrence Berkeley Laboratory (LBL). Leakage Area of a building is roughly the area of a single hole that would let air leak through at the same rate as it does through all the leaks in your building. Leakage Area can be measured with a blower door: air is blown into the house using a fan sealed in a door or a window, and the rate at which the air flows into the house is measured at several pressure differences. These flow and pressure measurements are put into a formula, which gives the leakage area of the building. If your infiltration is estimated rather than measured, air changes per hour should be used, which is easier to estimate without a measuring device such as a blower door.

Example: List of questions if Infiltration is measured with a Blower Door:

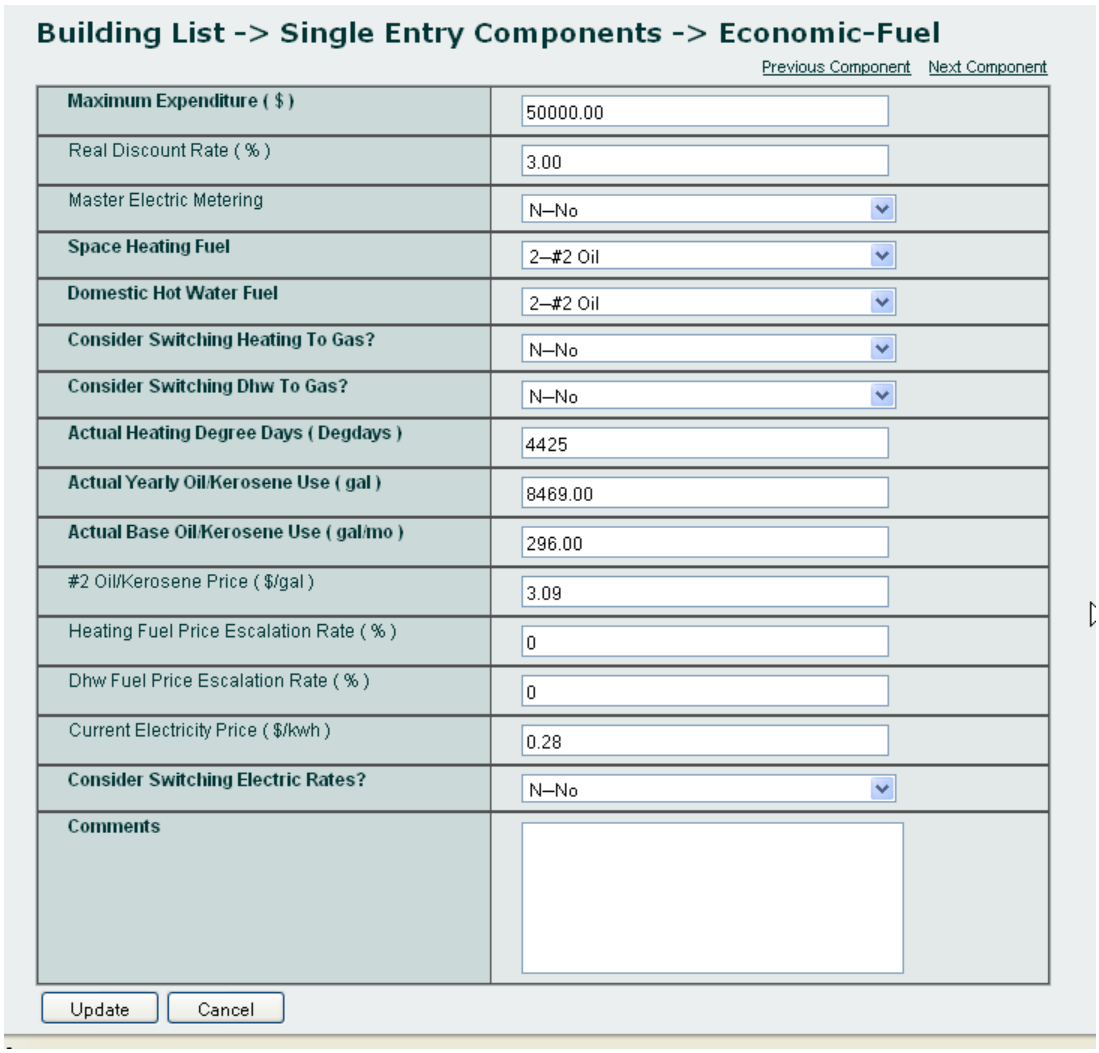



**Estimated air change per hour:** the average volume of air that escapes the building in an hour.

**Infiltration not measured:** EA-Quip will estimate an air change per hour infiltration ration based on the building envelope parameters and description (i.e. "large amount of leakage" on the roof).

## 2.3.5 Economics and Fuel

Click on Econ/Fuel on the bottom of the screen.




**Maximum Expenditure:** a reference number that is used for reporting purposes only. Under Weatherization Assistance Program for instance, it could be the maximum available budget for the building expenses.

**Real Discount Rate:** the cost of money to the owner, adjusted for inflation. In other words, it is the after-tax interest rate the homeowner has to pay to borrow money (e.g. home improvement loan), after correcting for inflation. It is also the after-tax return, corrected for inflation, of the best alternative investment available to the home Owner. Making a house energy-efficient usually means paying money up front and

let the savings accrue over time. A low Real Discount Rate means that you are willing to accept a steady stream of savings for a number of years, or that you think the investment is a safe one. A high Real Discount Rate means you want your savings very soon, or that you think the investment is a risky one. The default is 3%.

Formula:

$$\text{Real Discount Rate} = \frac{\text{After Tax Interest Rate - Inflation Rate}}{\text{1 + Inflation Rate}}$$

Example:

| Inflation Rate | After Tax Interest Rate | Real Discount Rate |
|---|---|---|
| 5% | 10% | 4.76% |
| 10% | 15% | 4.55% |

**Master electric metering:** enter "Yes" if the total building electric usage is metered under one single meter (master meter). Enter "No" if each apartment is individually metered.

**Energy prices and Escalation Rates** must be entered in dollars per unit fuel (e.g. $/Therm for natural gas). Escalation Rates are the expected future increases in fuel prices adjusted for inflation:

Formula:

$$\text{Real Escalation Rates} = \frac{\text{Rate of Price Increase - Inflation Rate}}{\text{1 + Inflation Rate}}$$

**Space heating Fuel:** Select the primary heating fuel from the list by pressing the down arrow.

**Domestic Hot Water Fuel:** Select the primary DHW fuel from the list by pressing the down arrow.

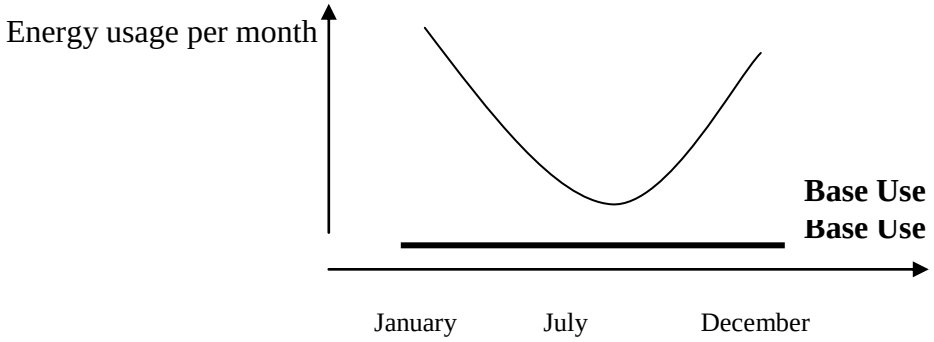
**Fuel Switching:** Providing space heat with gas may be cheaper than providing it with oil or electricity. If User considers switching to gas, EA-Quip will report the expected savings from this change.

**Cost Of Fuel Switching:** the cost to purchase and install necessary equipment to accomplish this change. This investment cost should be the sum of fuel switching cost for heating and for Domestic Hot Water.

**Actual Heating Degree Days:** Fuel consumption for space heating is generally proportional to the number of "degree-days" during the heating season. For any one day, the number of heating degree-days is the difference between 65 deg.F (the conventional "base" temperature) and the average temperature for the day. The number of actual heating degree-days is the total of these daily degree-days for the entire season **without weather normalization.** EA-Quip generates automatically this field based on results provided in Fuel Data entry screen. This default value can be overwritten.

**Actual Yearly "Fuel" Use:** "Fuel" corresponds to the type of primary fuel selected in the "space heating fuel" question. Actual Yearly "Fuel" Use is the total amount of fuel used in the average year as entered in the "fuel data" screen. If the building uses the same fuel for generating Domestic Hot Water, the actual yearly fuel use will contain DHW consumption as well. EA-Quip generates automatically this field based on results provided in Fuel Data entry screen. This default value can be overwritten.
In case of a secondary fuel for heating, User should overwrite the default value with the sum of the value generated from "fuel data" and the energy-equivalent yearly usage from secondary fuel.

**Actual Base Fuel Use:** the fuel use, excluding space heat and cooling. It is usually the minimum on the curve of fuel use per month.




**Actual Yearly Electricity Use:** the total building amount of electricity used in a year at the master meter.

**Current Electricity Price:** the total yearly electric bill divided by the number of kWh used in the year. EA-Quip does not perform rate analysis and does not separate out demand and usage.

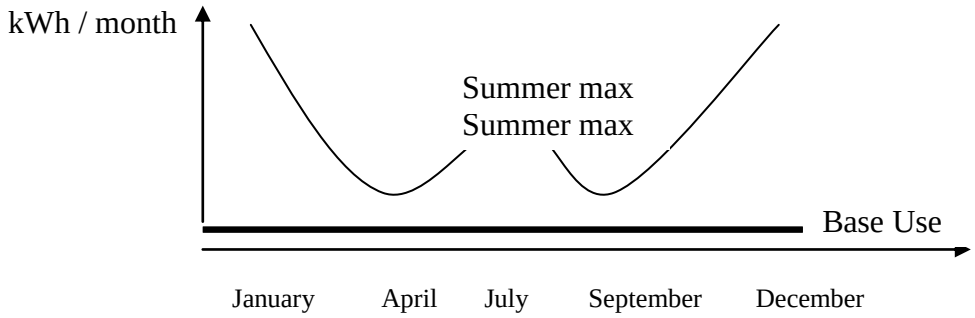
**Considering Switching electric rates:** Enter "Yes" if the average price of electricity would either increase or decrease as a result of fuel switching or any change in the electric rate schedule (i.e. switching from individual metering to master metering).

**New Electricity price:** Enter the average price of electricity after rate change. An additional line will appear in the retrofits list and display the savings or additional operational cost as a result of switching electric rate.

**For Electric buildings:**

EA-Quip considers a building as an electric building when heating fuel is electric. Domestic Hot Water could be either electric or another fuel.

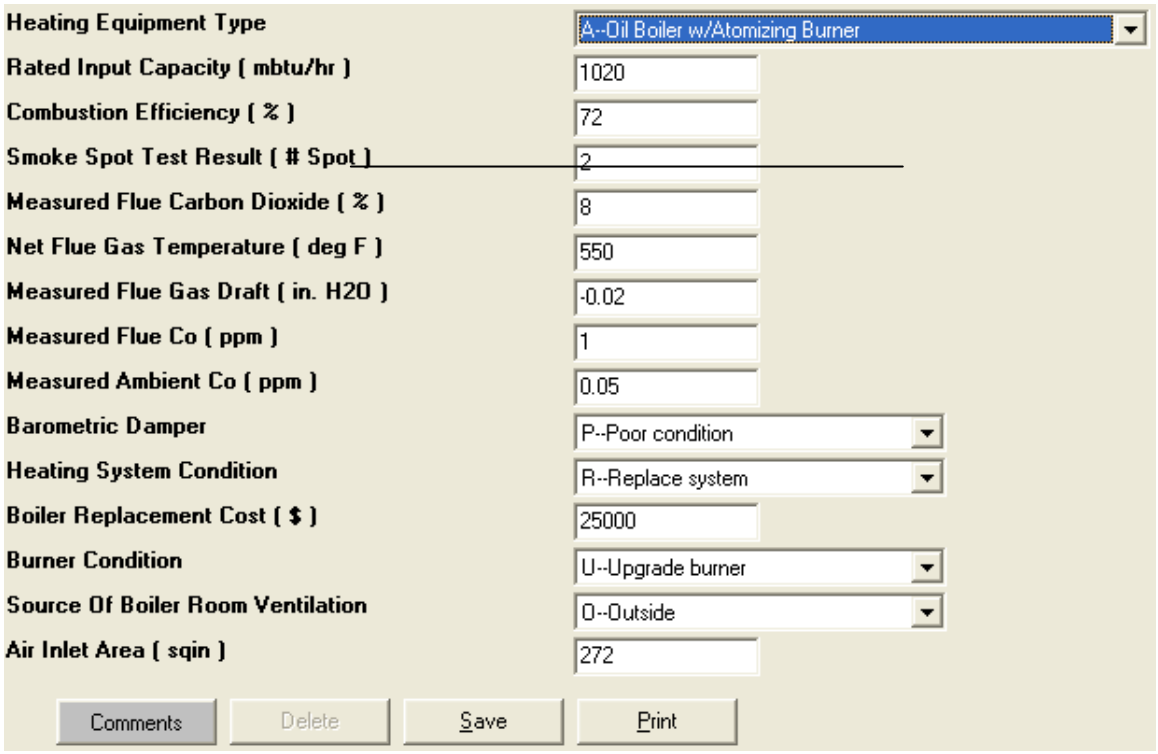
**Actual Base electric Use:** the electricity use, excluding space heat and cooling. It is usually the minimum on the curve of electricity use per month, if vacations and other anomalies are excluded.




**Actual Summer Max electric Use:** the maximum monthly usage between 07/01 and 10/01. EA-Quip uses this value to estimate building cooling usage. If there is no cooling equipment, Actual Summer Max electric Use should be equal to Actual Base Electric Use.

## 2.3.6 Heating System

Click on Heat Sys located at the bottom of the screen.




**Heating Equipment Type:** Select the heating equipment type from the list by pressing down arrow.

**Rated Input Capacity:** the amount of fuel that the heating equipment burns in an hour in thousands of British Thermal Units per hour (mbtu/hr). This number is usually found on a label on the unit; if there are two numbers, (e.g. 100,000 and 80,000), use the higher one, and divide it by 1,000 to convert it into mbtu/hr. (In this case you would enter 100).

Some heating units, such as Heat Pumps, are rated by their Output Capacity. This number is found on the manufacturer's label. If there are two numbers in a similar range around 100,000 Btu/hr, use the higher one and divide it by 1,000.

For multiple individual furnaces, enter aggregated input capacity.

For electric heating equipment, enter aggregated installed capacity in kW.

**Combustion Efficiency (Steady-State):** the heat output divided by the total fuel burned, times 100. Heat output is defined as what leaves the furnace, not what reaches the living space. Efficiency is measured using testing equipment such as the Bacharach kit.

If such equipment is not available, the Steady-State Efficiency can be read off the manufacturer's catalog. If efficiency isn't listed, two numbers usually are: Input capacity and Output (or BONNET) capacity. Divide the smaller number (the Output) by the larger one, and multiply by 100. The result should be between 60% and 90%. For Heat Pumps, divide the larger number by the smaller one, and multiply by 100. The result may be as high as 400%.

For multiple individual furnaces, enter average steady-state efficiency.

**Smoke Spot Test Result:** performed by passing the flue gas through a filter paper and comparing the darkened paper with a standard scale ranging from 0 to 9. This test determines how efficiently oil is being burned. For gas-fueled systems, the smoke test can reveal poor combustion that can lead to high levels of carbon monoxide (CO), even though there is no smoke.

**Measured Flue Carbon Dioxide:** indicates the percentage of CO2 in the boiler/furnace flue gas. This is an indicator of the burner efficiency.

**Net Flue Gas Temperature:** measured with a thermometer probe inserted into a small hole in the flue (tape it over when you've finished). If there is a draft hood, drill the hole in a place where the flue is exposed. The flue gas temperature to be entered is the DIFFERENCE between the temperature measured in the stack and the ambient temperature in the boiler room. This temperature as a test of the condition of the boiler and burner and is used to determine whether installing a heat recovery device will be cost effective and beneficial for the building.

**Measured Flue Gas Draft:** indicates how well the flow of air through the boiler is being controlled. High stack drafts indicate leaks that waste fuel. The stack draft is measured through a hole in the stack pipe using a draft gauge that measures the negative pressure (or suction) into the stack in units of inches of water.

**Measured Flue CO:** indicates presence of Carbon Monoxide in the breeching. Level can be measured using specific instrumentation. Results are in ppm.

**Measured Ambient CO:** indicates the presence of Carbon Monoxide in the boiler room. Level can be measured using specific instrumentation. Results are in ppm. The U.S. Environmental Protection Agency (EPA) recommends that a person should not breathe CO concentrations of 9 parts per million (ppm) or higher for any eight-hour period; 35 ppm or higher for any one-hour period; or 200 ppm or higher at any one time. Moreover, a person should not be exposed to any one of these three conditions more than once per year.

**Barometric damper:** Enter condition of the boiler barometric damper.

**Physical Condition:** of the heating system is used both to estimate its current efficiency and to evaluate possible retrofits for it.

**Boiler replacement cost:** If the "replace system" option is selected in "heating system condition", enter total investment cost for boiler replacement (include all parts and labor costs). It is not necessary to adjust the cost in parameter \ "retrofit cost" screen. Only this value will be considered for this cost of the retrofit "new heating system".

**Burner Condition:** of the heating system is used both to estimate its current efficiency and to evaluate possible retrofits for it.

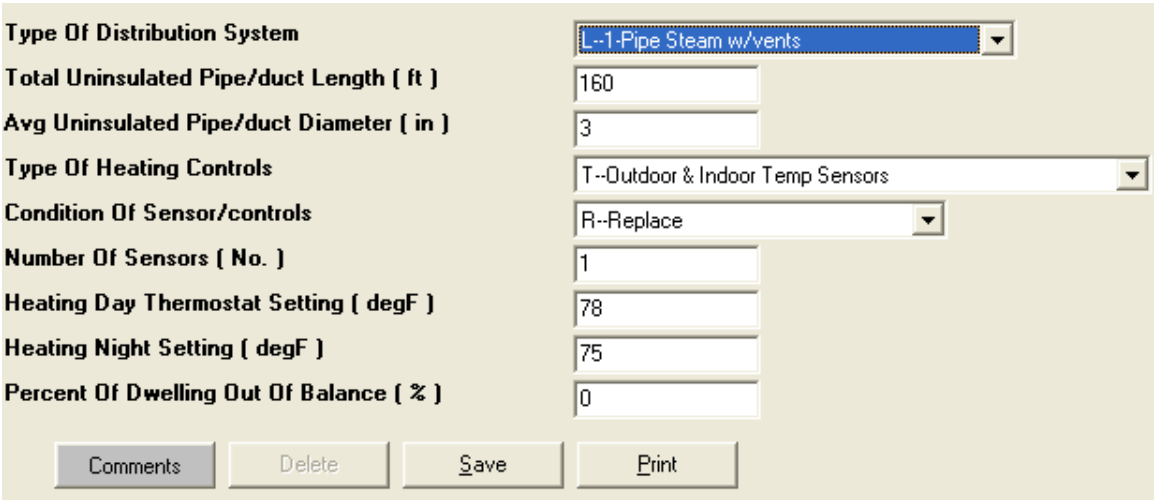
**Burner replacement cost:** If the "replace burner" option is selected in "burner condition", enter total investment cost for burner replacement (include all parts and labor costs). It is not necessary to adjust this cost in parameter \ "retrofit cost" screen. Only this value will be considered for the cost of the retrofit "replace burner". Note that Burner replacement cost should equal 0 if the boiler is to be replaced.

**Source of boiler room ventilation:** Enter "outside" if there is a fresh air louver in the boiler room. Enter "inside" if fresh air is pre-heated or not directly coming from the outside.

**Air inlet area:** enter net boiler room louver opening in square inches.

## 2.3.7 Control And Distribution

Click Ctrl/Dist located at the bottom of the screen.



**Type Of Distribution System:** transfers heat or cool air from the heating plant or HVAC to the living space. Often, the distribution system will be Forced Air (i.e. fans and ducts) in smaller dwellings. Older heating installations often rely on gravity to distribute the hot air. In larger buildings, the central boiler will be connected to radiators or baseboards using Steam or Hot water piping distribution system. "In-Room" distribution systems include non central heating system such as room air conditioners, room heat pumps, and electric baseboards. The distribution system may run either through non-heated space, such as a basement or crawlspace, and through the heated living space. EA-Quip calculates how much of the heat or cool air is totally lost, and how much will contribute indirectly to heating the living space.

**Total un-insulated pipe/duct length:** enter total linear feet of non-insulated heating pipe running in non-heated space: basement, crawlspace, etc.

**Average un-insulated pipe/duct diameter:** enter the average diameter of non-insulated heating pipe running in non-heated space: basement, crawlspace, etc….

**Type of heating Control:** the device that determines when the heating system is turned on and off. An indoor thermostat measures the interior temperature and turns the heating system on when that temperature falls below a preset value. It can be either a single- or a night-setback, or multiple-setback, device. An outdoor reset boiler control is a device that regulates the heating system in accordance with the outdoor temperature, without any reference to what the indoor temperature might be. Some sophisticated device also integrates measurement of the return lines' temperature to control boiler operation. Select "outdoor and indoor temperature sensors" in this case.

**Condition of sensors:** used both to estimate the current system efficiency and to evaluate possible retrofits.

**Number of sensors:** enter the total number of heating sensors in the building.

**Thermostat Setting:** the temperature setting on the dial of a thermostat. Day and night settings can be different settings. If the heat is turned off at night, enter the lowest permitted temperature as the night setting.

If the building does not have or use a thermostat, enter the estimate of the average **Temperature** in the building in winter.

**Percent Of Building Out Of Balance:** The percent of the building out of balance is the portion of the building that is regularly above or below the 'normal' temperature of the building during the winter period due to imbalances in the heat distribution system.

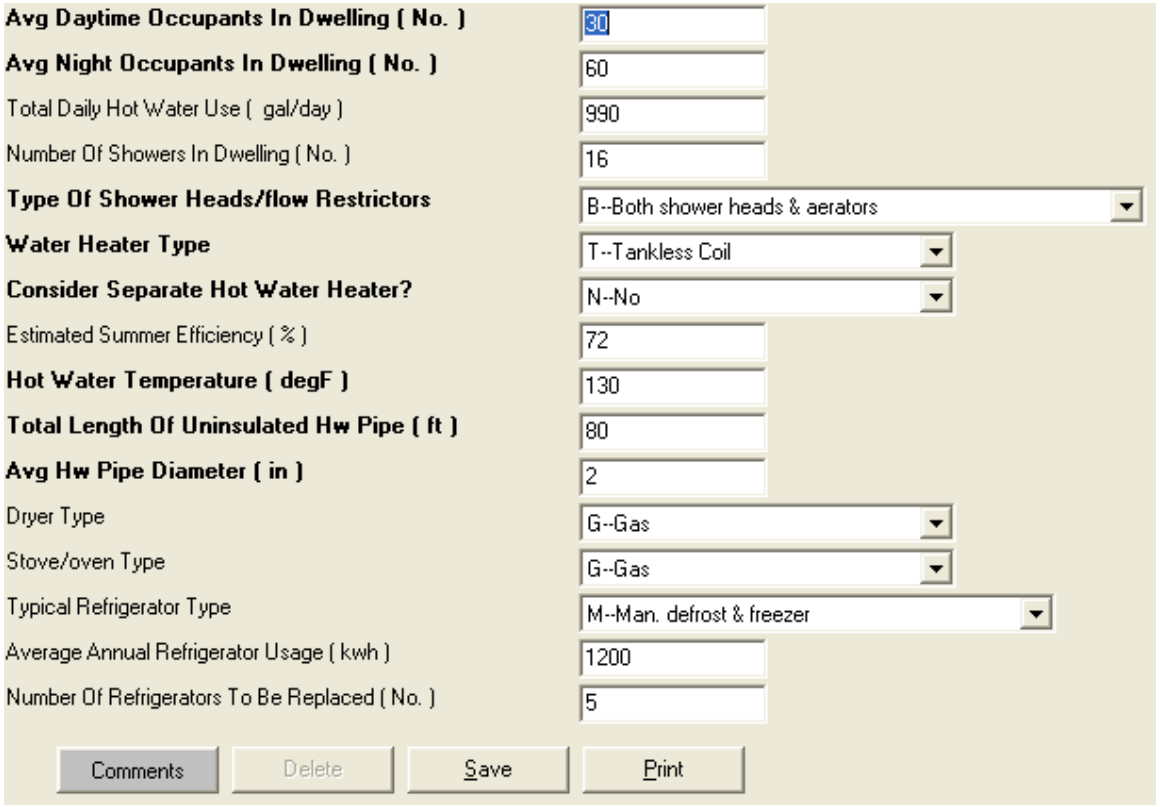
**Average Out-Of-Balance Temperature:** an estimate of the temperature which of the out-of-balance portion of the building regularly reaches during the coldest months of the year.

**Location of Imbalance:** the site of the over- or under-heated portions of the building. This description of the location of the imbalance is used to determine what would be the most appropriate retrofit to cure this system imbalance.

**Risers And Vents:** The information on the number of risers and vents and the condition of master venting is used to estimate the cost of retrofits. This data is not used in the heat load calculations, and the answer to this question will not affect those results.

## 2.3.8 Appliances

Click on the application button at the bottom of the screen.




**Average Daytime Occupants in Building:** the average number of people in the building between 8 am to 8 pm.

**Average Nighttime Occupants in Building:** the average number of people in the building from 8 pm to 8 am.

**Total Daily Hot Water Use:** the amount of domestic hot water used each day by the building. A good starting point is 20 gal/person/day for a typical multifamily building.

**Number of Showers in Building:** used to determine the cost of installing low-flow showerheads. So the value to enter is the number of showerheads, and not the number of showers the occupants might take a day. The number of showers in the building typically equals the number of apartments (one shower per apartment).

**Type of Shower Heads / Flow Restrictors:** should be identified in order to determine whether they should be added.

**Water Heater Type:** Select Domestic Hot Water equipment from drop-down menu.

**Consider Separate Hot Water Heater:** A separate gas- or oil-fired hot water heater will typically generate hot water more efficiently than a tankless coil in a boiler. If such a change is considered, EA-Quip will report the amount of savings to be expected, using the same fuel as is now used for space heating.

**Cost of Separate Hot Water Heater:** the cost to purchase and install a hot water heater, and to disable the tank-less coil currently producing hot water. It is assumed that the hot water heater burns the same fuel as the boiler currently producing hot water.

**Input Rating:** the capacity or amount of fuel used by the heater, in thousands of British Thermal Units per hour (mbtu/hr) for gas, oil, or propane heaters, and in kilowatts (kW) for electric water heaters. It should be marked on the manufacturer's label.

**Estimated Summer Efficiency:** If the system uses a tank-less coil, User should measure the steady-state efficiency of the system during the summer months when the boiler is being used for generating domestic hot water only. User should estimate the steady-state efficiency of the system if the measurement takes place during the winter months. At maximum, this value should be equal to the steady-sate efficiency entered in heating system description.

**Hot water Temperature:** the temperature of the hot water from the faucet closest to the hot water generation equipment.

**Total un-insulated DHW pipe length:** enter total linear feet of non-insulated DHW pipe running in non-heated space: basement, crawlspace, etc.

**Average un-insulated DHW pipe diameter:** enter the average diameter of non-insulated DHW pipe running in non-heated space: basement, crawlspace, etc.

**Location of Water Heater:** used to estimate how much of the waste heat from the water heater warms up the living space.

**Dryer type:** enter the most current fuel type used in the building for clothes dryers. Entry is used to calculate non-HVAC load.

**Stove/oven type:** enter most current fuel type used in the building for stove/range. Entry is used to calculate non-HVAC load.

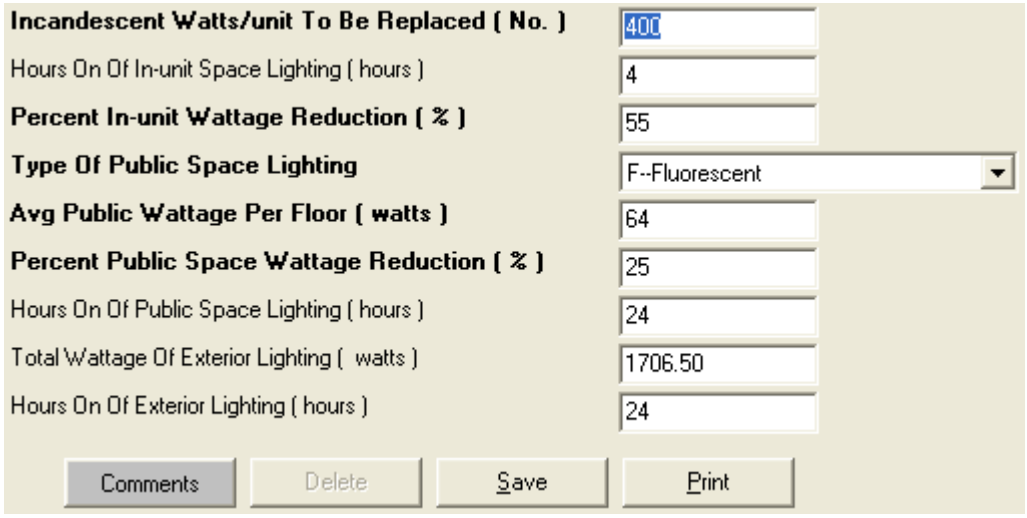
**Typical Refrigerator Type:** used to estimate the monthly electricity use of the refrigerator. However, it is best to obtain the actual average monthly consumption of electricity by the typical refrigerator in the building from a data book, since there is great variability from one unit to the next.

**Average Annual Refrigerator Usage:** used to predict the cost-effectiveness of replacing the refrigerator in each building unit with a model that consumes approximately 386 kWh per year.

**Number of refrigerators to be replaced:** enter either exact number of refrigerators to replace in the building (as a result of a full refrigerator audit) or an estimate.

### 2.3.9 Lighting

Click on the Lighting button at the bottom of the screen.




**Total lighting wattage per unit:** the average number of watts of lighting currently installed per apartment. This value includes both fluorescent and incandescent lighting.

**Hours On of In-Unit Space Lighting:** EA-Quip assumes that incandescent lighting in building units that is being replaced is normally turned on for 4 hours each day. This number can be altered.

**Percent in-unit wattage reduction**: the expected lighting wattage reduction before and after lighting retrofit in the apartments (%). This value is an average for the entire buildings (i.e. replacing incandescent lighting with Compact Fluorescents Lighting will generate 66% demand reduction).

**Type of public space lighting:** enter most common type of fixtures located in the building outside of the apartments (lobby, hallways, basement…)

**Average public space wattage per floor:** the average wattage of the lighting on one floor of the public space in the building. Average public space is the area of the public space (vestibules, hallway or staircases) on one floor of the building.

**Percent public space wattage reduction**: the expected lighting wattage reduction before and after lighting retrofit in public space (%). For example, replacing T12 fluorescent lighting with T8 fluorescents lighting will generate 25% demand reduction.

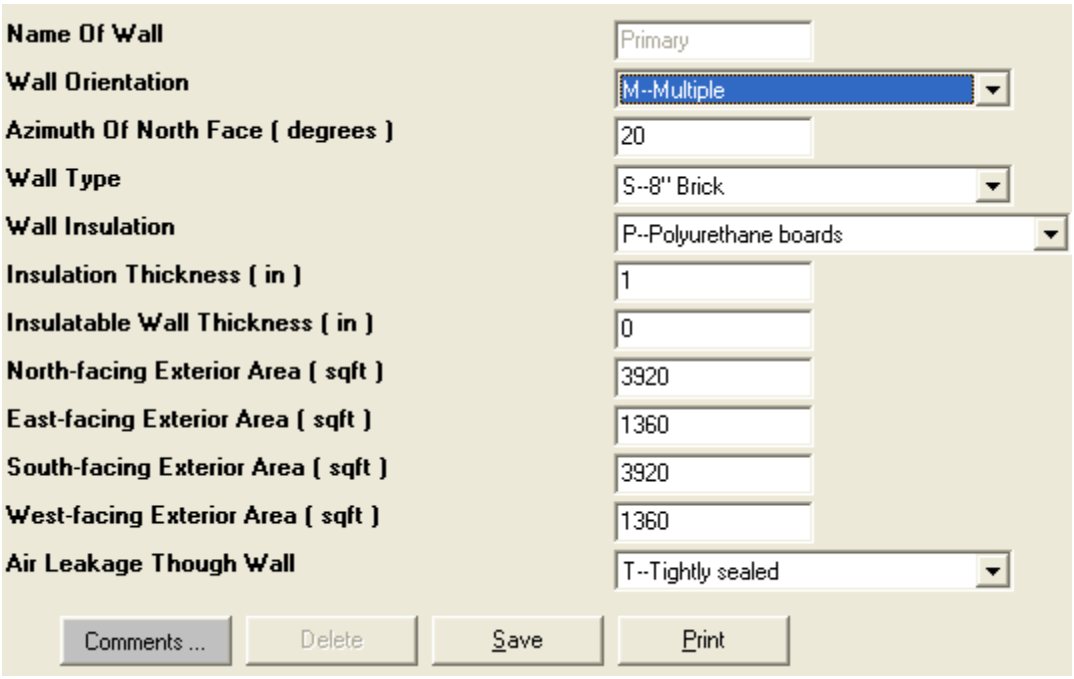
**Hours on of public space lighting:** EA-Quip assumes that public space lighting in the building is turned on for 24 hours each day for security reason.

**Total wattage of exterior lighting**: independently from the type of lighting, enter the sum of all lighting wattages installed on the perimeter of the building.

**Hours on of exterior lighting:** EA-Quip assumes that exterior lighting is turned on for an average of 12 hours a day (during nighttime).

### 2.3.10 Walls

Click on the Walls button at the bottom of the screen. EA-Quip will bring up a separate screen for each wall entered by the User.




**Name Of Wall:** given to each wall or group of walls. If two or more walls have the same characteristics (i.e. orientation, type etc.) they can be entered under one name. The area will then be the sum of the areas of the individual walls. Retrofits chosen by the computer for each wall or group of walls will use this name to identify which wall they apply to. Note: If a wall is shared with a garage, information about it should not be entered in this section. These walls should be treated as a separate type of wall. One wall must be named "Primary".

**Wall Orientation:** the compass point closest to the direction the wall faces: South, West, East or North. A wall may point up to 45 degrees East or West of South, and still be called "South". If this type of wall is on more than one facing of the building, choose Multiple and give the area of the walls of this type facing each direction (use 0 if no wall of this type faces in a particular direction).

**Azimuth:** the compass direction the house faces. It is used to calculate the solar energy that falls on each window and wall. Depending on the house orientation, enter:

0 if the north wall of the house faces exactly north;
10 if it faces 10 degrees east of north;
-20 if it faces 20 degrees west of north;

and so on, up to 45 or down to -45.

**Wall Type:** what type of wall you have, e.g. two-by-four wood frame, or solid brick. Walls shared with greenhouses or garages should be treated as a separate wall type.

**Wall Insulation:** the type of insulation inside (or outside) the wall. A close field inspection should determine the exact type of wall insulation. Good places to look are behind electrical wall fixtures or under loose window or door moldings.

**Wall R-Value:** the thermal resistance of the wall.

**Area of any hole in wall:** determines how much energy leaks through by infiltration and conduction. All holes in a wall should be repaired before any other energy-saving measures are introduced

**Specific Leakage area:** the leakage area divided by the area of the wall. The leakage area of a wall is the area of a single hole in the wall that would leak in the same way as all the leaks from cracks around the edge of the wall and around vents, penetrations, and window frames.

**Insulation Thickness:** the thickness of the insulation in the wall cavity, or inside or outside the wall.

**Insulatable Wall Thickness:** the width left in the wall cavity that can be insulated, or the maximum thickness of projected additional outside or exterior insulation.

**Wall Areas:** wall height multiplied by wall length. Area includes all opening areas such as doors and windows.

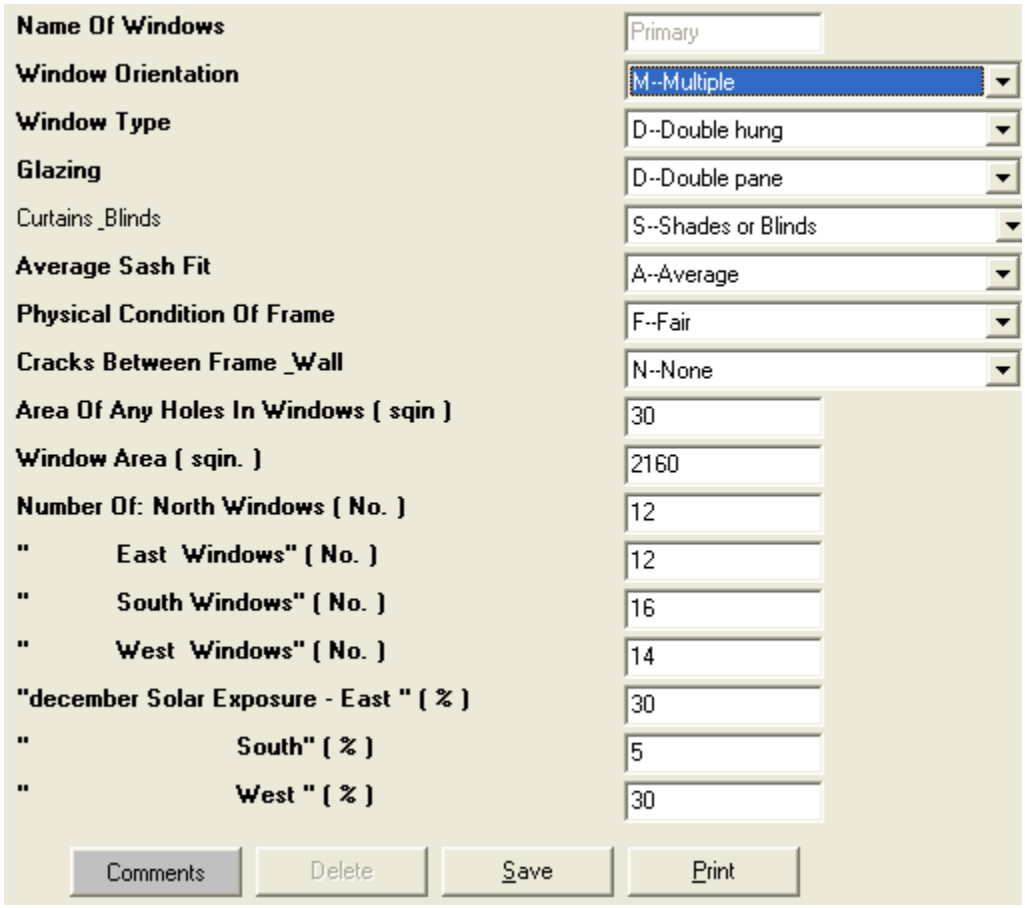
**Area of windows in wall:** enter the sum of all windows area for this wall (all orientation). **Value in square feet**. EA-Quip will deduct automatically this value to the total wall area to calculate heat conduction through walls.

**Area of doors in wall:** enter the sum of all doors area for this wall (all orientation). **Value in sq. ft**. EA-Quip will deduct automatically this value to the total wall area to calculate heat conduction through walls.

**Air Leakage though wall:** estimates of leakage of air through the walls, which is used to calculate the current air infiltration for the building.

## 2.3.11 Windows

Click on the Windows button at the bottom on the screen.




**Name of Windows:** given to each window or group of windows. If two or more windows have the same characteristics (i.e. orientation, type, glazing etc.) they can be entered together under the same name. The area then will be the sum of the areas of the individual windows. Retrofits chosen by the computer for each window or group of windows will use this name to identify which window they apply to. One window must be named "Primary".
*Note*: Sliding glass doors are to be entered as windows. If more than 50% of the door area is glass, treat the glass part as a window, the rest of the door area is small enough to be neglected.

**Window Orientation:** the compass direction nearest to the direction the window faces: South, West, East, North or Horizontal. A window may face up to 45 degrees east or west of south, and still be called "South". If this type of window is on more than one wall of the building, choose Multiple and give the number of windows facing each direction (use 0 if no windows of this type face in a particular direction).

**Window Type:** the type of window, e.g. double-hung, casement, horizontal sliding etc.

**Glazing:** the glass type for the selected type of windows: plain old-fashioned single pane, double-pane (sometimes called thermopane), or perhaps triple pane. Storm windows should be entered here.

**Curtains And Blinds:** any kind of window cover, including shades and blinds, but not including storm windows; they are treated in **Glazing**. Together with glazing, this information is used to calculate window U-Value and the solar gain factor.

**U-Value:** the heat conductance of the window, i.e. the inverse of the R-value.

**R-Value:** the heat resistance of the window. The User can estimate this value using ASHRAE standard tables. If a particular type of glazing is selected, EA-Quip will calculate the R-value automatically. It is recommended to use this function for any special type of glazing.

**Average Sash Fit:** how tightly the window sash fits in the window frame. Do not confuse the fit of the sash within the frame with the size of cracks, if any, between the frame and the wall.

Available Choices:

- Loose: if the sash rattles in the frame and/or if you can see light through or around the sash
- Tight: if outdoors noise decreases substantially when you close the window, and if it "feels" snug
- Average: for other cases

**Physical Condition of Frame:** If additional glazing is found to be cost-effective, the physical condition of the window frame is used to determine whether this should take the form of exterior storm windows, double- or triple-pane replacement windows. Storm windows would be applied if the condition of the frame were good or fair, while replacement windows would be suggested if the condition is poor.

**Cracks between Frame And Wall:** Cracks often develop in walls and window frames, allowing significant amounts of air infiltration. These cracks are most easily seen on interior walls, as spaces between the frame and the plaster wall. Estimate the size of the cracks and the number of windows having such cracks in each type of wall.

**Area of Any Holes in Windows:** Any broken windows should be repaired before any other energy-saving measures are introduced. The size of the break determines how much energy leaks through by infiltration and conduction. Enter the total holes area in square inches for the selected window name.

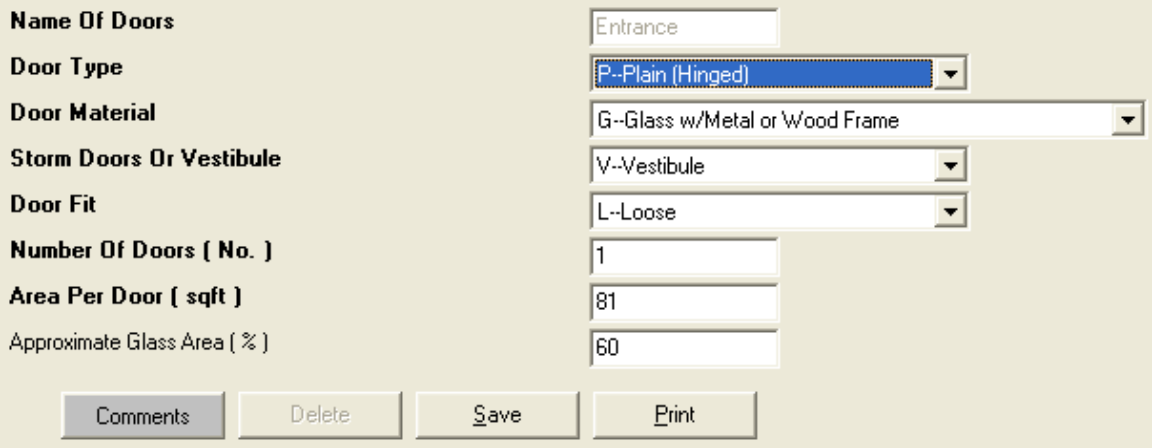
**Window Area:** refers to glass and sash *only*. Do not include the frame or molding. If the windows are of variable height or width, but are of the same 'type', use a 'typical' or 'average' height and width. For EA-Quip's purposes, the measurements need only be accurate to 5% (e.g. within 3 inches for a height of 60 inches). If more than 50% of a door area is glass, treat the glass part as a window; the rest of the door area is small enough to be neglected. *Note*: the window area should be entered in square inches.

**Number of Windows:** on each wall should be those, which have approximately the height and width, specified here. If there is a very different type of window on one or more of the walls, add that as a separate window name.

**December Solar Exposure:** is the fraction of total possible solar radiation that reaches the window through any obstacles, such as trees, adjacent buildings or hills. A building in the middle of a flat desert will have 100% solar exposure at all times. One on a large pasture in the mountains (or a house with some short trees around it) may still have almost 100% in summer, but maybe only 30% in winter when the sun is low. A low house in the middle of a large city may have a very low exposure all year. Try to project the path of the sun from horizon to horizon during the appropriate months. Remember, the sun will be quite high in the sky during the summer and low in the winter. Also remember that the greatest solar exposure occurs during the middle of the day.

## 2.3.12 Doors

Click on the Doors button at the bottom of the screen.




**Name of Doors:** given to each door or group of doors. If two or more doors have the same characteristics (i.e. type, fit etc.) they can be entered together under one name. The area of the door then will be the sum of the areas of the individual doors.
Retrofits chosen by the computer for each door or group of doors will use this name to identify which door they apply to. One door must be named "Entrance".
*Note:* "Sliding glass doors", and any door with more than 50% of its area glass are to be entered as windows.

**Door Type:** the kind of door, e.g. sliding, fixed or French. The door type together with the door material, storm doors, and glass area, are used to estimate the U-Value of the door.

**Door Material:** the substance of which the door is made, e.g. solid wood or steel filled with fiberglass. The door material, together with the door type, storm doors and glass area, is used to estimate the U-Value of the door.

**U-Value:** the heat conductance of the door, i.e. the inverse of R-value.

**Storm doors:** aluminum (or wood) frame doors, generally with a large glazed area that are installed next to a main door.

**Approximate Glass Area:** a percentage of the total door area. Any door with a glass area greater than 50%, e.g. a sliding glass door, should be entered as a window.

**Door Fit:** how tightly the door fits in its frame when closed. Do not confuse this door fit with the size of cracks around the frame.

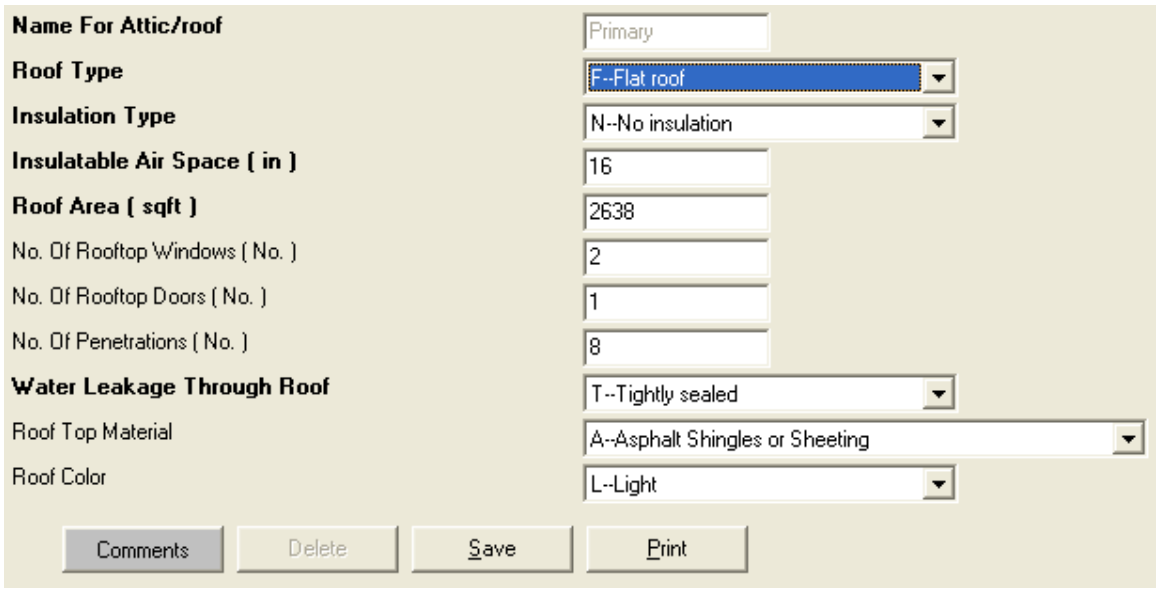
Available choices:

| | |
|---|---|
| Loose | if the door rattles in the frame and/or if you can see light at the bottom of the door. |
| Tight | if outdoor noise decreases substantially upon closing the door and it "feels" snug. |
| Average | all cases in between. |

**Area per Door:** the height of the door times its width. Include any glass in this area. Do *not* include the doorframe or moldings; these should be included in the wall area.

## 2.3.13 Roof

Click on the Roof button at the bottom of the screen.




**Name For Attic/Roof:** given to each attic/roof or group of attic/roof. If two or more roofs/ceilings have the same characteristics, (i.e. type, R-value etc.) they can be entered together under one name. The area of the attic/roof then is the combined area of the individual roofs/ceilings.

**Roof Type:**

Available Choices:

| | |
|---|---|
| Flat Roof | The ceiling parallels the roof at a distance given by the roof rafters; the resulting cavity may be retrofitted with insulation, as long as a 2" air space above the insulation is left for ventilation through the eave vents. |
| Low Pitch Roof | Very similar to unfinished attic, except that the space available for insulation may be limited (zero if the "attic" is inaccessible). |
| Unfinished Attic | Unheated, "A-frame"-like space between roof and living space; insulation, if any, is assumed to be on top of the living space ceiling (or attic floor). |

**Insulation Type:** Select type from the list by pressing down arrow.

**Roof Pitch:** pitch of 30% means that the roof line goes up 3 ft for every 10 ft horizontal travel. The roof area is computed automatically from the ceiling area and the roof pitch.

**Insulatable Air Space:** the depth, in inches, available for retrofit insulation.
Example: If floorboards cover the 2 by 6 ceiling joists in an attic with 2" of existing insulation, the insulatable air space is 3.5". If the attic is inaccessible, enter zero.

**Roof Area**: the total floor area of the attic or low-pitch roof. For cathedral ceilings, enter the horizontal projection, i.e. the floor area of the rooms covered by the cathedral **ceiling**.

**Number of rooftop windows:** enter total number of windows (typically skylights). This value, entered for calculation of air leakage through the roof, should be consistent with the number of rooftop windows entered in the window component.

**Number of rooftop doors:** enter total number of doors (typically bulkhead doors). This value, entered for calculation of air leakage through the roof, should be consistent with the number of doors entered in the door component.

**Number of leaky roof penetrations:** the total bathroom vents, kitchen exhausts, dumbwaiters, airshafts, and holes caused by wiring, plumbing and lighting fixtures. Count large, leaky penetrations as double or triple. EA-Quip evaluates the total air leakage area from both “number of penetrations” and “Water Leakage through roof” answers.

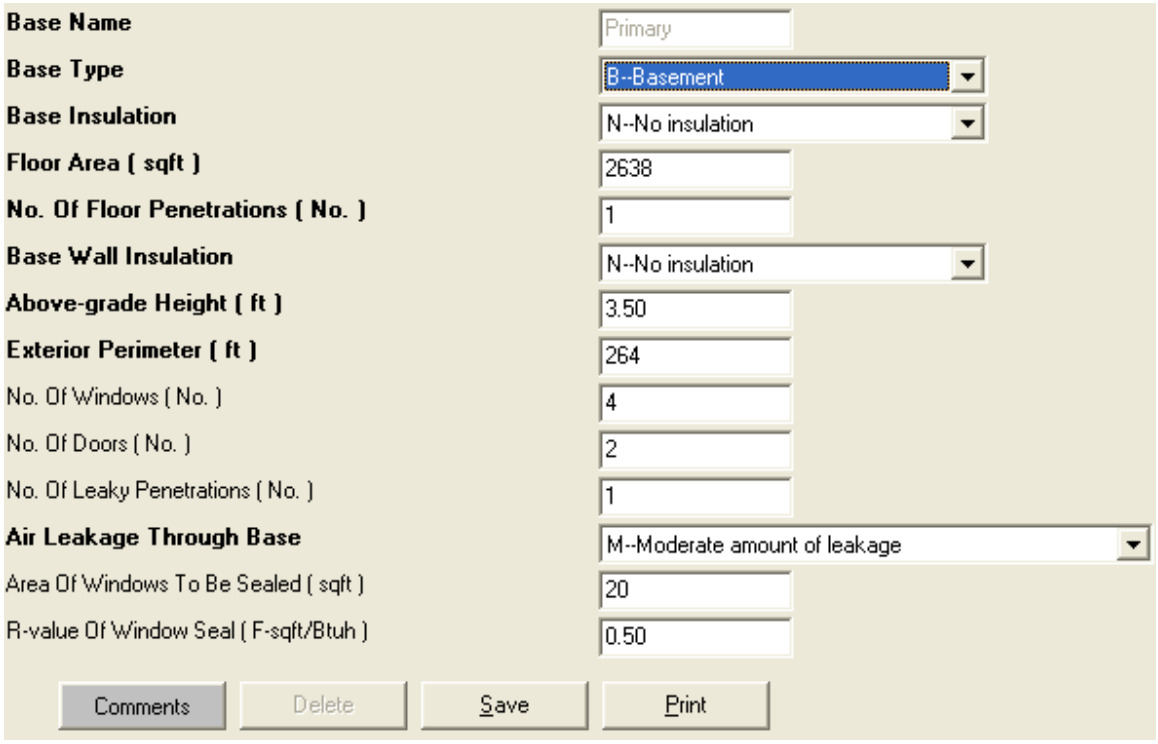
**Water Leakage Through Roof:** an estimate of leakage of air and water through the roof are used to calculate the current air infiltration for the building, and to evaluate possible retrofits for the roof.

**Roof Top material:** will determine the roof absorptivity along with "roof color"

**Roof color:** will determine the Roof absorptivity along with "rooftop material". The darker the color and the duller the material of the roof, the higher the Roof Absorptivity,

## 2.3.14 Basement

Click on Base button at the bottom of the screen.




**Base Name:** given to each sub floor or group of sub floors. If two or more have the same characteristics, they can be entered together under one name. The area would then be the sum of the areas of the individual sub floors. A house with a combination of sub floors (e.g. a partial basement and crawlspace) must have two sub floor names.

**Base Type:**

There are four sub floor types:

Basement: A space below the house generally used for storage, housing of HVAC equipment and its distribution system (ducts or pipes).

Only walls exposed to the outside are to be considered, not walls shared with neighbors or adjacent sub floor structures. Basement windows are assumed to be small and are not considered for retrofit. If they are large, and if the basement is heated and/or cooled, the above-grade part should be input under walls, windows, etc. and only the below-grade walls and the floor should be input as *sub floor*

Crawlspace: A space below the living space with floor-to-ceiling height of less than 5'6", with exposed or partially covered earth as a floor, at the same level as outside grade. Crawlspaces are assumed to be vented to the outside. As for basements, only walls exposed to the outside are to be considered.

Slab-On-Grade: A slab of reinforced concrete directly supporting the living space. When measuring the perimeter, do not include any shared walls, e.g. with the garage or the house next door.

Platform: The living space is elevated above the ground, as in a mobile home, and the space beneath the platform is, without protection, open to the elements.

**Base Insulation:** the type of insulation placed in the ceiling of the sub floor.

**Insulation Thickness:** the depth of base insulation.

**Base (floor) R-Value:** the total thermal resistance of the floor between the upper living space air and the sub floor air. If you stand in the sub floor, the insulation is above your head and the slab is beneath your feet. If the basement is heated and/or cooled, enter the minimum permitted value.

**Floor Area:** the area of the floor above this sub floor space.

**Floor Penetrations:** holes caused by furnace registers, wiring, plumbing, electrical outlets, dryer exhausts, cracks, and similar openings. Each adds to the leakage area and heat conduction.

There are Above Grade Walls in basements and crawlspaces. **Wall insulation Thickness** is the thickness of any insulation between furring or boards and the foundation wall.

**Above-Grade Height:** the height of the exposed wall, basement doors, etc. Usually, this will be the height from grade level to sub floor ceiling. However, if a "well" is dug around a portion of the foundation, exposing doors and/or windows, this should be the depth of this well.

**Exposed Perimeter:** the total length of above-grade walls or slab edge that are exposed to the outside.

**Number of basement windows:** enter total number of windows. This value, entered for calculation of air leakage through the base, should be consistent with the number of windows entered in the window component.

**Number of basement doors:** enter total number of doors for the basement. This value, entered for calculation of air leakage through the base, should be consistent with the number of doors entered in the door component.

**Number of leaky penetrations:** considered for retrofit analysis.

**Air leakage through base:** measures the outside air that leaks into the heated space of the building. Thus, if there is a basement, it is the air that leaks into the basement and then from the basement into the heated portion of the building. Estimates of leakage of air through the base are used to calculate the current air infiltration for the building.

If you wish to seal some basement windows, indicate their **Area of Windows to be Sealed** and the change in **R-Value of Window Seal** as a result of the sealing to be carried out.

# 3. Reports

The results of EA-Quip calculations can be viewed and printed. EA-Quip generates the following printable reports that can be accessed via Reports menu option.

## 3.1 Features

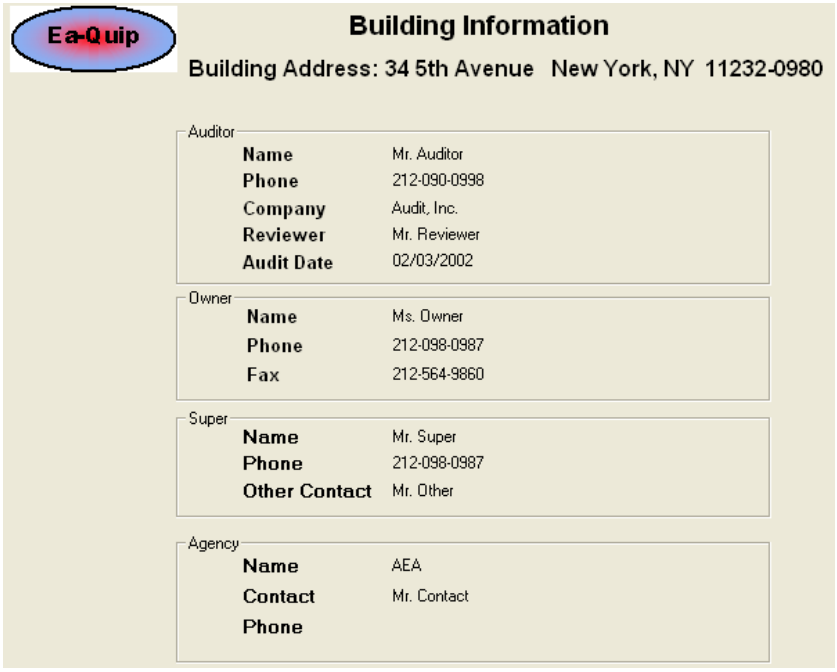
### 3.1.1 On-Screen Reports

EA-Quip reports can be viewed by clicking on the Reports link.

**Refer to section 4 for report description.**

The reports are presented in the following order:

1. Building Information



**Building Information**

Building Address: 34 5th Avenue New York, NY 11232-0980

Auditor

| | |
|---|---|
| Name | Mr. Auditor |
| Phone | 212-090-0998 |
| Company | Audit, Inc. |
| Reviewer | Mr. Reviewer |
| Audit Date | 02/03/2002 |

Owner

| | |
|---|---|
| Name | Ms. Owner |
| Phone | 212-098-0987 |
| Fax | 212-564-9860 |

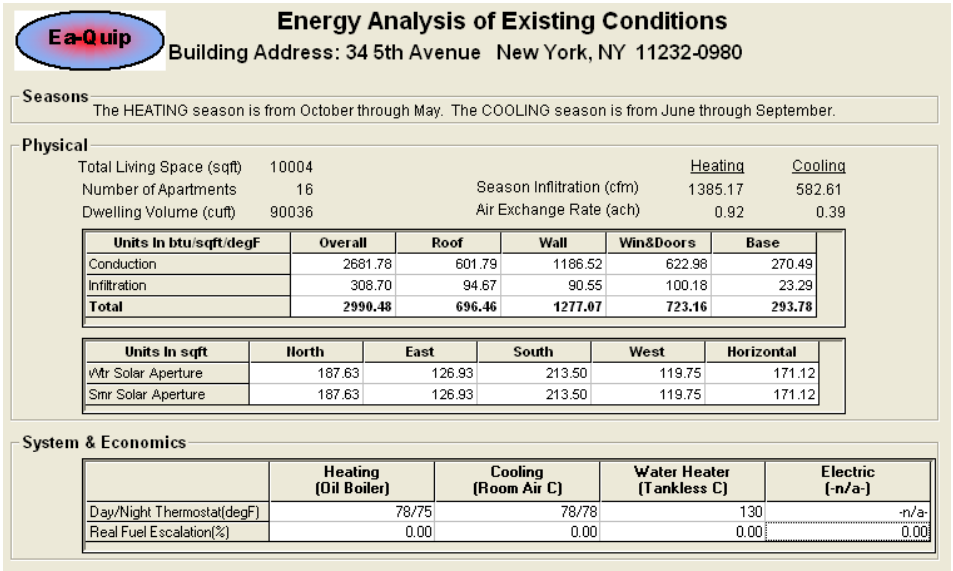
Super

| | |
|---|---|
| Name | Mr. Super |
| Phone | 212-098-0987 |
| Other Contact | Mr. Other |

Agency

| | |
|---|---|
| Name | AEA |
| Contact | Mr. Contact |
| Phone | |

2. Energy Analysis of Existing Conditions



**Energy Analysis of Existing Conditions**

Building Address: 34 5th Avenue New York, NY 11232-0980

Seasons

The HEATING season is from October through May. The COOLING season is from June through September.

Physical

| | | | Heating | Cooling |
|---|---|---|---|---|
| Total Living Space (sqft) | 10004 | | | |
| Number of Apartments | 16 | Season Infiltration (cfm) | 1385.17 | 582.61 |
| Dwelling Volume (cuft) | 90036 | Air Exchange Rate (ach) | 0.92 | 0.39 |

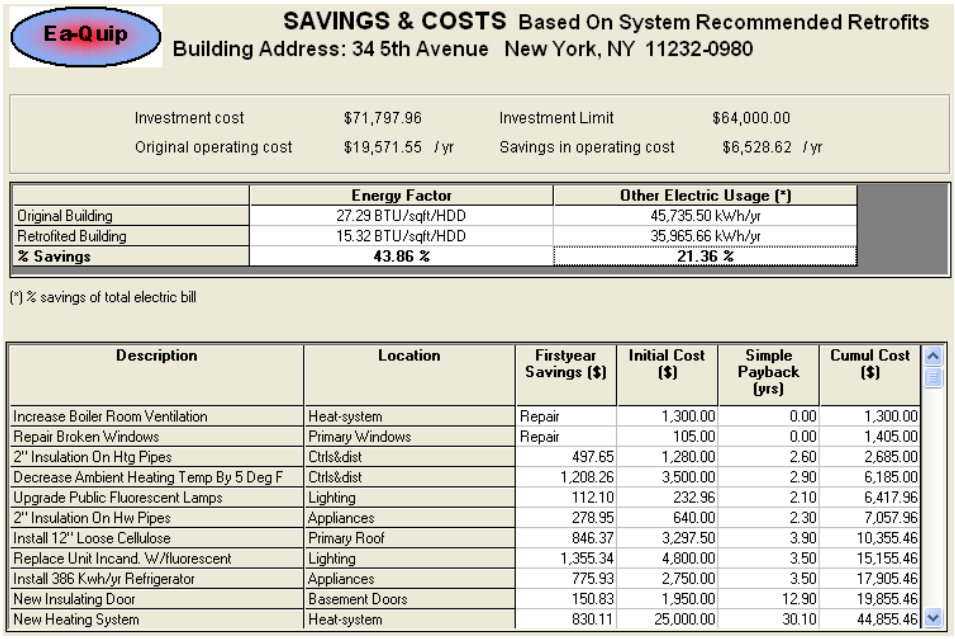
| Units In btu/sqft/degF | Overall | Roof | Wall | Win&Doors | Base |
|---|---|---|---|---|---|
| Conduction | 2681.78 | 601.79 | 1186.52 | 622.98 | 270.49 |
| Infiltration | 308.70 | 94.67 | 90.55 | 100.18 | 23.29 |
| **Total** | **2990.48** | **696.46** | **1277.07** | **723.16** | **293.78** |

| Units In sqft | North | East | South | West | Horizontal |
|---|---|---|---|---|---|
| Wtr Solar Aperture | 187.63 | 126.93 | 213.50 | 119.75 | 171.12 |
| Smr Solar Aperture | 187.63 | 126.93 | 213.50 | 119.75 | 171.12 |

System & Economics

| | Heating (Oil Boiler) | Cooling (Room Air C) | Water Heater (Tankless C) | Electric (-n/a-) |
|---|---|---|---|---|
| Day/Night Thermostat(degF) | 78/75 | 78/78 | 130 | -n/a- |
| Real Fuel Escalation(%) | 0.00 | 0.00 | 0.00 | 0.00 |

3. Savings And Cost Analysis



**SAVINGS & COSTS** Based On System Recommended Retrofits
Building Address: 34 5th Avenue New York, NY 11232-0980

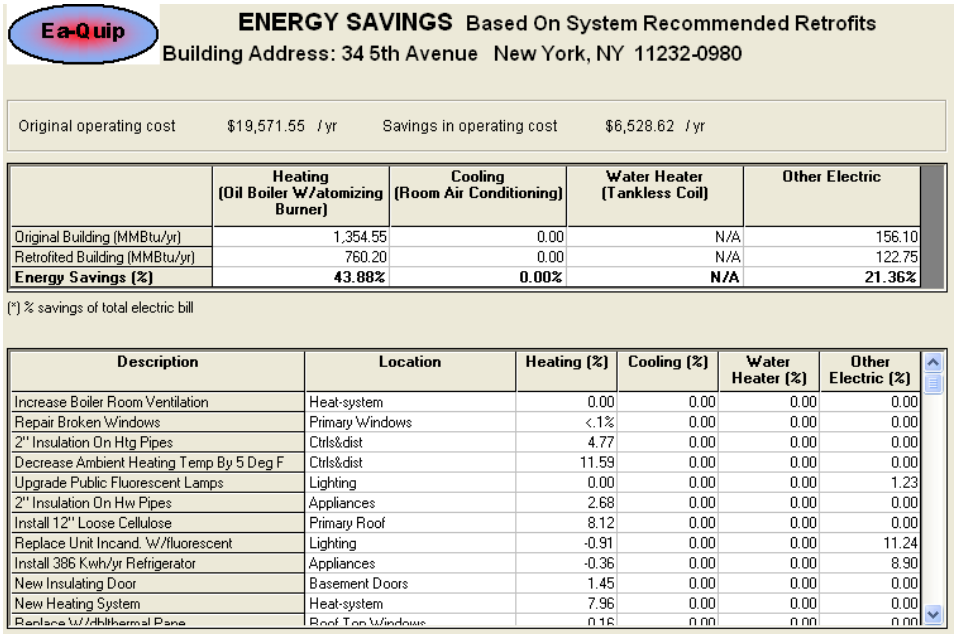
| | | | |
|---|---|---|---|
| Investment cost | $71,797.96 | Investment Limit | $64,000.00 |
| Original operating cost | $19,571.55 / yr | Savings in operating cost | $6,528.62 / yr |

| | Energy Factor | Other Electric Usage (*) |
|---|---|---|
| Original Building | 27.29 BTU/sqft/HDD | 45,735.50 kWh/yr |
| Retrofited Building | 15.32 BTU/sqft/HDD | 35,965.66 kWh/yr |
| **% Savings** | **43.86 %** | **21.36 %** |

(*) % savings of total electric bill

| Description | Location | Firstyear Savings ($) | Initial Cost ($) | Simple Payback (yrs) | Cumul Cost ($) |
|---|---|---|---|---|---|
| Increase Boiler Room Ventilation | Heat-system | Repair | 1,300.00 | 0.00 | 1,300.00 |
| Repair Broken Windows | Primary Windows | Repair | 105.00 | 0.00 | 1,405.00 |
| 2" Insulation On Htg Pipes | Ctrls&dist | 497.65 | 1,280.00 | 2.60 | 2,685.00 |
| Decrease Ambient Heating Temp By 5 Deg F | Ctrls&dist | 1,208.26 | 3,500.00 | 2.90 | 6,185.00 |
| Upgrade Public Fluorescent Lamps | Lighting | 112.10 | 232.96 | 2.10 | 6,417.96 |
| 2" Insulation On Hw Pipes | Appliances | 278.95 | 640.00 | 2.30 | 7,057.96 |
| Install 12" Loose Cellulose | Primary Roof | 846.37 | 3,297.50 | 3.90 | 10,355.46 |
| Replace Unit Incand. W/fluorescent | Lighting | 1,355.34 | 4,800.00 | 3.50 | 15,155.46 |
| Install 386 Kwh/yr Refrigerator | Appliances | 775.93 | 2,750.00 | 3.50 | 17,905.46 |
| New Insulating Door | Basement Doors | 150.83 | 1,950.00 | 12.90 | 19,855.46 |
| New Heating System | Heat-system | 830.11 | 25,000.00 | 30.10 | 44,855.46 |

## 4. Energy Saving Measures



**ENERGY SAVINGS** Based On System Recommended Retrofits
Building Address: 34 5th Avenue New York, NY 11232-0980

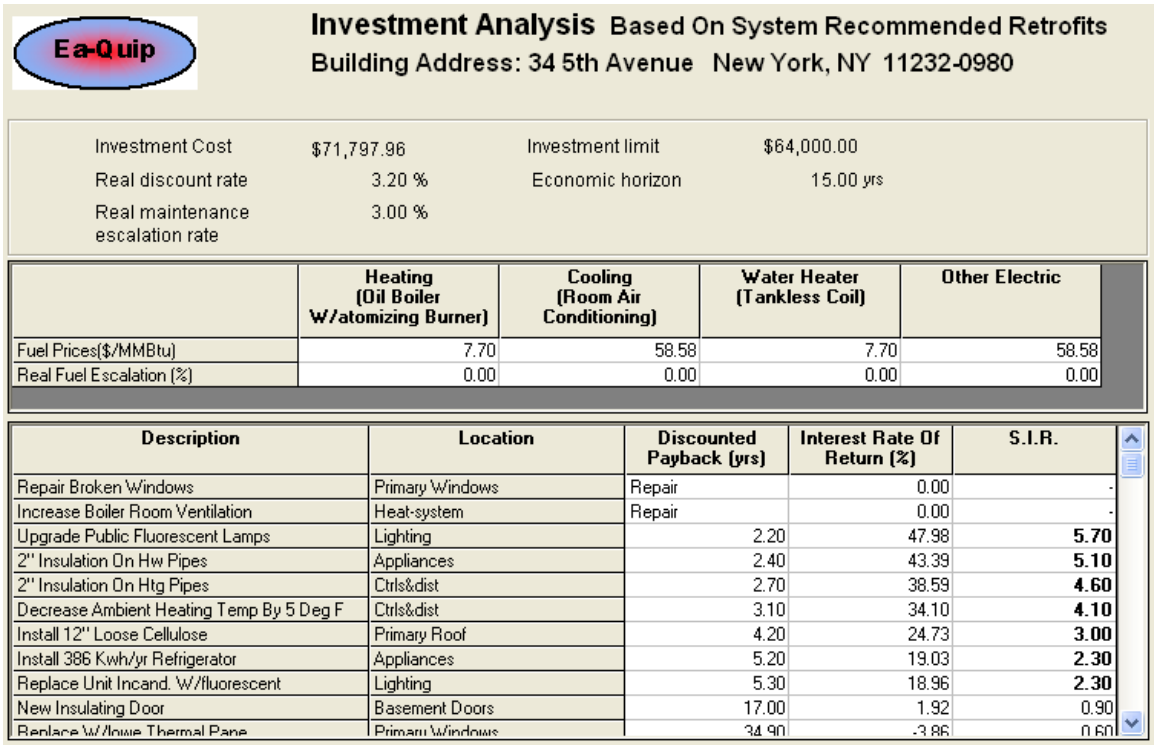
| | | | |
|---|---|---|---|
| Original operating cost | $19,571.55 / yr | Savings in operating cost | $6,528.62 / yr |

| | Heating (Oil Boiler W/atomizing Burner) | Cooling (Room Air Conditioning) | Water Heater (Tankless Coil) | Other Electric |
|---|---|---|---|---|
| Original Building (MMBtu/yr) | 1,354.55 | 0.00 | N/A | 156.10 |
| Retrofited Building (MMBtu/yr) | 760.20 | 0.00 | N/A | 122.75 |
| **Energy Savings (%)** | **43.88%** | **0.00%** | **N/A** | **21.36%** |

(*) % savings of total electric bill

| Description | Location | Heating (%) | Cooling (%) | Water Heater (%) | Other Electric (%) |
|---|---|---|---|---|---|
| Increase Boiler Room Ventilation | Heat-system | 0.00 | 0.00 | 0.00 | 0.00 |
| Repair Broken Windows | Primary Windows | <.1% | 0.00 | 0.00 | 0.00 |
| 2" Insulation On Htg Pipes | Ctrls&dist | 4.77 | 0.00 | 0.00 | 0.00 |
| Decrease Ambient Heating Temp By 5 Deg F | Ctrls&dist | 11.59 | 0.00 | 0.00 | 0.00 |
| Upgrade Public Fluorescent Lamps | Lighting | 0.00 | 0.00 | 0.00 | 1.23 |
| 2" Insulation On Hw Pipes | Appliances | 2.68 | 0.00 | 0.00 | 0.00 |
| Install 12" Loose Cellulose | Primary Roof | 8.12 | 0.00 | 0.00 | 0.00 |
| Replace Unit Incand. W/fluorescent | Lighting | -0.91 | 0.00 | 0.00 | 11.24 |
| Install 386 Kwh/yr Refrigerator | Appliances | -0.36 | 0.00 | 0.00 | 8.90 |
| New Insulating Door | Basement Doors | 1.45 | 0.00 | 0.00 | 0.00 |
| New Heating System | Heat-system | 7.96 | 0.00 | 0.00 | 0.00 |
| Replace W/dblthermal Pane | Roof Top Windows | 0.16 | 0.00 | 0.00 | 0.00 |

5. Investment Analysis



**Investment Analysis** Based On System Recommended Retrofits

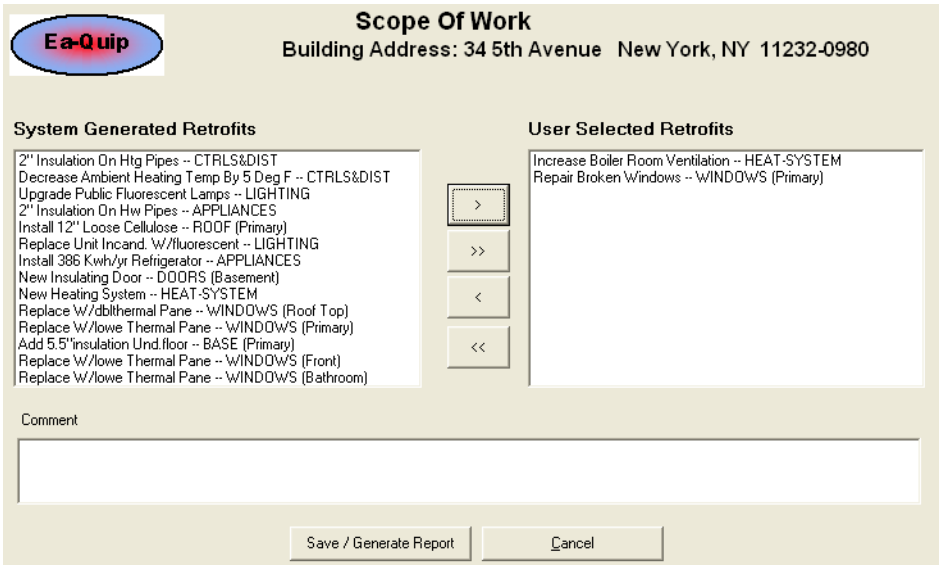
Building Address: 34 5th Avenue New York, NY 11232-0980

| | | | |
|---|---|---|---|
| Investment Cost | $71,797.96 | Investment limit | $64,000.00 |
| Real discount rate | 3.20 % | Economic horizon | 15.00 yrs |
| Real maintenance escalation rate | 3.00 % | | |

| | Heating (Oil Boiler W/atomizing Burner) | Cooling (Room Air Conditioning) | Water Heater (Tankless Coil) | Other Electric |
|---|---|---|---|---|
| Fuel Prices($/MMBtu) | 7.70 | 58.58 | 7.70 | 58.58 |
| Real Fuel Escalation (%) | 0.00 | 0.00 | 0.00 | 0.00 |

| Description | Location | Discounted Payback (yrs) | Interest Rate Of Return (%) | S.I.R. |
|---|---|---|---|---|
| Repair Broken Windows | Primary Windows | Repair | 0.00 | - |
| Increase Boiler Room Ventilation | Heat-system | Repair | 0.00 | - |
| Upgrade Public Fluorescent Lamps | Lighting | 2.20 | 47.98 | **5.70** |
| 2" Insulation On Hw Pipes | Appliances | 2.40 | 43.39 | **5.10** |
| 2" Insulation On Htg Pipes | Ctrls&dist | 2.70 | 38.59 | **4.60** |
| Decrease Ambient Heating Temp By 5 Deg F | Ctrls&dist | 3.10 | 34.10 | **4.10** |
| Install 12" Loose Cellulose | Primary Roof | 4.20 | 24.73 | **3.00** |
| Install 386 Kwh/yr Refrigerator | Appliances | 5.20 | 19.03 | **2.30** |
| Replace Unit Incand. W/fluorescent | Lighting | 5.30 | 18.96 | **2.30** |
| New Insulating Door | Basement Doors | 17.00 | 1.92 | 0.90 |
| Replace W/lowe Thermal Pane | Primary Windows | 34.90 | -3.86 | 0.60 |

6. Scope Of Work



**Scope Of Work**

Building Address: 34 5th Avenue New York, NY 11232-0980

**System Generated Retrofits**

2" Insulation On Htg Pipes -- CTRLS&DIST
Decrease Ambient Heating Temp By 5 Deg F -- CTRLS&DIST
Upgrade Public Fluorescent Lamps -- LIGHTING
2" Insulation On Hw Pipes -- APPLIANCES
Install 12" Loose Cellulose -- ROOF (Primary)
Replace Unit Incand. W/fluorescent -- LIGHTING
Install 386 Kwh/yr Refrigerator -- APPLIANCES
New Insulating Door -- DOORS (Basement)
New Heating System -- HEAT-SYSTEM
Replace W/dblthermal Pane -- WINDOWS (Roof Top)
Replace W/lowe Thermal Pane -- WINDOWS (Primary)
Add 5.5"insulation Und.floor -- BASE (Primary)
Replace W/lowe Thermal Pane -- WINDOWS (Front)
Replace W/lowe Thermal Pane -- WINDOWS (Bathroom)

> >> < <<

**User Selected Retrofits**

Increase Boiler Room Ventilation -- HEAT-SYSTEM
Repair Broken Windows -- WINDOWS (Primary)

Comment

Save / Generate Report Cancel

### 3.1.2 Printable Reports

Printable reports are created in a printer-friendly format and can be printed by File → Print from your browser. If both User Selected and System Recommended retrofits exists, a report will consist of two parts: one generated based on User retrofits and one based on System retrofits separated by a page break with continuous page numbering for both parts of the report facilitating ease of analysis and presentation.

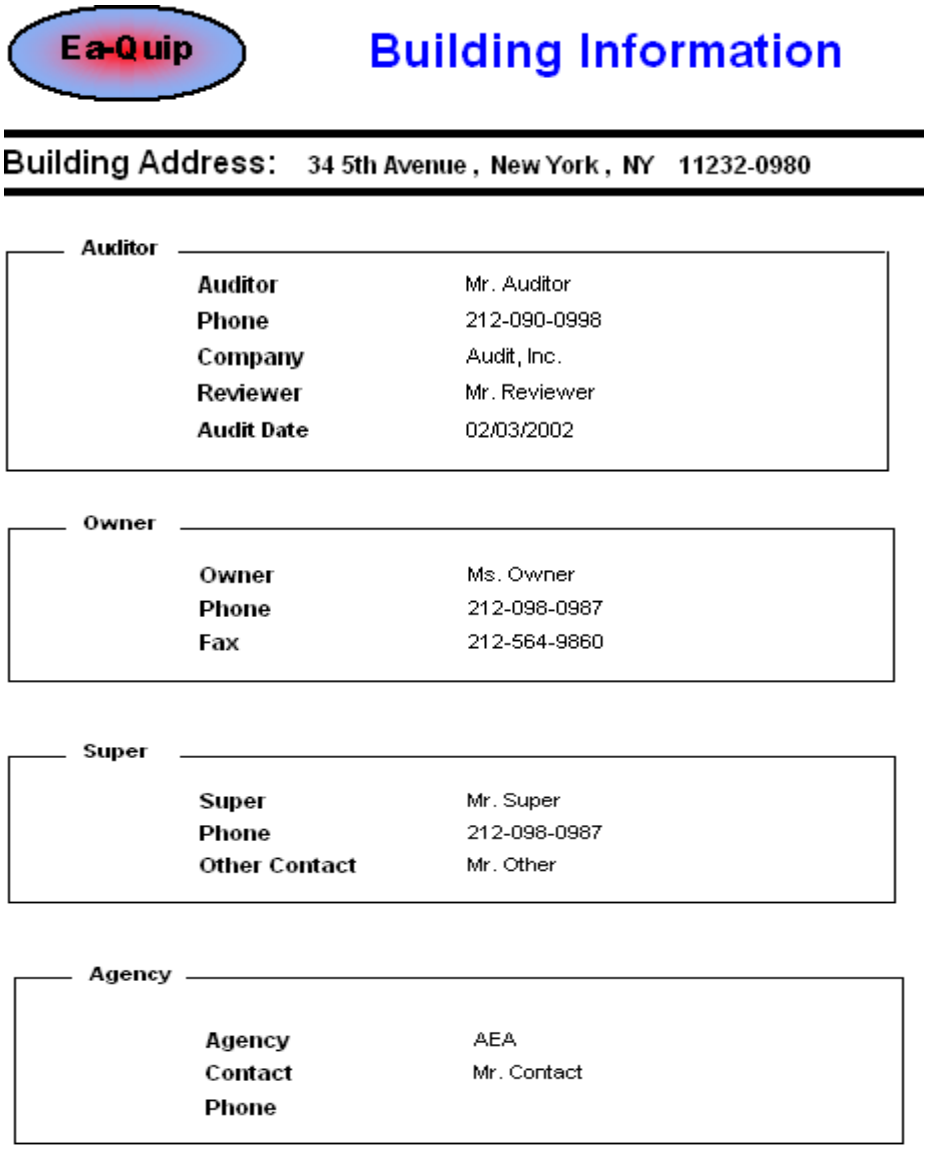
All printable reports follow the same format. Report Header includes EA-Quip Logo and Report Name as well as building address and auditor. Page Footer displays page number and report generation date and time. Additional headers and footers (such as website URL, etc) can be added or removed using your Broswer's Page Setup settings.

To send reports directly to the printer without preview, choose Print from the "Print/Export to Word" link in the report screen. A screen with all reports available for printing is displayed. Choose Reports to be sent directly to the printer by selecting them from Available Reports list and transferring to Selected Reports list. Click Print when done.

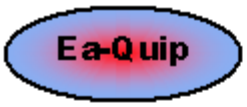
Reports can also be printed to .pdf if you have a pdf writer installed on your computer.

EA-Quip generates the following printable reports that can be accessed via the Reports sub menu in main menu option:

1. Building Information presents general information about Auditor, Owner, Super and Agency that pertain to the audit in a one-page report.



2. Building Data Report lists all component data for the building arranged by component and sub-component in the order of the components data entry screens. Below is a sample of page 1 of the report.




# Building Data

**Building Address:** 34 5th Avenue , New York , NY 11232-0980

**Auditor:** Mr. Auditor **Audit Date:** 02/03/2002

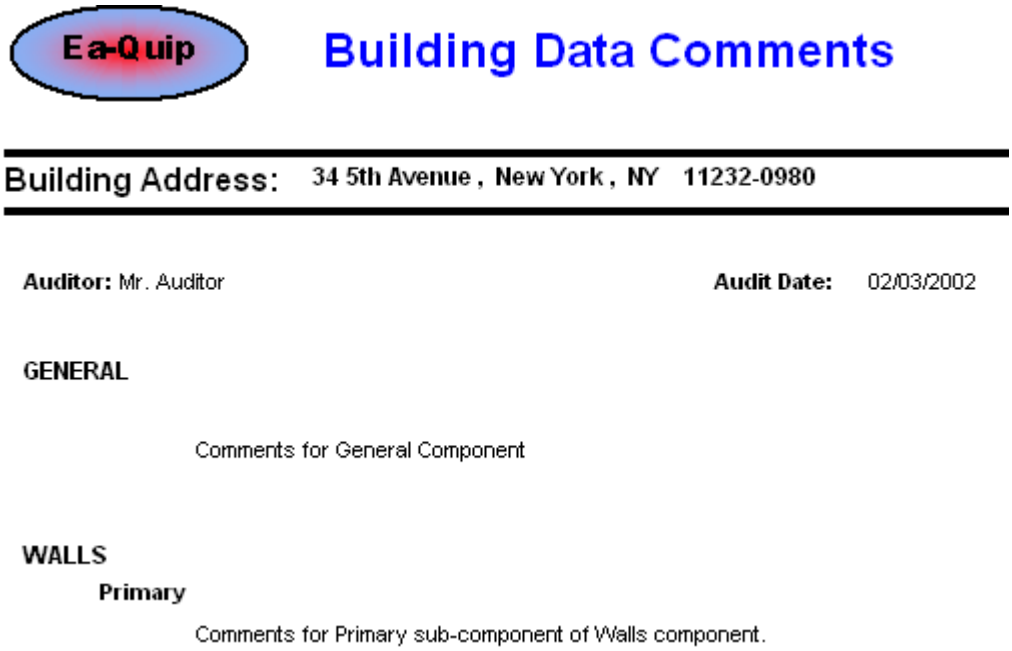
## GENERAL

| | |
|---|---|
| Terrain | D--Dense urban |
| Shielding | H--Heavy |
| Ground Surface | O--Old concrete |
| Number Of Heated Floors ( No. ) | 4 |
| Number Of Dwelling Units ( No. ) | 16 |
| Avg Heated Space Per Floor ( Sqft ) | 2501 |
| Ceiling Height ( Feet ) | 9 |
| Dwelling Mass | H--Heavy |
| Master Electric Metering | N--No |
| Cooling Equipment | R--Room Air Conditioning |
| No. Of Room Air Conditioners In Dwelling ( No. ) | 16 |
| Percent Of Dwelling Cooled ( % ) | 50 |
| Rated Cooling Capacity Per Unit ( Btu/hr ) | 48000 |
| Energy Efficiency Rating (eer) ( No. ) | 8.00 |
| Cooling Day Thermostat Setting ( Degf ) | 78 |
| Cooling Night Setting ( Degf ) | 78 |

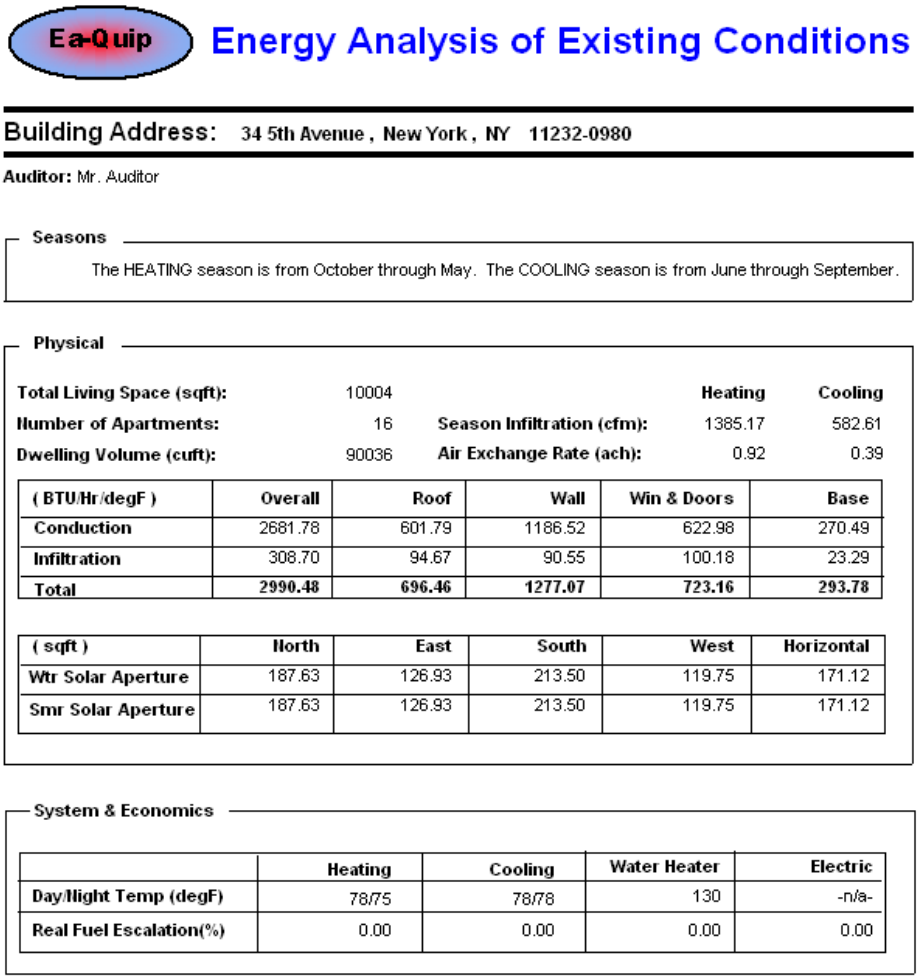
## INFILTRATION

| | |
|---|---|
| Infiltration Measured | E--Estimated air changes. |
| Estimated Air Changes/hour ( No. ) | 0.70 |

3. Building Data Comments lists all comments for all components arranged in component, sub-component order.



4. Energy Analysis of Existing Conditions provides information on the building characteristics in its current condition.



Ea-Quip

## Energy Analysis of Existing Conditions

**Building Address:** 34 5th Avenue , New York , NY 11232-0980

**Auditor:** Mr. Auditor

**Seasons**

The HEATING season is from October through May. The COOLING season is from June through September.

**Physical**

| | | | Heating | Cooling |
|---|---|---|---|---|
| **Total Living Space (sqft):** | 10004 | | | |
| **Number of Apartments:** | 16 | **Season Infiltration (cfm):** | 1385.17 | 582.61 |
| **Dwelling Volume (cuft):** | 90036 | **Air Exchange Rate (ach):** | 0.92 | 0.39 |

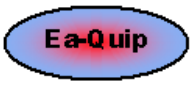
| ( BTU/Hr/degF ) | Overall | Roof | Wall | Win & Doors | Base |
|---|---|---|---|---|---|
| Conduction | 2681.78 | 601.79 | 1186.52 | 622.98 | 270.49 |
| Infiltration | 308.70 | 94.67 | 90.55 | 100.18 | 23.29 |
| **Total** | **2990.48** | **696.46** | **1277.07** | **723.16** | **293.78** |

| ( sqft ) | North | East | South | West | Horizontal |
|---|---|---|---|---|---|
| Wtr Solar Aperture | 187.63 | 126.93 | 213.50 | 119.75 | 171.12 |
| Smr Solar Aperture | 187.63 | 126.93 | 213.50 | 119.75 | 171.12 |

**System & Economics**

| | Heating | Cooling | Water Heater | Electric |
|---|---|---|---|---|
| Day/Night Temp (degF) | 78/75 | 78/78 | 130 | -n/a- |
| Real Fuel Escalation(%) | 0.00 | 0.00 | 0.00 | 0.00 |

5. Energy Saving Measures lists retrofit savings in %.




## Energy Savings Measures
### Based on User Selected Retrofits

**Building Address:** 34 5th Avenue , New York , NY 11232-0980

**Auditor:** Mr. Auditor

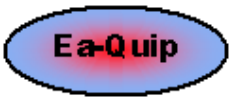
**Original Operating Cost:** $21,658.85 /yr **Savings In Operating Cost:** $6,390.16 /yr

| | Heating | Cooling | Water Heater | Other Electric (*) |
|---|---|---|---|---|
| **Original Building (MMBtu/yr)** | 1,353.22 | 35.81 | N/A | 156.10 |
| **Retrofitted Building (MMBtu/yr)** | 891.75 | 20.71 | N/A | 122.75 |
| **Energy Savings** | **34.10%** | **42.17%** | **N/A** | **21.36 %** |

(*) % savings of the following measures: apartments and public lighting, cooling equipment, refrigerators, dryers and stove (if electric) usage

| Description | Location | Heating (%) | Cooling (%) | Water Heater (%) | Other Electric (%) |
|---|---|---|---|---|---|
| 2" Insulation On Htg Pipes | Ctrls&dist | 4.77 | - | - | - |
| Upgrade Public Fluorescent Lamps | Lighting | - | - | - | 1.23 |
| Install 12" Loose Cellulose | Primary Roof | 9.73 | 17.30 | - | - |
| 2" Insulation On Hw Pipes | Appliances | 2.67 | <.1% | - | - |
| Install 386 Kwh/yr Refrigerator | Appliances | -0.38 | 0.76 | - | 8.90 |
| Replace Unit Incand. W/fluorescent | Lighting | -0.97 | 1.90 | - | 11.24 |

6. Savings And Cost Analysis




# Savings And Costs Analysis
## Based on User Selected Retrofits

**Building Address:** 34 5th Avenue , New York , NY 11232-0980

**Auditor:** Mr. Auditor

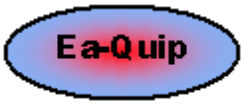
| | | | |
|---|---|---|---|
| **Investment Cost:** | $54,650.46 | **Investment Limit:** | $64,000.00 /yr |
| **Original Operating Cost:** | $19,560.93 /yr | **Savings In Operating Cost:** | $5,506.73 |

| | Energy Factor | Other Electric Usage (*) |
|---|---|---|
| Original Building | 27.27 BTU/sqft/HDD | 45735.50 kWh/yr |
| Retrofitted Building | 17.96 BTU/sqft/HDD | 35965.66 kWh/yr |
| **% Savings** | **34.14 %** | **21.36 %** |

(*) % savings of the following measures: apartments and public lighting, cooling equipment, refrigerators, dryers and stove (if electric) usage

| Description | Location | First Year Savings ($) | Initial Cost ($) | Simple Payback (yrs) | Cumulative Cost ($) |
|---|---|---|---|---|---|
| 2" Insulation On Htg Pipes | Ctrls&dist | 496.96 | 1280.00 | 2.6 yr | 1280.00 |
| Upgrade Public Fluorescent Lamps | Lighting | 112.10 | 232.96 | 2.1 yr | 1512.96 |
| 2" Insulation On Hw Pipes | Appliances | 278.82 | 640.00 | 2.3 yr | 2152.96 |
| Install 12" Loose Cellulose | Primary Roof | 1013.79 | 3297.50 | 3.2 yr | 5450.46 |
| Replace Unit Incand. W/fluorescent | Lighting | 1349.14 | 4800.00 | 3.6 yr | 10250.46 |

7. Investment Analysis




# Investment Analysis
## Based on User Selected Retrofits

**Building Address:** 34 5th Avenue , New York , NY 11232-0980

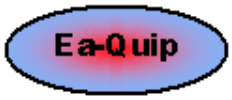
**Auditor:** Mr. Auditor

| | | | |
|---|---|---|---|
| **Initial Investment:** | $54,650.46 | **Investment Limit:** | $64,000.00 |
| **Real Discount Rate:** | 3.20 % | **Economic Horizon:** | 15 yrs |
| **Real Maintenance Rate:** | 3.00 % | | |

| | Heating | Cooling | Water Heater | Other Electric |
|---|---|---|---|---|
| **Type of equipment** | Oil Boiler w/Atomizing Burner | Room Air Conditioning | Tankless Coil | |
| **Fuel prices ($/MMBtu)** | 7.70 | 58.58 | 7.70 | 58.58 |
| **Real Fuel Escalation(%)** | 0.00% | 0.00% | 0.00% | 0.00% |

| Description | Location | Discounted Payback | Interest Rate of Return | S.I.R. |
|---|---|---|---|---|
| Upgrade Public Fluorescent Lamps | Lighting | 2.2 yr | 47.98% | 5.7 |
| 2" Insulation On Hw Pipes | Appliances | 2.4 yr | 43.37% | 5.1 |
| 2" Insulation On Htg Pipes | Ctrls&dist | 2.7 yr | 38.53% | 4.6 |

8. Building Modeling




## Building Modeling

**Building Address:** 34 5th Avenue , New York , NY 11232-0980

**Auditor:** Mr. Auditor

| Month | Calculated Fuel Use | Actual Fuel Use | DayTime Heat On-Time | NightTime Heat On-Time | Total Heating Load | Solar Gain | Infiltration | Overall Electricity Use |
|---|---|---|---|---|---|---|---|---|
| | gal | gal | % | % | MMBtu | MMBtu | ac/hr | MWh |
| January | 1,744.00 | 1,716.00 | 35.10 | 32.00 | 111.00 | 5.00 | 1.03 | 3.9 |
| February | 1,574.00 | 1,624.00 | 34.70 | 32.40 | 100.00 | 8.00 | 1.04 | 3.5 |
| March | 1,467.00 | 1,490.00 | 29.10 | 27.50 | 84.00 | 14.00 | 1.00 | 3.9 |
| April | 934.00 | 989.00 | 19.10 | 17.30 | 34.00 | 23.00 | 0.80 | 3.8 |
| May | 443.00 | 574.00 | 4.80 | 4.80 | 0.00 | 29.00 | 0.66 | 3.9 |
| June | 429.00 | 445.00 | 4.80 | 4.80 | -3.00 | 29.00 | 0.34 | 3.8 |
| July | 443.00 | 445.00 | 4.80 | 4.80 | -33.00 | 30.00 | 0.29 | 3.9 |
| August | 443.00 | 445.00 | 4.80 | 4.80 | -6.00 | 24.00 | 0.29 | 3.9 |
| Septemb | 429.00 | 445.00 | 4.80 | 4.80 | -2.00 | 17.00 | 0.35 | 3.8 |
| October | 886.00 | 714.00 | 18.00 | 14.90 | 27.00 | 9.00 | 0.69 | 3.9 |
| Novembe | 1,416.00 | 1,376.00 | 29.70 | 26.60 | 81.00 | 6.00 | 0.93 | 3.8 |
| Decembe | 1,653.00 | 1,619.00 | 33.60 | 30.10 | 102.00 | 4.00 | 0.97 | 3.9 |
| **Sum** | **11,861.00** | **11,882.00** | | | **495.00** | **198.00** | | **46** |
| **Average** | **988.42** | **990.17** | **18.61** | **17.07** | **41.25** | **16.50** | **0.70** | **3.83** |

9. WAP Scope Of Work

Ea-Quip

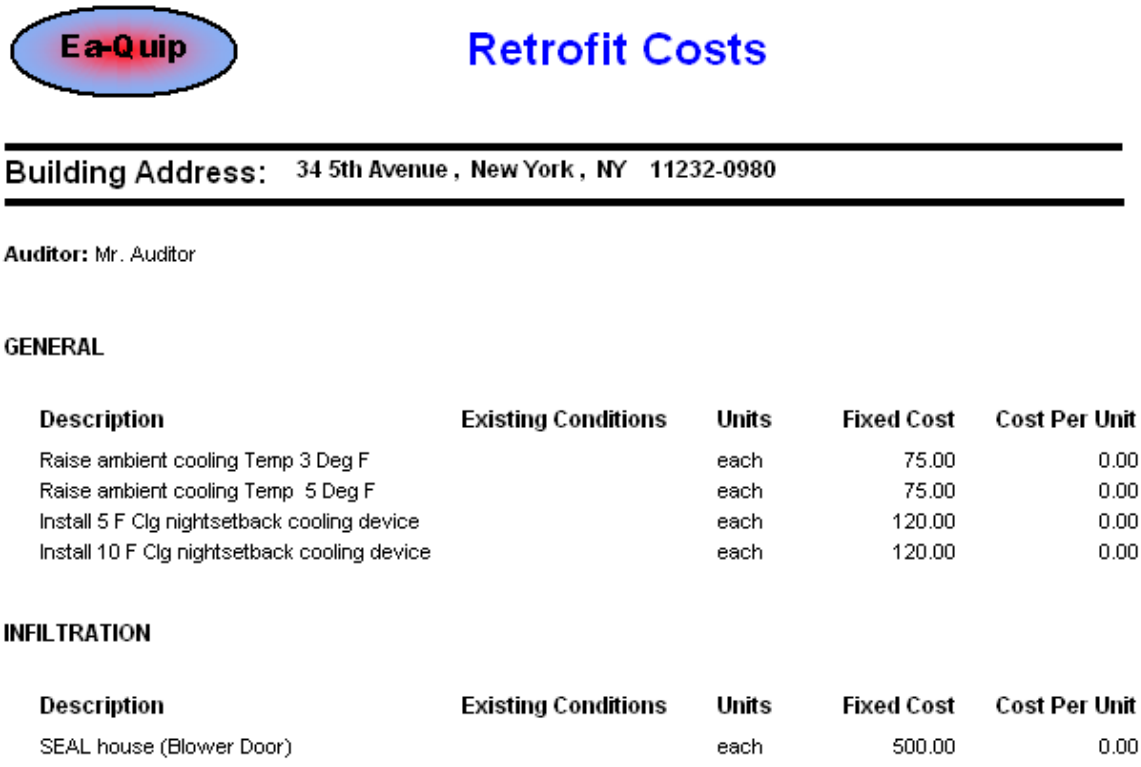
# WAP Scope Of Work

**Building Address:** 34 5th Avenue , New York , NY 11232-0980

**Auditor:** Mr. Auditor

| Proposed Retrofit | | Estimated Investment Cost | Projected 1st Year Monetary Savings | Savings to Insvestment Ratio (SIR) | Note |
|---|---|---|---|---|---|
| **1. Health and Safety and Immediately Hazardous Conditions** | | | | | |
| 1.1 | 2" Insulation On Htg Pipes | $1,280.00 | $497.65 | 4.6 | |
| **H&S Subtotal** | | **$1,280.00** | **$497.65** | | |
| **2. Most Cost Effective Measures (SIR>1)** | | | | | |
| **MCEM Subtotal** | | **$0.00** | **$0.00** | | |
| **3. Low-Cost Measures associated to the MCEM** | | | | | |
| **Low-Cost Subtotal** | | **$0.00** | **$0.00** | | |
| **4. Workscope eligible under WAP but not deemed cost effective measure** | | | | | |
| **SIR<1 Subtotal** | | **$0.00** | **$0.00** | | |
| **5. Operation and Maintenance Measure** | | | | | |
| 5.1 | Increase Boiler Room Ventilation | $1,300.00 | $0.00 | - | |
| **O&M Subtotal** | | **$1,300.00** | **$0.00** | | |
| **GRAND TOTAL** | | **$2,580.00** | **$497.65** | | |

10. Retrofit Costs: as a sample, page 1 of the retrofit costs report.



Ea-Quip

Retrofit Costs

Building Address: 34 5th Avenue , New York , NY 11232-0980

**Auditor:** Mr. Auditor

**GENERAL**

| Description | Existing Conditions | Units | Fixed Cost | Cost Per Unit |
|---|---|---|---|---|
| Raise ambient cooling Temp 3 Deg F | | each | 75.00 | 0.00 |
| Raise ambient cooling Temp 5 Deg F | | each | 75.00 | 0.00 |
| Install 5 F Clg nightsetback cooling device | | each | 120.00 | 0.00 |
| Install 10 F Clg nightsetback cooling device | | each | 120.00 | 0.00 |

**INFILTRATION**

| Description | Existing Conditions | Units | Fixed Cost | Cost Per Unit |
|---|---|---|---|---|
| SEAL house (Blower Door) | | each | 500.00 | 0.00 |

To view the report, click the Save/Generate report button at the bottom of the screen.

### 3.1.3 Exporting Reports to .txt, .html and MS-Word

EA-Quip reports may also be exported to MS-Word. To export report(s) to MS-Word document, choose Reports→Print/Export To Word option and choose reports to be exported from a list of available reports. A Word document will be generated consisting of chosen reports formatted as a complete package with title page and table of contents listing each exported report. Exported reports will be saved to a directory of your choice. Reports can also be printed to .pdf if you have a pdf writer installed on your computer.

# 4. EA-Quip Report Descriptions

## 4.1 Building Information

The Building Information report presents generic information pertaining to an audit: Auditing Agency's, Super's and Owner's names and contacts. Information for this report is based on the data entries on the Building Information screen. This information is *not* inherited from the starting file when creating a new building.
This report may be accessed via the Reports menu.

## 4.2 Building Data

Building Data report presents the data entered for each component on the component data entry screens. The information is listed in component, sub-component order. This report may be accessed via the Reports menu.

## 4.3 Building Data Comments

The Building Data Comments report presents a list of comments entered for each component and/or sub-component on the data entry screens. The data is arranged in component, sub-component order. This report may be accessed via Reports menu.

## 4.4 Energy Analysis Of Existing Conditions

The Energy Analysis Of Existing Conditions report presents a detailed view of the current physical and economic building conditions.

Physical conditions are described in terms of total living space, number of apartments and building volume, season infiltration and air exchange rates for heating and cooling. The report presents a breakdown of Conduction and Infiltration values for Overall, Roof, Wall, Windows and Doors and Basement. Also a breakdown of winter and Summer Solar Aperture is presented for North, East, South, West and Horizontal.

**Physical**

| | | | Heating | Cooling |
|---|---|---|---|---|
| Total Living Space (sqft) | 10004 | | | |
| Number of Apartments | 16 | Season Inflitration (cfm) | 1385.17 | 582.61 |
| Dwelling Volume (cuft) | 90036 | Air Exchange Rate (ach) | 0.92 | 0.39 |

| Units In btu/sqft/degF | Overall | Roof | Wall | Win&Doors | Base |
|---|---|---|---|---|---|
| Conduction | 2681.78 | 601.79 | 1186.52 | 622.98 | 270.49 |
| Infiltration | 308.70 | 94.67 | 90.55 | 100.18 | 23.29 |
| **Total** | **2990.48** | **696.46** | **1277.07** | **723.16** | **293.78** |

| Units In sqft | North | East | South | West | Horizontal |
|---|---|---|---|---|---|
| Wtr Solar Aperture | 187.63 | 126.93 | 213.50 | 119.75 | 171.12 |
| Smr Solar Aperture | 187.63 | 126.93 | 213.50 | 119.75 | 171.12 |

The report lists day and night thermostat setting and real fuel escalation values for heating, cooling, water heater, and electric.

System & Economics

| | Heating (Oil Boiler) | Cooling (Room Air C) | Water Heater (Tankless C) | Electric (-n/a-) |
|---|---|---|---|---|
| Day/Night Thermostat(degF) | 78/75 | 78/78 | 130 | -n/a- |
| Real Fuel Escalation(%) | 0.00 | 0.00 | 0.00 | 0.00 |

## 4.5 Energy Savings Measures

The Energy Analysis Of Existing Conditions Report presents a comparison between Original Operating Costs and Savings in Operating Costs as a result of applying recommended measures.

The report gives a breakdown on Original Operating Costs and Savings in Operating Costs for Heating, Cooling, Water Heater and Other Electric portions.

Energy Savings = 100* (Original Values – Retrofitted Values) / Original Values

| | Heating (Oil Boiler W/atomizing Burner) | Cooling (Room Air Conditioning) | Water Heater (Tankless Coil) | Other Electric |
|---|---|---|---|---|
| Original Building (MMBtu/yr) | 1,354.55 | 0.00 | N/A | 156.10 |
| Retrofited Building (MMBtu/yr) | 760.20 | 0.00 | N/A | 122.75 |
| **Energy Savings (%)** | **43.88%** | **0.00%** | **N/A** | **21.36%** |

(*) % savings of the following measures: apartments and public lighting, cooling equipment, refrigerators, dryers and stove (if electric) usage

And finally the report lists the recommended (or User selected) retrofits with their corresponding Location (component, sub-component), percent of Heating, Cooling, Water Heater, and Other Electric.

| Description | Location | Heating (%) | Cooling (%) | Water Heater (%) | Other Electric (%) |
|---|---|---|---|---|---|
| Increase Boiler Room Ventilation | Heat-system | 0.00 | 0.00 | 0.00 | 0.00 |
| Repair Broken Windows | Primary Windows | <.1% | 0.00 | 0.00 | 0.00 |
| 2" Insulation On Htg Pipes | Ctrls&dist | 4.77 | 0.00 | 0.00 | 0.00 |
| Decrease Ambient Heating Temp By 5 Deg F | Ctrls&dist | 11.59 | 0.00 | 0.00 | 0.00 |
| Upgrade Public Fluorescent Lamps | Lighting | 0.00 | 0.00 | 0.00 | 1.23 |
| 2" Insulation On Hw Pipes | Appliances | 2.68 | 0.00 | 0.00 | 0.00 |
| Install 12" Loose Cellulose | Primary Roof | 8.12 | 0.00 | 0.00 | 0.00 |
| Replace Unit Incand. W/fluorescent | Lighting | -0.91 | 0.00 | 0.00 | 11.24 |
| Install 386 Kwh/yr Refrigerator | Appliances | -0.36 | 0.00 | 0.00 | 8.90 |
| New Insulating Door | Basement Doors | 1.45 | 0.00 | 0.00 | 0.00 |
| New Heating System | Heat-system | 7.96 | 0.00 | 0.00 | 0.00 |
| Replace W/dblthermal Pane | Roof Top Windows | 0.16 | 0.00 | 0.00 | 0.00 |

## 4.6 Savings And Costs Analysis

The Savings And Costs Analysis report presents Original Operating Costs and Savings In Operating Costs based on the application of the recommended, or User selected measures.

The report compares the Energy Factor and Other Electric Usage for Original and Retrofitted Buildings and calculates the savings for each.

% Savings = 100* (Original Values – Retrofitted Values) / Original Values

| | Energy Factor | Other Electric Usage (*) |
|---|---|---|
| Original Building | 27.29 BTU/sqft/HDD | 45,735.50 kWh/yr |
| Retrofited Building | 15.32 BTU/sqft/HDD | 35,965.66 kWh/yr |
| **% Savings** | **43.86 %** | **21.36 %** |

(*) % savings of the following measures: apartments and public lighting, cooling equipment, refrigerators, dryers and stove (if electric) usage

The report also presents a list of User Selected or System Recommended retrofits along with their locations (component, sub-component), First Year Savings, Initial Investment Cost, Simple Payback and Cumulative Cost.

| Description | Location | Firstyear Savings ($) | Initial Cost ($) | Simple Payback (yrs) | Cumul Cost ($) |
|---|---|---|---|---|---|
| Increase Boiler Room Ventilation | Heat-system | Repair | 1,300.00 | 0.00 | 1,300.00 |
| Repair Broken Windows | Primary Windows | Repair | 105.00 | 0.00 | 1,405.00 |
| 2" Insulation On Htg Pipes | Ctrls&dist | 497.65 | 1,280.00 | 2.60 | 2,685.00 |
| Decrease Ambient Heating Temp By 5 Deg F | Ctrls&dist | 1,208.26 | 3,500.00 | 2.90 | 6,185.00 |
| Upgrade Public Fluorescent Lamps | Lighting | 112.10 | 232.96 | 2.10 | 6,417.96 |
| 2" Insulation On Hw Pipes | Appliances | 278.95 | 640.00 | 2.30 | 7,057.96 |
| Install 12" Loose Cellulose | Primary Roof | 846.37 | 3,297.50 | 3.90 | 10,355.46 |
| Replace Unit Incand. W/fluorescent | Lighting | 1,355.34 | 4,800.00 | 3.50 | 15,155.46 |
| Install 386 Kwh/yr Refrigerator | Appliances | 775.93 | 2,750.00 | 3.50 | 17,905.46 |
| New Insulating Door | Basement Doors | 150.83 | 1,950.00 | 12.90 | 19,855.46 |
| New Heating System | Heat-system | 830.11 | 25,000.00 | 30.10 | 44,855.46 |

## 4.7 Investment Analysis

Investment Analysis report presents investment information, such as Investment Cost, Investment Limit, Real Discount Rate, Economic Horizon and Real Maintenance Escalation Rate.

The report presents a breakdown of Fuel Prices (in MMBtu) and Fuel Escalation (in %) for Heating, Cooling, Water Heater and Other Electric.

| | Heating (Oil Boiler W/atomizing Burner) | Cooling (Room Air Conditioning) | Water Heater (Tankless Coil) | Other Electric |
|---|---|---|---|---|
| Fuel Prices($/MMBtu) | 7.70 | 58.58 | 7.70 | 58.58 |
| Real Fuel Escalation (%) | 0.00 | 0.00 | 0.00 | 0.00 |

The report also lists retrofits with their corresponding Location (component, sub-component), Discounted Payback (in years), Interest Rate Of Return an SIR (savings to investment ratio) in decreasing order. Repairs, which have no savings, are displayed at the top of the retrofits list.

| Description | Location | Discounted Payback (yrs) | Interest Rate Of Return (%) | S.I.R. |
|---|---|---|---|---|
| Repair Broken Windows | Primary Windows | Repair | 0.00 | - |
| Increase Boiler Room Ventilation | Heat-system | Repair | 0.00 | - |
| Upgrade Public Fluorescent Lamps | Lighting | 2.20 | 47.98 | **5.70** |
| Install 386 Kwh/yr Refrigerator | Appliances | 5.20 | 19.03 | **2.30** |
| Replace Unit Incand. W/fluorescent | Lighting | 5.30 | 18.96 | **2.30** |
| New Insulating Door | Basement Doors | 17.00 | 1.92 | 0.90 |
| Replace W/low-e Thermal Pane | Primary Windows | 34.90 | -3.86 | 0.60 |

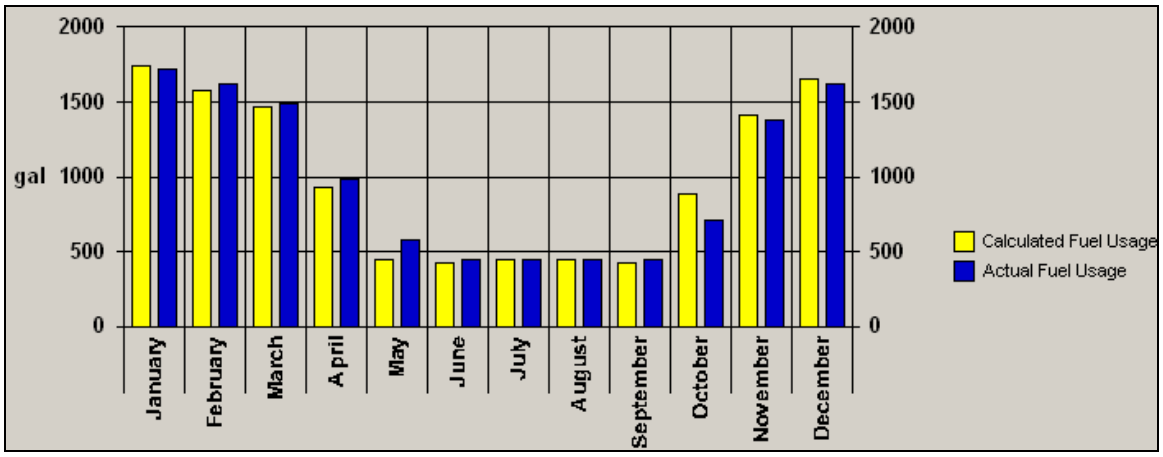
## 4.8 Building Modeling

Building Modeling report contains data of the annual energy calculations, i.e., monthly Fuel Usage, Day and Night Heat On-Time (in %), Total Heating Load (in MMBTU), Solar Gain (in MMBTU), Infiltration and Overall Electricity Use.

| | Calculated Fuel Use (gal) | Actual Fuel Use (gal) | Daytime Heat On-Time (%) | Nighttime Heat On-Time (%) | Total Heating Load (MMBtu) | Solar Gain (MMBtu) | Infiltration (ac/hr) | Overall Electricity Use (MWh) |
|---|---|---|---|---|---|---|---|---|
| January | 1744.0 | 1716.0 | 35.1 | 32.0 | 111.0 | 5.0 | 1.03 | 3.9 |
| February | 1574.0 | 1624.0 | 34.7 | 32.4 | 100.0 | 8.0 | 1.04 | 3.5 |
| March | 1467.0 | 1490.0 | 29.1 | 27.5 | 84.0 | 14.0 | 1.0 | 3.9 |
| April | 934.0 | 989.0 | 19.1 | 17.3 | 34.0 | 23.0 | 0.8 | 3.8 |
| May | 443.0 | 574.0 | 4.8 | 4.8 | 0.0 | 29.0 | 0.66 | 3.9 |
| June | 429.0 | 445.0 | 4.8 | 4.8 | -3.0 | 29.0 | 0.34 | 3.8 |
| July | 443.0 | 445.0 | 4.8 | 4.8 | -33.0 | 30.0 | 0.29 | 3.9 |
| August | 443.0 | 445.0 | 4.8 | 4.8 | -6.0 | 24.0 | 0.29 | 3.9 |
| September | 429.0 | 445.0 | 4.8 | 4.8 | -2.0 | 17.0 | 0.35 | 3.8 |
| October | 886.0 | 714.0 | 18.0 | 14.9 | 27.0 | 9.0 | 0.69 | 3.9 |
| November | 1416.0 | 1376.0 | 29.7 | 26.6 | 81.0 | 6.0 | 0.93 | 3.8 |
| December | 1653.0 | 1619.0 | 33.6 | 30.1 | 102.0 | 4.0 | 0.97 | 3.9 |
| | | | | | | | | |
| **Sum** | **11861.0** | **11882.0** | | | **495.0** | **198.0** | | **46.0** |
| **Average** | **988.42** | **990.17** | **18.61** | **17.07** | **41.25** | **16.5** | **0.7** | **3.83** |

The Building Modeling chart is a bar chart that presents the relationship between Calculated and Actual Fuel Usage for every month of the year. For a properly modeled building using fossil fuel, the shape of the chart should have a normalized U-shape usage profile with the lowest values during summer months, and highest values during winter months. For an electric building equipped with a cooling system, the shape of the chart should have a dual-peak usage profile. A proper modeling is critical for a correct analysis and scope of work. For each month, each "calculated usage" bar should match the "actual usage" bar with a difference not greater than 10%. Although it is critical that this percentage is respected for both baseload and winter months, it is often the case that shoulder months (April, May, September) exceed this ratio. A 25% differential is acceptable for these shoulder months.

The building modeling report is available by accessing the building modeling link on the toolbar or via the reports page. To access the building modeling chart, choose the building modeling link on the toolbar, scroll down, and select "Display Chart".




## 4.9 Scope Of Work

The Scope Of Work Screen presents a list of system-generated retrofits with an option to narrow down the retrofit selection based on User choices. A report can be generated based on system recommended retrofits only, or both User-selected retrofits and system recommended retrofits. EA-Quip recalculates measurements based on the User's selection only if such exist. If there are no User-selected retrofits, the report consists of one page with System Recommended Retrofits. If User-Selected Retrofits exist, they are displayed on the first page of the report, followed by System-Recommended Retrofits on a separate page of the same report.

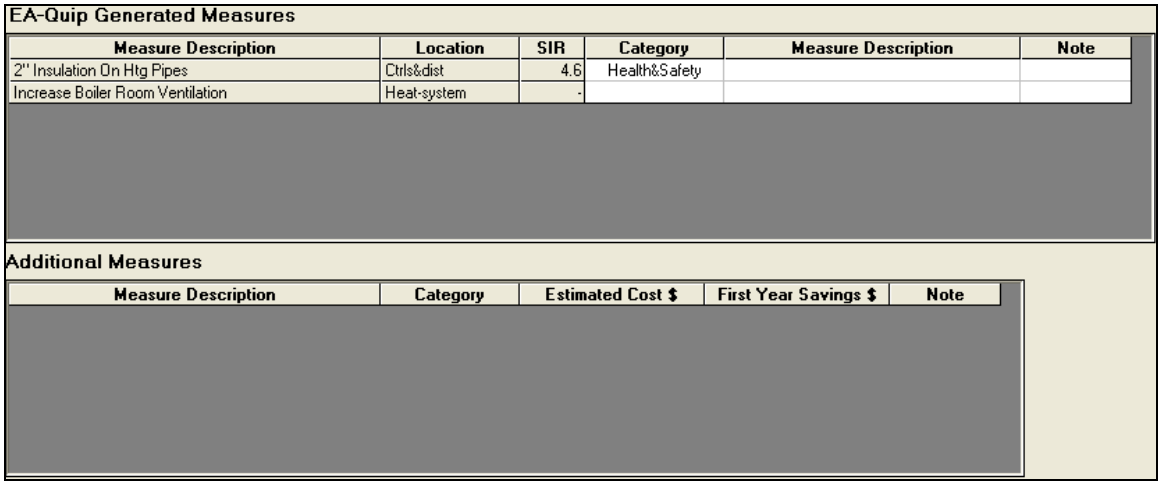
Excerpt from the report:

| Description | Location | Initial Cost ($) | First Year Savings ($) | S.I.R. |
|---|---|---|---|---|
| Increase Boiler Room Ventilation | Heat-system | 1,300.00 | Repair | - |
| 2" Insulation On Htg Pipes | Ctrls&dist | 1,280.00 | 497.65 | 4.60 |
| **Total** | | **$2,580.00** | **$497.65** | |

## 4.10 WAP (Weatherization Assistance Program) Scope Of Work

Prior to running WAP Scope Of Work, User should verify the validity of Scope Of Work, as the values for WAP Scope Of Work are derived from User-Selected retrofits on Scope Of Work report if such exist. Otherwise, System-Recommended retrofits are extracted from the Scope Of Work report into the WAP Scope Of Work report.

WAP Scope Of Work presents a list of User-selected retrofits, if such exist; otherwise, system recommended retrofits are displayed. Each of the retrofits that must be assigned to a category defined by WAP guidelines may be given an alternate description and a comment.

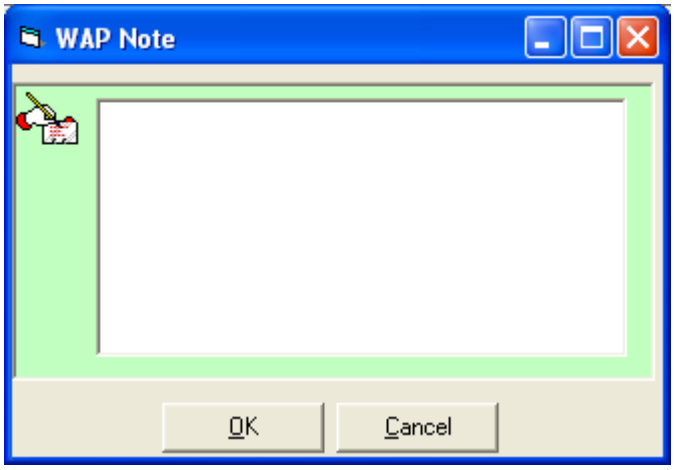



There are five categories to choose from:

| | |
|---|---|
| **Health&Safety** | Health and Safety and Immediately Hazardous Conditions |
| **MCEM** | Most Cost Effective Measures (SIR>1) |
| **O&M** | Operation and Maintenance Measure |
| **Low-Cost** | Low-Cost Measures associated to the MCEM |
| **NotCEM** | Workscope eligible under WAP but not deemed cost effective measure |

A User may add additional descriptions, assign them to a category and enter Estimated Cost and First Year Savings. A report can be generated combining system and User measure descriptions. To add additional description, click Add Description button, and a new row will appear at the end of all rows in Additional Descriptions grid. To delete an Additional Description, highlight a row and click Delete Additional Description button.

A comment can be added to any or all WAP measures by clicking on the cell in the Note column. A data entry screen will be displayed.




After the Note is saved, the first 10 characters of the note followed by an ellipsis (…) will appear in the Note cell. To view/edit the entire note, click on the Note cell.

The WAP Scope Of Work report summarizes all WAP measures based on WAP categories with sub totals for each category and a grand total for all categories. All notes are listed at the end of the report.

## 4.11 Retrofit Costs Report

The Retrofit Costs Report lists all retrofits with corresponding existing conditions, units, fixed cost, and cost per unit ordered by component.

Excerpt from Retrofit Costs Report:

**GENERAL**

| Description | Existing Conditions | Units | Fixed Cost | Cost Per Unit |
|---|---|---|---|---|
| Raise ambient cooling Temp 3 Deg F | | each | 75.00 | 0.00 |
| Raise ambient cooling Temp 5 Deg F | | each | 75.00 | 0.00 |
| Install 5 F Clg nightsetback cooling device | | each | 120.00 | 0.00 |
| Install 10 F Clg nightsetback cooling device | | each | 120.00 | 0.00 |

**INFILTRATION**

| Description | Existing Conditions | Units | Fixed Cost | Cost Per Unit |
|---|---|---|---|---|
| SEAL house (Blower Door) | | each | 500.00 | 0.00 |

## 4.12 Quality Control (AutoCheck)

EA-Quip provides an Auto Check function that performs quality control based on information entered into the system for a building. To run Auto Check, choose Auto Check Report from the Reports Menu. The Auto Check report presents a list of building parameters, their values, acceptable ranges, and the status (OK, Out Of Range, N/A). Auditor can add free text in the Comments box for this specific section.

Excerpt from the report:

| Parameter | Value | Valid Range | Status | Comments |
|---|---|---|---|---|
| Floor area per apartment (sqft) | 593.55 | 400 < Value < 900 | OK | |
| Economic time horizon | 15 | = 15 | OK | |
| Real Discount rate | 3.2% | < 3.2 | OK | |
| Heating degree days | 4961 | 3767 < Value < 5650 | OK | |
| Heating fuel price escalation rate | 0.0% | < 0 | OK | |
| DHW fuel price escalation rate | 0.0% | < 0 | OK | |
| Electricity price escalation rate | 0.0% | < 0 | OK | |
| #2 oil cost | 1.07 | 0 < Value < 1.4 | OK | |
| #4 oil cost | N/A | 0 < Value < 1.25 | N/A | |
| #6 oil cost | N/A | 0 < Value < 1 | N/A | |
| Natural gas cost ($/Therm) | 0.65 | 0 < Value < 1.35 | OK | |
| % Heating savings (Based on User Retrofits) | 4.76% | 20 < Value < 40 | Out Of Range | |
| % Heating savings (Based on System Retrofits) | 43.86% | 20 < Value < 40 | Out Of Range | |

The Autocheck function should be seen as a “safety net” type of tool for the User. One “out of range” value should flag a possible data entry error or lead the User to ask him/herself if it is specific to the building he/she is auditing.