

eQUEST Training Module 2

Intermediate Energy Modeling



Integrated Design Lab, Bozeman
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Tom Wood, Director
Lab Assistants Christopher
Hancock, Shelby Hinchliff,
Justina Hohmann, Amy Lindgren,
Heather Schroeder, Bill Zanoni,
Emily Sikorski, and Colleen DeVoe

406-994-4934
twood@montana.edu
www.idlbozeman.com





The Integrated Design Lab - Bozeman is funded by the Northwest Energy Efficiency Alliance. Our services include energy and lighting analysis for Montana architects and engineers who wish to become more aware of the environmental impacts of energy consumption.

As a member of the BetterBricks Lab Network, Montana State University's Integrated Design Lab- Bozeman is your Montana contact for energy and daylighting information, education and tools for assessing integrated design decisions, including daylighting and efficient electric lighting techniques.

We are available for consulting and training workshops.

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BetterBricks is the commercial building initiative of the Northwest Energy Efficiency Alliance (NEEA), which is supported by Northwest electric utilities. Through BetterBricks, NEEA advances ideas to accelerate energy savings in new and existing commercial buildings. BetterBricks education & training, online resources and recognition of industry leaders guide and inspire building professionals to embrace best practices, improve energy performance and achieve their sustainability goals. Visit www.BetterBricks.com to connect to these powerful energy ideas and more.

WHAT IS eQUEST?

eQUEST is a building energy simulation tool from James J. Hirsch and Associates that is based on the older and more widely known energy analysis program, DOE-2, from the Lawrence Berkeley National Laboratory. While DOE-2 was a powerful tool, it was too complicated to be useful to the entire design team and too time-consuming for it to fit into the budget of most projects.

eQUEST took the brains of DOE-2 and added a graphic user interface, wizards, and industry-standard defaults. Now eQUEST can be used for anything from basic energy strategizing to detailed life-cycle costing by anyone from new users to experienced energy modelers.

This training module series focuses on the intuitive side of eQUEST, understanding that not everyone has the time for or need to create highly detailed building simulations. Some of the benefits of simple energy modeling include:

- Gain an intuitive understanding of the effects that basic energy-saving variables can have on a design.
- Study relative cost analysis (i.e. cost #1 vs. cost #2 if x, y, z changes are made) in a short amount of time.
- Propose new and innovative energy design ideas to skeptical critics.

The Integrated Design Lab—Bozeman has created a series of four modules that teach the basics and some advanced features of eQUEST. Designed for architects, engineers, and students, this module series explains everything from the simplest to the more complex features, and gives users more tools for the building performance simulations.

The modules will first walk you through the use of the Schematic Design Wizard, a wizard designed to be used in the earliest stages of design when little detailed information is known about the systems of the building. The Energy Efficiency Measure Wizard, a tool for analyzing multiple options for a model at once, is also covered. An introduction to the Design Development Wizard follows for when you are prepared for more specific modeling control. Then eQUEST's Life-Cycle Cost Analysis features are demonstrated. Finally, in-depth explanations of how to perform Parametric Runs and how to use the Detail Data Edit mode are presented, providing the user with access to the more advanced features of eQUEST.

For more information concerning eQUEST and a free download, visit:
<http://www.doe2.com/equest/>.

THE TRAINING MODULES

Since eQUEST is a powerful computer program, four training modules have been created for the purposes of teaching eQUEST to the interested user. Each module builds on the information presented in the previous module and all of the modules include an example at the end that the user can recreate by following step-by-step instructions. Each module is explained in more detail below:

- **Module 1: Basic Energy Modeling and Comparative Runs**
This module gives an overview of some of the very basic functions of eQUEST and teaches the user how to set up a simple energy model based on schematic design information using the Schematic Design (SD) Wizard. It then explains how to use the Energy Efficiency Measure (EEM) Wizard to create multiple scenarios for portions of the model that can be compared in order to provide the user with data as to which scenario is the best for the building.
- **Module 2: Intermediate Energy Modeling**
This module teaches the user how to navigate the Design Development (DD) Wizard and create a more comprehensive energy model for simulations. The module highlights some of the main features of this wizard and walks the user through creating a model from scratch as well as updating a previously-created SD Wizard model.
- **Module 3: Life-Cycle Cost Analysis**
This module explains what a Life-Cycle Cost Analysis is and how to perform such an analysis using eQUEST.
- **Module 4: Advanced Energy Modeling and Complex Comparative Runs**
This module shows the user how to modify the properties of an energy model to suit the specific needs of the project. The Detailed Data Edit mode is explored and Parametric Runs are created in order to perform more specific energy analysis.

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EXECUTIVE SUMMARY

eQUEST is a free building energy simulation tool based on the older and more widely known energy analysis program, DOE-2, from the Lawrence Berkeley National Laboratory and James J. Hirsch and Associates (JJHA). Although DOE-2 is powerful, it is very complicated and can be very difficult for the entire design team to use. eQUEST integrates the DOE-2 engine with a graphic user interface, wizards, and industry-standard defaults, making it a useful design tool for both beginner and experienced energy modelers.

The Integrated Design Lab Bozeman has created a series of four modules that teach the basics and some advanced features of eQUEST. Designed for architects, this module series explains everything from the simplest to the more complex features, and gives users more tools for the building profession.

Module 2 in the series builds on the previous module and explores the Design Development (DD) Wizard in eQUEST. It is recommended that you already have a working knowledge of eQUEST and have read through Module 1 before proceeding with this module. The DD Wizard can be used for more advanced energy modeling, and this module explains how to do just that. Also, some more EEM Wizard features that pertain to the DD Wizard are covered. Finally the user is shown how to modify the graphical reports in eQUEST to better display data. At the end of this module, the user will be able to create a more comprehensive energy model of a single building or multiple buildings.

ARE YOU USING THE LATEST VERSION OF eQUEST?

On August 25, 2010 JJHA released a new version of eQUEST, eQUEST v. 3.64. This version includes many program and utility rate updates. If you have not already upgraded to this new version, do so before beginning this tutorial. For more information on the version updates, please see the Appendix. To learn more about eQUEST and to download your free copy, go to: doe2.com/equest.

Some things to ALWAYS keep in mind while working in eQUEST:

- **Work in a linear fashion.** It is important to note that the DD wizard overall is not dependent upon sequential modifications. However, within each component you should still try to input information as linearly as possible because information on earlier screens will affect model choices on later screens.
- **Save frequently.** Like any computer program, some newer versions of eQUEST have a tendency to crash at inconvenient moments. Make sure you are prepared.
- **Keep it simple.** There are some details in your building design that will have little or no impact on energy performance. Leave them out!
- **Analyze the results with caution.** Always check the reports for numbers that seem inappropriate under the circumstances. While the computer is a valuable tool, it does not understand the output it is producing. Use your knowledge to recognize potential inaccuracies!
- **Update your version** New versions of eQUEST come with better help and new features.

NOTE: This eQUEST Module assumes that the user already has a working knowledge of eQUEST and is familiar with the concepts and processes outlined in eQUEST Module 1. Please refer to Module 1 if you are unfamiliar with any of the material presented here. *Module 1: Basic Energy Modeling and Comparative Runs* can be accessed at the following website: <http://www.idlbozeman.com/equest/> For more information, please contact IDL | Bozeman (see the front cover of this module for contact information).

THE DESIGN DEVELOPMENT WIZARD

Now that you have mastered the SD Wizard, it is time to explore some intermediate energy modeling in eQUEST. To do this, we will be using the Design Development (DD) Wizard. In its opening wizard screen, eQUEST says of its Design Development Wizard: “Use this for later, more detailed design (when more detailed information is available), for larger, more complicated structures, or for more detailed internal loads, schedules, and HVAC system assignments” Basically, the DD Wizard should be used when more is known about the project design and its systems, or when there are multiple buildings or complicated components to model. For instance, the DD Wizard might be used to model mixed-use facilities, buildings with complex floor plans, or campus-style programs.

In addition to providing you with more modeling flexibility, the DD Wizard requires that you use more caution and take a greater responsibility for your energy model information than you did with the SD Wizard. With the DD Wizard, you have more control over entering information about schedules, loads, zones, building construction, and HVAC systems. Consequentially, eQUEST uses more complex calculation methods within the DD Wizard model than it did in the SD Wizard model. So with this greater freedom, comes greater responsibility.

To help accommodate a more complex energy model, the eQUEST DD Wizard interface is broken up into several sub-wizards that can be revisited in any order. This is different than the process used in the SD Wizard which relies on sequential input in order to build a basic energy model. This diagram explains the differences in input order between the two wizards. The arrows show the flow of the user inputting information.

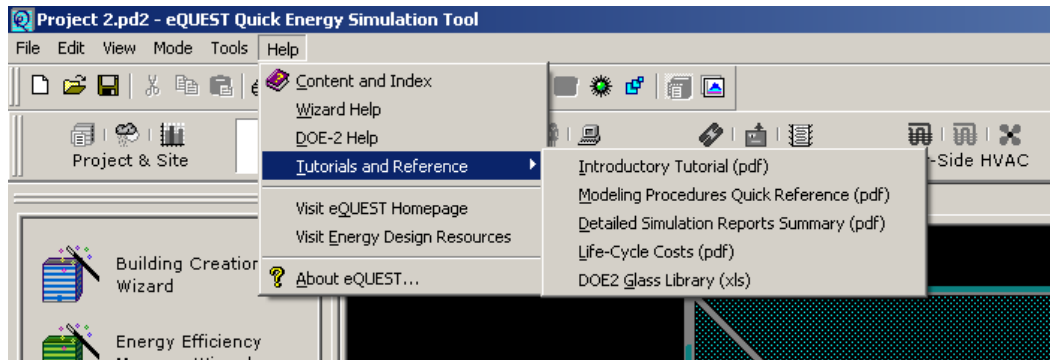


As you can see, the DD Wizard allows you to input data somewhat regardless of order. However, it is still recommended that you work linearly in each component. You will still be inserting the basic information that you provided the SD Wizard, but at many points you will be allowed to go back and refine this information to help build a more accurate, detailed energy model. As you progress through this module and begin to work with the DD Wizard, its layout

and non-sequential input system will make more sense.

At certain points during this module, we will refer to eQUEST's more advanced modeling option called Detailed Data Edit (DDE). While we will explore its functions in depth throughout Module 4, we encourage you to explore some resources that eQUEST provides in its help menu including:

- Introductory Tutorial (pdf)
- Modeling Procedures Quick Reference (pdf)
- Detailed Simulation Reports Summary (pdf)



All of these documents can be accessed from the main eQUEST screen, under the **Help** menu in the Tutorials and Reference section. To find out how to access DDE and gain an understanding of what to use it for, refer to the Appendix.

As with Module 1 and the SD Wizard, we have included a set of forms for the DD Wizard, which can be found in the Forms section of this module. We will mention specific forms as we move through this module. We encourage you to use these forms to help you document information and keep track of the changes that you make to your module.

The following pages describe how to use the DD Wizard in depth, but the basic steps for creating a DD Wizard energy model and running the simulation are listed here:

1. Open eQUEST and begin a DD Wizard model.
2. Input basic information and enter the DD Wizard Project Navigator.
3. Modify the project and site information.
4. Model the building shell.
5. Model the plant equipment systems.
6. Model the air-side systems.
7. Model the DHW systems.
8. Close the wizard, add EEMs if desired, and simulate the building.
9. Review the results.
10. Make changes if necessary.

STEP 1: OPEN eQUEST AND BEGIN A DD WIZARD MODEL.

Because eQUEST has the capacity to assist designers throughout many phases of the design process, there are two ways you can begin a DD Wizard energy model:

1. Convert an existing SD Wizard model into a DD Wizard model.
2. Create a model from scratch using only the DD Wizard.

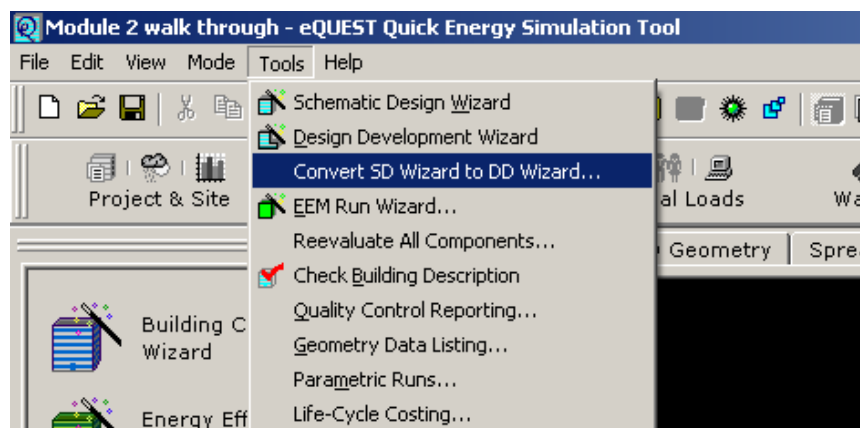
In order to use method one, you must already have created an SD Wizard model and be ready to move on to more complex energy modeling. eQUEST makes it easy for you to take such a model and transition it into a DD Wizard model, giving you the opportunity to continue your energy modeling throughout the design process.

However, sometimes it is simply more appropriate to start a brand new energy model with the DD Wizard so you can jump right into more complex forms and conditions. To assist you in either case, both of these methods are explained here.

CONVERT AN EXISTING SD WIZARD MODEL INTO A DD WIZARD MODEL

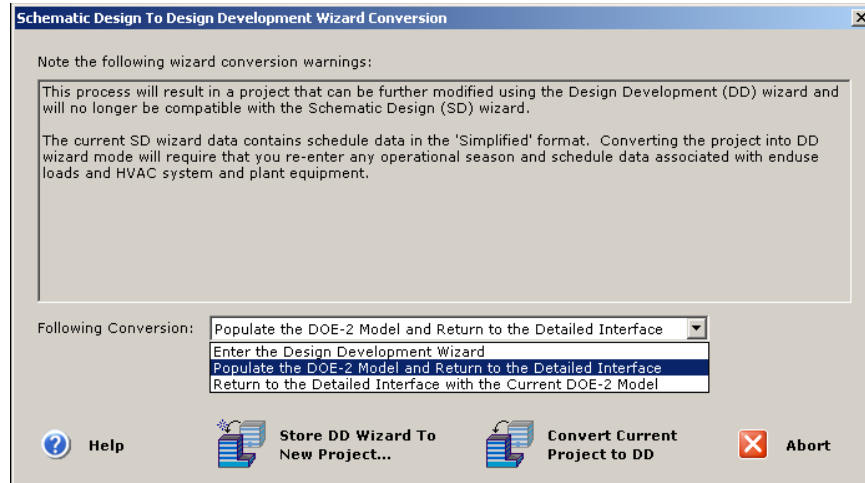
If you have already created an energy model in eQUEST using the SD Wizard, locate your existing model in the drop-down box and select either **Open Recent Project** or **Select an Existing Project to Open** then click OK. If you select **Open Recent Project**, eQUEST will automatically load your project and show it in the Main eQUEST Window. If you choose **Select an Existing Project to Open**, eQUEST will load an **Open** window, allowing you to navigate to your previously saved project file in an open dialog box.

Once your SD Wizard model has been opened in eQUEST, select **Convert SD Wizard to DD Wizard** from the **Tools** menu.



The **Schematic Design To Design Development Wizard Conversion** screen will appear. This screen provides you with some warning information as well as a few options. The warnings simply caution you that once the model is converted to a DD Wizard model, you will no longer be able to use the SD Wizard to edit it. Be aware that comparing results from the schematic design wizard to the results from the design development wizard is irrelevant because of the difference in the level of analysis between the two wizards. If your SD Wizard model contains a

simplified schedule, you will be warned that you will have to re-enter specific load and HVAC schedule information in the DD Wizard via hourly enduse profile.



Below the warnings, you will be asked what it is you would like to do after the model is converted. The following table explains what each option does:

FOLLOWING CONVERSION OPTIONS	RESULT
Populate the DOE-2 Model and Return to the Detailed Interface	Takes all of the SD Wizard info and quickly converts it into a DD Wizard model (including adding hourly enduse profile information) and then builds the pre-simulation file, bringing you directly to the Main eQUEST Window where you can choose to Simulate the Building (among other things)
Return to the Detailed Interface with the Current DOE-2 Model	Simply dumps the information into the DD Wizard, but without creating the pre-simulation file. It will also take you to the Main eQUEST Window

To complete the conversion, you must select one of the following:

SAVING OPTIONS	RESULT
Store DD Wizard To New Project	This option will take the information in the current SD Wizard model and generate an entirely new DD Wizard model based on this information, while simultaneously saving a copy of the original SD Wizard model.
Convert Current Project to DD Wizard	This transforms the SD Wizard model into a DD Wizard model without saving the original SD Wizard file.
Abort	This option cancels the conversion and will leave the model in SD Wizard form.

Choose the option that is best for you, keeping in mind that if you choose to convert the SD project into the DD project, you will be unable to undo this conversion. It is recommended that you **Save As** with a new file name in order to keep the SD project.

Another way to access this screen is to select **Design Development Wizard** from the Tools menu. This will bring up the same screen as before, except the **Following Conversion** options will be omitted. However you will still be able to convert the SD Wizard model into a DD Wizard model.

Once you have converted your project into a DD Wizard model, you will be able to enter the DD Wizard, if you have not already. Simply clicking **Building Creation Wizard** in the Main eQUEST Window will bring up the DD Wizard Project Navigator. At this point you can skip to the Navigating the DD Wizard Project Navigator section on page 10.

CREATE A MODEL USING ONLY THE DD WIZARD

To create an energy model using only the DD Wizard, select **Create a New Project via the Wizard** from the **eQUEST Startup Options** and click OK.

eQUEST will open the **Which Wizard?** dialogue box. Instead of choosing the Schematic Design Wizard as was done in Module 1, select **Design Development Wizard**.



This will take you directly into the Design Development Wizard, and you should see the following screen:

The screenshot shows the 'eQUEST DD Wizard: Project and Site Data' dialog box. It is divided into several sections:

- General Information:** Project Name: Project 13; Code Analysis: - none -; Building Type: Office Bldg, Two Story.
- Building Location and Jurisdiction:** Location Set: California (Title 24); Region: Los Angeles Area (CZ06); City: Los Angeles AP; Jurisdiction: CA Title24.
- Utilities and Rates:** Electric: SCE (CA); Rate: GS-2 (non-TOU, 20 < kW < 500, three-phase service); Gas: SCG (CA); Rate: GN-10 (buildings with < 20800 therms/mo).
- Other Data:** Analysis Year: 2010; Usage Details: Hourly Enduse Profile.

At the bottom, there is a 'Wizard Screen' indicator (1 of 7), a 'Help' button, and navigation buttons for 'Previous Screen', 'Next Screen', and 'Continue to Navigator'.

Going directly into the Design Development wizard allows you to create the entire model within this wizard. These beginning screens are similar to the Schematic Design Wizard, asking basic information about the Project name, location, and utility services. For further help on these screens, refer to Module 1 with the Schematic Design Wizard screens or the following page of this manual.

Note: The Building Type will set up the default selections for the rest of the wizard, so choose this appropriately. If you are working with a mixed-use facilities model, select the primary occupancy as the building type. Additional building types can be selected as you create more building shells later on in the wizard. If you are unsure as to which building type you should select, choose **Unknown, Custom, or Mixed Use**, and then pay special attention to the information that eQUEST sets as defaults, adjusting it as needed.

STEP 2: INPUT BASIC INFORMATION AND ENTER THE DD WIZARD PROJECT NAVIGATOR

If you have chosen to convert an SD Wizard model into a DD Wizard model, you can skip this step, as the information that eQUEST is asking for here has already been collected from your SD Wizard model and you should already be in the DD Wizard Project Navigator.

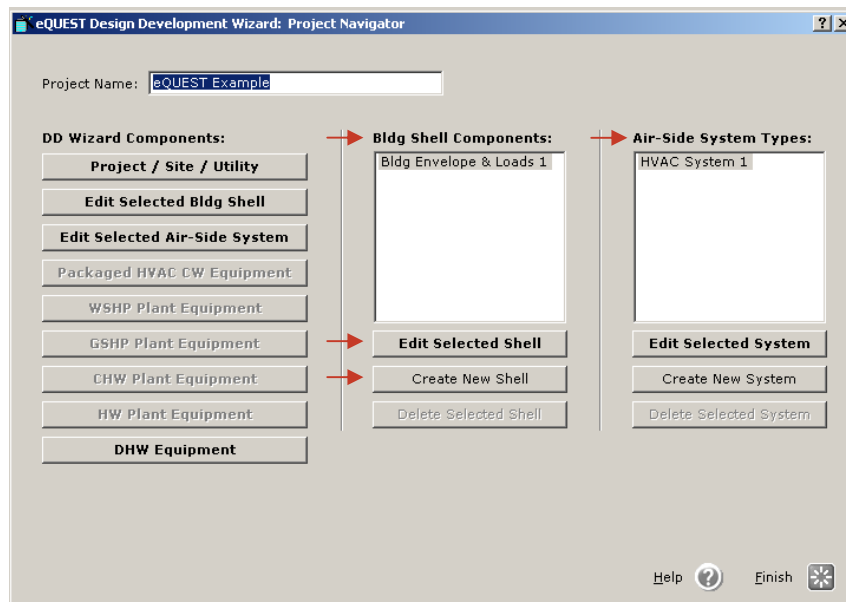
If you are creating a DD Wizard model from scratch, the **General Information** screen will be the first screen that opens. This and the following screens correspond to the DD Form **Project/ Site/ Utility**. A blank copy of this form can be found in the Forms section of this module.

The General Information screen is similar to the one found in the SD Wizard because you can input the building name, type, and location. However you will notice that some input boxes are missing. This is because, in the DD Wizard, information is spread out across more screens. The rest of these details will be entered in the following screens.

At this point, enter the **Project Name**—which will be used to generate the project file name—and select the primary **Building Type**—WHICH YOU WILL BE UNABLE TO CHANGE LATER—and adjust the other information you know on this first screen. Click **Continue to Navigator**. We will come back and modify the rest of these screens shortly.

NAVIGATING THE DD WIZARD PROJECT NAVIGATOR

The **Project Navigator** is the command center for the DD Wizard. As you will notice, it is organized differently from the SD Wizard. This means that the way we think about entering information in eQUEST will change slightly. As opposed to changing settings on 50 screens in sequence, the screens have been divided into components, and each component has a series of screens pertaining to that component.



On the left side of the **Design Development Wizard: Project Navigator**, you can select any component that you would like to modify. This panel of buttons is very convenient for editing specific parts of your model. Entering **Bldg Shell Components** allows you to create multiple building shells to create a campus of buildings, change the building type for several floors of a mixed-use building, or have a part of the building a different shape than the rest of the building.

Entering the **Air-Side System Types** you can add multiple air-side systems that can be assigned to different building shells and zones.

To access each set of screens by component, simply click on the appropriate button on the left-hand side of the Project Navigator. Building Shell Components can be added by selecting **Create New Shell** located in the center of the Navigator. Air-Side System Types can be added by selecting **Create New System** to the right of the building shell components. To edit a Building Shell Component, highlight the appropriate component, then click either **Edit Selected Shell** under the highlighted components or click **Edit Selected Bldg Shell** under **DD Wizard Components**. To edit an air-side system, highlight the appropriate system, then click **Edit Selected System** under the highlighted component. We will be discussing both of these in further detail further along in this module.

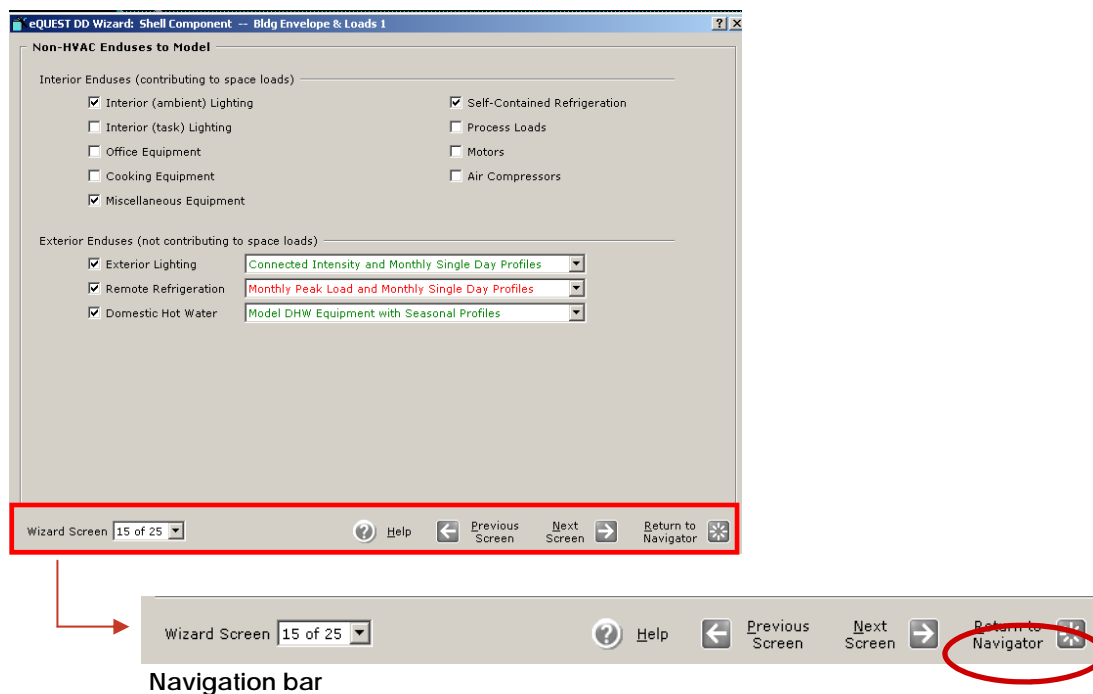
Depending on the state of your model, some of the component buttons are grayed-out and cannot be accessed, where others are available to the user. eQUEST will always give you access to the following four components: **Project/Site/Utility**, **Edit Selected Bldg Shell**, **Edit Selected Air-Side System**, and **DHW Equipment**. These are components that will contain information for every energy model you create. The plant equipment components will only become available as you select certain settings in the air-side systems screens. We will describe how to access each plant equipment screen as we go through this module. The following chart gives an overview of the type of information you will be asked to modify in each component. We will discuss each component in more detail in the following pages.

COMPONENT	INFORMATION NEEDED	STEP
Project/Site/Utility	General project information, season definitions, utility rates and charges	Step 3
Edit Selected Bldg Shell	Use this to access all of the screens used to define the building shell.	Step 4
Edit Selected Air-Side System	Use this to access all of the screens needed to design an air-side HVAC system.	Step 5
Packaged HVAC CW Equipment	<i>This option is not yet configured into eQUEST</i>	Step 6
WLHP Plant Equipment	These components control central heating and cooling equipment specifications. Depending on your air-side system selections, you can gain access to either WLHP, GSHP, or a combination of CHW and HW Plant Equipment. At this time, eQUEST does not support multiple plant equipment systems in one file.	Step 6
GSHP Plant Equipment		Step 6
CHW Plant Equipment		Step 6
HW Plant Equipment		Step 6
DHW Equipment	Use this to access domestic hot water equipment specifications.	Step 7

As in Module 1, there are forms provided to help you organize the information you input into the DD Wizard. These forms have been divided into categories to help you gather and record the information for your energy model, because, as you will soon see, at certain times you will need more copies of one component form than another. Any of these forms can be accessed at the back of Module 1. Remember that while you are going through the Design Development Wizard and filling the forms some portions of the forms will not be defined and some you will use multiple copies of one form. This is based on the specifications you defined in previous screens.

As you are working with the DD Wizard screens in each component, you will notice that most of the navigation bars are the same as the SD Wizard screen navigation bar. You can use this bar to move between screens in each component. **It is important to note that while the DD Wizard overall is not dependent upon sequential modifications, within each component, you should try to enter information as linearly as possible. This is because information on earlier screens will affect model choices on later screens.**

One difference is the DD Wizard screens have a **Return to Navigator** button instead of a **Finish** button. From the DD Wizard Navigator you can click **Finish** at any time and eQUEST will create the input file for your energy model. This will send you to the main eQUEST screen. You will be reminded of this again at Step 8.



Because so many of the DD Wizard screens are similar to the SD Wizard screens in this module, we will only be explaining significant differences in the DD Wizard screens. Again, if there is something you do not understand, refer back to Module 1.

STEP 3: MODIFY THE PROJECT AND SITE INFORMATION

Now that you are well acquainted with the DD Wizard Project Navigator, it is time to start building and modifying the energy model. Click the **Project/Site/Utility** button on the left side of the screen. This component corresponds to the DD Form—Project Site Utility. You will only need one copy of this form. Opening this component should bring you to the following screen:

If this screen does not appear initially, click on the **Previous Screen** arrow until screen 1 is reached or select **Wizard Screen 1 of 7** in the bottom left corner pull-down menu. There are a couple of reasons why this screen may not appear automatically:

- The model started originally as an SD Wizard model and most of the information has already been entered.
- You previously went through the screens upon opening the DD Wizard.

This brings up an important concept when working with the DD Wizard. When opening components in the Project Navigator they will open up to the last screen you were working with, regardless of when or with which wizard. As with the SD Wizard, you can use the Wizard Screen drop-down menu to navigate throughout a component. As we have said before, it is important that you try to work as sequentially as possible within components in order to prevent later information from being changed due to modifying earlier screens.

SCREEN 1: GENERAL INFORMATION

If you have come from an SD Wizard model, you will notice that the amount of information on screen 1 of the DD Wizard is less than on screen 1 of the SD Wizard. This is because the SD Wizard holds more information in a smaller number of screens to allow for someone to quickly create an energy model without a lot of details. The DD Wizard takes this information and spreads it out among more screens, providing more detailed settings to be modified. Keep this in mind as you work through each set of screens.

The screenshot shows the 'eQUEST DD Wizard: Project and Site Data' window with the 'General Information' tab selected. The form is organized into several sections:

- Project Name:** Module 2 Walk-Thru
- Code Analysis:** - none -
- Building Type:** Office Bldg, Two Story
- Building Location and Jurisdiction:**
 - Location Set: All eQUEST Locations
 - State: Montana
 - City: Billings
 - Jurisdiction: - other -
- Utilities and Rates:**
 - Electric: NorthWestern (MT) (Utility) | GS1-S-Sm (secondary, <= 1,000 kW, non-demand) (Rate)
 - Gas: NorthWestern (MT) | GS1a (< 300 CuFt/hr)
- Other Data:**
 - Analysis Year: 2010
 - Usage Details: Hourly Enduse Profile
 - Prevent duplicate model components

At the bottom, there is a 'Wizard Screen' dropdown set to '1 of 7', and navigation buttons for 'Help', 'Previous Screen', 'Next Screen', and 'Return to Navigator'.

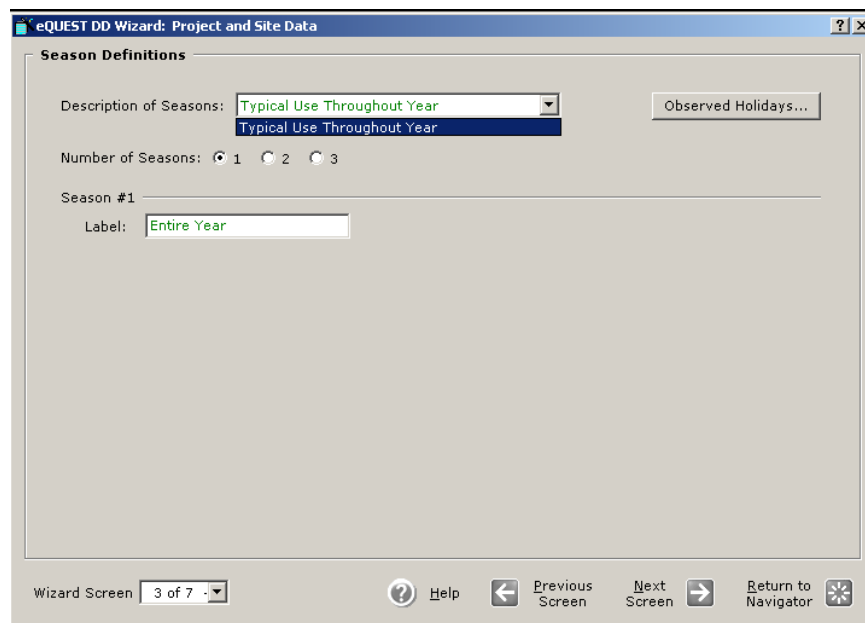
Screen 1 of the Project/Site/Utility component is very similar to the General Information screen in the SD Wizard (see Module 1, screen 1). It allows you to modify the project name, building type, location and utility information. As you modify this screen, here are some points to remember:

- The **Project Name** is still the file name for your model. (See the Appendix for additional information on saving and locating eQUEST files in version 3.63.)
- Notice that the **Building Type** is grayed out. You selected this building type in either the SD Wizard or the first time you opened the DD Wizard in the general information screens. From this point on you will be unable to change it.
- You will still need to download weather files from the internet if you have not already installed them on your computer. This will take place when you simulate the building for the first time at a location. Make sure you have a working internet connection before you run a simulation.
- eQUEST now allows you to select pre-saved custom utility rate files. To do this, select **-file-** from the **Utility** drop-down boxes to the right of Electric and Gas. Then in the **rate** drop-down box, select the appropriate file name. If you would like to create such files, select **-custom-** in each box. This will unlock other screens in the wizard. For most Montana projects this will not be necessary as NorthWestern Energy has already provided their utility rates for you to select.

- Notice that the **Hourly Enduse Profile** is the only option available under **Usage Details**. This means that the DD Wizard will create a model that eQUEST will simulate for every hour. This will create a finer, more specific set of data than was originally modeled in the SD Wizard using the Simplified Schedule option.

SCREEN 3: SEASON DEFINITIONS

Screen 3 is very similar to the Season Definitions screen in the SD Wizard (see Module 1). It deals strictly with season definitions and allows you to be very specific with your seasons and the days and hours of occupancy.



Having prior knowledge of when the building will be occupied throughout the year will help inform the design more accurately and allow for the integration of more energy efficient strategies. Please note that some building types only have one season available.

Now that you are getting into more advanced energy modeling, it is recommended that you pay even more attention to the seasons (seasons of building usage) and dates created here. Based on your building type, eQUEST will already have set up some default options, which will be available to you in the **Description of Seasons** drop-down menu. Some building types only have one season you can modify. Other building types have the option of defining several seasons. For each season defined you must specify the dates of the season. Also, clicking on the **Observed Holiday** icon brings up a list of holidays that may be observed by the occupants. These can be modified to satisfy the individual project needs. If you think you will need more than one season for the energy model, define them now, even if the primary building type will only require one season. For example, if you are modeling a school, you would have 3 preset seasons. For our example, an office building, we only have 1 season, however, you do have the option to define up to three seasons. If you do not take care of this now, you will have to come back to this screen and redefine them later.


As you modify this screen here are some points to keep in mind:

- You can specify the 2nd and 3rd season, then let the rest of the dates fall to season 1, like in a school (make season 1 all breaks, and then have 2 and 3 be the different semesters).
- Date periods in seasons do not have to be contiguous.
- Season labels are used in other screens throughout the wizard. (Remember to use the forms at the end of the module to help you keep a hard copy record of the different settings, options, etc. used in your project)

SCREENS 4 AND 6: ELECTRIC UTILITY CHARGES AND FUEL UTILITY CHARGES

If you selected **-custom-** from the Utility drop-down boxes on Screen 1, then the Electric and Fuel Utility Charges screens will be available to you. Here you have a chance to set up your own specific utility rates and charges. If this is something you previously set up in your SD Wizard model, then the information should still be there. Otherwise you will see eQUEST defaults. Based on your selection in the **Type** drop-down box, options throughout the rest of the screen will change. It is important that you input as much accurate information on this screen as you can, because it is much easier to change this information in a wizard screen than it will be in Detailed Data Edit.

Electric Utility Charges

Rate Name: Type: Block Type: 

Uniform Charges
Time-of-Use Charges
Block Charges

Season:

Entire Year





Customer Charge:

Uniform Charges:

Energy Blocks	Blk Size	\$ / kWh
1 kWh Block	99,999	0.000000
2 - select another -		

Demand Blocks	Blk Size	\$ / kW
1 kW Block	99,999	0.000

Wizard Screen

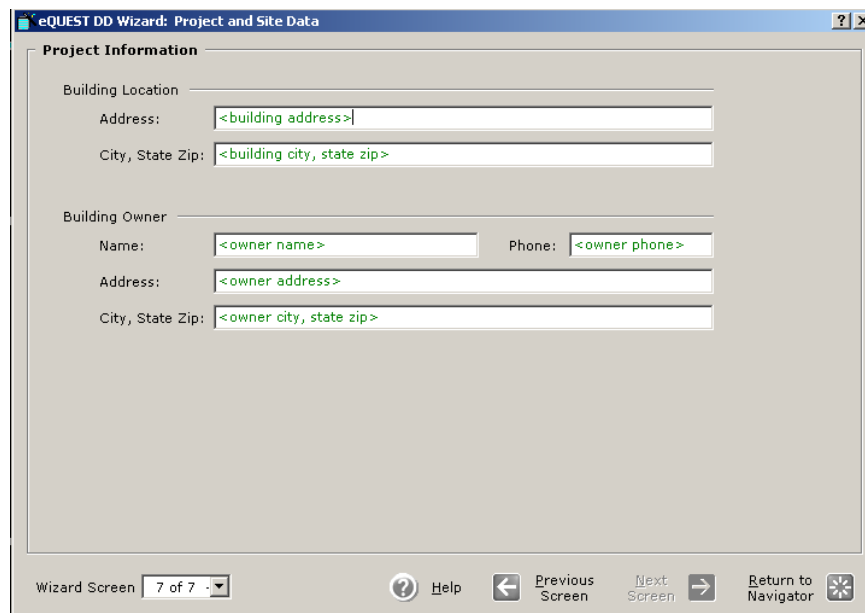
 Help  Previous Screen  Next Screen  Return to Navigator

If you plan to use these custom rates again, eQUEST now provides you with a way to save them. You will notice a small icon of a floppy disk in the upper right-hand corner of each screen. Clicking this icon will allow you to save your rate schedules for future use—a new feature of version 3.63. You can then use these rate schedules again by selecting **- file -** on Screen 1 of this component. There is a trick to gaining access to these saved rate schedules. They must be saved in the appropriate eQUEST folder, otherwise they will not be available for

future use. Currently, you can only save rates developed in the SD and DD Wizards. If you are interested in learning more about developing, modifying, and saving rates in the Detailed Data Edit mode, eQUEST provides more information in the **Introductory Tutorial**, starting on page 90, available through the Help menu of the program.

SCREEN 7: PROJECT INFORMATION

This screen is nearly identical to the Project Information screen in the SD Wizard (the last screen, see Module 1). If you have converted an SD Wizard model into the DD Wizard, then the information from this screen should have been retained. Otherwise you are welcome to enter the necessary information for future reference.



When you are finished with this component, click **Return to Navigator**.

Since there are so many additional components to model in the DD Wizard, we have included a checklist at the end of the DD Form—Project Site Utility. Use this checklist to help keep track of the portions of the model that are completed.

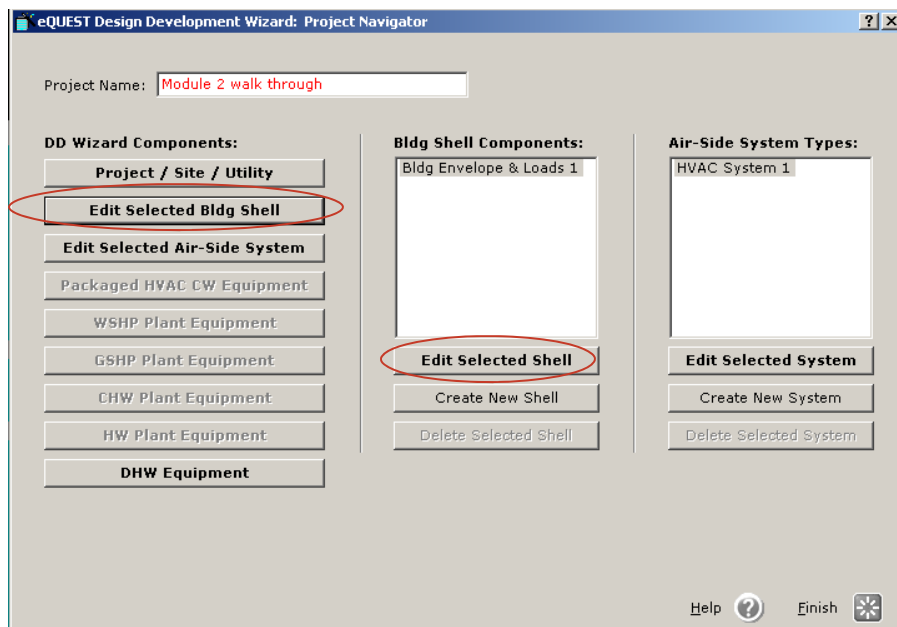
STEP 4: MODEL THE BUILDING SHELL

Once the basic project information has been established and the primary building type has been set, it is now time to model the building shell. If you are working with a model previously developed in the SD Wizard, then this is the chance to modify portions of the building that have progressed throughout the design process. It is also a good time to make sure that windows and doors are defined and placed appropriately, and that floor plates and zones have been modeled accurately. At this point, the more detail you can add to your energy model, the more accurate your results will be. Remember it is always easier to add detail through the wizards than to wait until you enter Detailed Data Edit mode.

Whether or not you are beginning your DD Wizard model from scratch, now is a good time to add some complexity to the building shell. One of the main advantages of the DD Wizard is

that it can assist you with some simple modifications that will help you create an energy model closer to the actual design conditions. You are no longer restricted to one floor plate shape, one occupancy type, one building type, etc. You are now free to create many of these situations in one model. The trick is to remember that ultimately energy modeling needs to be somewhat simple. Some of the finer geometries that have been designed into the building (such as multiple angles or a curved wall) can be reduced to more simplified shapes that will still provide accurate results within a margin of error.

The Building Shell component allows you to define the geometry of the building shell, along with its material properties, as well as set up specific operation and loads schedules. There are two ways you can access Building Shell screens. First, highlight in gray the building shell you would like to modify (if you have not yet modeled additional shells, there should only be one). Then click either the **Edit Selected Bldg Shell** button in the panel on the left, or **Edit Selected Shell** in the center panel underneath the selected component. Both options will take you to the same place.



The DD Wizard allows you to create several building shell components that work together to form your energy model. Before we explain how to do this, here are some specific examples for how this might be useful:

- A multi-story atrium in an office building
- A campus of buildings using one set of plant equipment
- A mixed-use facility with a few residential floors above several floors of retail and an underground parking garage
- A school with a two-story gymnasium wing
- A high rise that has several different floor plate shapes

Whether you have started a DD Wizard model from scratch or have updated this model from a previous SD Wizard model, eQUEST will have already created a Building Shell Component labeled Bldg Envelope & Loads 1. The first time you go to edit this component, it will open to

screen 1 (see image below). When you return to modify this shell's settings, the wizard will open to the last screen you modified. This will also be true for additional shells you create.

Because many of the screens in the Building Shell Component screens are similar to screens in the SD Wizard, we will only cover significant changes in the DD Wizard and key points you should keep in mind as you model. (For basic information on the screens not covered here, Refer to eQUEST Module 1 and the Introductory Tutorial included in eQUEST v. 3.64). We recommend that as you create and modify building shells, you record your information on the DD Form—Building Shell Component, which has been provided in the **Forms** section of this module. Use a separate form for each new building shell component.

SCREEN 1: GENERAL SHELL INFORMATION

The General Shell Information screen allows you to lay out some basic information about the building shell—name, type, location, square footage, number of floors, etc.

Most of these settings are straightforward, but a few things need to be clarified:

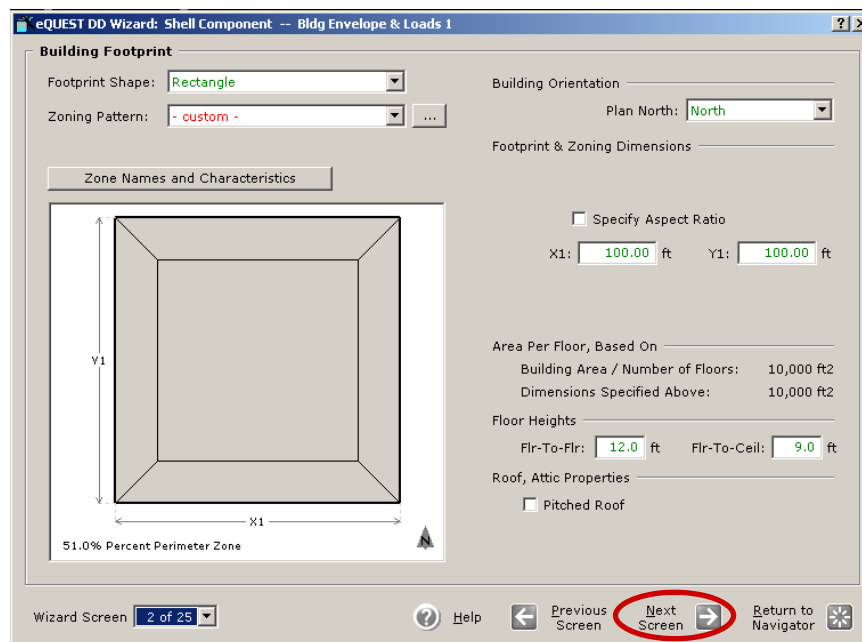
- The **Shell Name** is what will replace **Bldg Envelope & Loads 1** in the DD Wizard Project Navigator. Give each shell a clear name so it will be recognizable later.
- As stated before, the **Building Type** regulates the default settings that eQUEST provides on subsequent screens. If you have to change it later, eQUEST will reset all of your chosen values to default on later screens, potentially erasing all of your work.
- If you plan to work with multiple building shells, specifying exact coordinates now will assist you later by providing you with a reference point from which to locate additional shells. (0, 0, 0 is bottom left corner of initial building shell, reference the bottom left corner of subsequent shells.) To create a new shell go to page 31 and read the **Creating Additional Building Shell Components**.

- Building area is TOTAL floor area. (e.g. 2 story building that is 100 feet by 100 feet= 20,000 square feet)
- Make sure you set the area and number of floors now, as changing them later will overwrite custom door and window placement.
- The Shell Multiplier reproduces an exact copy of your building shell in your energy calculations without showing it in the Main eQUEST Window 2D and 3D graphic interface. Typically the Shell Multiplier will always be set at 1. An exception to this would be if you were modeling three identical buildings (such as dormitories or apartment buildings) and wanted to assess the energy usage from three identical buildings all at once, as opposed to modeling each building individually. Since this is the only place that shows the Shell Multiplier, you must keep this in mind as you analyze your results if you have changed this number.
- Daylighting Controls no longer have to be set to Yes if you want to explore top and side lighting. It will still be accessible through the EEMs and other building shells you may create. However, at this time eQUEST is unable to perform energy calculations on day-lit basements.

When you are finished click **Next Screen** to continue through this part of the wizard.

SCREEN 2: BUILDING FOOTPRINT

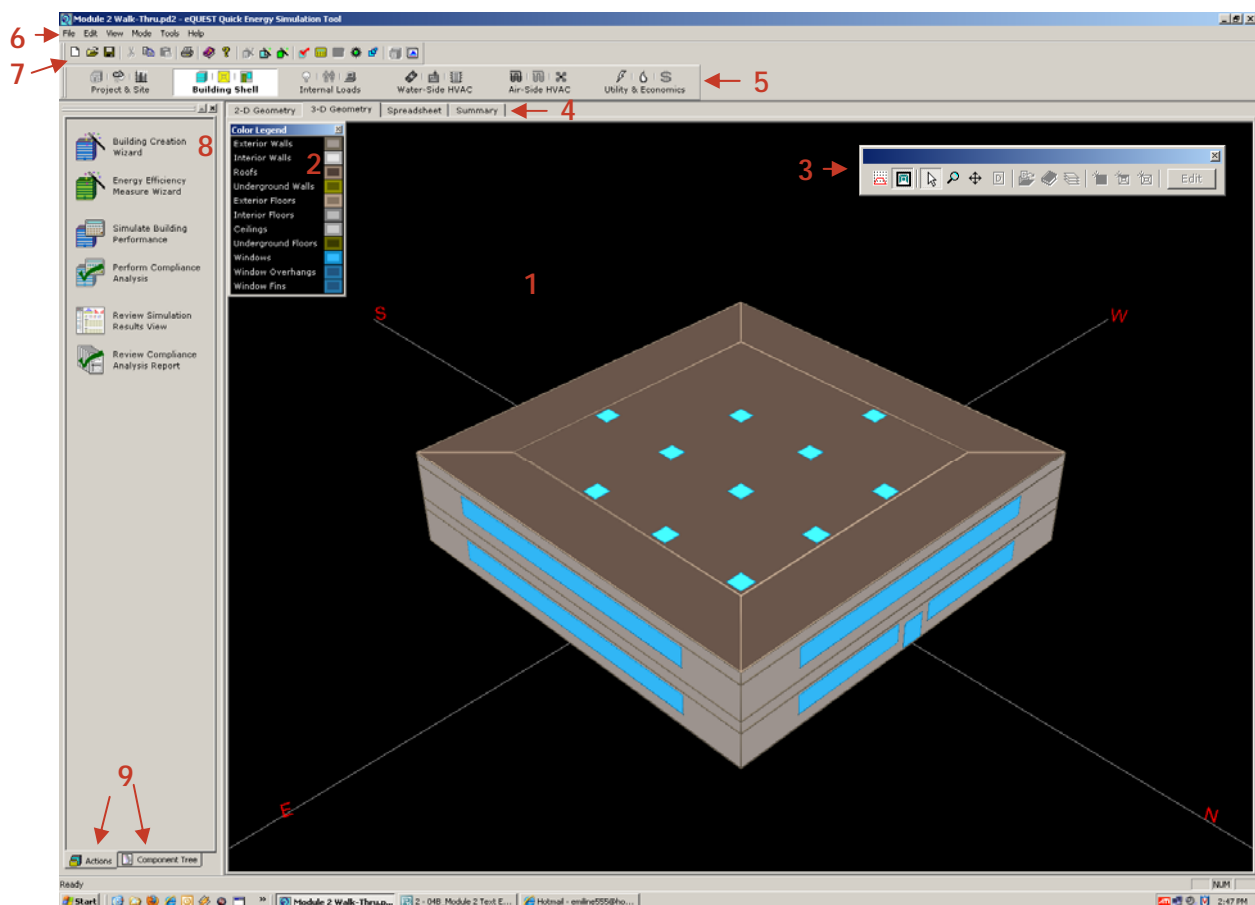
Once again the Building Footprint screen in the DD Wizard is very similar to the Building Footprint screen in the SD Wizard. However, now that the energy model is starting to take on some specific details, a few key points must be remembered when working with the building shell footprint and its related zones. If you are anticipating modeling several building shells you need to locate the same vertex for each shell. The easiest way to do this is to use a common x, y, z coordinate in the lower left-hand corner of the custom footprint screen. If the shells do not have any common x, y, z coordinates, use the vertex closest to the shell origin coordinates to define the first vertex of the different shells. If you are creating a new footprint above an existing shell with a different footprint, the footprint of the first shell will appear in the custom footprint screen as a grey outline, which can be used as a guide. By organizing all of these footprint details now, you will save time and decrease the chances of creating an inaccurate energy model. Remember, any changes you make to this footprint later will erase any settings in the custom window and door placement. If your project has differing building footprints see page 3 and read **Creating Additional Building Shell Components** for an explanation on how to create this.



Review: NAVIGATING THE MAIN eQUEST WINDOW

After clicking **Finish** in the DD Wizard, you will enter the main eQUEST window. While you are here, you should take a few minutes to familiarize yourself with this screen. Every time you open your project after this, you will begin in this view. The following list outlines the important features and controls in this window:

1. Main Viewport
2. Legend for Main Viewport
3. Floating Toolbar: used to navigate and toggle view types
4. View Tabs: used for toggling between energy model views, spreadsheets, and summaries
5. Project Navigation Toolbar: used to review different energy model systems
6. Menu Bar: contains menus of program commands, many of which are repeated graphically throughout this view
7. Main Toolbar: contains basic program commands
8. Action Toolbar: opens wizards, simulates buildings, and allows user to view reports
9. Action Toolbar Tabs: allows user to toggle between Actions and the Component Tree



The **Main Viewport (1)** shows a view of your project. When you initially open eQUEST or exit a wizard you will see a 2-D roof plan view of the project. To change your view, simply click one of the **View Tabs (4)** to toggle between views. You can check rough dimensions in the 2-D Geometric view by clicking on the **Shape View Mode** icon, the **first icon** on the **Floating Toolbar (3)**.

Change to a 3-D view of your energy model by clicking the **3-D Geometry Tab** on the **View Tabs (4)**. In this view you can rotate the model by holding down the Ctrl key and the left mouse button simultaneously while moving the mouse. To zoom hold down the Ctrl key and the right mouse button simultaneously while moving the mouse up or down. To return to the original camera view, right-click and select **Reset Camera**.

Try toggling between different systems views of your project. On the **Project Navigation Toolbar (5)** click the fifth tab called **Air-Side HVAC**. This will display a graphical view of the air-side HVAC system. The other tabs will show different systems in your energy model. As you progress farther in the design process, you may choose to edit the components in these views to more accurately match your design. This will be explained in eQUEST Module 4. For now, leave these settings as they are.

At this stage of the energy model, more care needs to be taken with drawing zones. eQUEST offers two automatic zoning schemes: one-per-floor and core-perimeter. Your design most likely has at least a few exceptions that you can model through the custom Zone Characteristics screens now to avoid doing it later in Detailed Data Edit mode (see later modules). As you are modeling zones keep in mind the following:

- Lower level zones can be separated from upper level zones so the lower zone boundaries meet the upper level shell perimeters appropriately. Go to page 31, **Creating Additional Building Shell Components**, for more detailed information.
- Large zones, where daylighting is a potential, should be split into smaller zones in order to make it easier to modify those zones in later screens as well as simplify other portions of the energy model.
- You can define the floor-to-ceiling height as the floor-to-floor to eliminate empty plenums in the model.
- If you want to create dissimilar zones on different floors you will have to create a new building shell for that individual zone. To do this, adjust your z height value for the new building shell.
- To create clerestories, areas of higher ceilings, pop up sky lights, etc., make a new building shell. Refer to page 31, **Creating Additional Building Shell Components**.

All of these instructions may be confusing at first, but you are encouraged to make as many changes and modifications to your energy model using the DD Wizard. It is much more difficult to make the same modifications in the Detailed Data Edit mode (see later modules). If you need additional help with this screen, refer to pages 14-18 in Module 1, how to create custom zones or footprints.

BUILDING CONSTRUCTION SCREENS

In regards to the building construction screens, remember that eQUEST's defaults are set according to the building type selected and are created from industry standards for construction types based on those standards. You may want to consider accepting the defaults now and then using the EEM Wizard to determine the improvements in energy performance, unless you are certain about info you are changing.

If your material is not available, select the closest alternative. You can get more specific in detailed data edit.

Specify u-value, window details, % of gross wall area

EXTERIOR DOORS AND WINDOWS SCREENS

eQUEST v. 3.63 added a **DOE2 Glass Library** Excel spreadsheet to its **Help** menu under **Tutorials and Reference**, also available on eQUEST v. 3.64. This library documents every glass type available through eQUEST and all of their specifications, making it easier for you to search for an appropriate glazing for your project. Be warned that the spreadsheet contains built-in macros. Meaning, if your security settings in Microsoft Excel are set at High or Very High, then you will be unable to accept the macros and will consequently lose some of the built-in functionality of the spreadsheet. To adjust your security settings, open Microsoft Excel, and go to the Tools menu. Select Macro, then Security. On the Security Level tab, choose Medium (recommended) or Low. Then reopen the spreadsheet from the eQUEST Help menu. This will allow you to be able to sort the spreadsheet by different columns simply by clicking the column heading buttons. The sorted columns button appears in red text. Using this you can quickly find a quick glazing type based on its characteristics. Note that modifying any of the information in this spreadsheet will not affect or update the DOE2 glazing library in eQUEST. You are always welcome to develop custom glazing specifications.

SCREENS 5 AND 6: EXTERIOR DOORS AND WINDOWS

Screen 5 and 6 in the DD Wizard are the same as in the SD Wizard. For more information look on pages 20-21 in Module 1.

The screenshot shows the 'Exterior Doors' dialog box in eQUEST. It is titled 'eQUEST DD Wizard: Shell Component -- Bldg Envelope & Loads 1'. The dialog is split into two sections.

Describe Up To 3 Door Types

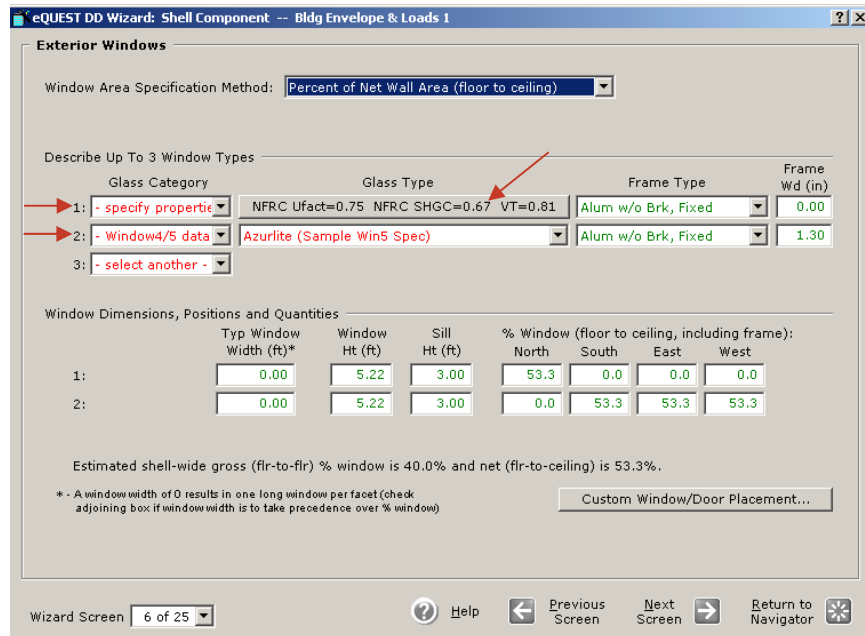
Door Type	# Doors by Orientation:			
	North	South	East	West
1: Glass	1	1	0	0
2: - select another -				

Door Dimensions and Construction / Glass Definitions

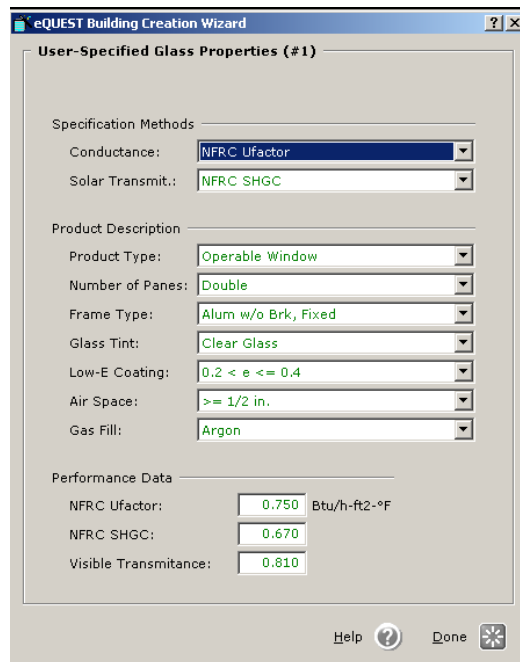
Ht (ft)	Wd (ft)	Construction -or- Glass Category and Glass Type	Frame Type	Frame Wd (in)	
1: 7.0	6.0	Double Low-E	Dbl Low-E (e3=.4) Clear 1/8in, 1/4in Air	Alum w/o Brk	3.0

At the bottom of the dialog, there is a 'Wizard Screen' dropdown set to '5 of 25', a 'Help' button, and navigation buttons for 'Previous Screen', 'Next Screen', and 'Return to Navigator'.

If the type of glazing you want to use is not in the **DOE2 Glass Library** you have two options to choose from. One option is to define your own glazing by choosing **specific properties** in the pull down menu under **Glass Category**.



After selecting **specify properties** click on the adjacent bar under the **Glass Type** column. The following screen will appear:



Go through the different categories and select the appropriate properties. When completed click **Done**.

Another alternative for choosing glazing type is the **Window4/5** database. This is an external program that calculates the total window thermal performance. For more information and downloads you can visit <http://windows.lbl.gov/software/window/window.html>

SCREEN 12: BUILDING OPERATIONS SCHEDULE

The information provided on the **Building Operations Schedule** screen was generated from the data you provided on Screen 3—Season Definitions—in the Project/Site/Utility component. The number of seasons you can modify will depend on the number you established on the previous screen. At this point eQUEST will ask you to define the times of day for each day of the week that the building will be active, as well as specify the type of use. You defined these different seasons and dates earlier in the Project/Site/Utility screens. If you are working with a building type that only requires one season, specify the same schedule for each season. Take care as you input this data as these schedules will be used to help eQUEST calculate the Hourly Enduse Profiles. Remember these key points when considering the building's operating schedule:

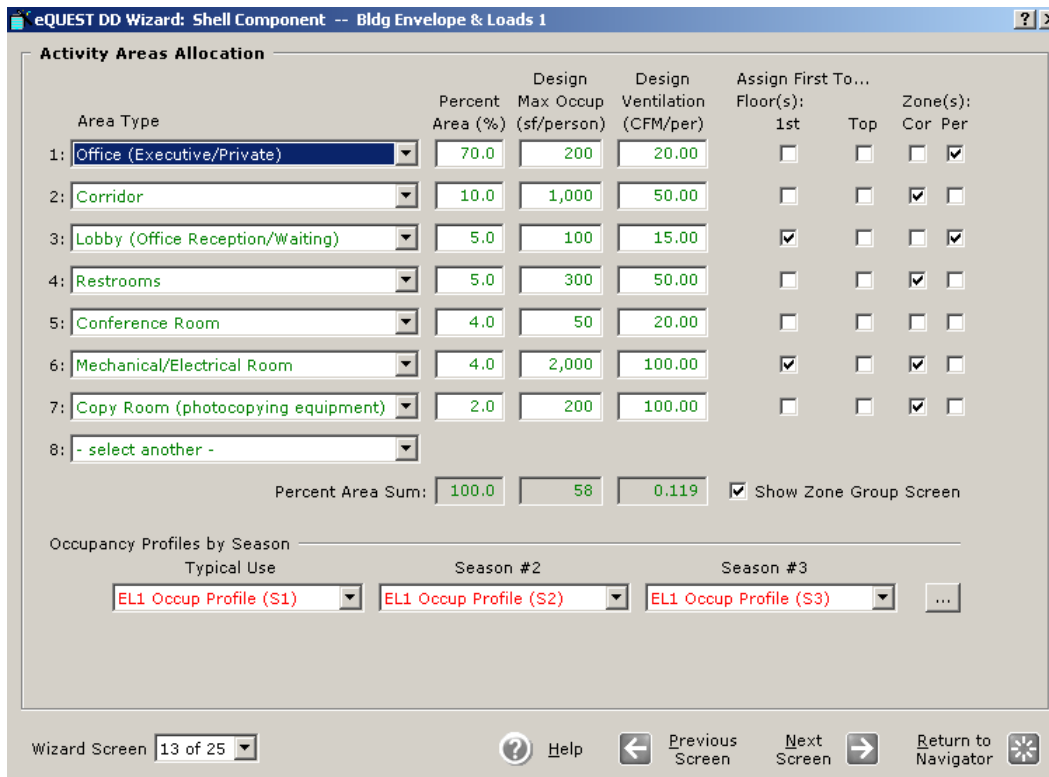
- Schedules are mostly used to regulate building loads — occupancy, lighting, internal equipment, etc. — which is all required input for your energy model
- You can also use schedules in eQUEST to simulate other situations: using blinds, a seasonal shade tree, outdoor air temps that regulate HVAC, etc.
- They can be simple or complex
- “*Simplified Schedules* are simple on/off “step-type” schedules (e.g. two values) that allow users to specify occupied versus unoccupied levels of use (e.g., for occupancy, lighting, and internal equipment) and the times building occupancy begins and ends. *Simplified Schedules* can have up to three weekly day types and up to two annual seasons, i.e., just enough to approximate schools.”
- *Hourly Enduse Profiles* are more flexible — three seasons per year, assume daily profiles that tend to vary hourly, etc. — but still not as powerful as Detailed Interface (up to 52 schedules, one for each week)
- **Use** automatically sets up profiles (choices for use are based on building type selected)
- There will be more on schedules in the Detailed Interface module.

SCREEN 13: ACTIVITY AREAS ALLOCATION

In Module 1 we accepted the defaults the SD Wizard provided for this screen, based on the building type we chose. As you begin to add more detail to your energy model in the DD Wizard, you may want to evaluate some of these settings to see if something needs to be adjusted for your specific project. eQUEST only allows you to choose 8 Area Types per building shell. If you adjust any of the numbers, make sure your **Percent Area Sum** totals add up to 100%, as eQUEST will give you a warning if they do not total 100%, but will not adjust these numbers for you.

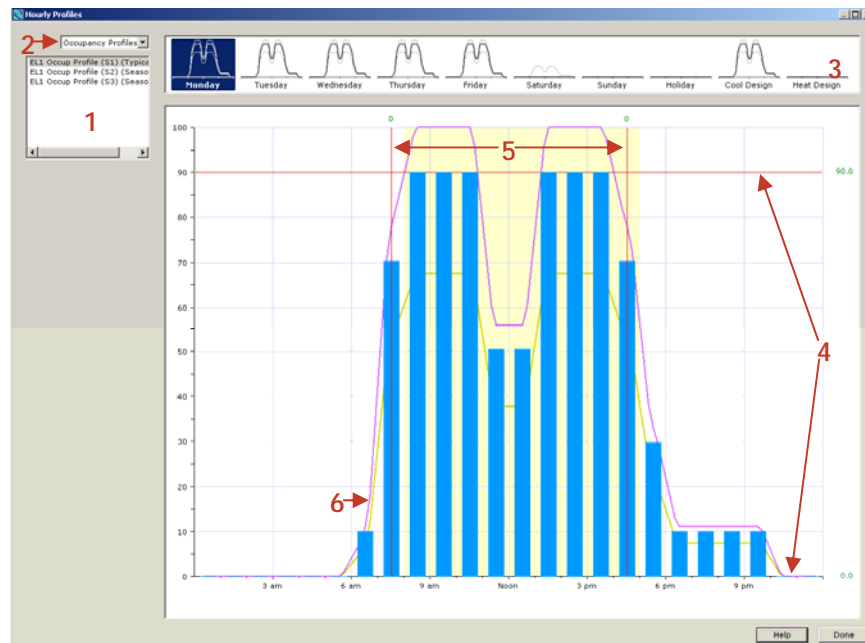
If you use a custom building type, you will have to input all of this information for each use you input, eQUEST will generate a design max occupancy and design ventilation.

A feature in the DD wizard that is not in SD wizard is the ability to assign where specific area types are located. On screen 13 you can tell eQUEST what floor and where on the floor the area is located. Defining these points allows for a more accurate energy model.



HOURLY PROFILES SCREENS

The small button to the right of the **Occupancy Profiles by Season** drop-down boxes on Screen 13 brings up an **Hourly Profiles** screen, which you will potentially see many times before leaving the DD Wizard. This screen allows you to graphically check and modify the overall profile shape of different schedules for specific days and seasons.



There are several components on this screen:

1. Profile Group Box: Allows you to select which schedule you would like to modify.
2. Active Profile Box: Allows you to choose which profile season you want to modify.
3. Day Selector: Choose the day you want to examine and modify.
4. Profile Maximums/Minimums: You can change these two numbers to affect the overall profile shape.
5. Start/End Hours: You can change these two numbers (using whole numbers like “2” or “-1”) in order to set the hours when the profile begins and ends.
6. Other Active Profiles: These colored lines behind the blue bar graph allow you to compare the other profile seasons to the currently selected profile.

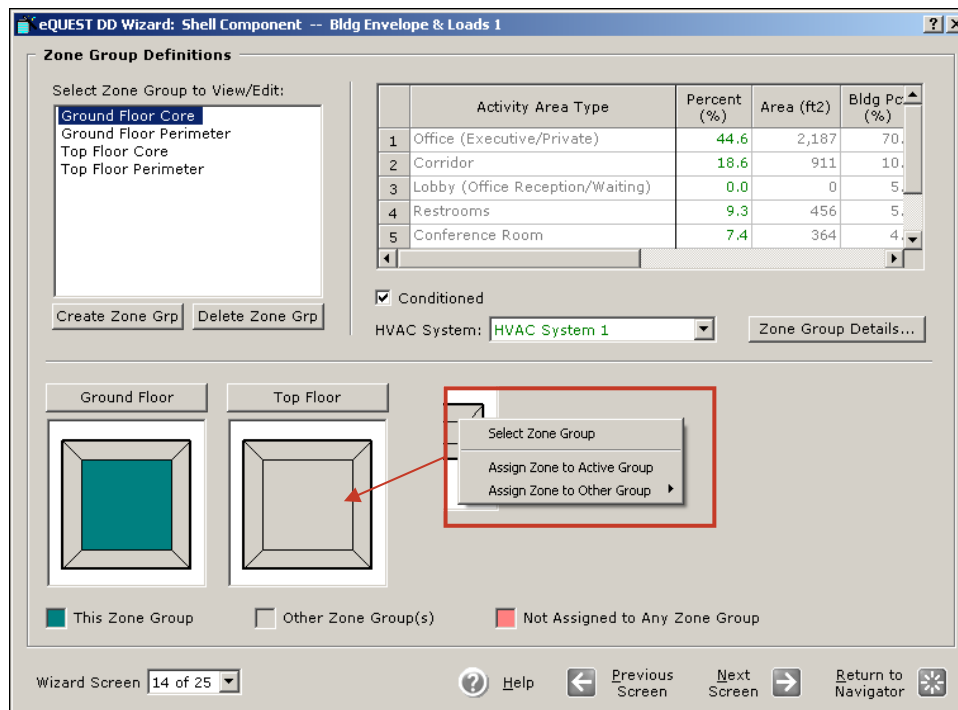
You will notice that the **Profile Group Box (1)** allows you to select several different load schedules to view, including: occupancy, ambient lighting, office equipment, miscellaneous equipment, exterior lighting, domestic hot water, etc.*.

*Depending on building type and non-HVAC defined on screen 15 a profile screen will be available in the **Hourly Profiles** chart—interior lighting, loads, cooking, misc. equip, interior task lighting, office equipment., refrigeration, etc...DHW, exterior lighting. You can accomplish this by jumping ahead to screen 15 to enable settings by checking the appropriate box. Return to screen 13, **Hourly Profiles**, to view the charts.

SCREEN 14: ZONE GROUP DEFINITIONS

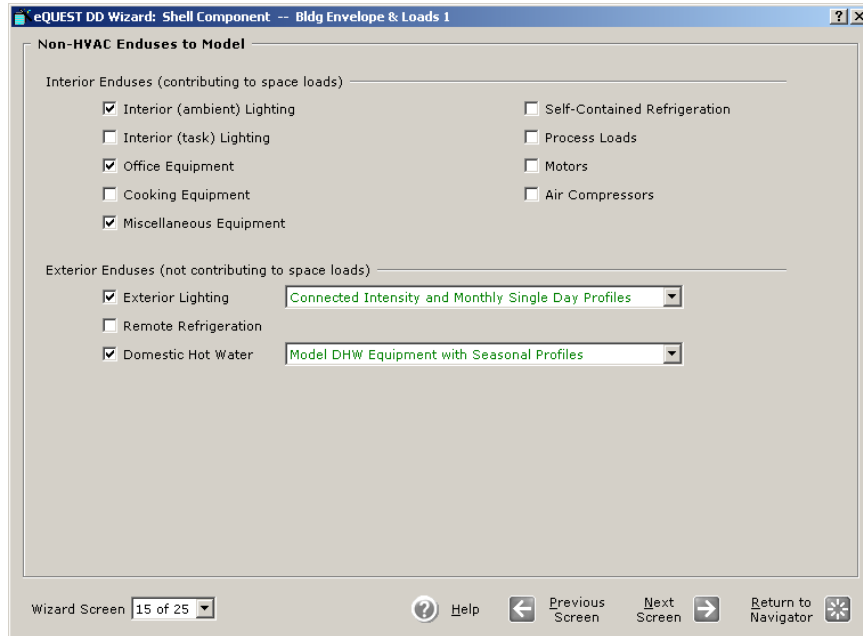
Screen 14 will only appear if the **Show Zone Group Screen** box is checked on screen 13. This is where activities are assigned by zone/zone group. Here you can assign activities and HVAC by zone/zone group and check that the activities are appropriate.

If you have separate HVAC systems for different zones (not including separate building shells), you would define them here. To assign zones, left click on the corresponding zone in the zone diagram and follow the desired selection.



SCREEN 15: NON-HVAC ENDUSES TO MODEL

If you want something to be included in the energy model, it must be selected here. This will enable the remaining loads and profiles screens that plug into the Hourly Profiles screens.



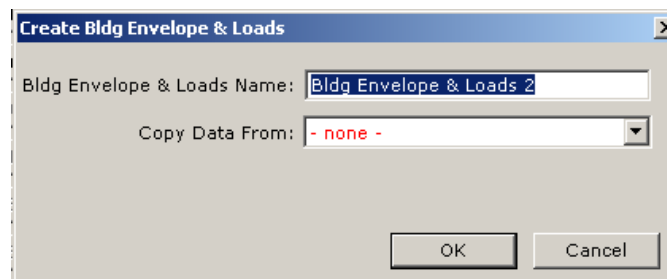
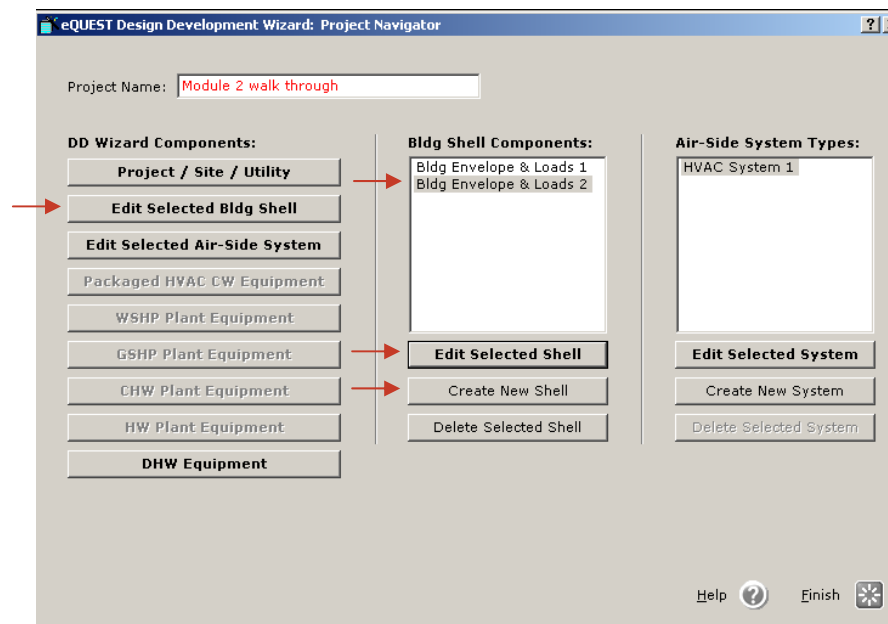
The remainder of the screens in the **Shell Component — Bldg Envelope & Loads 1** guide you through defining equipment loads and profiles. These categories include: interior lighting, office equipment, cooking, self-contained refrigeration, miscellaneous, exterior lighting, remote refrigeration, and domestic water-heating. For more information refer to pages A23-A26 in the appendix.

CREATING ADDITIONAL BUILDING SHELL COMPONENTS

Once you complete the Building Shell screens, click **Return to Navigator**. This will bring you back to the DD Wizard Project Navigator. There are a couple of options when creating new and/or different building shells. One option is to use a footprint from a previous shell. This will allow you to maintain a consistent floor plan but change occupancy use for a multi-use facility. Another option is to create a campus of buildings that will have different uses, shapes, orientations, etc. There are many combinations between these two options that are also possible.

Before creating a new building shell, take note of the coordinates of the first building shell. This will guide you in placing the new building shell(s) in reference to the first building shell. Coordinates are specified on page 1 of the **Shell Components** screens. Check **Specify Exact Site Coordinates**, and then x, y, and z coordinates will appear. Unless you specified coordinates when creating the first building shell, the lower left corner coordinates will be $x=0$, $y=0$, $z=0$.

To begin creating a new building shell click **Create New Shell** in the **Project Navigator**. This will bring up a **Create Bldg Envelope & Loads** screen, giving you the opportunity to rename your new building shell component (default name: **Bldg Envelope & Loads 2**). After entering a shell name and selecting the desired data, click OK.



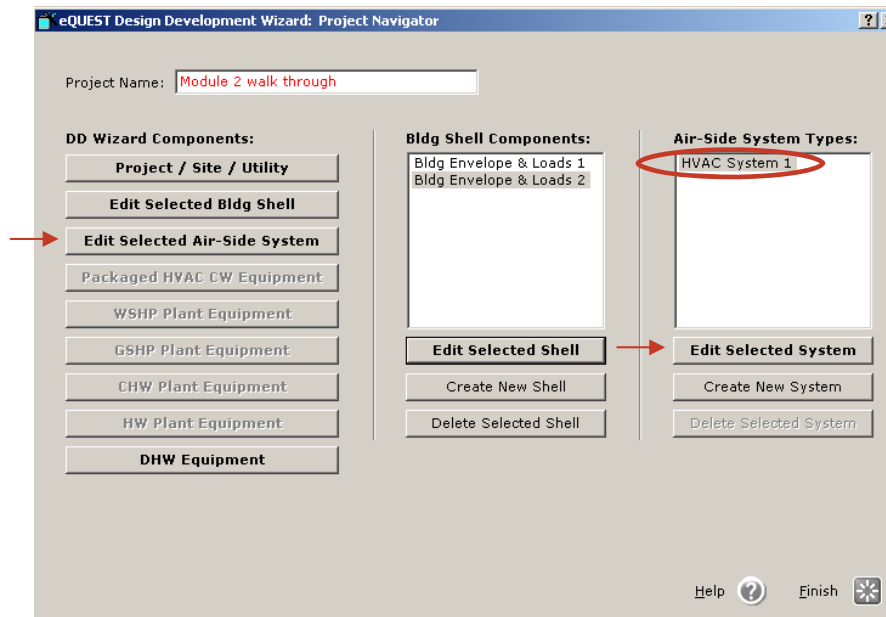
This will take you to a new set of **Shell Component** screens, identical to the screens for the original building shell, where you will specify the properties of this new building shell, including its coordinates. When completed, return to Project Navigator. Note: When you calculate your project you will not see the new building shell(s) in the 2-D model geometry, but you can view it in the 3-D model geometry.

You can choose to edit any of these building shell components at any point by returning to the DD Wizard Project Navigator, highlighting the appropriate building shell in the list and clicking either **Edit Selected Bldg Shell** or **Edit Selected Shell**.

STEP 5: MODEL THE HVAC AIR-SIDE SYSTEMS

Now that you have set up some building shell components, it is time to establish the HVAC air-side systems. eQUEST will always set up HVAC System 1 for you, but unlike the SD Wizard, you now have the option of creating multiple HVAC air-side systems.

The Air-Side System component allows you to define the HVAC systems of a particular air-side system, along with its mechanical properties, as well as set up specific operating schedules for fans, etc. There are two ways you can access HVAC Air-Side System screens. First highlight the air-side system shell you would like to modify (if you have not yet modeled additional systems, there should only be one). Then click either the **Edit Selected Air-Side System** button in the panel on the left, or **Edit Selected System** in the right panel underneath. Both options will take you to the same place.



HVAC System Definition

System Type Name: HVAC System 1

Cooling Source: DX Coils

Heating Source: Furnace

System Type: Packaged Single Zone DX with Furnace

System per Area: System per Zone

Return Air Path: Ducted

Component Name Prefix: S1

Suffix:

(# Prefix+Suffix characters must be <= 4)

Prevent duplicate model components

System Assignment to Thermal Zones

	Shell Component(s)	Description of Assigned Zones
1	Bldg Envelope & Loads 1	All Zones
2	- undefined -	

Wizard Screen 1 of 7

Help Previous Screen Next Screen Return to Navigator

Once into the Air-Side System category, you will see a series of screens similar to the HVAC screens presented with in the SD Wizard. Depending on the options you select, more or less screens will become available to you.

When you finish modeling the HVAC air-side systems, go back to the building shells and assign them at Screen 14. If you use the assignment on screen one of HVAC, eQUEST will “push” the template to the building shell. However this is a very “broad brush” method, quick, but allowing for little detail. eQUEST recommends that you “pull” the air-side system into the appropriate building shell, giving you more flexibility in making HVAC assignments.

It is important to note that despite eQUEST's seemingly new flexibility in the DD Wizard, it is still best to define and specify the information in order. As you assign air-side systems, make sure they are specified to the correct building shell, especially as you assign zones. Occasionally, when assigning zones, eQUEST will NOT update screens on the system side. It is always a good idea to check that your systems are assigned to the right zone in both places.

Once you are finished creating HVAC air-side systems and assigning zones, return to the DD Wizard Project Navigator.

STEP 6: MODEL THE PLANT EQUIPMENT SYSTEMS

These components that relate to plant equipment systems control central heating and cooling equipment specifications. Depending on your air-side system selections you can gain access to either WLHP, GSHP, or a combination of the CHW and HW Plant Equipment.

At this time, eQUEST does not support multiple plant equipment systems in one file. This is important to keep in mind, especially since the DD Wizard allows you to create multiple air-side systems, each with a different HVAC system within one energy model. If you must specify different plant equipment systems in one model, consider using the Detailed Data Edit, explained later in this module.

The CHW and HW Plant Equipment components can be turned on simultaneously to allow for you to specify both cold water and hot water loop plant systems. Unfortunately, these cannot be used in conjunction with GSWP and WLHP Plant Equipment components.

When you initially begin the DD Wizard, the plant system components will be grayed out, or locked. To access any of these components, you must first specify specific settings under your **Edit Selected Air-side Systems in HVAC System 1** in the **Project Navigator**. Select this system and click Edit Selected System to open up the component.

Go through all of the screens defining the different components as accurately as possible. The Plant Equipment components can be accessed using the following settings on this screen: Hopefully this information was assigned as you were building your air-side systems. If not, make sure you go back through your screens to verify that none of your custom settings have been lost.

COMPONENT	HVAC SYSTEM SELECTION
WLHP Plant Equipment	Cooling Source: DX Coils Heating Source: DX Coils (Heat Pump) Heat Pump Src: Water Loop
GSHP Plant Equipment	Cooling Source: DX Coils Heating Source: DX Coils (Heat Pump) Heat Pump Src: Ground Loop
CHW Plant Equipment	Cooling Source: Chilled Water Coils
HW Plant Equipment	Heating Source: Hot Water Coils Heat Water Src: Hot Water Loop

Once you select a particular combination of Cooling and Heating Sources to unlock a Plant Equipment category, you can click Return to Navigator to take you back to the DD Wizard Project Navigator. At this point, the appropriate Plant Equipment category should be accessible (no longer grayed out.) Clicking on a Plant Equipment category will take you to a set of 1 to 3 screens, depending on equipment. See pages A27-A30 in the appendix to view these screens.

The Plant Equipment screens contain a myriad of settings relating to mechanical equipment, controls, and schedules. eQUEST will generate the default information on these screens based on your chosen building types and other ASHRAE specifications. You may want to consult a mechanical engineer in order to further define information in this part of the Wizard. After you make the necessary adjustments to the Plant Equipment, you can return to the DD Wizard Project Navigator. You will be able to re-access this particular category as long as you maintain the appropriate heating and cooling sources in your *first air-side HVAC system*. Even if you select more heating and cooling sources in additional air-side systems, eQUEST will give preferential treatment to the first system in the list (regardless of name) and only open up Plant Equipment systems based on this air-side system.

Make sure you record all of your changes to your plant equipment systems on the appropriate forms and click **Return to Navigator** when you are finished.

STEP 7: MODEL THE DHW SYSTEMS

The **DHW Equipment** component corresponds to the DD Form—DHW Equipment, which can be found at the end of this module. You will only need one copy of this form. To enter this component, select **DHW Equipment** from the list of components in the DD Wizard Project Navigator.

DOMESTIC WATER HEATING SCREENS

Depending on the building type(s) you have selected, you will be given access to one or two screens within this portion of the wizard. If you have selected a residential building type in either the Project/Site/Utility component or any of your building shell components, another screen for Residential Domestic Water Heating will be available. This is an update in eQUEST v. 3.63, which now provides you with more specific options and settings in both the SD Wizard and the DD Wizard for this component.

The defaults for these screens are generated by eQUEST based on rules of thumb and ASHRAE standards depending on the building types you have selected. As you adjust these settings you will be provided with different options that allow you to input more specific information into the energy model. If you are unsure of how to modify these settings, either accept these defaults or consult your mechanical engineer.

Currently, there is no way to specify more than these two DHW boilers (non-residential and residential). They will serve the entire project. If you require different settings for multiple shells, it is recommended that you develop additional energy models in separate files using the DD Wizard. If you do not want either one of these boiler equipment systems to affect the project, simply select **-none-** under **Heater Fuel**.

Remember to record all of your information on the wizard form and click **Return to Navigator** when you are finished.

STEP 8: CLOSE THE WIZARD, ADD EEMS IF DESIRED, AND SIMULATE THE BUILDING

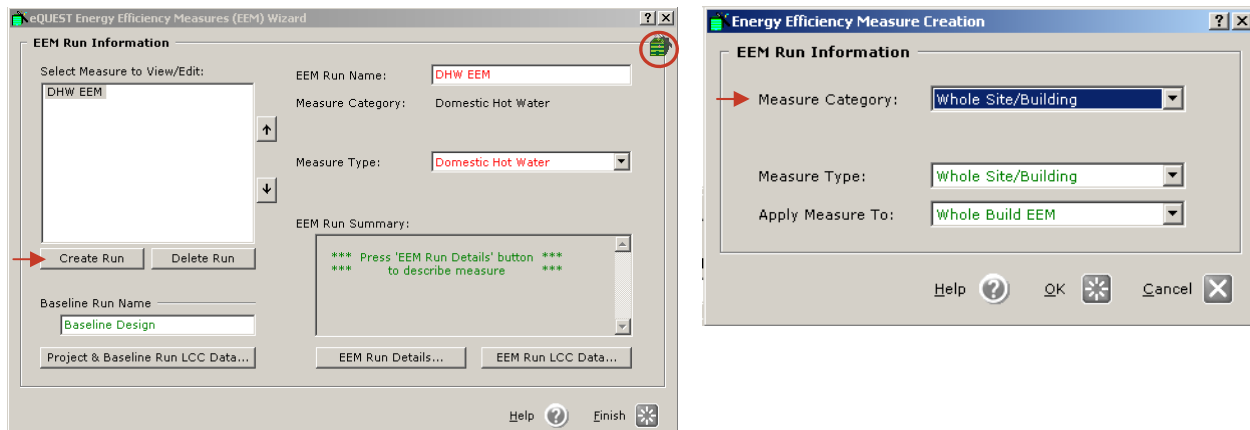
At this point you should have modified every portion of the DD Wizard model at least once. Unless you want to go back to a particular component and make changes, it is time to close the DD Wizard and move on to calculating the model. Click **Finish** in the DD Wizard Project Navigator. Doing this will instruct eQUEST to make or update a BDL Load file for the project which will then be used to simulate the building. Depending on the amount of information in your model, this may take a few moments. Be patient! Remember that eQUEST is still sparing you painful hourly calculations throughout an entire year.

At this point, you now have several options:

1. Simulate the building.
2. Add EEMs.
3. Make changes to the existing base model.

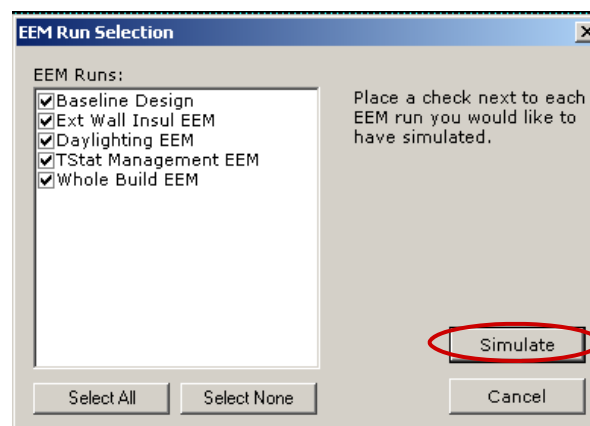
Since options 1 and 2 were covered in depth in module 1 (pages 48-50) we will cover option 3 in step 10, we will just take a few moments to discuss some changes to the EEM Wizard:

- The EEM Wizard now contains a "Whole Site/Building" EEM option that allows you to modify the entire base model as opposed to selecting one specific element. This setting is available when the green box with the wand appears in the upper right corner of the EEM screen. When you select this option, eQUEST brings you to another DD Wizard Project Navigator where you can change any portion of the base model. To select the "Whole Site/Building" option click **Create Run**. In the **EEM Run Information** box select **Whole Site/Building** option under **Measure Category**.



- Remember to take note of your changes so you can interpret your comparative results accurately.
- Items in the EEM Wizard cannot be reordered using the up and down arrows to the right of the EEM run list. eQUEST will not allow you to move a run above another run upon which it is dependent—a warning will appear. Runs that are applied to the base case can be moved to any point in the list. As you move a run farther down in the list, you will gain access to more runs in the **Apply Measure To** dropdown box to the right.

After you have input the EEMs, it is a good idea to simulate your building. To do this, click Finish at the bottom of the EEM Run Information screen. In the Action Screen click **Simulate Building Performance**. The EEM Run Selections box will appear. Select the components you would like to see the results of. Click **Simulate**.



STEP 9: REVIEW THE RESULTS

Once you have simulated your model, you should review your results. While eQUEST is a sophisticated program it is still a good idea to critically read through the reports to ensure realistic results. We will not be reviewing all of the reports in this module, as most of them were covered in eQUEST Module 1. Instead we will be discussing how to critically analyze your results and how to modify the reports to meet your needs.

There are a few things that you should look at when reviewing your results. By checking these factors, you will quickly be able to get a picture of the energy usage of your project.

What we look at in the LAB to make sense of reports:

- Monthly Energy Consumption by Enduse
 - Graphs
 - Units—remember that while the graphs look like they are showing the same amounts of energy, the scale of the units change, so you cannot visually compare them. Be sure to look at the actual numbers for accurate comparisons.
 - Electric—make sure your cooling spike happens at an appropriate time of year and that the overall curve makes sense. Is there an inappropriate spike somewhere? What could be causing that?
 - Gas—make sure that heating is happening at the right time of year and that the curve makes sense. Is there a spike somewhere? What could be causing that?
 - Both—check how each enduse is being used throughout the year—is there anything that looks unusual? If so, is that because of something modeled or something not modeled?
 - Tables
 - Units—remember you cannot compare numbers from different charts.
 - The totals for both—do these numbers seem reasonable? If they are reasonable, these are good numbers to compare different runs, as they give a sense, quantitatively, of how much these changes actually affect the model.

The following enduse profile descriptions should help you understand some of the reports a little more:

- Area Lighting: indoor overhead, ambient lighting; it can be controlled by daylight settings
 - These numbers should be the same throughout the year.
 - To reduce energy usage with lighting, consider adding daylight control. To add daylight controls go to the 1st page of the **DD Wizard: Shell Component** (see page 22 of this module for a screen shot)
 - Be sure there is an adequate amount of daylighting in your project, while also considering orientation of the building and the seasons of building location.
 - Task Lighting an other option for lighting a space and requires less energy than area lighting
- Misc. Equip: includes indoor equipment energy, indoor electric equipment, other indoor energy sources, process loads assigned directly to a circulation loop, and

indoor energy sources which do not contribute to space loads (e.g. equipment in exhausted spaces)

- This is something you work with when you get more into schedules in the Detailed Data Edit mode.
- Space Heating: includes space heating by boilers, heat pumps, thermostats, and the impact of outdoor ventilation air, air-side economizers, fan heat, and pump heat
 - This is affected by factors such as lighting, daylighting, windows, building construction, etc. Different factors will impact the demand for space heating.
 - Space Cooling: includes space cooling by chillers and package DX systems, as well as the impact of outdoor ventilation air, air-side economizers, fan-heat, pump heat, and desiccant cooling, if any.
 - Space cooling, like space heating, is also impacted by lighting, daylighting, windows, building construction, etc.
- Heat Reject: cooling towers and other heat rejection devices
- Pumps & Aux: circulation pumps and auxiliary power consumed by various components: all circulation pumping energy, e.g. chilled water, condenser water, space heat hot water, domestic hot water, including all pumps attached directly to loops or primary equipment, any of numerous auxiliary power requirements, e.g. control panels, gas pilot lights, solution pumps, crankcase heaters, heat tracing on a pipe: auxiliary energy is energy usage that is minor or secondary to the actual equipment
- Vent Fans: all ventilation fans, e.g. supply, return and exhaust fans (does not include condenser fans or draft fans)
- Refrig Display: refrigerated display cases and associated systems
- HT Pump Supplement: Heat pump supplemental and defrost energy
- Domestic Hot Wtr: Domestic Hot Water Energy
- Ext Usage: Energy usage on the exterior of the building, such as exterior lighting (e.g. parking lots or signage)
- Graphs and legends can be pasted into other documents (Word, etc.)
- If there is a specific type or color of graph you would like to display you can change the appearance by changing the properties in the **2D Chart Control Properties** window. Right click anywhere on the graph, select **properties...** And the window will appear.
 - Changes made to properties of graphs only affect current graph, not future graphs, and will not remain in effect once another report is viewed
- Parametric runs are reports that compare multiple runs at the same time. Parametric runs show three kinds of information:
 - Total: show the annual results for energy, demand, and utility costs for each run.
 - Incremental: Reports the impact associated with each run; calculated by subtracting current run from previous run
 - Cumulative: reports annual savings, assumes cases were run on top of each other and reports the impact associated with the growing package of efficiency measures, relative to the base case → calculated by 'annual results base' - 'annual results case EEM'
 - If all runs are only compared to the base case then the cumulative results will be the same as the incremental results.
 - To maintain accurate results all cases need to be rerun if any other case is being rerun.
 - eQUEST does not provide default acquisition, replacements, or maintenance costs

in Detail Data Edit means no user input has been given, therefore resulting net savings should be interpreted as net present value of utility savings.

- Parametric reports do not update automatically if something is changed in the model. You must re-simulate for these reports for accurate results.
- If runs are independent then their costs are only for each independent case; if runs are cascaded then costs should be cumulative for each run

STEP 10: MAKE CHANGES IF NECESSARY.

Once you have completed analyzing your results, you can return to the Main eQUEST Window by clicking **Return to Building Description Mode** in the Reports View. At this point you can choose to save the model (File→Save) and exit the program (File→Exit), or continue to modify your energy model in the SD Wizard and add more EEM runs. To continue modifying the model, click **Building Creation Wizard** on the **Action Toolbar** and the DD Wizard will open. (Keep in mind that eQUEST thinks in a linear fashion.) To add more EEM runs, click **Energy Efficiency Measure Wizard** on the **Action Toolbar**. To view your latest simulation results, click **Review Simulation Results View**.

You can make changes in your eQUEST model and then run your building simulation as many times as you wish. After the building is simulated, you will be able to review the updated results reports for the energy model. Keep updating the SD Wizard Form and the EEM Forms as you make changes. They will continue to be a convenient tool, and help you track the changes you make in your energy model.

CONCLUSION

In this module you have learned how to model your project in the Design Development Wizard of eQuest. You have come a long way since the Schematic Design Wizard and have realized the many benefits of using this more detailed modeling and simulation tool. If you are confused or frustrated while using this program we encourage you to not give up!! The more you use eQUEST the more comfortable and helpful this program will be.

For information on how to analyze a less detailed energy model, please read eQUEST Module 1: Basic Energy Modeling and Comparative Runs

For information about performing Life-Cycle Cost Analysis through eQUEST, refer to eQUEST Module 3: Life Cycle Cost Analysis

For Information on more complex every modeling, see eQUEST Module 4: Advanced Energy Modeling and Complex Comparative Runs

Thanks to the people supporting the Integrated Design Lab—Bozeman:

- Northwest Energy Efficiency Alliance
- NorthWestern Energy in Montana
- School of Architecture, Montana State University

APPENDIX



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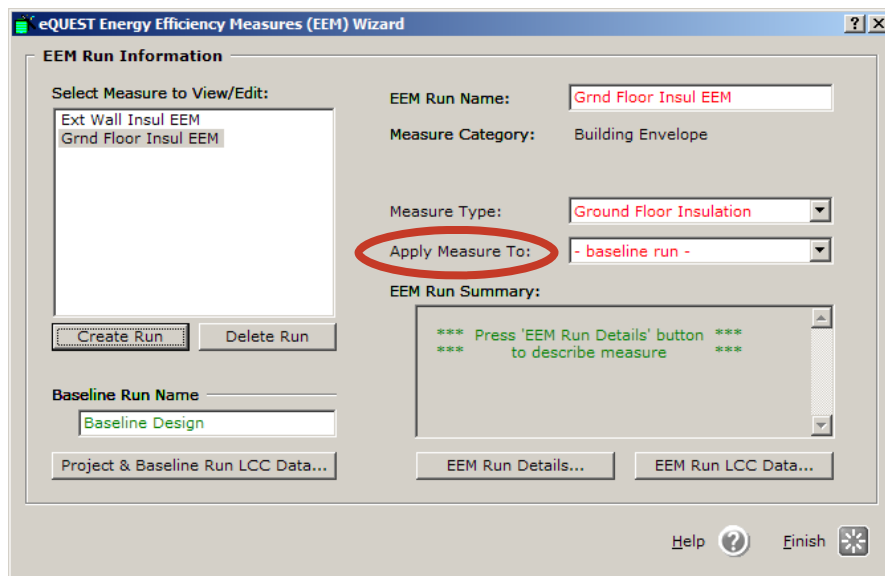
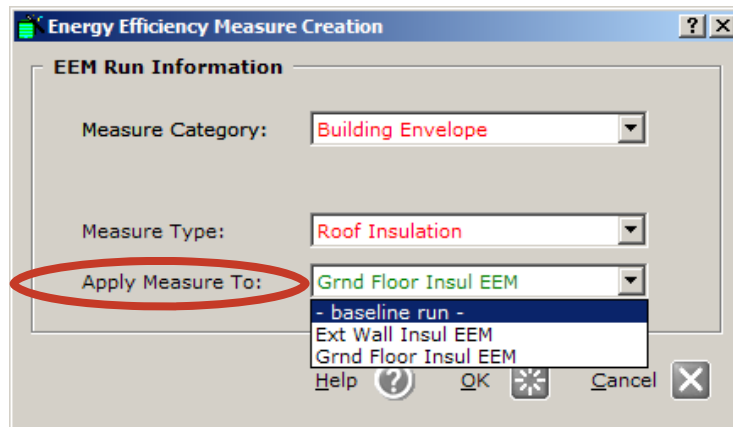
2D Chart Properties Control A46

INTRODUCTION

This appendix explores more of the features and options provided in the Energy Efficiency Measures Wizard. Each Measure Type allows specific data about envelope, loads, or systems to be input in the EEM Details Screen.

EEM runs that you create can be compared to either a baseline design or analyzed in a 'stacked' format with or against other input measures types. It is easy to apply each run to either the baseline run or to a previous run for comparison. The 'Apply Measure To' option is found on either the EEM Creation dialogue box or the Main EEM Wizard screen. Both are shown below.

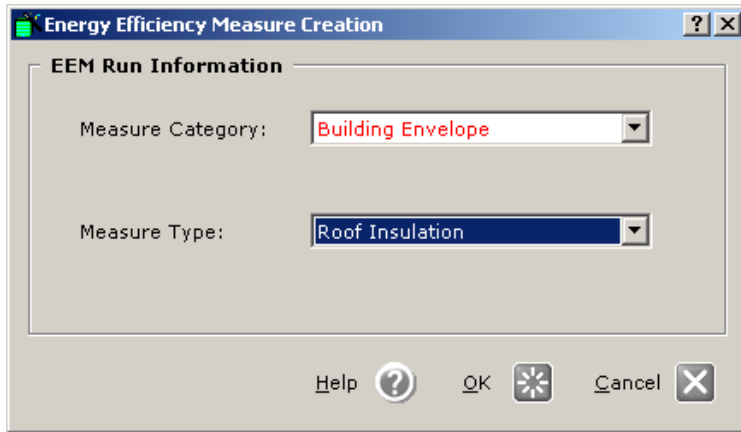
APPENDIX



For the purposes of this appendix, the focus will be on the options available in each of the EEM Detail screens for each of the listed Measure Types. All the EEM Detail screens in the appendix show examples of measure types as compared to a baseline run. The baseline run is shown on each screen, but not available for editing. eQUEST displays the EEM Detail screens this way so as to show you what your measure run is going to be compared against. If you were to apply the measure to a previous run, the previous run would be displayed here instead.

EEM Run Name:	Baseline Design		Window Area EEM	
Glass Type(s)**:	1	2	1	2
Typ Win Width (ft)*:	0.00	0.00	0.00	0.00
Window Height (ft):	5.22	5.22	5.22	5.22
Window Sill Ht (ft):	3.00	3.00	3.00	3.00
% North Window:	53.3	0.0	53.3	0.0
% South Window:	0.0	53.3	0.0	53.3
% East Window:	0.0	53.3	0.0	53.3
% West Window:	0.0	53.3	0.0	53.3

* A width of 0 results in one long window per facet (check box if window width is to take precedence over % window)
 ** Glass Types: 1) Double Clear 1/4in, 1/2in Air (2004)
 2) Double Bronze 1/4in, 1/4in Air (2203)



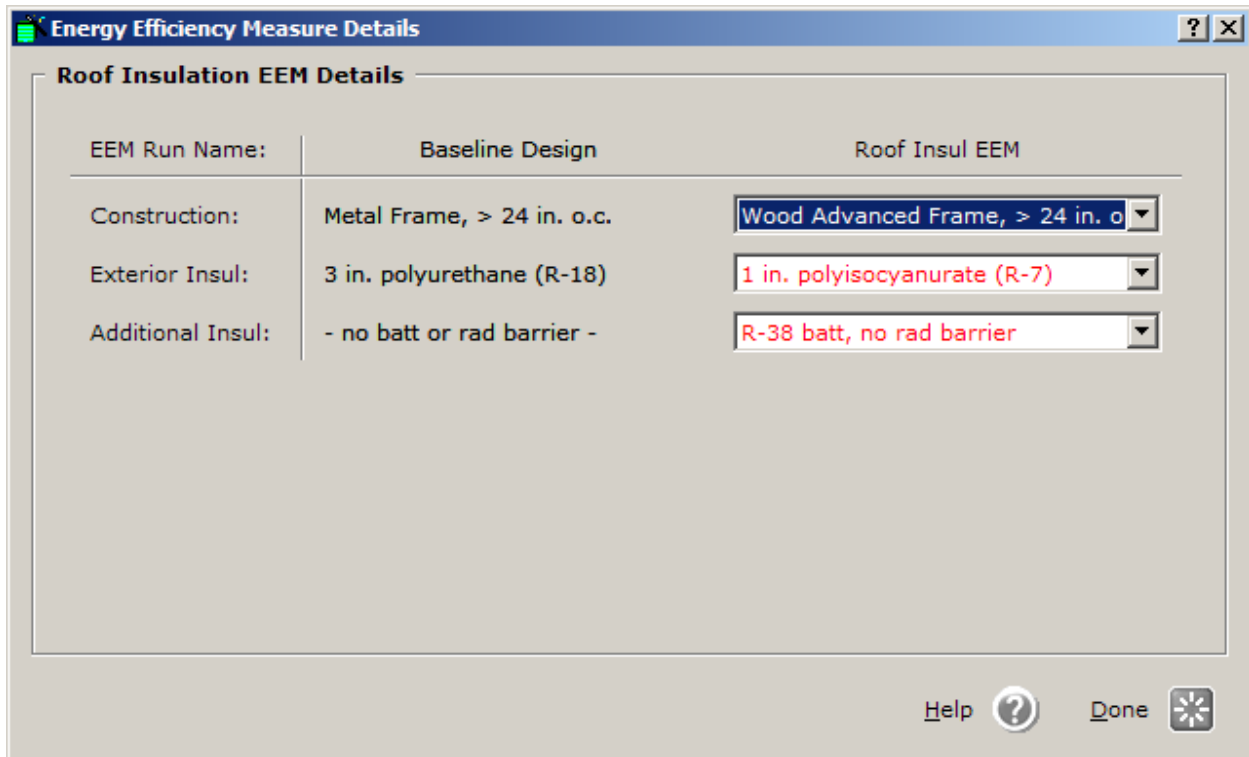
Building Envelope

Roof Insulation

- Exterior Wall Insulation
- Ground Floor Insulation
- Window Area
- Window Glass Type
- Window Exterior Shading
- Skylight Area

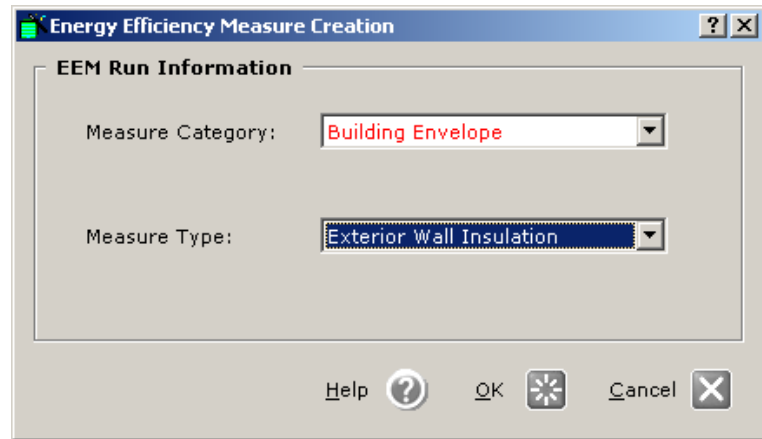
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The first three Measure Types in the Building Envelope category deal with construction types and insulation inputs for the roof, walls and floors. These Measure Types could be useful in considering such factors as energy loss due to thermal bridging and the point at which insulation values surpass a margin of diminishing returns. The following pages of insulation Measure Types show an example of insulation options for different construction types.

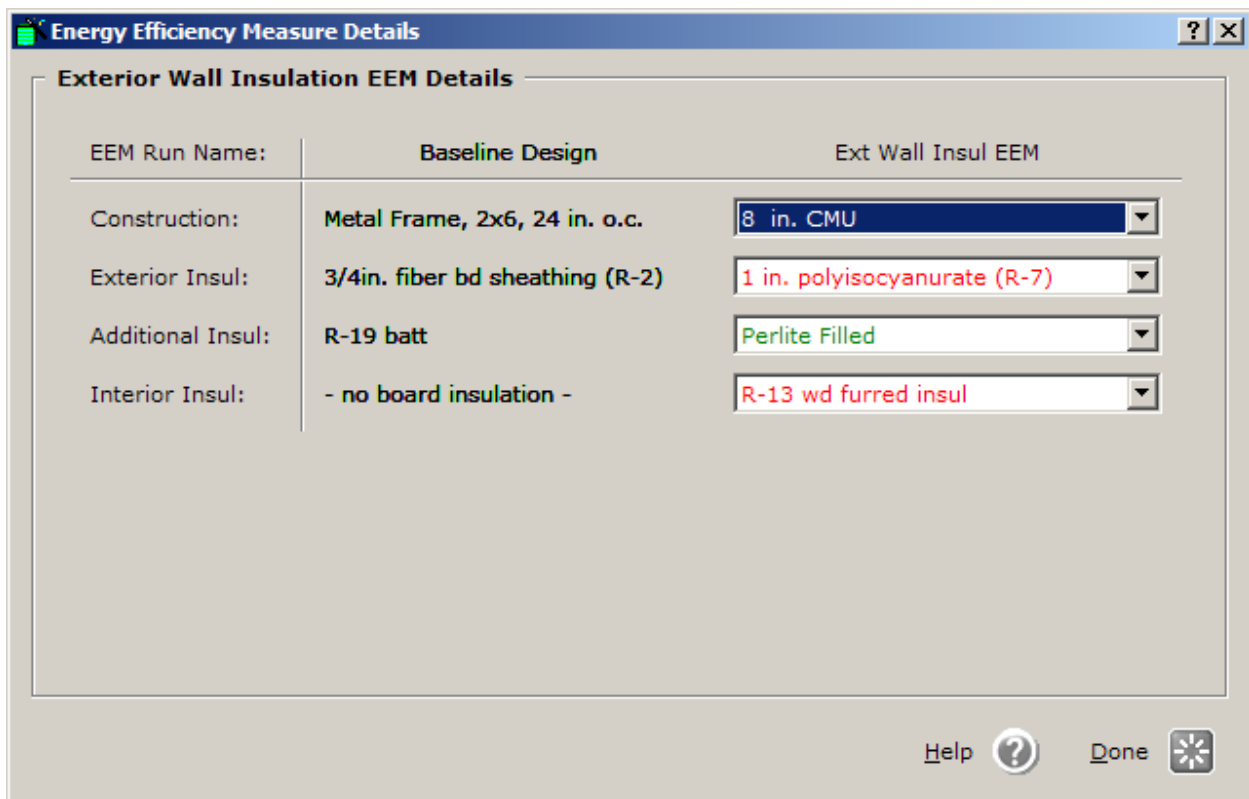


Building Envelope

Roof Insulation
 Exterior Wall Insulation
 Ground Floor Insulation
 Window Area
 Window Glass Type
 Window Exterior Shading
 Skylight Area

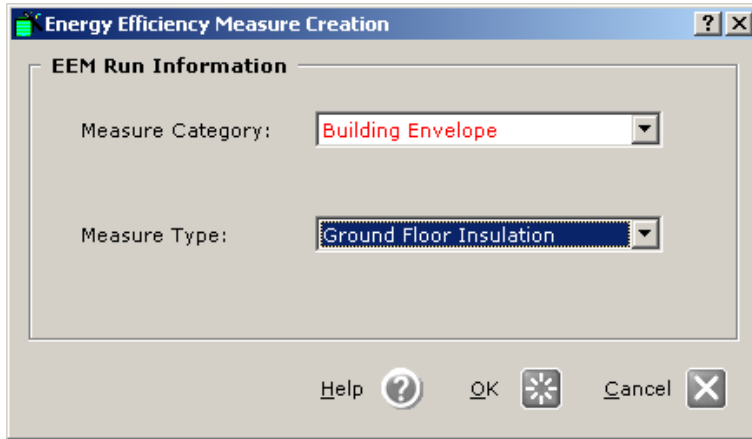


The Exterior Wall Insulation EEM is similar to the roof insulation options. This wizard screen offers the ability to compare energy efficiencies of varying wall construction types such as wood framing, metal framing, and masonry structures. This screen also offers varying insulation options based on the construction types chosen.

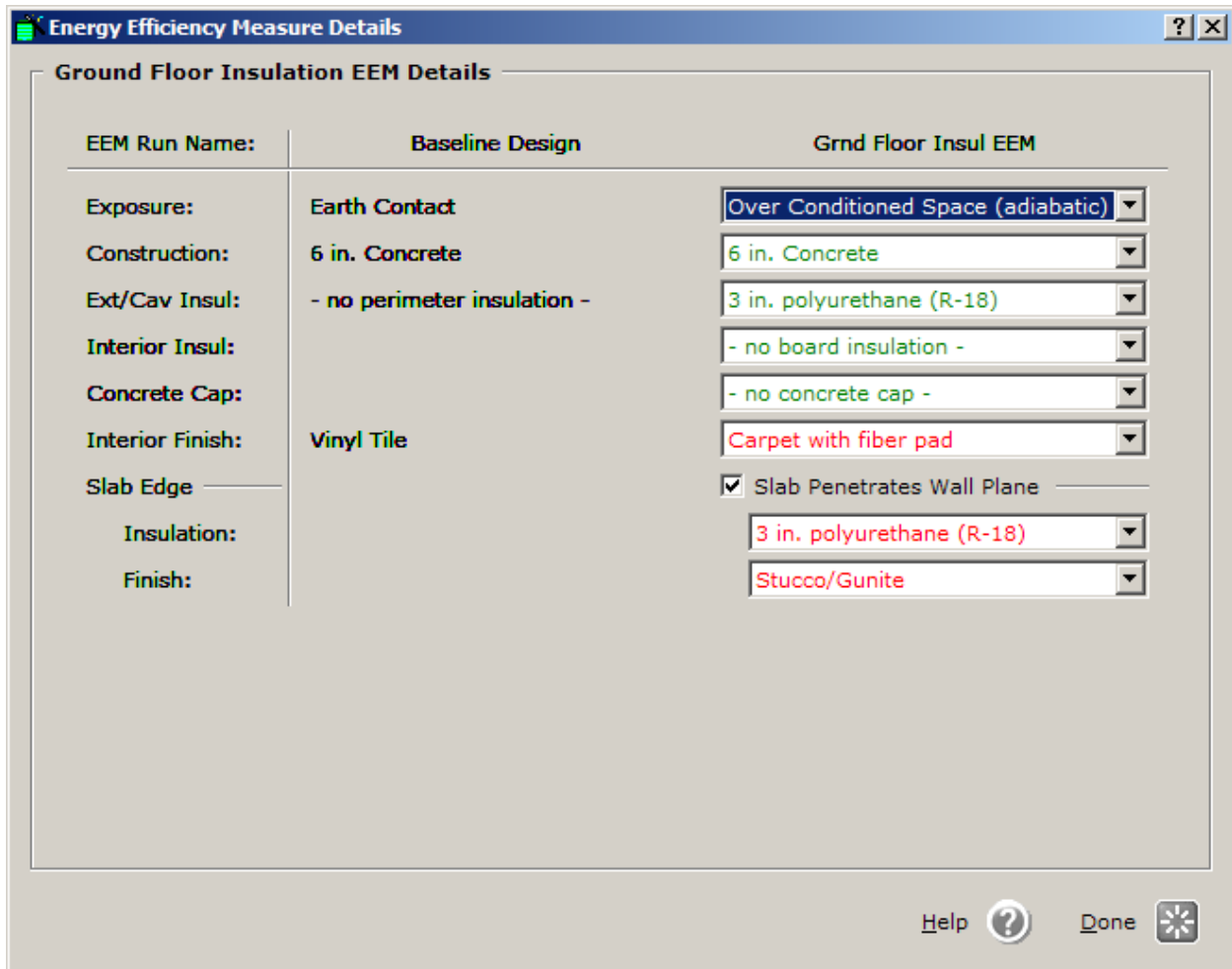


Building Envelope

- Roof Insulation
- Exterior Wall Insulation
- Ground Floor Insulation
- Window Area
- Window Glass Type
- Window Exterior Shading
- Skylight Area

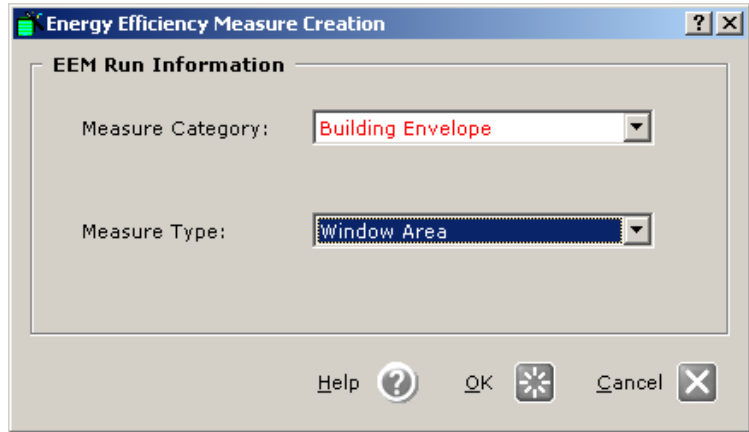


The Ground Floor Insulation EEM screen considers substructure energy efficiency details such as exposure to the ground, slab connection details, and interior floor finishes that can provide differing insulating properties and better thermal characteristics.



Building Envelope

- Roof Insulation
- Exterior Wall Insulation
- Ground Floor Insulation
- Window Area
- Window Glass Type
- Window Exterior Shading
- Skylight Area



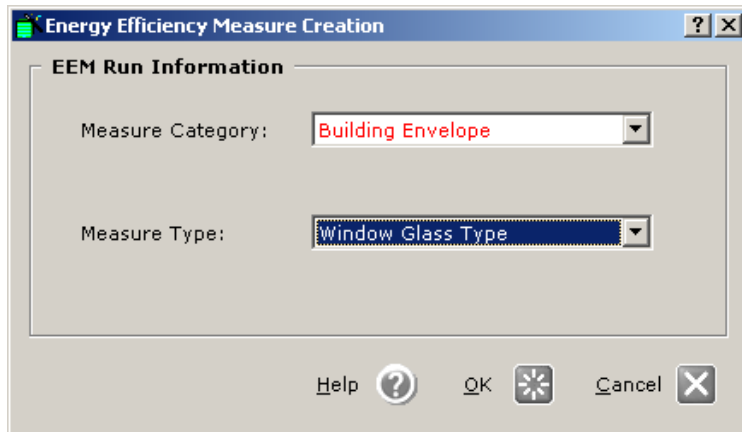
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The Window Area EEM details screen is almost identical to the SD Wizard screen. The options allow you to enter either window area percentages per wall or known window widths and heights. It should be noted that window widths equal glass plus a typical 2" frame. Glass types can be associated with specific window orientations. Additional glass types can be included in the following measure type—Window Glass Types EEM—on the next page. This EEM screen differs from our baseline comparison format to show the added glass type.

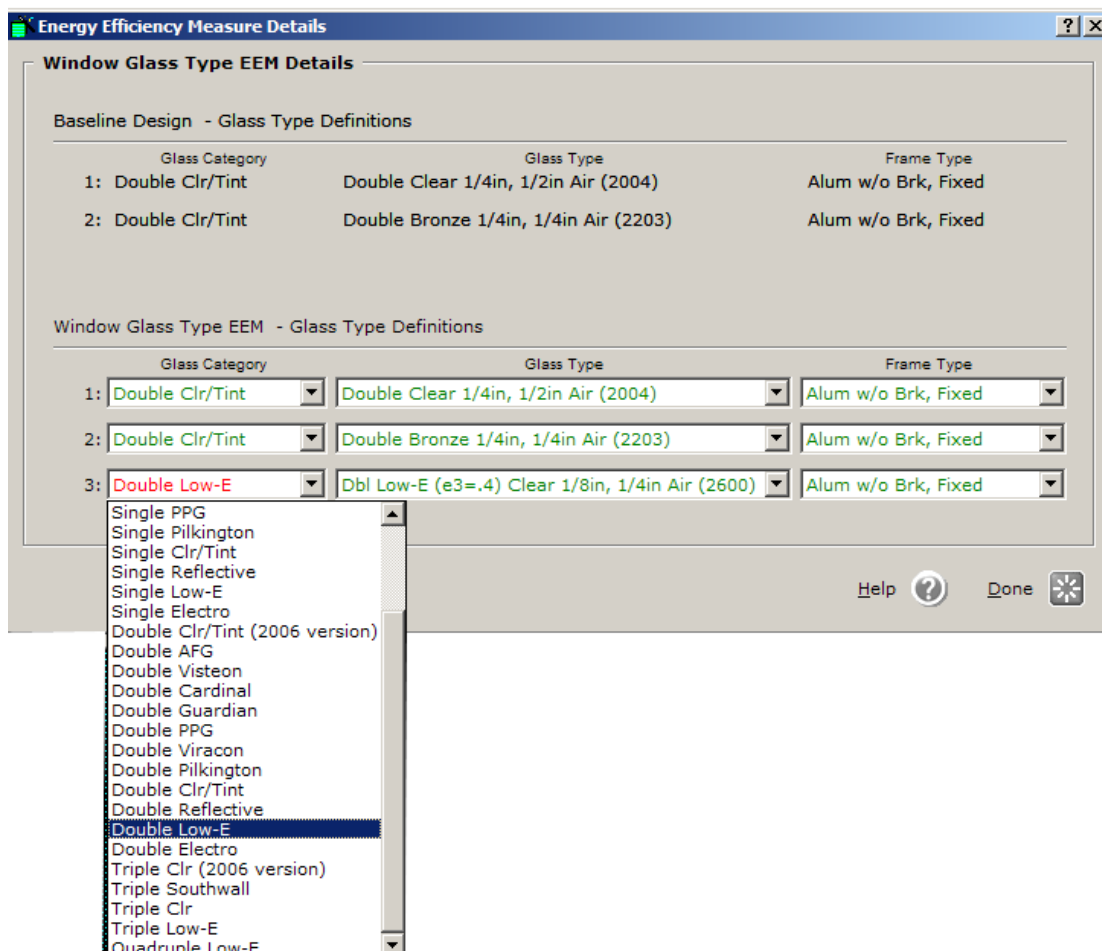


Building Envelope

- Roof Insulation
- Exterior Wall Insulation
- Ground Floor Insulation
- Window Area
- Window Glass Type
- Window Exterior Shading
- Skylight Area

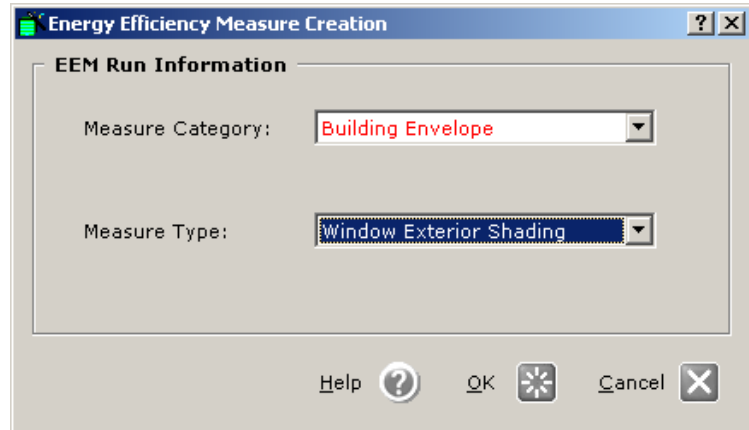


This EEM is set up just like the SD Wizard options for establishing window glass types in your baseline model. The screen below shows the glass types that were set up and applied to the EEM on the previous page. eQUEST provides many glass examples and frame types for energy comparisons.



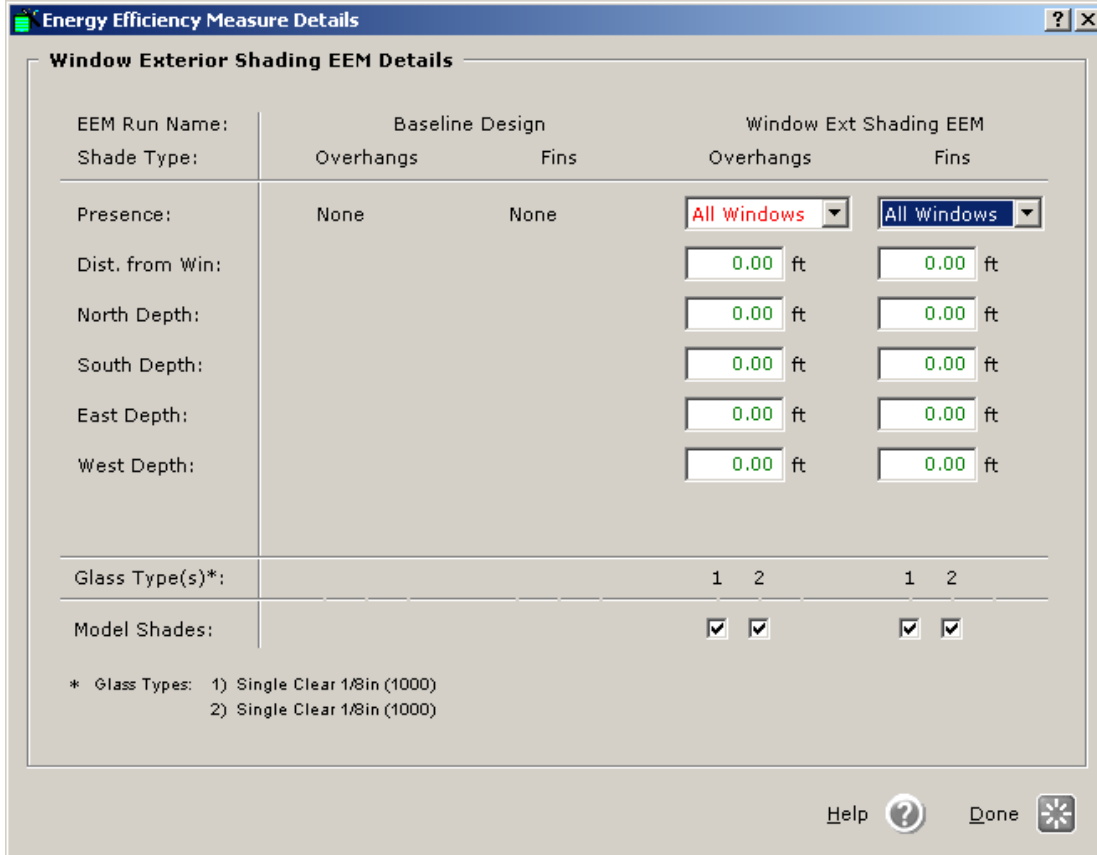
Building Envelope

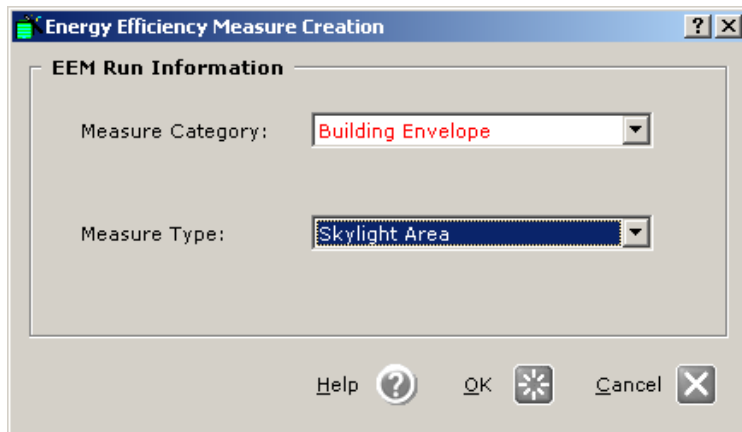
- Roof Insulation
- Exterior Wall Insulation
- Ground Floor Insulation
- Window Area
- Window Glass Type
- Window Exterior Shading
- Skylight Area



APPENDIX

Window overhangs and vertical fins are valuable considerations for shading unwanted solar heat gain. The EEM detail screen allows you to manipulate which windows receive overhangs or fins. This can be done by floor, orientation, or glass type. The distance from window option for overhangs recognizes positive values as the distance above the window and negative values as the distance below the top of the window that can be used for the construction of light shelves. The same process for the fins assumes positive and negative values in relation to the window edge.

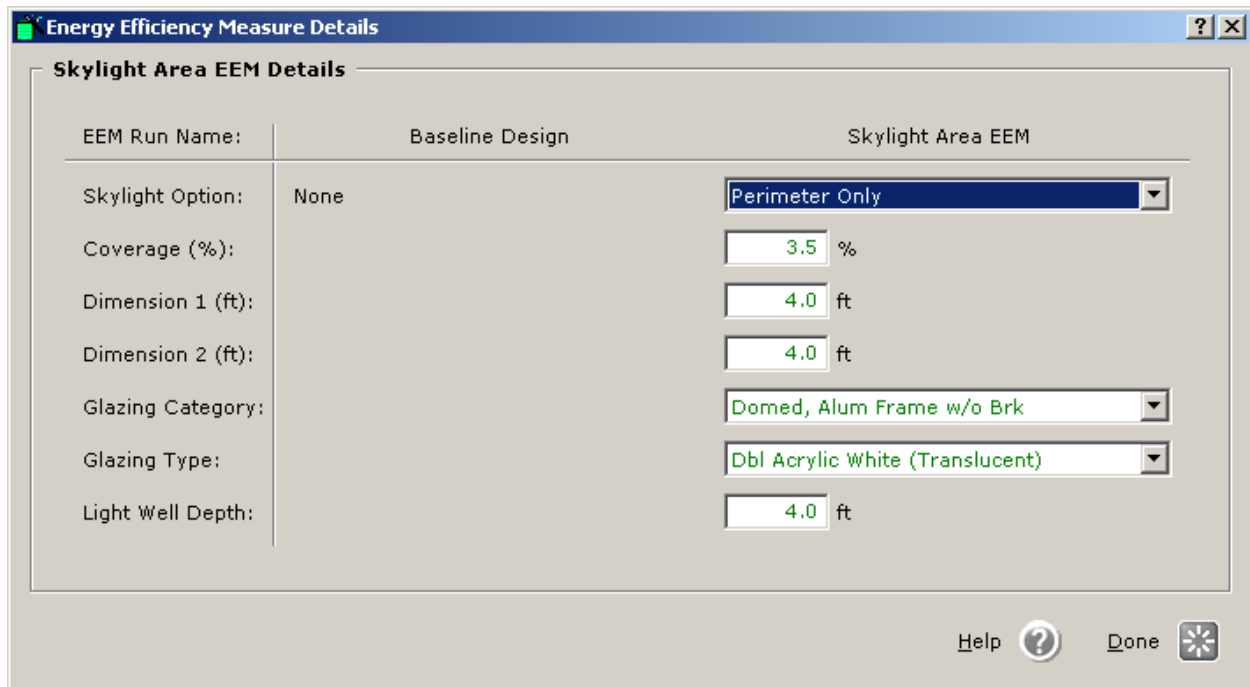




Building Envelope

- Roof Insulation
- Exterior Wall Insulation
- Ground Floor Insulation
- Window Area
- Window Glass Type
- Window Exterior Shading
- Skylight Area

Skylight Area EEM runs work similarly to the Window Area EEMs. Coverage of skylight area is based on percentage. Exact placement is not necessary, but its location over a given zone (perimeter, core or both) is important. Glazing type and skylight depth are other valuable options to compare.

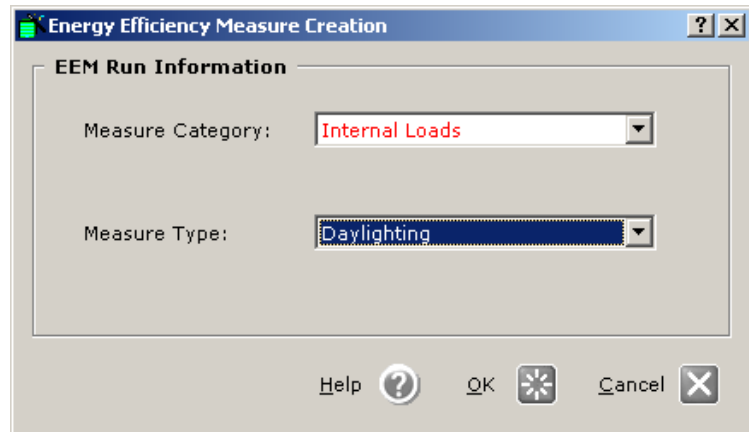


Internal Loads

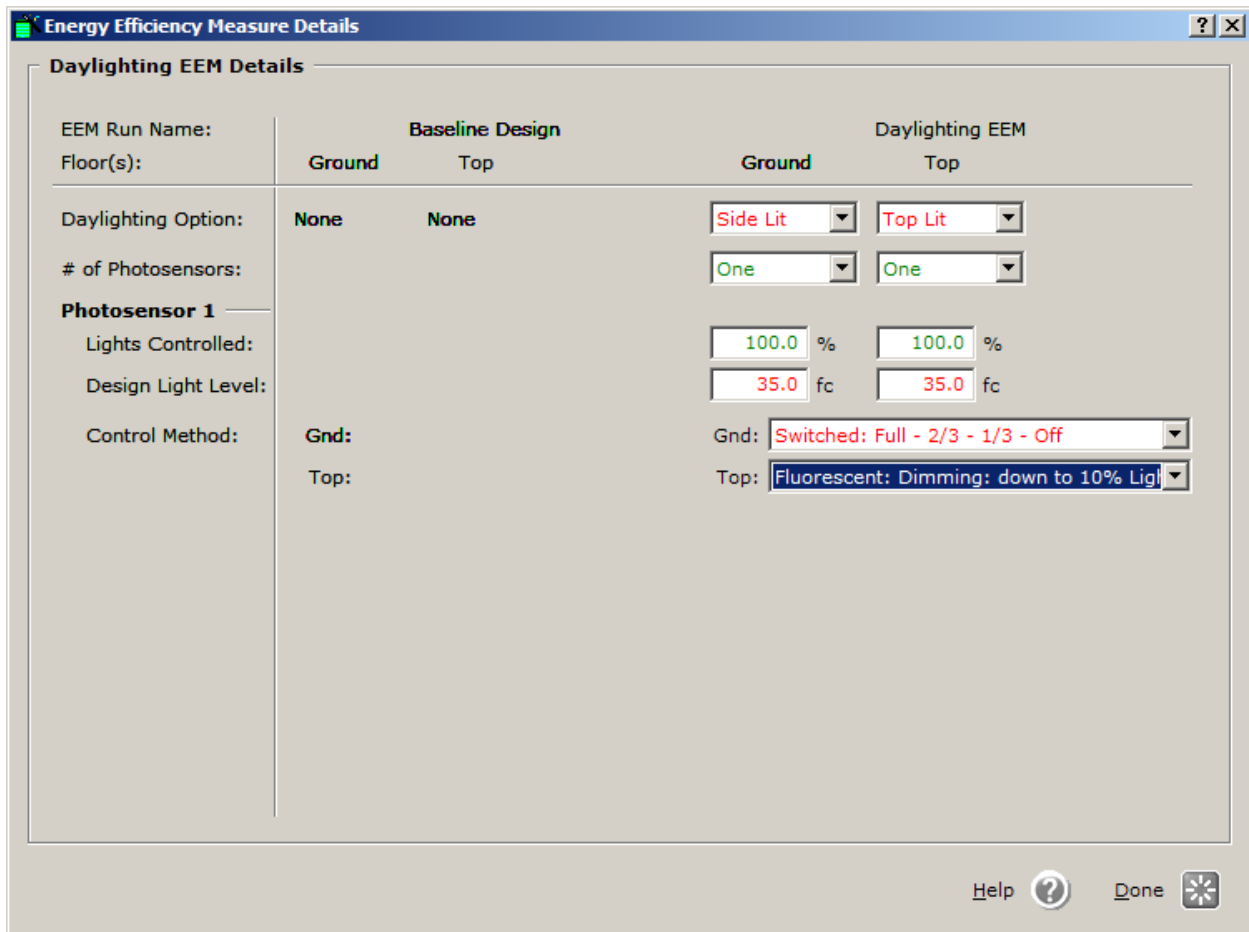
Daylighting

Lighting Power Density
Equipment Power Density

APPENDIX

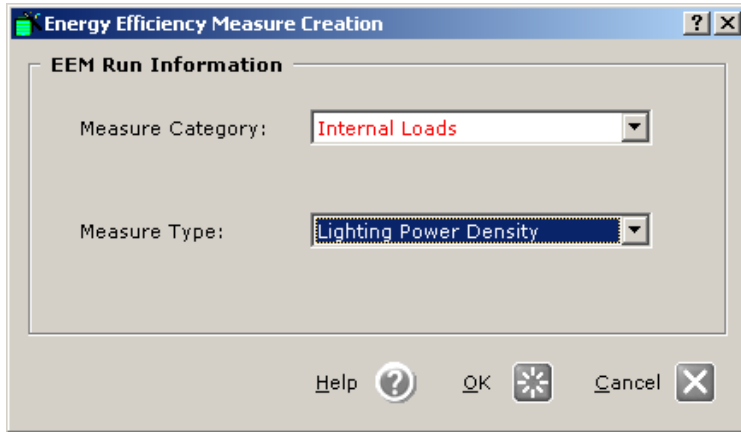


The Daylighting EEM allows you to compare different daylighting controls and settings to maximize efficiency. It allows you to choose between side lit and top lit controls, the number of sensors, percentage of lights controlled, and design light levels. Control Method provides varying efficiencies and functions.



Internal Loads

- Daylighting
- Lighting Power Density
- Equipment Power Density

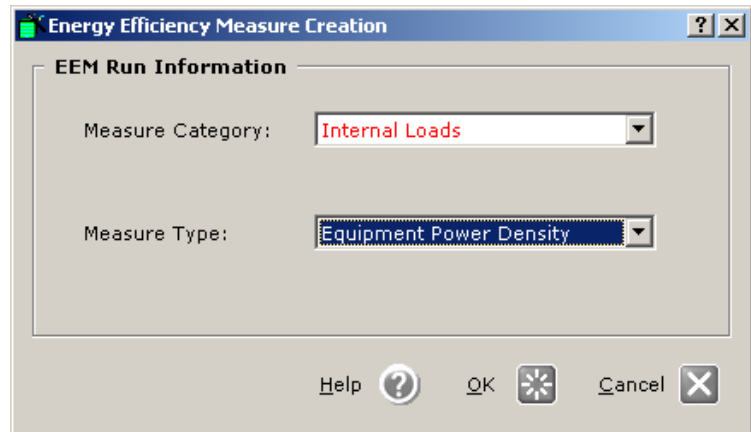


The Lighting Power Density EEM allows you to adjust the lighting power and load percentages for Activity Areas. The actual hourly ambient lighting power levels are a product of the lighting density multiplied by the fractional value established in the hourly lighting schedules. This will define the loads available for daylighting controls assuming window or skylight adjacencies. This does not include task lighting. The lighting levels during unoccupied hours can also be manipulated thus affecting lighting schedule multipliers. The defaults are based on the Activity Area Type.

Activity Areas	Area (%)	Baseline Design		Lighting Power EEM	
		Lighting (W/SqFt)	Unoccupied Load (%)	Lighting (W/SqFt)	Unoccupied Load (%)
1: Office (Executive/Private)	70.0	1.30	0.0	1.30	0.0
2: Corridor	10.0	0.60	10.0	0.60	10.0
3: Lobby (Office Reception/Waiting)	5.0	1.10	10.0	1.10	10.0
4: Restrooms	5.0	0.60	0.0	0.60	0.0
5: Conference Room	4.0	1.60	0.0	1.60	0.0
6: Mechanical/Electrical Room	4.0	0.70	0.0	0.70	0.0
7: Copy Room (photocopying equipment)	2.0	1.50	0.0	1.50	0.0

Internal Loads

- Daylighting
- Lighting Power Density
- Equipment Power Density

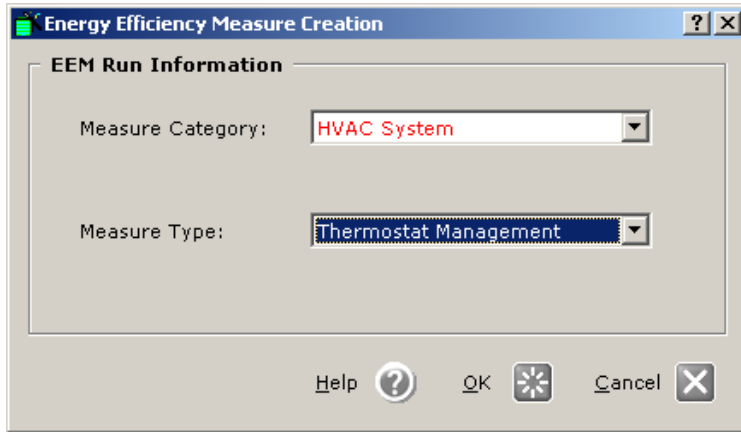


Equipment power density levels can be manipulated similarly to the Lighting Power Density EEM. The EEM screen allows you to adjust the equipment plug loads during occupied and unoccupied hours. The defaults for these inputs are based on the Activity Area Type.

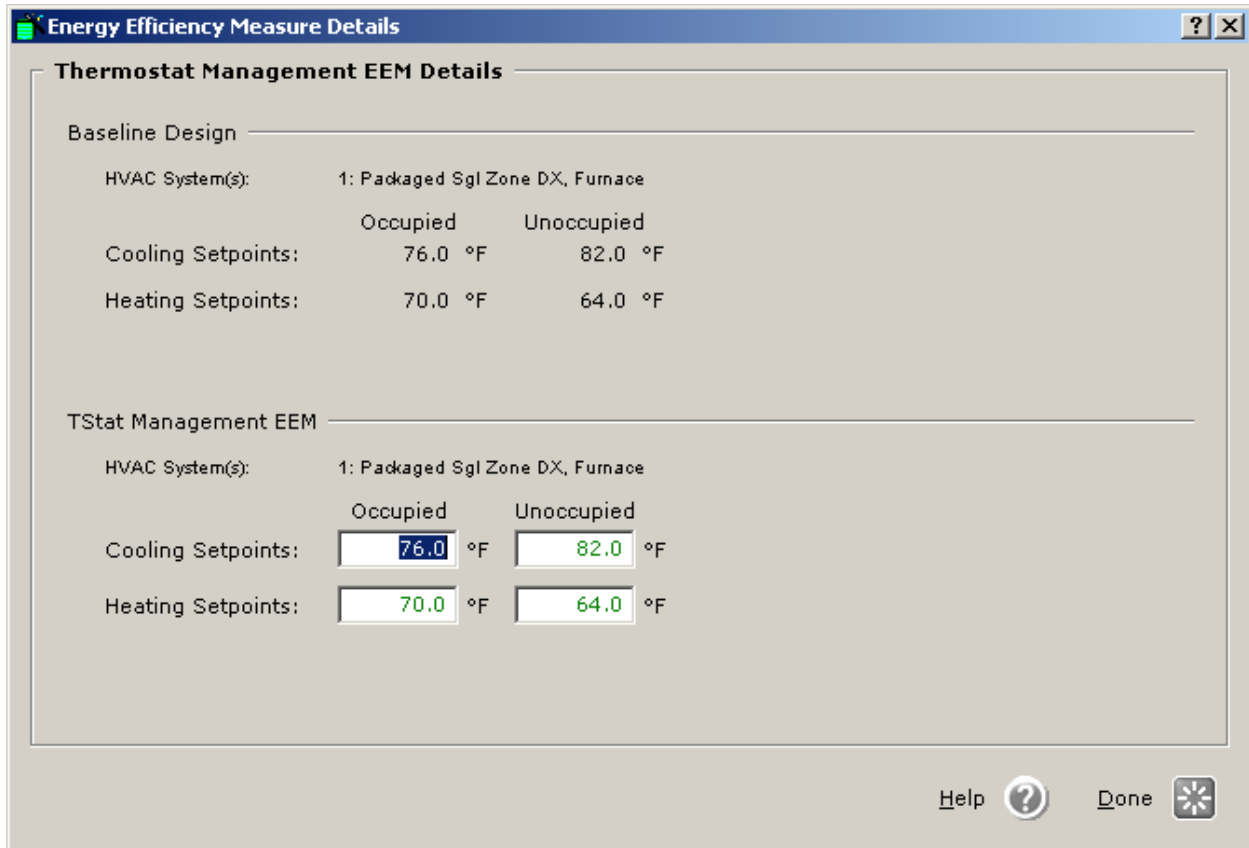
Activity Areas	Area (%)	Baseline Design		Equipment Power EEM	
		Plug Loads (W/SqFt)	Unoccupied Load (%)	Plug Loads (W/SqFt)	Unoccupied Load (%)
1: Office (Executive/Private)	70.0	1.50	20.0	1.50	20.0
2: Corridor	10.0	0.20	0.0	0.20	0.0
3: Lobby (Office Reception/Waiting)	5.0	0.50	0.0	0.50	0.0
4: Restrooms	5.0	0.20	0.0	0.20	0.0
5: Conference Room	4.0	1.00	0.0	1.00	0.0
6: Mechanical/Electrical Room	4.0	0.20	20.0	0.20	20.0
7: Copy Room (photocopying equipment)	2.0	3.00	20.0	3.00	20.0

HVAC System

- Thermostat Management
 - Fan Power & Control
 - Ventilation and Economizer
 - Deck Reset
 - Package HVAC Efficiency



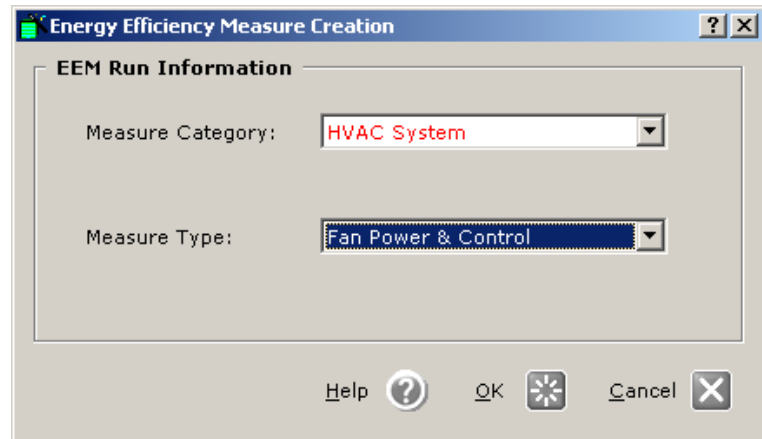
The Thermostat Management EEM details include cooling and heating set points pertaining to each designated system. The cooling set point should be greater than or equal to the cooling indoor design temperature. Inversely the heating set point should be less than or equal to the heating indoor design temperature. Unoccupied dead band ranges will be greater than occupied ranges.



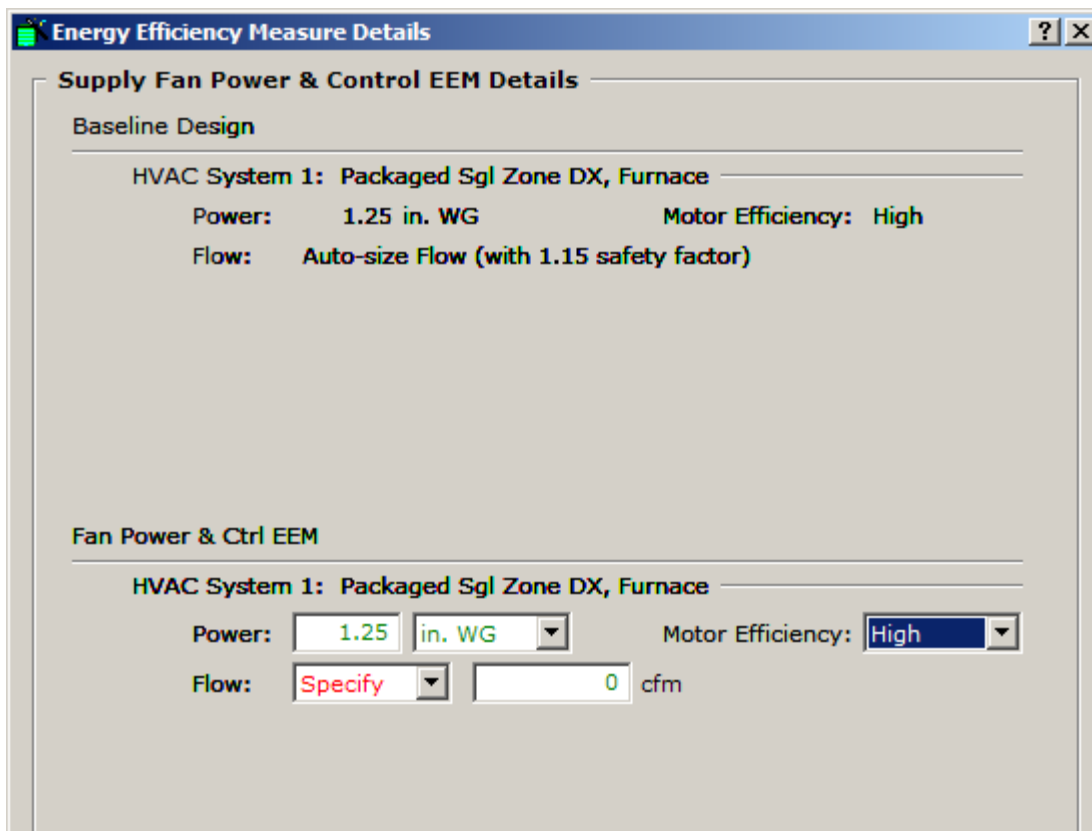
APPENDIX

HVAC System

Thermostat Management
 Fan Power & Control
 Ventilation & Economizer
 Deck Reset
 Package HVAC Efficiency

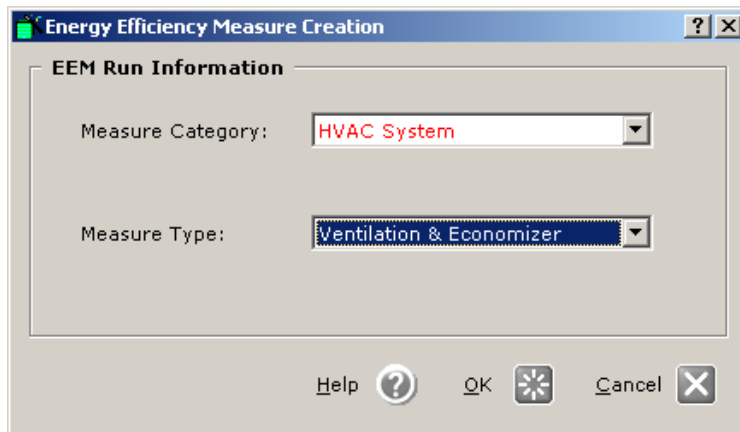


Fan power and control can be modified on this EEM detail screen. Supply fan power can be defined by either of two units: in. WG = total static pressure (in inches of water) or BHP = Brake Horsepower. The default for motor efficiency is 'High' in accordance with ASHRAE 90.1. 'Standard' setting would pertain to older equipment in existing buildings. Design flow rates can be specified as a ratio or as an exact CFM.

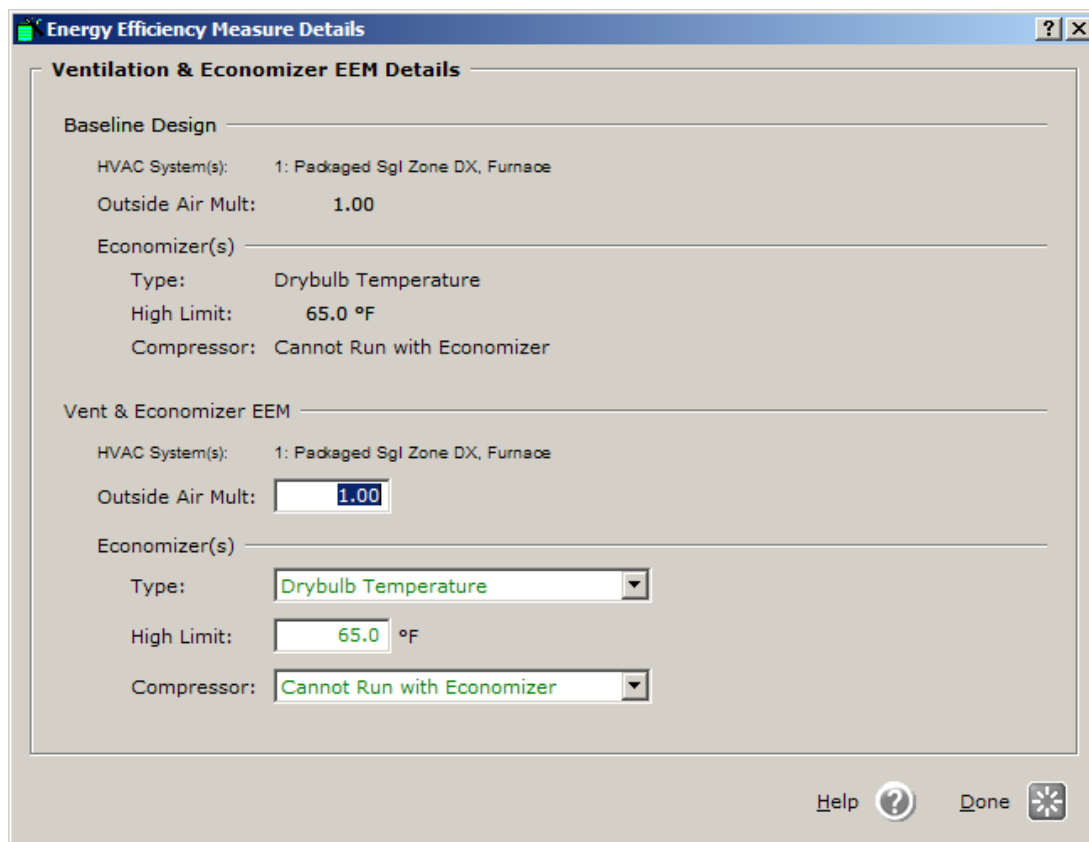


HVAC System

Thermostat Management
 Fan Power & Control
 Ventilation and Economizer
 Deck Reset
 Package HVAC Efficiency

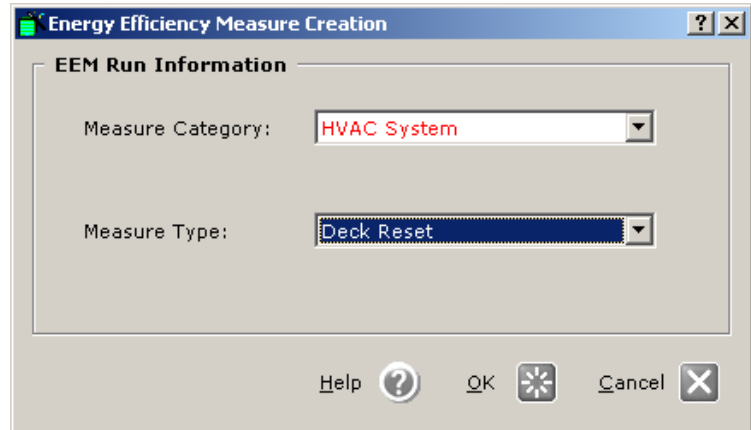


The Ventilation and Economizer EEM Details screen relates to the specifics of your HVAC system. The outside air multiplier sets a fractional value that allows for appropriate ventilation based on the design flow rate. The economizer types available are either dry bulb temperature or enthalpy. Systems that do not have direct outside factors (such as water source heat pumps) do not have this economizer option. The high limit option is only available for the dry-bulb economizer. Cannot Run with Economizer is the default option. This offers freeze protection for the compressor.

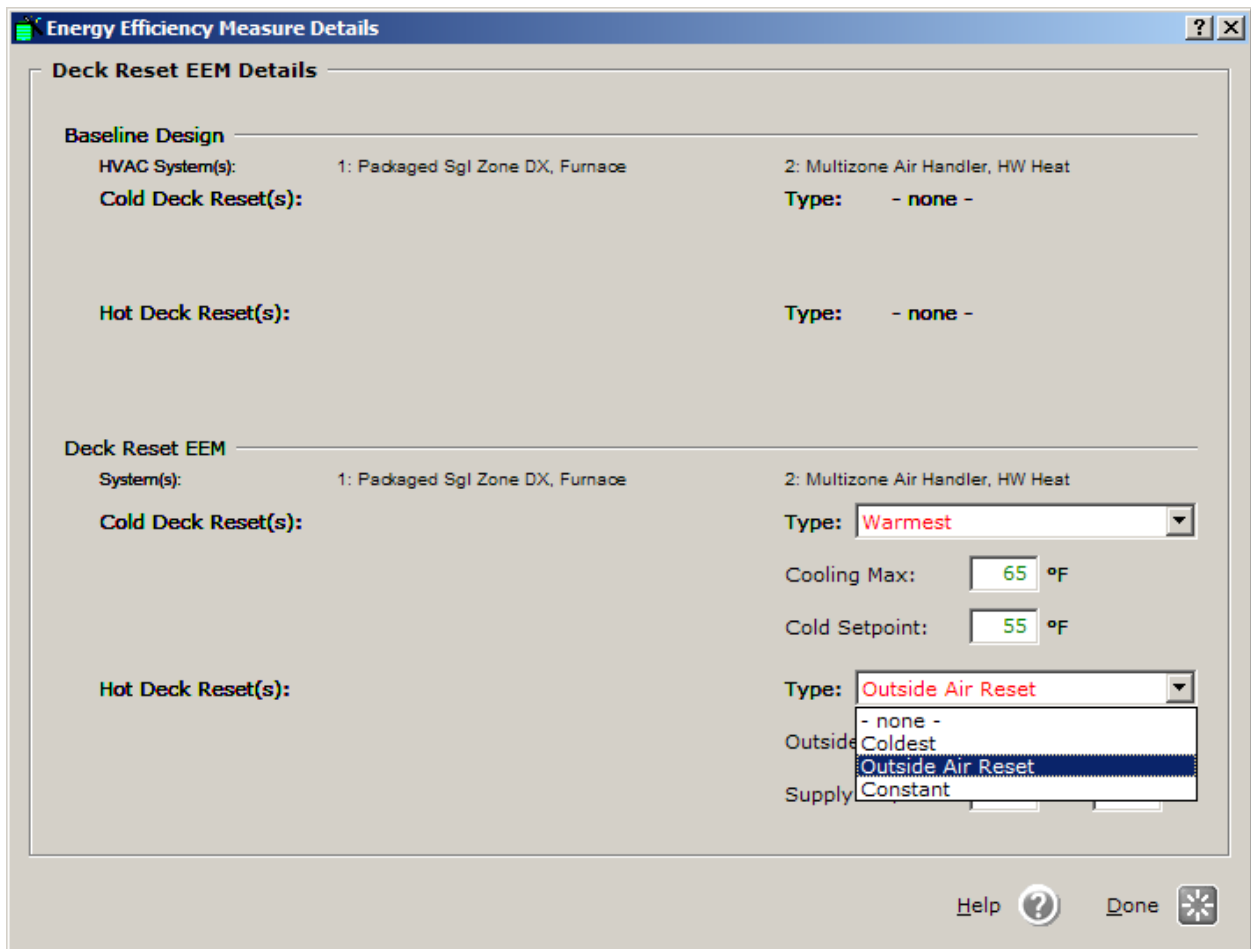


HVAC System

- Thermostat Management
- Fan Power & Control
- Ventilation & Economizer
- Deck Reset
- Package HVAC Efficiency

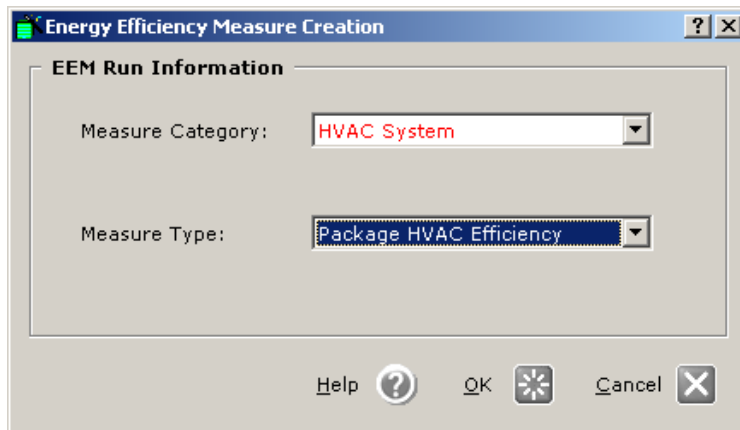


The Deck Reset screen will not always allow you to change information. This is determined by the HVAC systems selected in the baseline energy model. As you can see in this example only the second HVAC system prompted the ability for changes to be made in the EEM Run.



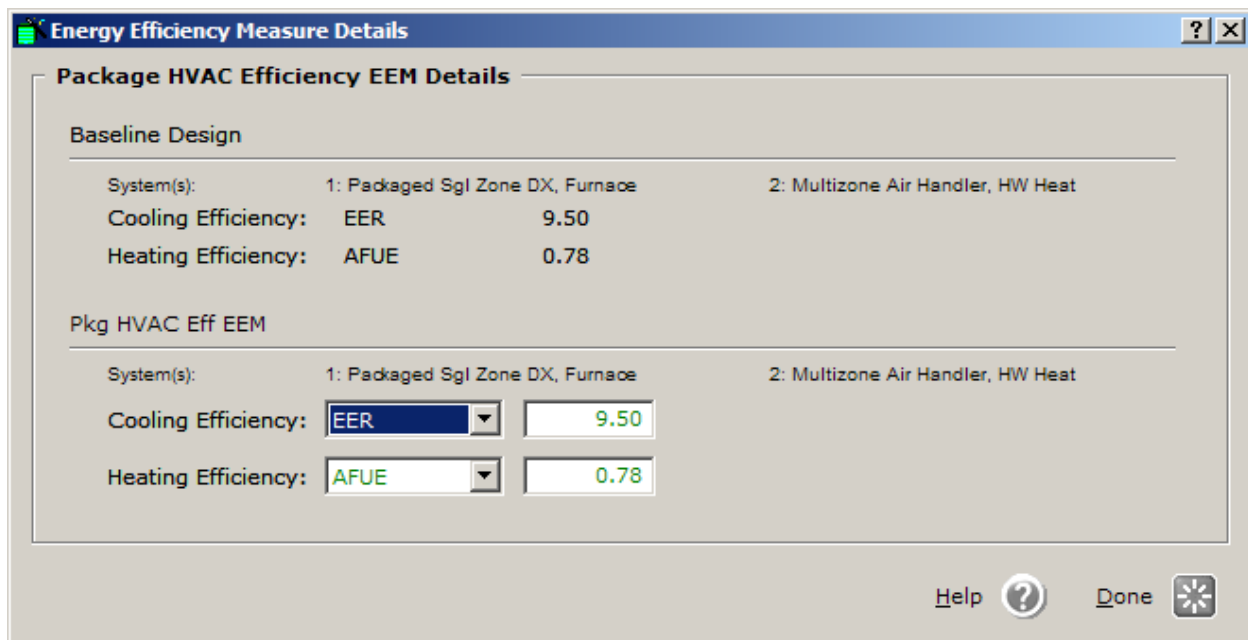
HVAC System

Thermostat Management
 Fan Power & Control
 Ventilation and Economizer
 Deck Reset
 Package HVAC Efficiency



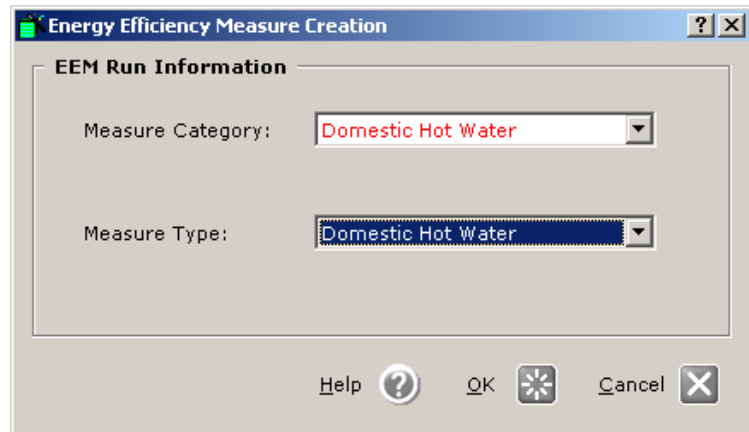
This EEM screen defines the Package HVAC System efficiencies.

- The **cooling system** is defined by the **Energy Efficiency Ratio (EER)**. This is the ratio of net cooling capacity (Btu/hr) to total rate of electrical energy (Watts).
- The **heating system** is defined in a number of ways depending on the system type.
- **Efficiency** —the instantaneous combustion efficiency —is the ratio of net heating capacity (Btu/hr) to total rate of fuel required (Btu/hr), of a combustion heating system (e.g., a furnace) under designated operating conditions.
- **Annual Fuel Utilization Efficiency (AFUE)** — is a measure of the percentage of heat from the combustion of gas or oil which is transferred to the space being heated during a year.
- **Coefficient of Performance (COP)** — is the ratio of net heating capacity (Btu/hr) to total rate of electrical energy (Watts), of a heat pump system operating in heating mode, under designated operating conditions (e.g., for air-cooled units, 47°F outdoor, 70°F indoor).
- **Heating Seasonal Performance Factor (HSPF)** — is the total heating output of a heat pump (in Btus) during its normal use period for heating divided by the total electrical energy input (in watt-hours) during the same period.



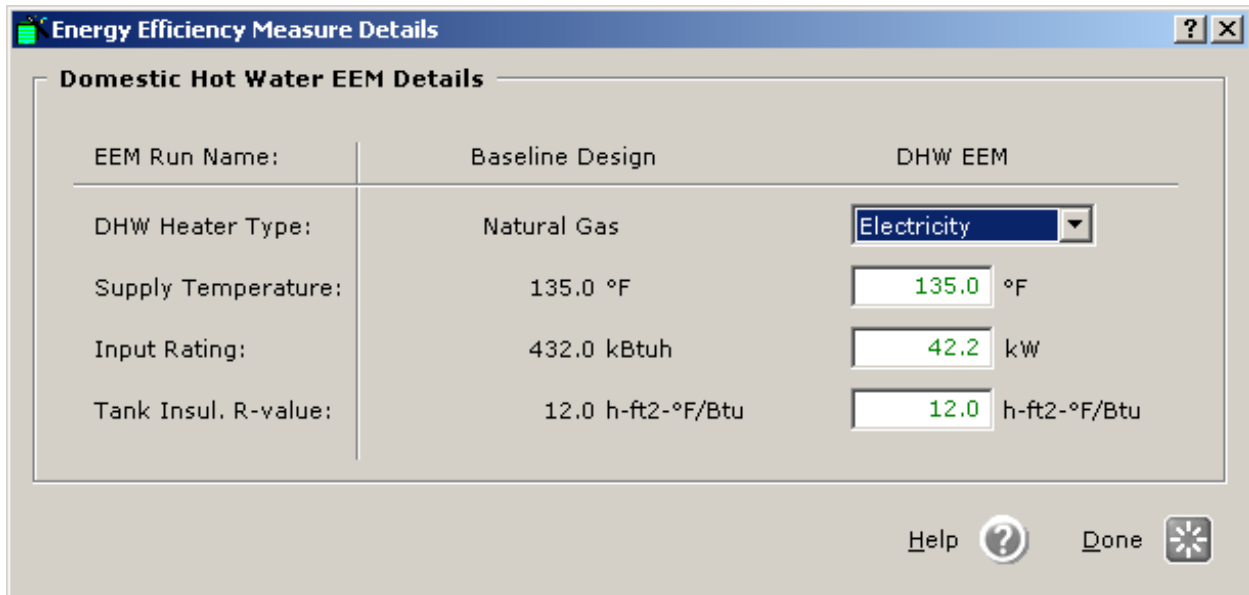
Domestic Hot Water

Domestic Hot Water



The screenshot shows the 'Energy Efficiency Measure Creation' dialog box. It has a title bar with a question mark and a close button. The main area is titled 'EEM Run Information' and contains two dropdown menus. The first is labeled 'Measure Category:' and is set to 'Domestic Hot Water'. The second is labeled 'Measure Type:' and is also set to 'Domestic Hot Water'. At the bottom, there are buttons for 'Help' (with a question mark icon), 'OK' (with a star icon), and 'Cancel' (with an 'X' icon).

The Domestic Hot Water EEM Detail screen allows specific input for the water heater type (gas or electric), temperature settings and overall system efficiency as defined by manufacturer descriptions.



The screenshot shows the 'Energy Efficiency Measure Details' dialog box. It has a title bar with a question mark and a close button. The main area is titled 'Domestic Hot Water EEM Details' and contains a table comparing 'Baseline Design' and 'DHW EEM' values. The table has four rows: 'DHW Heater Type', 'Supply Temperature', 'Input Rating', and 'Tank Insul. R-value'. The 'DHW EEM' column contains dropdown menus and text input fields. At the bottom, there are buttons for 'Help' (with a question mark icon) and 'Done' (with a star icon).

EEM Run Name:	Baseline Design	DHW EEM
DHW Heater Type:	Natural Gas	Electricity
Supply Temperature:	135.0 °F	135.0 °F
Input Rating:	432.0 kBtuh	42.2 kW
Tank Insul. R-value:	12.0 h-ft ² -°F/Btu	12.0 h-ft ² -°F/Btu

DOWNLOADING AND INSTALLING eQUEST

The eQUEST energy analysis software package is available free from the Department of Energy. The program will require about 26 MB of storage plus sufficient storage space (up to 10-20 MB each) for simple projects.

To download eQUEST:

1. Go to www.doe2.com and look for the eQUEST box.
2. Click on eQUEST 3.64 or the newest version available.
3. Scroll down the page to the eQUEST version 3.61b Download box and click on "Download a complete eQUEST version 3.64 installation" or newest version available.
4. Follow the on-screen directions to load the program.


Welcome to DOE2.com
The Home of DOE-2 based Building Energy Use and Cost Analysis Software

Thank you for visiting DOE2.com. This site is the place where you can obtain information and products from the developers of DOE-2 and DOE-2 based products including eQUEST. This site is maintained by and for [EnerLogic](#) and [James H. Hirsch & Associates](#).

The DOE-2 software was developed by [James J. Hirsch & Associates \(JHA\)](#) in collaboration with [Lawrence Berkeley National Laboratory \(LBNL\)](#), with [LBNL DOE-2 work](#) performed mostly under funding from the [United States Department of Energy \(USDOE\)](#) and other work performed mostly under funding from a wide range of industry organizations and ourselves. This site, however, is not sponsored or endorsed by either USDOE or LBNL, and use of "DOE" in names in this site does not imply any endorsement or recommendation of any listed products or services by the United States Government, LBNL, or anyone else.

Follow this link to [review a brief comparison of DOE-2.1E, DOE-2.2, eQUEST and PowerDOE](#). eQUEST is our most up-to-date complete building energy use simulation tool; it is **free** and contains a complete version DOE-2.2 and its documentation.

Note: Most documents posted on this website are published using Adobe's Portable Document Format (PDF) with most using PDF version 1.1 (created using Acrobat version 5) and may not be readable with versions prior to 6. To update your Acrobat Reader go to the [Adobe site](#) for a free download.



eQUEST™ is a sophisticated, yet easy to use, **free** software building energy use analysis tool that provides professional-level results with an affordable level of effort. eQUEST was designed to allow you to perform detailed comparative analysis of building designs and technologies by applying sophisticated building energy use simulation techniques but without requiring extensive experience in the "art" of building performance modeling. This is accomplished by combining schematic and design development building creation wizards, an energy efficiency measure (EEM) wizard and a graphical results display module with a complete up-to-date DOE-2 (version 2.2) building energy use simulation program. You can read the [eQUEST Overview](#) to get a more complete summary of the features and capabilities of this excellent program.

eQUEST 3.64 is the most recent release. For descriptions of the new features read [this document](#). [eQ_WithProc](#) can convert EnergyPlus (epw) files into eQUEST/DOE-2 (bin) files, see weather data [here](#).

You can see [more information about eQUEST including download of program and documentation](#). You can also [view the eQUEST download area](#) to see recent versions of the program, documentation and updates.

Note: Effective 9 September 2009, eQUEST is Qualified Software ([eQUEST 3.63b](#)) for Calculating **Commercial Building Tax Deductions** first enacted under the Energy Policy Act of 2005 (EPACT) and later extended by the Emergency Economic Stabilization Act of 2008. The requirements for software to be qualified for use in these deductions were first covered by [IRS Notice 2008-52](#) and amplified by [IRS IRB 2008-14](#) with further [guidelines provided by DOE](#). The submission packages, including ASHRAE Standard 140 testing, can be found [here](#).

NEW: On 25 August 2010 our [eQUEST 3.64 submittal](#) was approved by the California Energy Commission for approval as a **2008 Title 24 non-residential ACMs**. eQUEST 3.6 and D2comply 3.6 were approved by the California Energy Commission as 2005 Title 24 non-residential ACMs by the CEC at their 11 April 2007 business meeting. eQUEST 3.6 and 3.61b are approved for use with [Savings By Design](#).

eQUEST is supported as a part of the [Energy Design Resources](#) program which is funded by California utility customers and administered by Pacific Gas and Electric, San Diego Gas & Electric, Southern California Edison, Southern California Gas under the auspices of the California Public Utilities Commission as well as the Sacramento Municipal Utilities District.

eQUEST Version 3.64 Download:

Current Release (posting date: 8/25/2010, ~14MB): [Download a complete eQUEST version 3.64 installation for Windows 7/Vista/XP](#) (and previous versions of Windows dating back to Win98). This version contains the current standard [release](#). [Due to the large file size of the program](#) we suggest that you download the program to your hard drive (select save after left clicking the link or right click on the link and "save target as") rather than opening or running the installation procedure from your browser.

Owing to MS Windows 7 security considerations and to facilitate installation within military and corporate IT environments, eQUEST files are now installed by default into your "My Documents" folder (the installation option "Just Me" is now the default.)

For details on the enhancements made to eQUEST and its DOE-2.2 simulation engine since version v3.63b please review the following three documents:

- [DOE-2.2 Documentation, Volume 6: New Features](#) describes DOE-2.2 simulation engine enhancements
- [Bugfixes-047h.pdf](#) describes DOE-2.2 simulation engine bug fixes

An updated [eQUEST 3.64 Tutorial](#) self-training guide is also available; this document is included in the eQUEST installation package above.

On 25 August 2010 our [eQUEST 3.64 submittal](#) was approved by the California Energy Commission for approval as a **2008 Title 24 non-residential ACM** for use in new construction/additions projects.

Documentation for the DOE-2.2 version 47h2, as contained within the online help for this eQUEST release, can be downloaded in PDF format using the links below or visit the [DOE-2.2 page](#). You should save these files to your hard drive (right click on link then "save target as") prior to opening them as they are each several megabytes in size.

[Volume 2: DOE-2.2 Language Dictionary](#) (complete description of BDL Language)

[Volume 5: DOE-2.2 Compliance Analysis](#) (covers modeling topics related to the 2008 Title 24 Compliance Analysis)

WHAT IS A WEATHER TAPE?

When you choose a location for your project on screen 1 in the Schematic Design Wizard, you are telling the program to find the .bin file in the weather directory in the eQUEST folder under 'Program Files.' If your computer is connected to the internet, the program will find the appropriate weather file when you start a simulator.

My Computer → Local Disk (C:) → Program Files → eQUEST 3-61 → Weather → TMY2

The primary data used for the site component in eQUEST is TMY (Typical Meteorological Year) data. TMY data contains solar and weather data for a 1-year period in a given location intended to be used in various types of computer simulations. Using weather data collected over several years, it creates a "typical" year that incorporates a selection of months from a thirty year period where each real month closely matches what would be an average month. TMY2 data, the newer version of TMY data, was created by the National Renewable Energy Laboratory (NREL) and is available through the following link (paste in the TMY2 folder, see file path above):

<http://doe2.com/Download/Weather/TMY2/>

Although many cities may appear to have TMY2 data for a given state, chances are that only the major cities were studied with all other locations interpolated or merely assigned the closest study site. For example, there are nine weather sites in Montana: Billings, Cut Bank, Glasgow, Great Falls, Helena, Kalispell, Lewistown, Miles City, and Missoula. As such, a .bin weather file for any other city in Montana must be based on one of the previous nine study locations.

PROFILE SCREENS

eQUEST DD Wizard: Shell Component -- Bldg Envelope & Loads 1

Interior Lighting Loads and Profiles

Area Type	Percent Area (%)	Lighting (W/SqFt)	Task Lt (W/SqFt)
1: Office (Executive/Private)	70.0	1.49	0.00
2: Corridor	10.0	0.57	0.00
3: Lobby (Office Reception/Waiting)	5.0	1.52	0.00
4: Restrooms	5.0	0.77	0.00
5: Conference Room	4.0	0.92	0.00
6: Mechanical/Electrical Room	4.0	0.81	0.00
7: Copy Room (photocopying equipment)	2.0	1.64	0.00

Multipliers on above intensities: 1.00 1.00

Interior Lighting Hourly Profiles by Season

Typical Use	Season #2	Season #3
Ambient: EL1 InsLtg Profile (S1)	EL1 InsLtg Profile (S2)	EL1 InsLtg Profile (S3)
Task: EL1 TskLtg Profile (S1)	EL1 TskLtg Profile (S2)	EL1 TskLtg Profile (S3)

Wizard Screen 16 of 25

Help Previous Screen Next Screen Return to Navigator

eQUEST DD Wizard: Shell Component -- Bldg Envelope & Loads 1

Office Equipment Loads and Profiles

Area Type	Percent Area (%)	Office Eq (W/SqFt)
1: Office (Executive/Private)	70.0	0.00
2: Corridor	10.0	0.00
3: Lobby (Office Reception/Waiting)	5.0	0.00
4: Restrooms	5.0	0.00
5: Conference Room	4.0	0.00
6: Mechanical/Electrical Room	4.0	0.00
7: Copy Room (photocopying equipment)	2.0	0.30

Office Equipment Hourly Profiles by Season

Typical Use	Season #2	Season #3
EL1 OffEq Profile (S1)	EL1 OffEq Profile (S2)	EL1 OffEq Profile (S3)

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Help Previous Screen Next Screen Return to Navigator

APPENDIX

eQUEST DD Wizard: Shell Component -- Bldg Envelope & Loads 1

Cooking Loads and Profiles

Area Type	Percent Area (%)	Electric Equip. Load (W/SqFt)	Electric Equip. Sensible Ht (frac)	Natural Gas Equip. Load (Btuh/SF)	Natural Gas Equip. Sensible Ht (frac)
1: Office (Executive/Private)	70.0	0.00	0.00	0.0	0.00
2: Corridor	10.0	0.00	0.00	0.0	0.00
3: Lobby (Office Reception/Waiting)	5.0	0.00	0.00	0.0	0.00
4: Restrooms	5.0	0.00	0.00	0.0	0.00
5: Conference Room	4.0	0.00	0.00	0.0	0.00
6: Mechanical/Electrical Room	4.0	0.00	0.00	0.0	0.00
7: Copy Room (photocopying equipment)	2.0	0.00	0.00	0.0	0.00

Cooking Equipment Hourly Profiles by Season

Typical Use: Season #2: Season #3:

Wizard Screen 18 of 25

Help Previous Screen Next Screen Return to Navigator

eQUEST DD Wizard: Shell Component -- Bldg Envelope & Loads 1

Self-Contained Refrig Loads and Profiles

Area Type	Percent Area (%)	Refrig Equip. Load (W/SqFt)	Refrig Equip. Sensible Ht (frac)
1: Office (Executive/Private)	70.0	0.00	1.00
2: Corridor	10.0	0.00	1.00
3: Lobby (Office Reception/Waiting)	5.0	0.00	1.00
4: Restrooms	5.0	0.00	1.00
5: Conference Room	4.0	0.00	1.00
6: Mechanical/Electrical Room	4.0	0.00	1.00
7: Copy Room (photocopying equipment)	2.0	0.00	1.00

Self-Contained Refrigeration Equipment Hourly Profiles by Season

Typical Use: Season #2: Season #3:

Wizard Screen 19 of 25

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eQUEST DD Wizard: Shell Component -- Bldg Envelope & Loads 1

Miscellaneous Loads and Profiles

Area Type	Percent Area (%)	----- Electric -----		---- Natural Gas ----	
		Load (W/SqFt)	Sensible Ht (frac)	Load (Btuh/SF)	Sensible Ht (frac)
1: Office (Executive/Private)	70.0	0.75	1.00	0.00	1.00
2: Corridor	10.0	0.00	1.00	0.00	1.00
3: Lobby (Office Reception/Waiting)	5.0	0.25	1.00	0.00	1.00
4: Restrooms	5.0	0.10	1.00	0.00	1.00
5: Conference Room	4.0	0.10	1.00	0.00	1.00
6: Mechanical/Electrical Room	4.0	0.10	1.00	0.00	1.00
7: Copy Room (photocopying equipment)	2.0	0.70	1.00	0.00	1.00

Miscellaneous Equipment Hourly Profiles by Season

Typical Use: Season #2: Season #3:

Wizard Screen 20 of 25

Help Previous Screen Next Screen Return to Navigator

eQUEST DD Wizard: Shell Component -- Bldg Envelope & Loads 1

Exterior Lighting Loads and Profiles

Connected Load

Exterior Lighting Load: W/ft2

Monthly Single-Day Profiles

Jan: May: Sep:

Feb: Jun: Oct:

Mar: Jul: Nov:

Apr: Aug: Dec:

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Help Previous Screen Next Screen Return to Navigator

eQUEST DD Wizard: Shell Component -- Bldg Envelope & Loads 1

Remote Refrigeration Loads and Profiles

Monthly Refrigeration Energy Use

January:	<input type="text" value="0.0000"/> kWh/ft2	July:	<input type="text" value="0.0000"/> kWh/ft2
February:	<input type="text" value="0.0000"/> kWh/ft2	August:	<input type="text" value="0.0000"/> kWh/ft2
March:	<input type="text" value="0.0000"/> kWh/ft2	September:	<input type="text" value="0.0000"/> kWh/ft2
April:	<input type="text" value="0.0000"/> kWh/ft2	October:	<input type="text" value="0.0000"/> kWh/ft2
May:	<input type="text" value="0.0000"/> kWh/ft2	November:	<input type="text" value="0.0000"/> kWh/ft2
June:	<input type="text" value="0.0000"/> kWh/ft2	December:	<input type="text" value="0.0000"/> kWh/ft2

Resulting Annual Energy Use

Energy: MWh Intensity: kWh/ft2

Load Profiles by Season

Typical Use	Season #2	Season #3	
<input type="text" value="EL1 Refrig Profile (S1)"/>	<input type="text" value="EL1 Refrig Profile (S2)"/>	<input type="text" value="EL1 Refrig Profile (S3)"/>	...

Wizard Screen 24 of 25

Help Previous Screen Next Screen Return to Navigator

eQUEST DD Wizard: Shell Component -- Bldg Envelope & Loads 1

Domestic Water Heating Hourly Profiles

DHW Hourly Profiles by Season

Typical Use	Season #2	Season #3	
<input type="text" value="EL1 DHW Profile (S1)"/>	<input type="text" value="EL1 DHW Profile (S2)"/>	<input type="text" value="EL1 DHW Profile (S3)"/>	...

Wizard Screen 25 of 25

Help Previous Screen Next Screen Return to Navigator

Air side System Screens
Water Source Heat Pump Screen

APPENDIX

Ground Source Heat Pump Screen

Chilled Water Plant Equipment Screens

eQUEST DD Wizard: CHW Plant Equipment

Cooling Primary Equipment

Chilled Water System

CHW Loop: Head: ft Design DT: °F

Pump Configuration: Number of System Pumps:

CHW Loop Flow:

Loop Pump: Head: ft Flow: gpm Motor Efficiency:

Estimated CHW Load: 36,178 ft² Served x Size Factor: / ft²/ton = 90.4 tons.
 Total Chiller Capacity by Type: Type 1: (auto-sized) Type 2: (none) = (auto-sized)

Describe Up To 2 Chillers

	Chiller 1	Chiller 2
Chiller Type(s):	<input type="text" value="Electric Reciprocating Hermetic"/>	<input type="text" value="- select another -"/>
Condenser Type(s):	<input type="text" value="Packaged Air-Cooled"/>	
Chiller Counts & Sizes:	<input type="text" value="1"/> <input type="text" value="Auto-size"/> <input tons")"="" type="text" value("<150=""/>	
Chiller Efficiency:	<input type="text" value="1.302"/> <input type="text" value="kW/ton"/>	

Wizard Screen

Help Previous Screen Next Screen Return to Navigator

eQUEST DD Wizard: CHW Plant Equipment

Cooling Primary Equipment

Chilled Water System

CHW Loop: Head: ft Design DT: °F

Pump Configuration: Number of System Pumps:

CHW Loop Flow:

Loop Pump: Head: ft Flow: gpm Motor Efficiency:

Estimated CHW Load: 36,178 ft² Served x Size Factor: / ft²/ton = 90.4 tons.
 Total Chiller Capacity by Type: Type 1: (auto-sized) Type 2: (none) = (auto-sized)

Describe Up To 2 Chillers

	Chiller 1	Chiller 2
Chiller Type(s):	<input type="text" value="Electric Reciprocating Hermetic"/>	<input type="text" value="- select another -"/>
Condenser Type(s):	<input type="text" value="Packaged Air-Cooled"/>	
Chiller Counts & Sizes:	<input type="text" value="1"/> <input type="text" value="Auto-size"/> <input tons")"="" type="text" value("<150=""/>	
Chiller Efficiency:	<input type="text" value="1.302"/> <input type="text" value="kW/ton"/>	

Wizard Screen

Help Previous Screen Next Screen Return to Navigator

eQUEST DD Wizard: CHW Plant Equipment

Chilled Water System Control and Schedule

Setpoint is: **Fixed** Setpoint Value: **44.0** °F

Operation: **Standby**

Typical Use (all remaining dates)		Season #2 6/1 thru 8/31		Season #3 6/1 thru 8/31	
On At	Off At	On At	Off At	On At	Off At
Mon: 7 am	6 pm	Mon: 7 am	6 pm	Mon: 7 am	6 pm
Tue: 7 am	6 pm	Tue: 7 am	6 pm	Tue: 7 am	6 pm
Wed: 7 am	6 pm	Wed: 7 am	6 pm	Wed: 7 am	6 pm
Thu: 7 am	6 pm	Thu: 7 am	6 pm	Thu: 7 am	6 pm
Fri: 7 am	6 pm	Fri: 7 am	6 pm	Fri: 7 am	6 pm
Sat: Off		Sat: Off		Sat: Off	
Sun: Off		Sun: Off		Sun: Off	
Hol: Off		Hol: Off		Hol: Off	

Wizard Screen 3 of 3

Help Previous Screen Next Screen Return to Navigator

APPENDIX

Hot Water Plant Equipment Screens

APPENDIX

eQUEST DD Wizard: HW Plant Equipment

Heating Primary Equipment

Hot Water System

HW Loop: Head: ft Design DT: °F

Pump Configuration: Number of System Pumps:

HW Loop Flow:

Loop Pump: Head: ft Flow: gpm Motor Efficiency:

Describe Up To 2 Boilers

	Boiler 1	Boiler 2
Boiler Type(s) / Fuel:	<input type="text" value="HW Boiler (Natural Dr..."/> <input type="text" value="Nat. Gas"/>	<input type="text" value="- select another -"/>
Boiler Count / Output:	<input type="text" value="1"/> <input type="text" value="Auto-size"/>	<input type="text" value="300 - 2,500 kBt"/>
Boiler Efficiency:	<input type="text" value="80.0"/> % <input type="text" value="Efficiency"/>	

Wizard Screen

Help Previous Screen Next Screen Return to Navigator

eQUEST DD Wizard: HW Plant Equipment

Hot Water System Control and Schedule

Setpoint is: Setpoint Value: °F

Operation:

Typical Use (all remaining dates)	Season #2 6/1 thru 8/31	Season #3 6/1 thru 8/31
On At	On At	On At
Mon: <input type="text" value="7 am"/> - <input type="text" value="6 pm"/>	Mon: <input type="text" value="7 am"/> - <input type="text" value="6 pm"/>	Mon: <input type="text" value="7 am"/> - <input type="text" value="6 pm"/>
Tue: <input type="text" value="7 am"/> - <input type="text" value="6 pm"/>	Tue: <input type="text" value="7 am"/> - <input type="text" value="6 pm"/>	Tue: <input type="text" value="7 am"/> - <input type="text" value="6 pm"/>
Wed: <input type="text" value="7 am"/> - <input type="text" value="6 pm"/>	Wed: <input type="text" value="7 am"/> - <input type="text" value="6 pm"/>	Wed: <input type="text" value="7 am"/> - <input type="text" value="6 pm"/>
Thu: <input type="text" value="7 am"/> - <input type="text" value="6 pm"/>	Thu: <input type="text" value="7 am"/> - <input type="text" value="6 pm"/>	Thu: <input type="text" value="7 am"/> - <input type="text" value="6 pm"/>
Fri: <input type="text" value="7 am"/> - <input type="text" value="6 pm"/>	Fri: <input type="text" value="7 am"/> - <input type="text" value="6 pm"/>	Fri: <input type="text" value="7 am"/> - <input type="text" value="6 pm"/>
Sat: <input type="text" value="Off"/>	Sat: <input type="text" value="Off"/>	Sat: <input type="text" value="Off"/>
Sun: <input type="text" value="Off"/>	Sun: <input type="text" value="Off"/>	Sun: <input type="text" value="Off"/>
Hol: <input type="text" value="Off"/>	Hol: <input type="text" value="Off"/>	Hol: <input type="text" value="Off"/>

Wizard Screen

Help Previous Screen Next Screen Return to Navigator

Air-Side HVAC System Parameters

Air-Side HVAC System Parameters [?] [X]

Currently Active System: **EL2 Sys2 (EVAP-COOL) (G.S1)** System Type: Evaporative Cool

Basics | Fans | Outdoor Air | Cooling | Heating | Preconditioner | Meters | Refrigeration

System Name: **EL2 Sys2 (EVAP-COOL) (G.S1)**
 System Type: **Evaporative Cool**

General Parameters
 Return Air Path: **Duct**
 Control Zone: **EL2 South Perim Zn (G.)**
 System Reports: **Yes**
 Dual Duct Type: **n/a**
 WL/GS Ht Pump: **n/a**

System Sizing
 Sizing Ratio: **1.15** ratio
 Sizing Option: **n/a**

DX Performance Data
 DX Cooling: **n/a**
 DX Heat/Cool: **n/a**

Duct Losses
 Duct Air Loss: **ratio**
 Air Loss Type: **n/a**
 Duct Air Loss OA: **n/a** ratio
 Duct Zone: **n/a**
 Supply Duct UA: **Btu/h-°F**
 Duct Delta T: **°F**
 Return Duct UA: **n/a** Btu/h-°F
 Hot Duct UA: **n/a** Btu/h-°F
 Hot Duct DT: **n/a** °F

Humidity Control
 Maximum Humidity: **n/a** %
 Minimum Humidity: **n/a** %
 Humidifier Type: **n/a**
 Humidifier Location: **n/a**

Done

APPENDIX

Air-Side HVAC System Parameters [?] [X]

Currently Active System: **EL2 Sys2 (EVAP-COOL) (G.S1)** System Type: Evaporative Cool

Basics | Fans | Outdoor Air | Cooling | Heating | Preconditioner | Meters | Refrigeration

Fan Power and Control | Flow Parameters | Night Cycle Control

Fan Power Parameters for single-duct systems

	Design kW/cfm	Delta T °F	Static in WG	Tot Eff Frac	Mech Eff Frac	Fan EIR = f(PLR)
Supply:	n/a	n/a	2.00	0.33	0.55	n/a
Unused:	n/a	n/a	n/a	n/a	n/a	n/a
Return:		n/a		0.33		n/a

Fan Control and Placement

	Fan Schedules	Fan Control	Fan Placement	Motor Placement
Cooling:	S2 Sys2 (EVAP-COOL)	Constant Volume	Blow Through	In Airflow
Unused:	n/a	n/a	n/a	n/a
Return:		n/a	n/a	
Exhaust:	- undefined -			

Done

Air-Side HVAC System Parameters [?] [X]

Currently Active System: **EL2 Sys2 (EVAP-COOL) (G.S1)** System Type: Evaporative Cool

Basics | Fans | Outdoor Air | Cooling | Heating | Preconditioner | Meters | Refrigeration

Fan Power and Control | **Flow Parameters** | Night Cycle Control

Flow Parameters for single-duct systems

	Design cfm	Min Flow cfm/ft2	Min Flow Ratio	Min Fan Ratio	Max Fan Ratio
Supply Flow:	23		1.00	0.30	1.10
Heating Mode:					
Return Flow:	n/a				

Min Flow Source: n/a

Indoor Fan Mode: Intermittent

Induction Ratio: n/a

Return Cap Ratio: n/a ratio

Dual Speed Fan/Compressor Ratios —

n/a n/a n/a n/a

Done

Air-Side HVAC System Parameters [?] [X]

Currently Active System: **EL2 Sys2 (EVAP-COOL) (G.S1)** System Type: Evaporative Cool

Basics | Fans | Outdoor Air | Cooling | Heating | Preconditioner | Meters | Refrigeration

Fan Power and Control | **Flow Parameters** | Night Cycle Control

Night Venting

Night Vent Control: Not Available

Night Vent Schedule: n/a

Vent Temperature Sch: n/a

Night Vent Delta T: n/a °F

Night Cycle Fan Control

Night Cycle Control: Stay Off

Night Cycle Fans: n/a

Night Vent Ratios

Supply CFM:	n/a	Return CFM:	n/a
Supply kW:	n/a	Return kW:	n/a
Supply dT:	n/a	Return dT:	n/a

Done

Air-Side HVAC System Parameters [?] [X]

Currently Active System: **EL2 Sys2 (EVAP-COOL) (G.S1)** System Type: Evaporative Cool

Basics | Fans | **Outdoor Air** | Cooling | Heating | Preconditioner | Meters | Refrigeration

Outside Air and Economizer | Heat Recovery 1 | Heat Recovery 2 | Natural Ventilation

Outdoor Ventilation Air

Minimum Outside Air: ratio

Minimum OA Control Method:

Minimum OA Sizing Method:

Minimum Air Schedule:

Outside Air from System:

Air-Side Economizer Cycle

Outside Air Control:

Lockout Compressor:

Drybulb High Limit: °F

Economizer Low Limit: °F

Enthalpy High Limit: Btu

Maximum OA Fraction: ratio

Air-Side HVAC System Parameters [?] [X]

Currently Active System: **EL2 Sys2 (EVAP-COOL) (G.S1)** System Type: Evaporative Cool

Basics | Fans | **Outdoor Air** | Cooling | Heating | Preconditioner | Meters | Refrigeration

Outside Air and Economizer | Heat Recovery 1 | Heat Recovery 2 | Natural Ventilation

Basic Specifications

ERV Device Installed:

ERV Device Type:

Design Outdoor Airflow: cfm

Design Exhaust Airflow: cfm

OSA Increase for Purge: ratio

HX Performance

HX Configuration:

	Sensible	Latent
Effectiveness:	<input type="text" value="n/a"/>	<input type="text" value="n/a"/> ratio
HX Air Film Resist:	<input type="text" value="n/a"/>	<input type="text" value="n/a"/> ratio
Air Film Resist Exp:	<input type="text" value="n/a"/>	<input type="text" value="n/a"/> ratio

Control Sequences

Operation:

Operating Mode:

Schedule:

Make-up Air Temp Ctrl:

Outsd / Exhst Air Delta T: °F

Capacity Control:

Outsd / Exhst Air Delta Enth: Btu/lb

Make-up Air Heat/Cool Setpt: °F

Air-Side HVAC System Parameters [?] [X]

Currently Active System: **EL2 Sys2 (EVAP-COOL) (G.S1)** System Type: Evaporative Cool

Basics | Fans | **Outdoor Air** | Cooling | Heating | Preconditioner | Meters | Refrigeration

Outside Air and Economizer | **Heat Recovery 1** | Heat Recovery 2 | Natural Ventilation

ERV Power

HX Power: kW kW/cfm

ERV Pwr f(PLR): Make-Up Exhaust

ERV Fans: Fan Pwr @ Dsgn Flow: kW

ERV Fan Efficiency: ratio Fan Pwr / Unit Flow: kW/cfm

Fan Motor Eff: Delta P @ Dsgn Flow: in. water

Fan Pwr f(flow): Pressure Drop Exponent: ratio

Condensation/Frost Control

Cond/Frost Ctrl: Preheat Setpoint Temperature: °F

ERV Preheat Ctrl: Preheat Air Delta T: °F

Preheat Source: Preheat Water Delta T: °F

Preheat Inlet Water & Air Delta T: °F

Done

Air-Side HVAC System Parameters [?] [X]

Currently Active System: **EL2 Sys2 (EVAP-COOL) (G.S1)** System Type: Evaporative Cool

Basics | Fans | **Outdoor Air** | Cooling | Heating | Preconditioner | Meters | Refrigeration

Outside Air and Economizer | **Heat Recovery 1** | Heat Recovery 2 | **Natural Ventilation**

Natural Ventilation

Ventilation Method:

Vent Use Schedule:

Ventilation Temperature Sched:

Window Open Probability Sched:

Sherman-Grimsrud Method

Air Changes / Hour (max): units/h

Total Vent Area Fraction: ratio

Horizontal Vent Area Fraction: ratio

Air Change Method

Air Changes / Hour (fixed):

Done

Air-Side HVAC System Parameters [?] [X]

Currently Active System: **EL2 Sys2 (EVAP-COOL) (G.S1)** System Type: Evaporative Cool

Basics | Fans | Outdoor Air | **Cooling** | Heating | Preconditioner | Meters | Refrigeration

Coil Cap / Control | Unitary Power | Condenser | Cap Curves | **Evap Cooling** | Economizer | Stages

Cooling Capacity

Cool Source: n/a

Total Cooling Capacity: n/a Btu/h

Sensible Cooling Capacity: n/a Btu/h

Cool Sizing Ratio: 1.00 ratio

RPM Limits, Max & Min: n/a rpm

Min Cycling Part Load Ratio: n/a ratio

CHW Coil Head: n/a ft

CHW Coil Delta T: n/a °F

CHW Valve Type: n/a

CHW Loop: n/a

Coil Design Bypass Factor: n/a ratio

Cooling Control and Reset

Zone Entering Min Supply Temp: 55.0 °F

Cold Deck Min Leaving Temp: n/a °F

Cool Control Range: n/a °R

Min Supply Sch: n/a

Cold Deck Sch: n/a

Availability Sch: - undefined -

Cool Control: n/a

Reset Priority: n/a

Cool Reset Sch: n/a

Maximum Cooling Reset Temp: n/a °F

Minimum Cooling Reset Temp: n/a °F

Minimum Reset Flow: n/a ratio

Done

Air-Side HVAC System Parameters [?] [X]

Currently Active System: **EL2 Sys2 (EVAP-COOL) (G.S1)** System Type: Evaporative Cool

Basics | Fans | Outdoor Air | **Cooling** | Heating | Preconditioner | Meters | Refrigeration

Coil Cap / Control | Unitary Power | Condenser | Cap Curves | **Evap Cooling** | Economizer | Stages

Cooling Power

Cooling Electric Input Ratio: n/a Btu/Btu

Cooling Compressor

Compressor Type: n/a

Minimum Unload Ratio: n/a ratio

Min Hot Gas Bypass Ratio: n/a ratio

Crankcase Power

Crankcase Heat: n/a kW

Crankcase Max Temperature: n/a °F

Cooling Electric Input Ratio Curves

f(t entering wetbulb, t enter condenser): n/a

f(part load ratio): n/a

f(RPM): n/a

Low Speed Electric Input Ratio Curve

f(t entering wetbulb, t outdoor drybulb): n/a

Gas Heat Pump Auxiliary Electric

Gas HP Pump kW: n/a W/Btu

Gas HP Aux kW: n/a kW

Done

Air-Side HVAC System Parameters [?] [X]

Currently Active System: **EL2 Sys2 (EVAP-COOL) (G.S1)** System Type: Evaporative Cool

Basics | Fans | Outdoor Air | **Cooling** | Heating | Preconditioner | Meters | Refrigeration

Coil Cap / Control | Unitary Power | **Condenser** | Cap Curves | Evap Cooling | Economizer | Stages

Air-Cooled Condenser & Outdoor Fan

Condenser Type:

Outside Fan Mode:

Outside Fan Temperature: °F

Outside Fan Electric: W/Btu

Outdoor Fan Pwr = f(cool PLR, osa db):

Outdoor Fan Pwr = f(heat PLR, osa db):

Evaporative Precooler

Evap Condenser Effectiveness: Btu/Btu

Evap Cond Sched:

Evap Condenser Electric: W/Btu

Water-Cooled Condenser

Condenser Water Coil Head: ft

Condenser Water Coil Delta T: °F

Isolation Valve?:

CW Loop:

Done

Air-Side HVAC System Parameters [?] [X]

Currently Active System: **EL2 Sys2 (EVAP-COOL) (G.S1)** System Type: Evaporative Cool

Basics | Fans | Outdoor Air | **Cooling** | Heating | Preconditioner | Meters | Refrigeration

Coil Cap / Control | Unitary Power | **Condenser** | Cap Curves | Evap Cooling | Economizer | Stages

f(temperatures)

Total Capacity Sensible Capacity Bypass Factor

f(t entering wetbulb, t entering drybulb):

f(t entering wetbulb, t entering water):

f(flow)

Total Capacity Bypass Factor

f(supply air flow):

f(CHW flow):

f(part load)

Total Capacity Bypass Factor

f(cycling on/off):

f(RPM):

Min temp used in cooling curves: °F

Done

Air-Side HVAC System Parameters [?] [X]

Currently Active System: **EL2 Sys2 (EVAP-COOL) (G.S1)** System Type: Evaporative Cool

Basics | Fans | Outdoor Air | **Cooling** | Heating | Preconditioner | Meters | Refrigeration

Coil Cap / Control | Unitary Power | Condenser | Cap Curves | **Evap Cooling** | Economizer | Stages

Stand-Alone Evaporative Cooling

Evap Cooler Type: **Indirect/Direct** Drybulb High Limit: **120.0** °F

Return Air Used at Indirect Stage: **No** Pump & Secondary kW: **0.000100** kW/cfm

	Rating ratio	f(air flow)
Direct Effectiveness:	0.85	Direct-Effectiveness-fFlow
Indirect Effectiveness:	0.80	Indirect-Effectiveness-fFlow

Done

Air-Side HVAC System Parameters [?] [X]

Currently Active System: **EL2 Sys2 (EVAP-COOL) (G.S1)** System Type: Evaporative Cool

Basics | Fans | Outdoor Air | **Cooling** | Heating | Preconditioner | Meters | Refrigeration

Coil Cap / Control | Unitary Power | Condenser | Cap Curves | **Evap Cooling** | Economizer | Stages

Water-Side Economizer

Water-Side Economizer: **n/a**

WS Economizer Effectiveness: **n/a** ratio

CW Coil Delta T: **n/a** °F

Water-Side Econo Coil Head: **n/a** ft

Water-Side Econo Coil Delta T: **n/a** °F

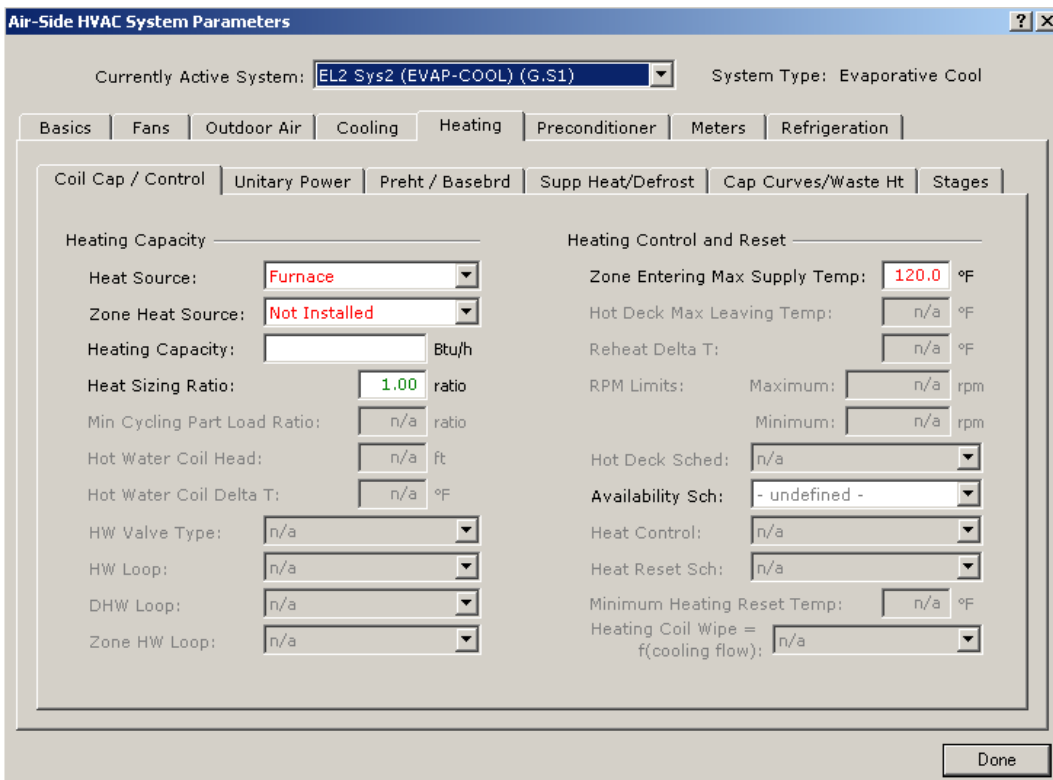
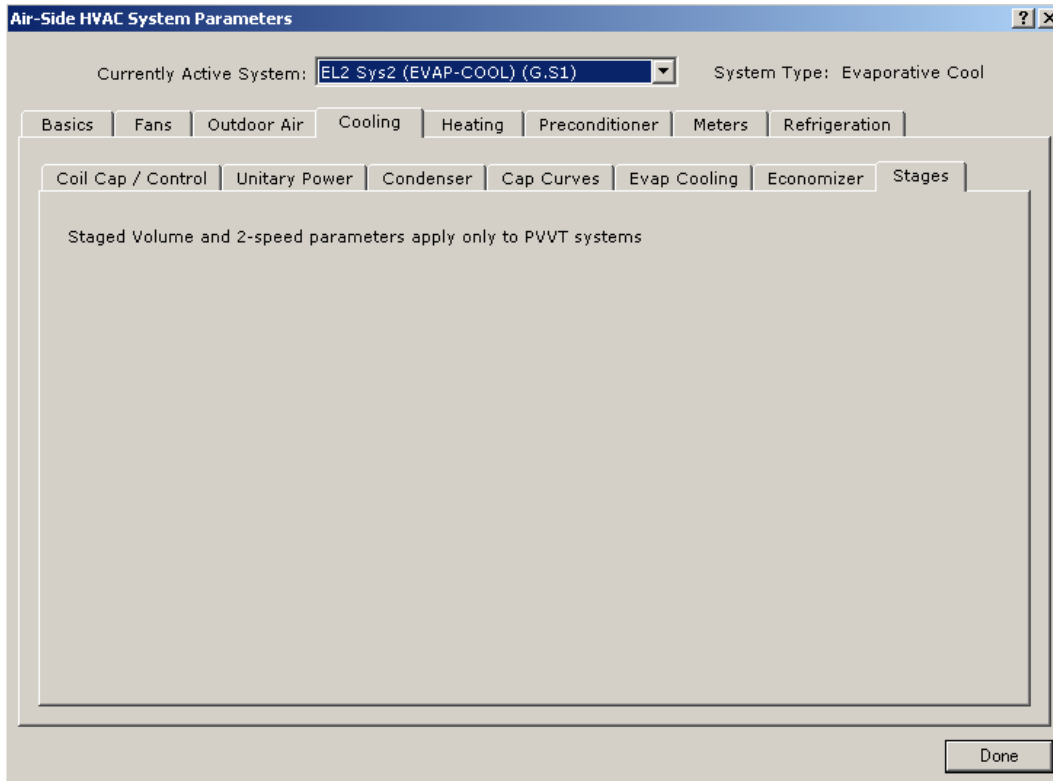
Water-Side Econo Valve Type: **n/a**

Water-Side Econo Loop: **n/a**

WS Economizer Fan Delta T: **n/a** °F

Water-Side Economizer kW: **n/a** kW/cfm

Done



Air-Side HVAC System Parameters [?] [X]

Currently Active System: **EL2 Sys2 (EVAP-COOL) (G.S1)** System Type: Evaporative Cool

Basics | Fans | Outdoor Air | Cooling | Heating | Preconditioner | Meters | Refrigeration

Coil Cap / Control | Unitary Power | Preht / Basebrd | Supp Heat/Defrost | Cap Curves/Waste Ht | Stages

Heating Electric Power

Heating Electric Input Ratio: **0.3700** Btu/Btu

Furnace

Furnace Heat Input Ratio: **1.2407** Btu/Btu

Furnace Fuel Auxiliary: **0.0** Btu/h

Furnace Electric Auxiliary: **0.00** kW

Furnace HIR = f(plr): **Furnace-HIR-fPLR**

Furnace Off Loss: **- undefined -**

Heating Electric Input Ratio Curves

f(t entering wetbulb, t outdoor drybulb): **RESYS-Heat-EIR-fEC**

f(part load ratio): **RESYS-Heat-EIR-fPL**

f(RPM): **n/a**

Low Speed Electric Input Ratio Curve

f(t entering wetbulb, t outdoor drybulb): **n/a**

Gas Heat Pump Auxiliary Electric

Gas HP Pump kW: **n/a** W/Btu

Gas HP Aux kW: **n/a** kW

Done

Air-Side HVAC System Parameters [?] [X]

Currently Active System: **EL2 Sys2 (EVAP-COOL) (G.S1)** System Type: Evaporative Cool

Basics | Fans | Outdoor Air | Cooling | Heating | Preconditioner | Meters | Refrigeration

Coil Cap / Control | Unitary Power | Preht / Basebrd | Supp Heat/Defrost | Cap Curves/Waste Ht | Stages

Preheat

Preheat Source: **Not Installed**

Preheat Capacity: **n/a** Btu/h

Preheat Leaving Temp: **n/a** °F

PHW Coil Head: **n/a** ft

PHW Coil Delta T: **n/a** °F

PHW Valve Type: **n/a**

PHW Loop: **n/a**

Baseboards

Baseboard Source: **Not Installed**

Baseboard Sched: **n/a**

Baseboard Coil Head: **n/a** ft

Baseboard Delta T: **n/a** °F

Baseboard Valve Type: **n/a**

Baseboard Loop: **n/a**

Done

Air-Side HVAC System Parameters [?] [X]

Currently Active System: **EL2 Sys2 (EVAP-COOL) (G.S1)** System Type: Evaporative Cool

Basics | Fans | Outdoor Air | Cooling | Heating | Preconditioner | Meters | Refrigeration

Coil Cap / Control | Unitary Power | Preht / Basebrd | **Supp Heat/Defrost** | Cap Curves/Waste Ht | Stages

Supplemental Heat ————

HP Supp Source:

HP Supp Heat Capacity: Btu/h

Minimum HP Heat Temp: °F

Maximum HP Supp Temp: °F

Resistive Cap / HP Cap Ratio: ratio

Defrost ————

Defrost Type:

Defrost Control:

Maximum Defrost Temperature: °F

Defrost Runtime Frac = f(outdoor drybulb, wb):

Done

Air-Side HVAC System Parameters [?] [X]

Currently Active System: **EL2 Sys2 (EVAP-COOL) (G.S1)** System Type: Evaporative Cool

Basics | Fans | Outdoor Air | Cooling | Heating | Preconditioner | Meters | Refrigeration

Coil Cap / Control | Unitary Power | Preht / Basebrd | **Supp Heat/Defrost** | Cap Curves/Waste Ht | Stages

Total Capacity as f(temperatures) ————

f(t entering wetbulb, t entering drybulb):

f(t entering drybulb, t entering water):

Total Capacity as f(flow) ————

f(supply air flow):

f(HW flow):

Total Capacity as f(part load) ————

f(cycling):

f(RPM):

Waste Heat ————

Waste Heat Use:

Ht Rec DHW Heater:

Max Cond Recvry for Spc Heat: ratio

Waste Heat Available from Cooling and Heating ————

Frac Heat Input Avail from Cool: Btu/Btu

Waste Ht Cap from Cool f(outdoor drybulb):

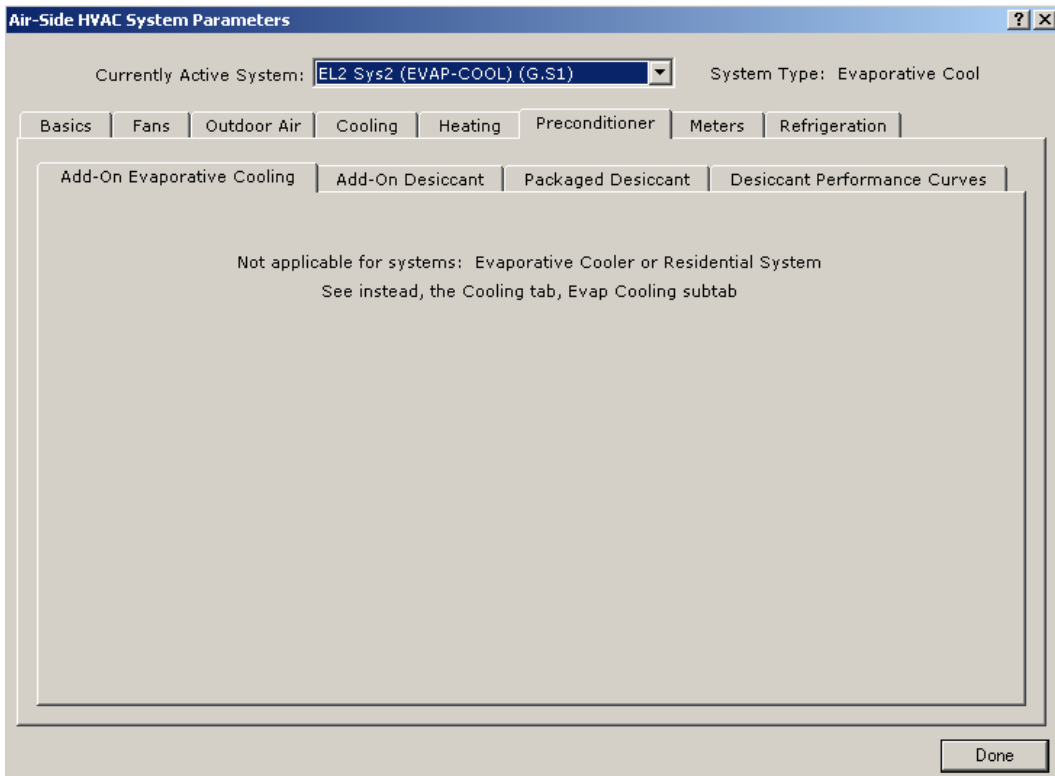
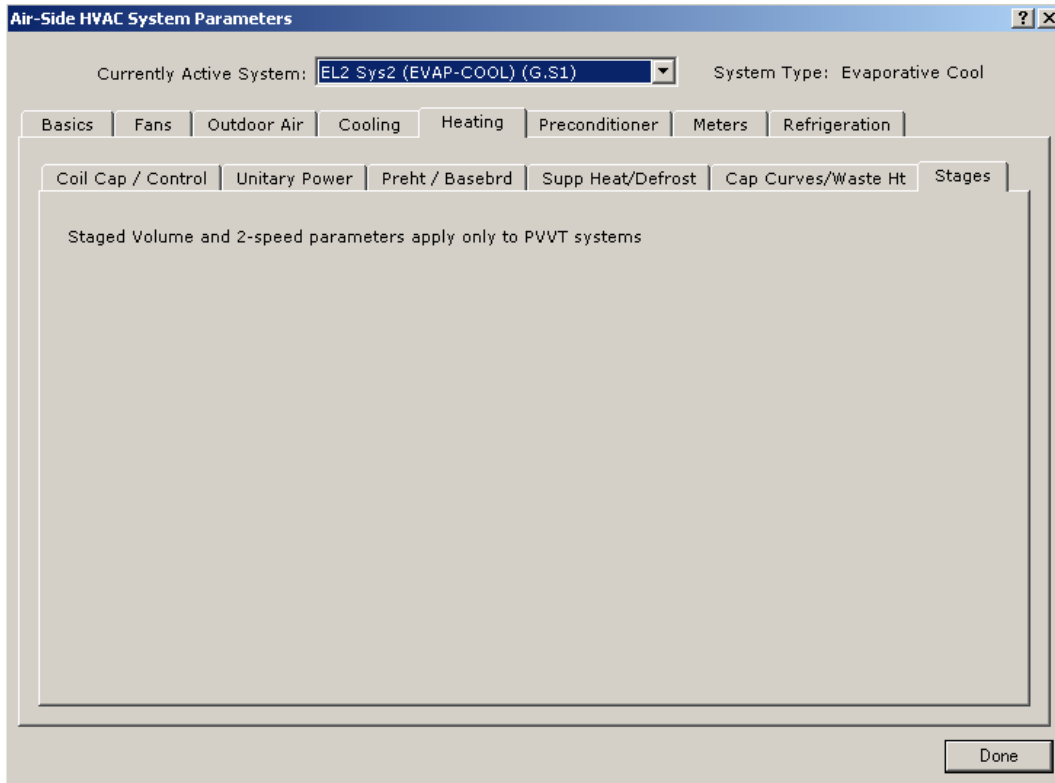
Waste Ht Cap from Cool f(compressor RPM):

Frac Heat Input Avail from Heat: Btu/Btu

Waste Ht Cap from Heat f(outdoor drybulb):

Waste Ht Cap from Heat f(compressor RPM):

Done



Air-Side HVAC System Parameters [?] [X]

Currently Active System: **EL2 Sys2 (EVAP-COOL) (G.S1)** System Type: Evaporative Cool

Basics | Fans | Outdoor Air | Cooling | Heating | Preconditioner | Meters | Refrigeration

Add-On Evaporative Cooling | **Add-On Desiccant** | Packaged Desiccant | Desiccant Performance Curves

Add-On Desiccant Cooling

Desiccant Sys Type: n/a
 Desic Heat Source: n/a
 Desic Frac of Design Flow: n/a
 Desic Ctrl Mode/Configuration: n/a
 Desic Circulation Loop: n/a
 Desiccant Chiller: n/a
 Desiccant Valve Type: n/a
 Desiccant Coil Head: n/a ft
 Desiccant Coil Delta T: n/a °F

Liquid Vent Air 1 & 2 Systems

Desiccant Exiting Dewpoint: n/a °F

Solid Vent Air 1 Heat Exchanger

Heat Exch Effectiveness: n/a ratio
 Heat Exch Delta P: 1.00 in. water

Done

Air-Side HVAC System Parameters [?] [X]

Currently Active System: **EL2 Sys2 (EVAP-COOL) (G.S1)** System Type: Evaporative Cool

Basics | Fans | Outdoor Air | Cooling | Heating | Preconditioner | Meters | Refrigeration

Add-On Evaporative Cooling | Add-On Desiccant | **Packaged Desiccant** | Desiccant Performance Curves

Packaged Total-Gas Solid Desiccant System Performance:

Performance at Full Load

Exit Temperature = f(return wb & outdoor wb): n/a
 Exit Humid Ratio = f(return wb & outdoor wb): n/a
 Regen Energy = f(return wb & outdoor wb): n/a

Performance at 25% Part Load

Exit Temperature, 25% pl = f(return wb & outdoor wb): n/a
 Exit Humid Ratio, 25% pl = f(return wb & outdoor wb): n/a
 Regen Energy, 25% pl = f(return wb & outdoor wb): n/a

Done

Air-Side HVAC System Parameters [?] [X]

Currently Active System: **EL2 Sys2 (EVAP-COOL) (G.S1)** System Type: Evaporative Cool

Basics | Fans | Outdoor Air | Cooling | Heating | Preconditioner | Meters | Refrigeration

Add-On Evaporative Cooling | Add-On Desiccant | Packaged Desiccant | Desiccant Performance Curves

System Performance (Liq Vent Air 1 only)

Exit Temperature = f(entering t & humid ratio): n/a

Exit Humidity Ratio = f(entering t & humid ratio): n/a

Gas Usage = f(entering t & humid ratio): n/a

Auxiliary kW = f(entering t & humid ratio): n/a

Done

Air-Side HVAC System Parameters [?] [X]

Currently Active System: **EL2 Sys2 (EVAP-COOL) (G.S1)** System Type: Evaporative Cool

Basics | Fans | Outdoor Air | Cooling | Heating | Preconditioner | Meters | Refrigeration

System-Level Meter Assignments by End-Use:

Electric Meters

Master Elec Meter: - undefined - Heat Rejection: EM1

Area Lighting: EM1 Pumps and Misc: EM1

Task Lighting: EM1 Ventilation Fans: EM1

Elec Equipment: EM1 Refrigeration: EM1

Source Elec: EM1 Supplemental Heat: EM1

Space Heating: EM1 Domestic Hot Water: EM1

Space Cooling: EM1

Fuel Meters

Master Fuel Meter: - undefined - Space Cooling: FM1

Source Fuel: FM1 Supplemental Heat: FM1

Space Heating: FM1 Domestic Hot Water: FM1

Done

Air-Side HVAC System Parameters [?] [X]

Currently Active System: **EL2 Sys2 (EVAP-COOL) (G.S1)** System Type: Evaporative Cool

Basics | Fans | Outdoor Air | Cooling | Heating | Preconditioner | Meters | Refrigeration

Design Parameters | Condenser | Heat Recovery | Anti-Sweat | Performance Curves

System Design Parameters (by evaporator temperature range)

	Refrigeration Circuit Type	Capacity Btu/h	EER Btu/W
Evaporator Temp Range 1 (coldest):	n/a	n/a	n/a
Evaporator Temp Range 2:	n/a	n/a	n/a
Evaporator Temp Range 3 (warmest):	n/a	n/a	n/a

Compressor Sizing Ratio: ratio

Direct Return Fraction: ratio

Walkin Box

Load: Btu/h

Location:

Schedule:

Done

Air-Side HVAC System Parameters [?] [X]

Currently Active System: **EL2 Sys2 (EVAP-COOL) (G.S1)** System Type: Evaporative Cool

Basics | Fans | Outdoor Air | Cooling | Heating | Preconditioner | Meters | Refrigeration

Design Parameters | Condenser | Heat Recovery | Anti-Sweat | Performance Curves

Condenser Type:

Condenser Control:

Condenser Size:
(by evaporator temperature range)

coldest:	<input type="text" value="n/a"/> Btu/h
med:	<input type="text" value="n/a"/> Btu/h
warmest:	<input type="text" value="n/a"/> Btu/h

Done

Air-Side HVAC System Parameters [?] [X]

Currently Active System: **EL2 Sys2 (EVAP-COOL) (G.S1)** System Type: Evaporative Cool

Basics | Fans | Outdoor Air | Cooling | Heating | Preconditioner | Meters | Refrigeration

Design Parameters | Condenser | Heat Recovery | Anti-Sweat | Performance Curves

Compressors Available for Heat Recovery:
(by evaporator temperature range)

coldest: med: warmest:

Heat Recovery Grouping:

Total Recoverable Heat: Btu/h

Heat Recovery Cond Setpoint: °F

Frac of Heat Recov (1st Stage): ratio

Frac of Heat Recov (2nd Stage): ratio

Done

Air-Side HVAC System Parameters [?] [X]

Currently Active System: **EL2 Sys2 (EVAP-COOL) (G.S1)** System Type: Evaporative Cool

Basics | Fans | Outdoor Air | Cooling | Heating | Preconditioner | Meters | Refrigeration

Design Parameters | Condenser | Heat Recovery | Anti-Sweat | Performance Curves

Anti-Sweat Heater Installed kW:
(by evaporator temperature range)

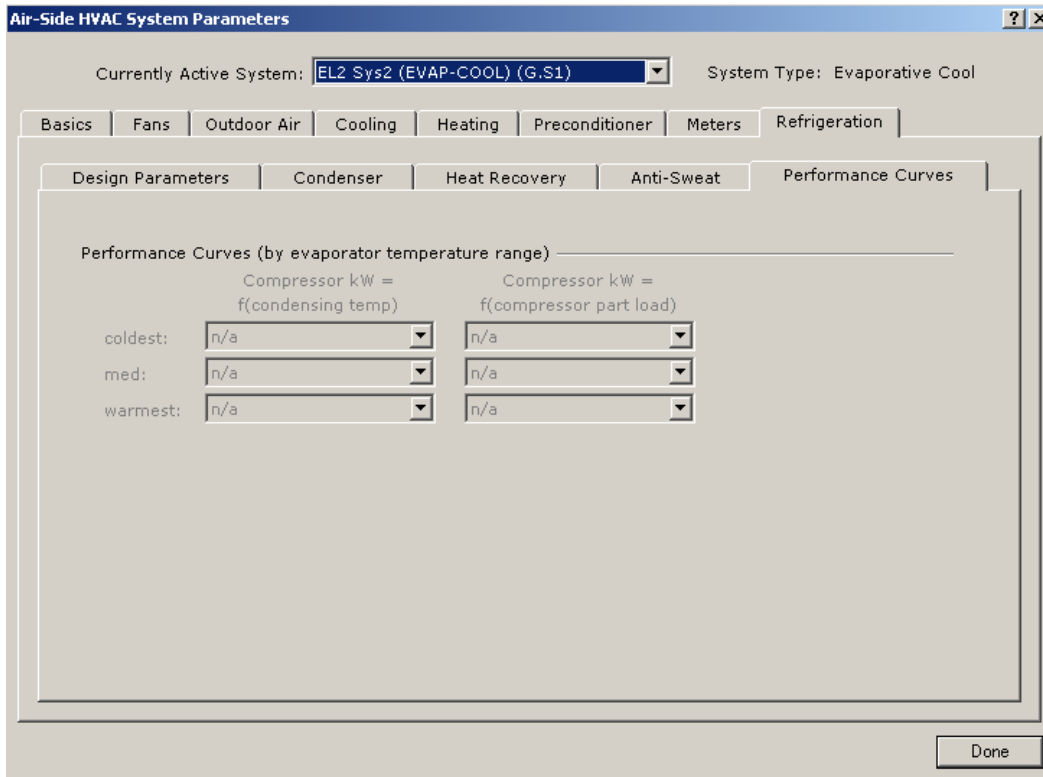
coldest: kW
med: kW
warmest: kW

Anti-Sweat Control Points

Absolute Humidity Low: lb/lb
Absolute Humidity High: lb/lb

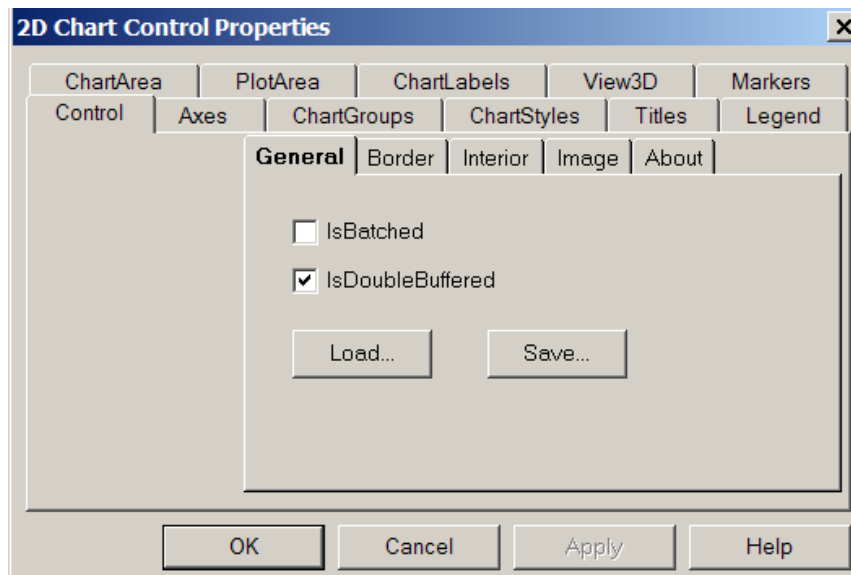
Fraction of Anti-Sweat and Aux Load to Refrig Case Compressors: ratio

APPENDIX



2D Chart Control Properties

To change the appearance of a graph, right click on the graph, then click properties. The 2D Chart Control Properties box will appear. Simply go through and make the desired changes.



EXAMPLE



EXAMPLE

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EXECUTIVE SUMMARY

The following set of instructions directs the reader to create a detailed energy model in the Design Development (DD) Wizard of eQUEST, as well as use the Energy Efficiency Measure (EEM) Wizard to create runs that can be compared to the base model. For more information about any of these steps, please refer to the text of this training module.

NOTE

More information and the latest version of eQUEST, version 3-64, can be downloaded from the DOE-2 website. Visit www.doe2.com.

Welcome to **DOE2.com**
The Home of DOE-2 based Building Energy Use and Cost Analysis Software

Thank you for visiting DOE2.com. This site is the place where you can obtain information and products from the developers of DOE-2 and DOE-2 based products including eQUEST. This site is maintained by and for [EnerLogic](#) and [James J. Hirsch & Associates](#).

The DOE-2 software was developed by [James J. Hirsch & Associates \(JHA\)](#) in collaboration with [Lawrence Berkeley National Laboratory \(LBNL\)](#), with [LBNL DOE-2 work](#) performed mostly under funding from the [United States Department of Energy \(USDOE\)](#) and other work performed mostly under funding from a wide range of industry organizations and ourselves. This site, however, is not sponsored or endorsed by either USDOE or LBNL, and use of "DOE" in names in this site does not imply any endorsement or recommendation of any listed products or services by the United States Government, LBNL, or anyone else.

Follow this link to [review a brief comparison of DOE-2.1E, DOE-2.2, eQUEST and PowerDOE](#). eQUEST is our most up-to-date complete building energy use simulation tool; it is **free** and contains a complete version DOE-2.2 and its documentation.

Note: Most documents posted on this website are published using Adobe's Portable Document Format (PDF) with most using PDF version 1.1 (created using Acrobat version 9) and may not be readable with versions prior to 6. To update your Acrobat Reader go to the [Adobe site](#) for a free download.

eQUEST® is a sophisticated, yet easy to use, **turnware** building energy use analysis tool that provides professional-level results with an affordable level of effort. eQUEST was designed to allow you to perform detailed comparative analysis of building designs and technologies by applying sophisticated building energy use simulation techniques but without requiring extensive experience in the "art" of building performance modeling. This is accomplished by combining schematic and design development building creation wizards, an energy efficiency measure (EEM) wizard and a graphical results display module with a complete up-to-date DOE-2 (version 2.2) building energy use simulation program. You can read the [eQUEST Overview](#) to get a more complete summary of the features and capabilities of this excellent program.

eQUEST 3.64 is the most recent release. For descriptions of the new features read [this document](#). [eD_WthProc](#) can convert EnergyPlus (.epw) files into eQUEST/DOE-2 (.bin) files, see [weather data links below](#).

You can see [more information about eQUEST including download of program and documentation](#). You can also [view the eQUEST download area](#) to see recent versions of the program, documentation and updates.

Notes: Effective 9 September 2009, eQUEST is Qualified Software ([eQUEST 3.63b](#)) for Calculating [Commercial Building Tax Deductions](#) first enacted under the Energy Policy Act of 2005 (EPACT) and later extended by the Emergency Economic Stabilization Act of 2008. The requirements for software to be qualified for use in these deductions were first covered by [IRS Notice 2009-53](#) and then amplified by [IRS IRB 2009-14](#) with further [guidelines provided by DOE](#). The submission packages, including ASHRAE Standard 140 testing, can be found [here](#).

NEW: On 25 August 2010 our [eQUEST 3.64 submittal](#) was approved by the California Energy Commission for approval as [2008 Title 24 non-residential ACMs](#). eQUEST 3.6 and D2comply 3.6 were approved by the California Energy Commission as 2005 Title 24 non-residential ACMs by the CEC at their 11 April 2007 business meeting. eQUEST 3.6 and 3.61b are approved for use with [Savings By Design](#).

eQUEST is supported as a part of the [Energy Design Resources](#) program which is funded by California utility customers and administered by Pacific Gas and Electric, San Diego Gas & Electric, Southern California Edison, Southern California Gas under the auspices of the California Public Utilities Commission as well as the Sacramento Municipal Utilities District.

Some things to ALWAYS keep in mind while working in eQUEST:

- **Work in a linear fashion.** The dynamic defaults in the program automatically change information further in the program. If you are working backwards, this may be information you have already customized. Working linearly from start to finish and avoiding back stepping can guarantee that your user input stays put!
- **Save frequently.** Like any computer program, some newer versions of eQUEST have a tendency to crash at inconvenient moments. Make sure you are prepared.
- **Keep it simple.** There are some details in your building design that will have little or no impact on energy performance. Leave them out!
- **Analyze the results with caution.** Always check the reports for numbers that seem inappropriate under the circumstances. While the computer is a valuable tool, it does not understand the output it is producing. Use your knowledge to recognize potential inaccuracies!
- **Update your version.** There are several versions of eQUEST, and each have some variations. It is a good idea to update your version of eQUEST to the most current version. For the purposes of this and all subsequent modules, we will be using eQUEST version 3.64.

USING THE DD WIZARD

The following list of steps was taken directly from eQUEST Module 2 on the Design Development (DD) Wizard. This example will walk the user through these steps in order to create a detailed energy model. Once this has been completed, the results will be viewed and the example will move on to part two where the Energy Efficiency Measure (EEM) Wizard will be explored. The next several pages will go through the following steps in detail:

1. Convert SD energy model into a DD energy model.
2. Navigate through the DD Wizard screens.
3. Simulate the building.
4. Review the results.
5. Make changes if necessary.
6. Use EEM Wizard to do comparison runs

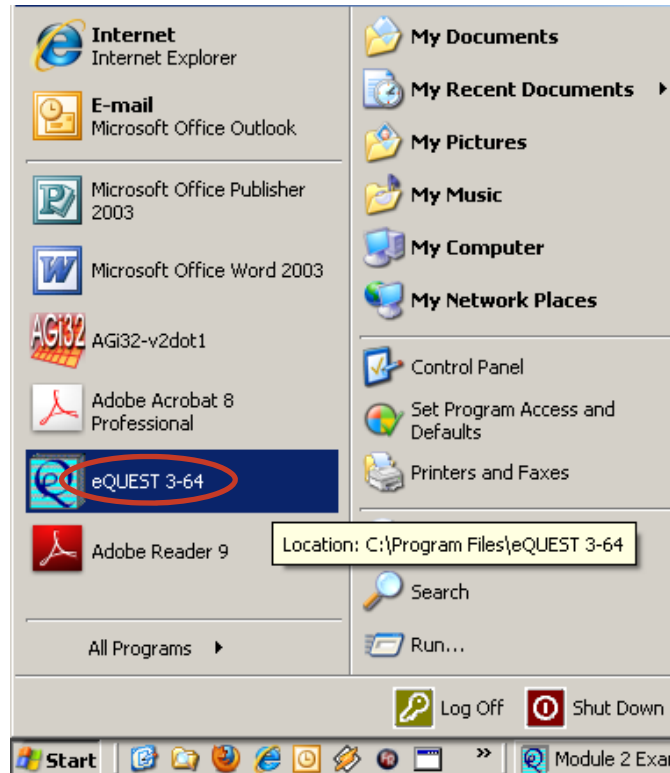
The first thing we will do is convert the SD energy model from Module 1 into a DD energy model. This project is a basic rectangular two-story office building in Billings, Montana. After we convert the SD model into a DD model we will add more details to the project.

As you go through the DD Wizard, you will want to fill out an **DD Wizard Form** which can be found at the end of this module. This will help you gather all of your information in one place and allow someone else to understand how the energy model was built.

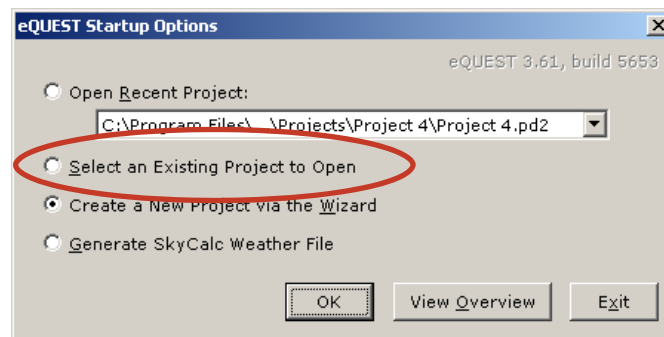
To see completed versions of the DD Wizard Form for this first energy model, turn to page E34.

MODULE 2 EXAMPLE

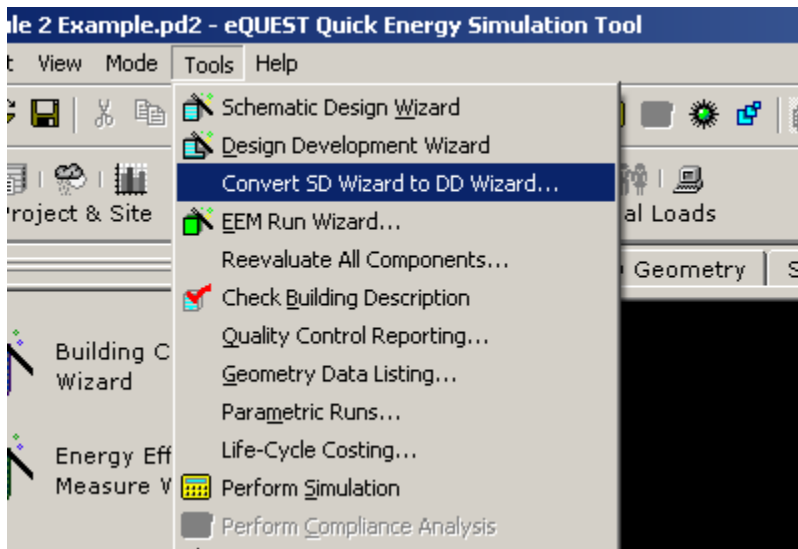
1. Open eQUEST and open the SD project you want to convert in to a DD file.
 - Open eQUEST from the Start menu.



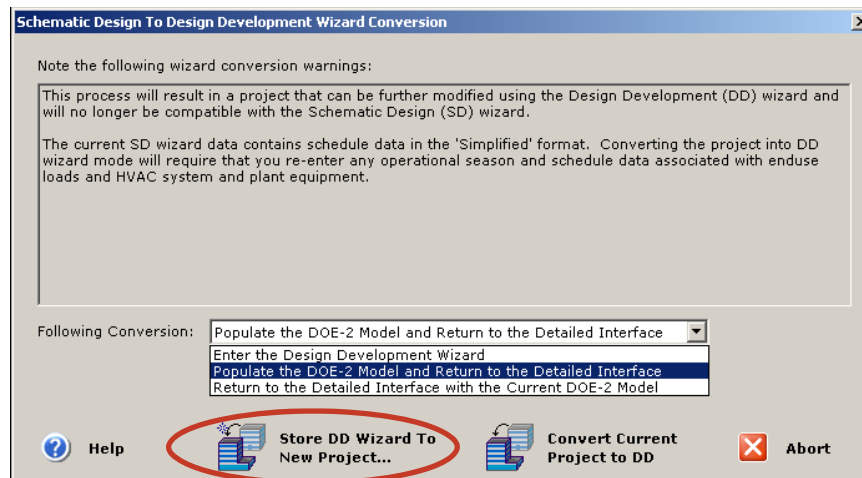
- Select **Select an Existing Project to Open**.
- Open project from file



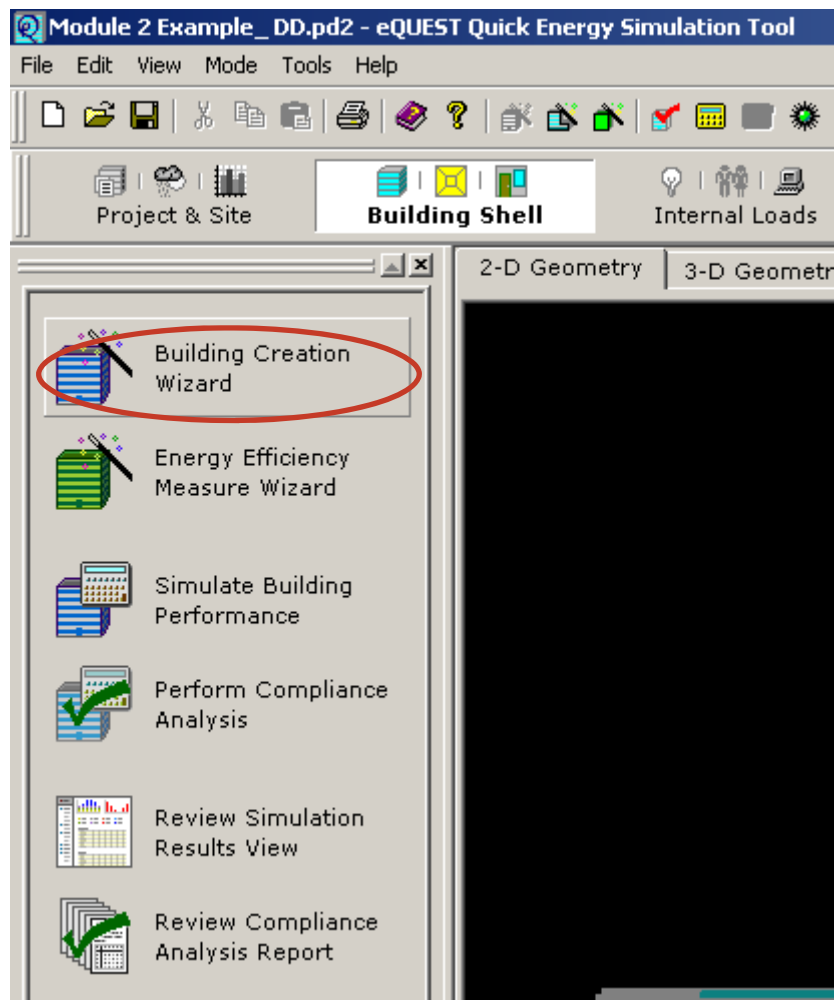
- Click **Tools** from the menu bar and Select **Convert SD Wizard to DD Wizard...**



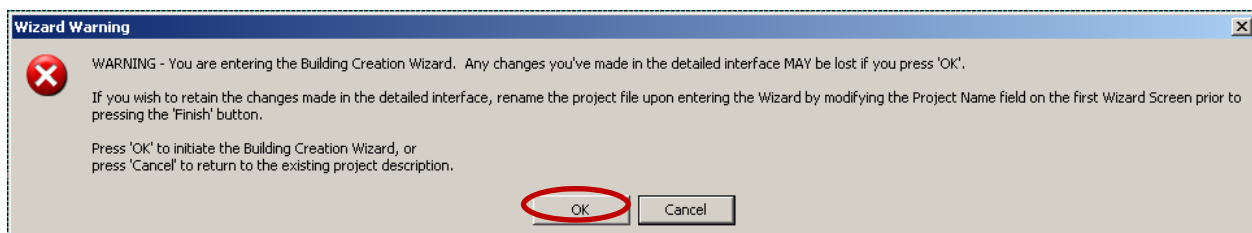
- In the **Schematic Design To Design Development Wizard Conversion** window select **Populate the DOE-2 Model and Return to the Detailed Interface** option
- Click **Store DD Wizard To New Project**. This give you the option to save and rename the SD project while keeping the original file name for the DD project.



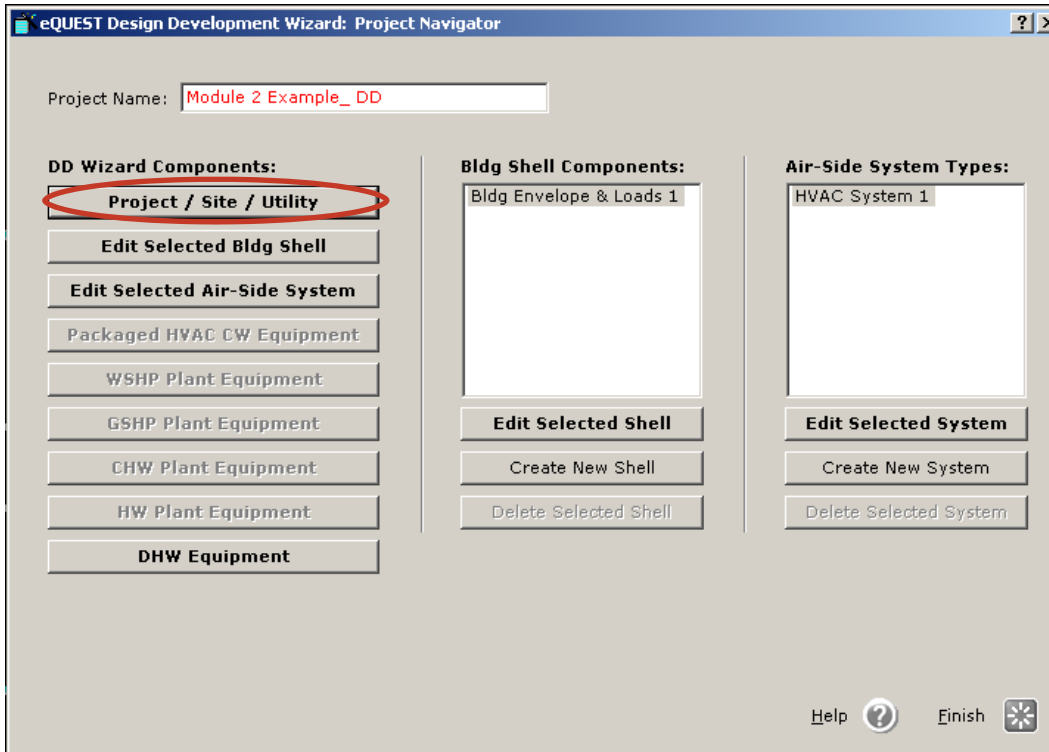
- Click Building Creation Wizard



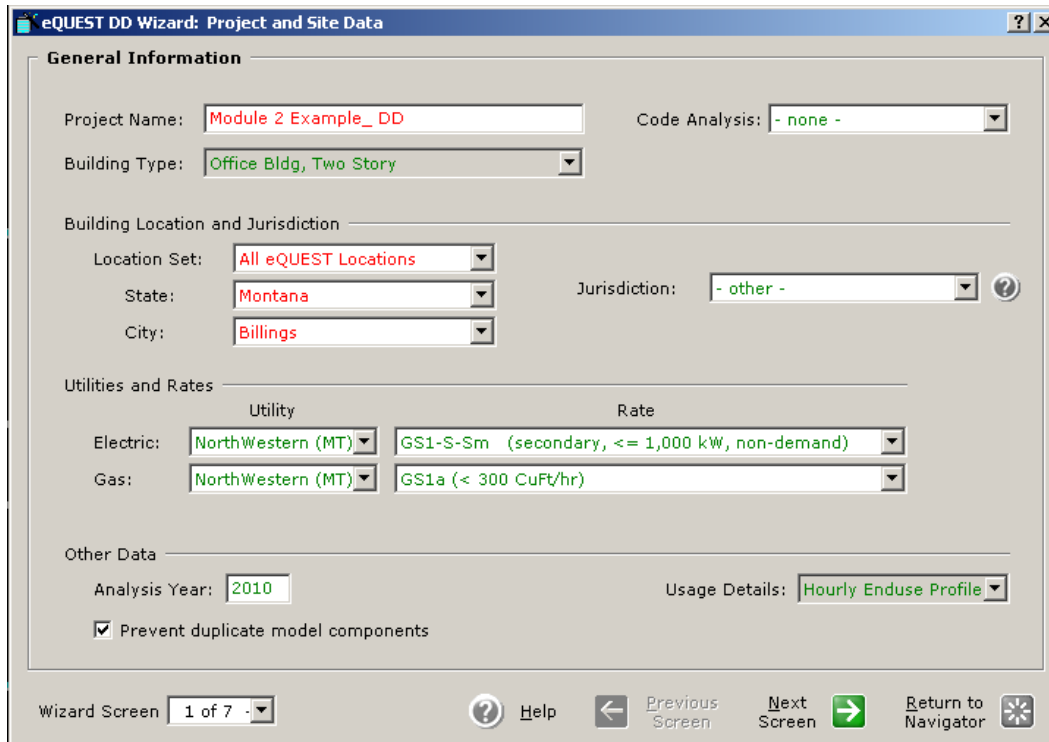
- Select **OK** at the **Wizard Warning** window



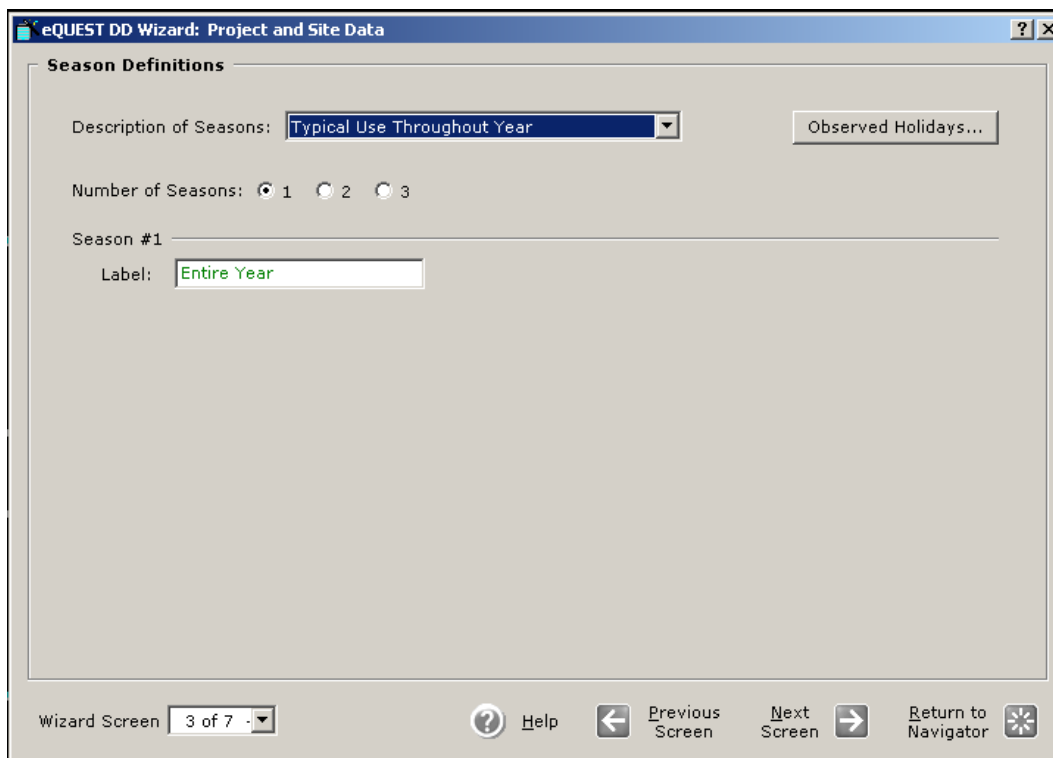
2. Begin Building Creation Wizard
3. Select **Project / Site / Utility** and begin to detail edit your project



- Go through screens and make desired changes

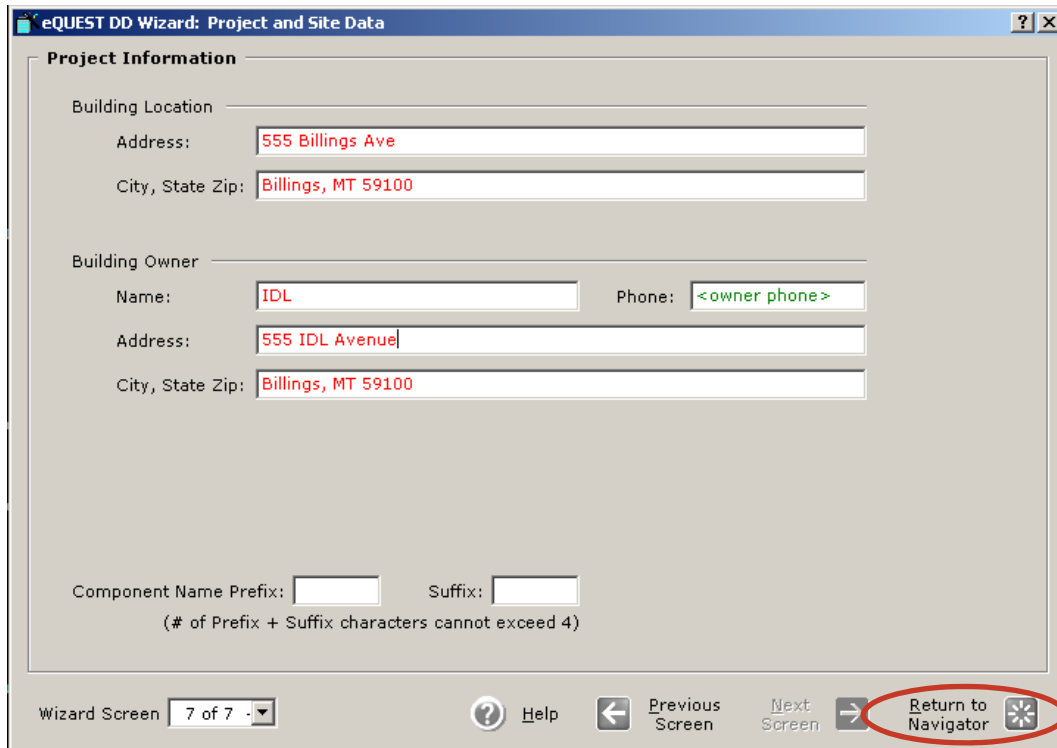


EXAMPLE

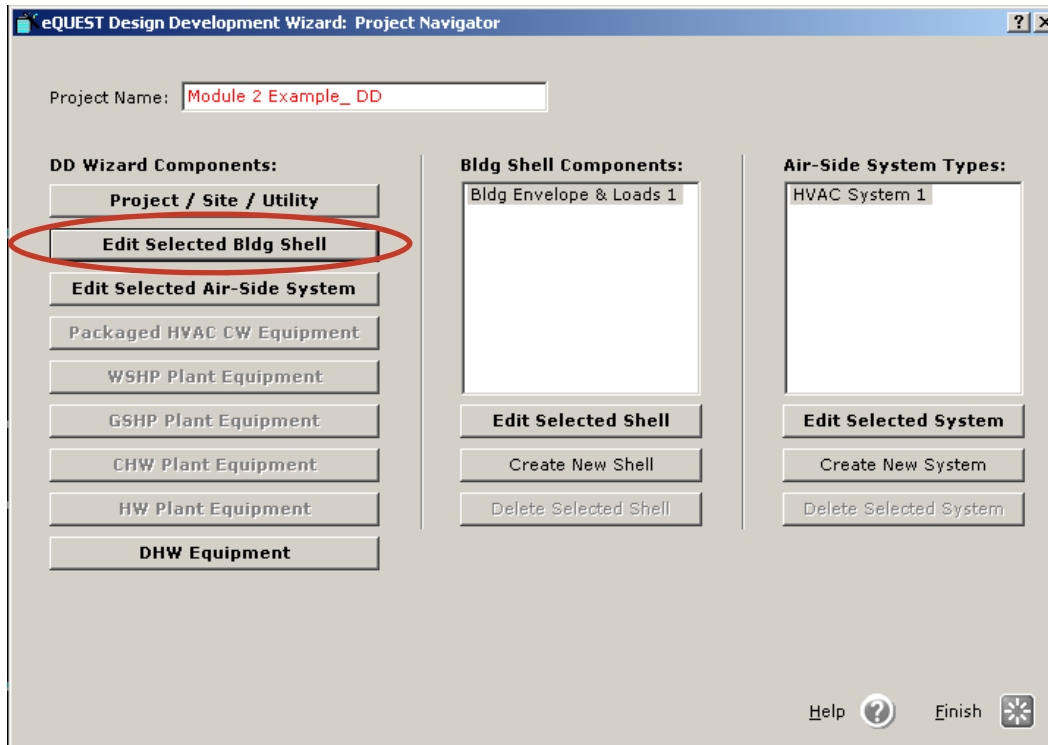


EXAMPLE

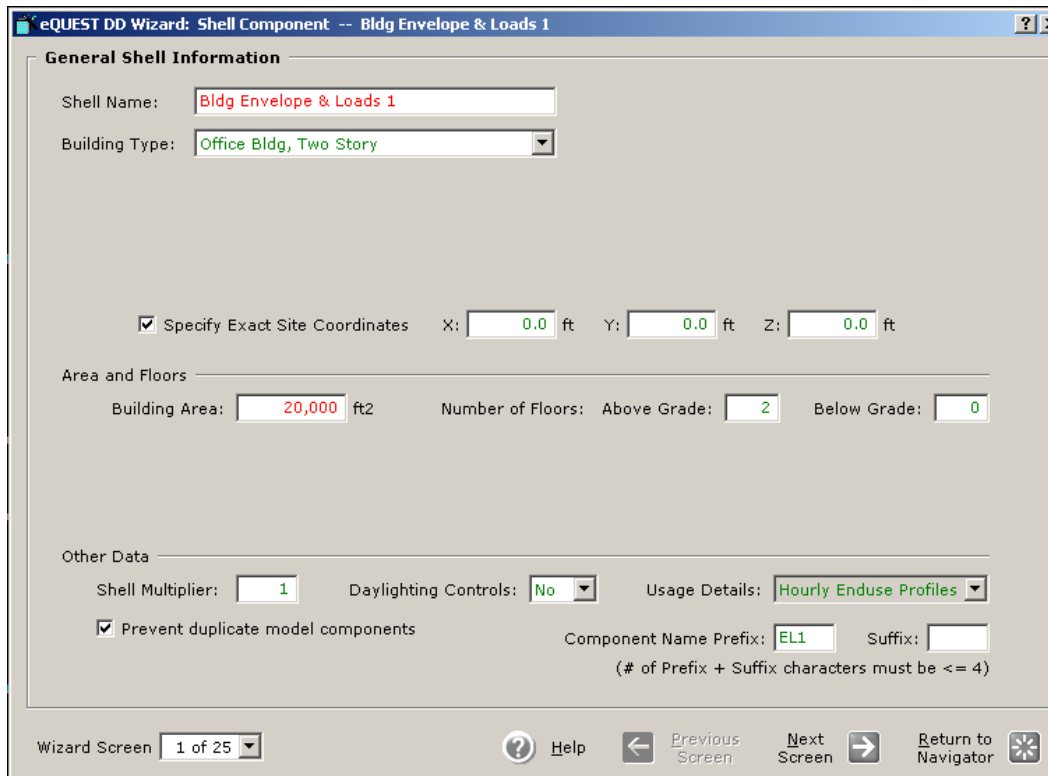
- When complete click **Return to Navigator**



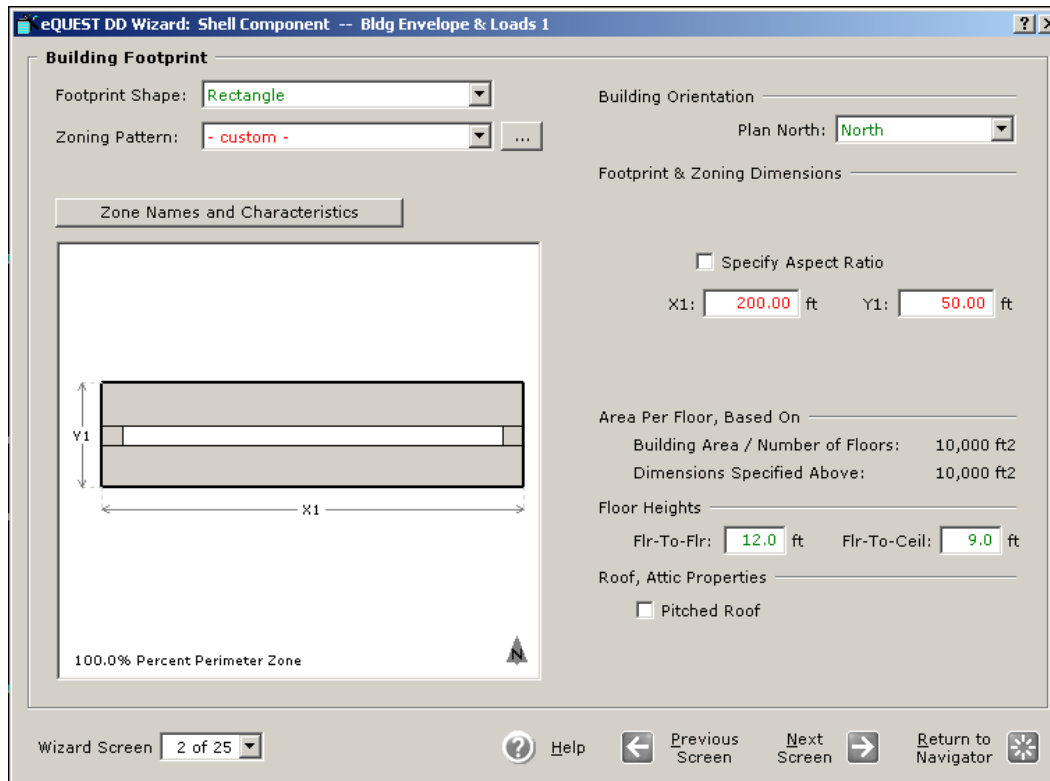
- Continue to **Edit Selected Bldg Shell**.



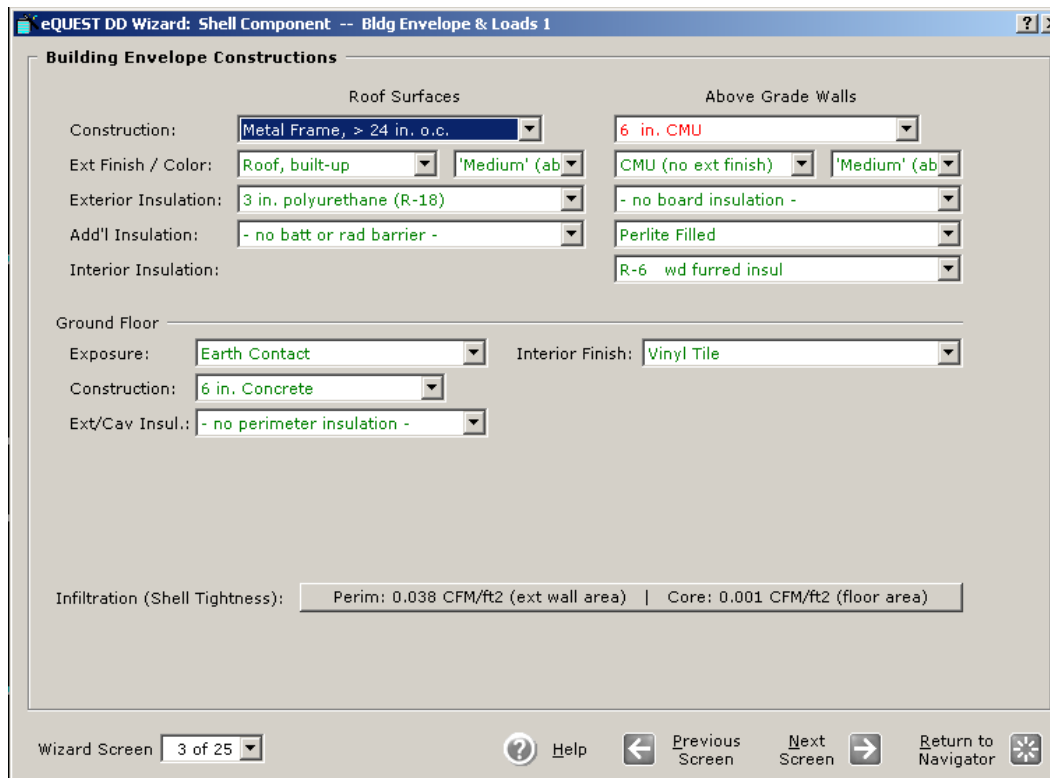
- Make desired changes in the following dialogs. Click **Next Screen** to continue to the next dialog.



EXAMPLE



EXAMPLE



EXAMPLE

eQUEST DD Wizard: Shell Component -- Bldg Envelope & Loads 1

Building Interior Constructions

Ceilings

Int. Finish: Lay-In Acoustic Tile Batt Insulation: - no ceiling insulation -

Vertical Walls

Wall Type: Air (none)

Floors

Int. Finish: Vinyl Tile Rigid Insulation: - no board insulation -

Construction: 6 in. Concrete Slab Penetrates Wall Plane

Concrete Cap: - no concrete cap -

Wizard Screen 4 of 25 ? Help < Previous Screen Next Screen > Return to Navigator

eQUEST DD Wizard: Shell Component -- Bldg Envelope & Loads 1

Exterior Doors

Describe Up To 3 Door Types

Door Type	# Doors by Orientation:			
	North	South	East	West
1: Glass	1	1	1	1
2: - select another -				

Door Dimensions and Construction / Glass Definitions

Ht (ft)	Wd (ft)	Construction -or- Glass Category and Glass Type	Frame Type	Frame Wd (in)	
1: 7.0	6.0	Single Clr/Tint	Single Clear 1/4in (1001)	Alum w/o Brk	3.0

Wizard Screen 5 of 25 ? Help < Previous Screen Next Screen > Return to Navigator

eQUEST DD Wizard: Shell Component -- Bldg Envelope & Loads 1

Exterior Windows

Window Area Specification Method:

Describe Up To 3 Window Types

	Glass Category	Glass Type	Frame Type	Frame Wd (in)
1:	<input type="text" value="Double Clr/Tint"/>	<input type="text" value="Double Clear 1/4in, 1/2in Air (2004)"/>	<input type="text" value="Alum w/o Brk, Fixed"/>	<input type="text" value="1.30"/>
2:	<input type="text" value="- select another -"/>			

Window Dimensions, Positions and Quantities

	Typ Window Width (ft)*	Window Ht (ft)	Sill Ht (ft)	% Window (floor to floor, including frame):			
				North	South	East	West
1:	<input type="text" value="0.00"/>	<input type="text" value="5.22"/>	<input type="text" value="3.00"/>	<input type="text" value="40.0"/>	<input type="text" value="40.0"/>	<input type="text" value="0.0"/>	<input type="text" value="0.0"/>

Estimated shell-wide gross (flr-to-flr) % window is 32.0% and net (flr-to-ceiling) is 42.7%.

* - A window width of 0 results in one long window per facet (check adjoining box if window width is to take precedence over % window)

Wizard Screen

EXAMPLE

eQUEST DD Wizard: Shell Component -- Bldg Envelope & Loads 1

Exterior Window Shades and Blinds

Exterior Window Shades

Overhangs:

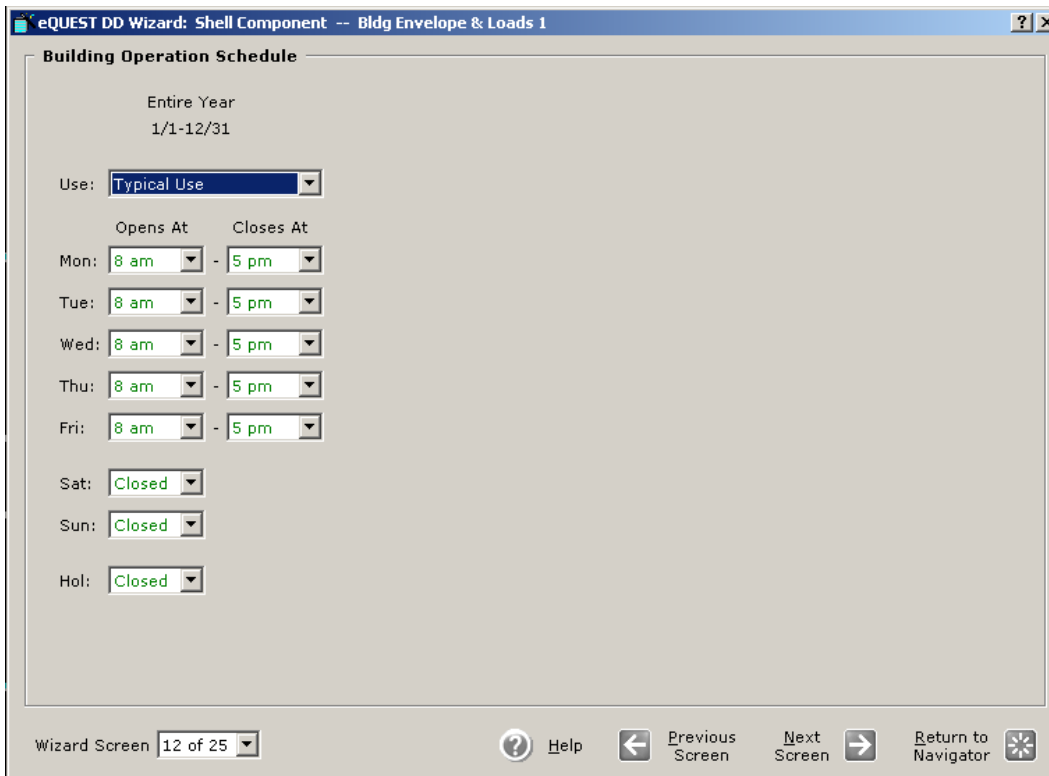
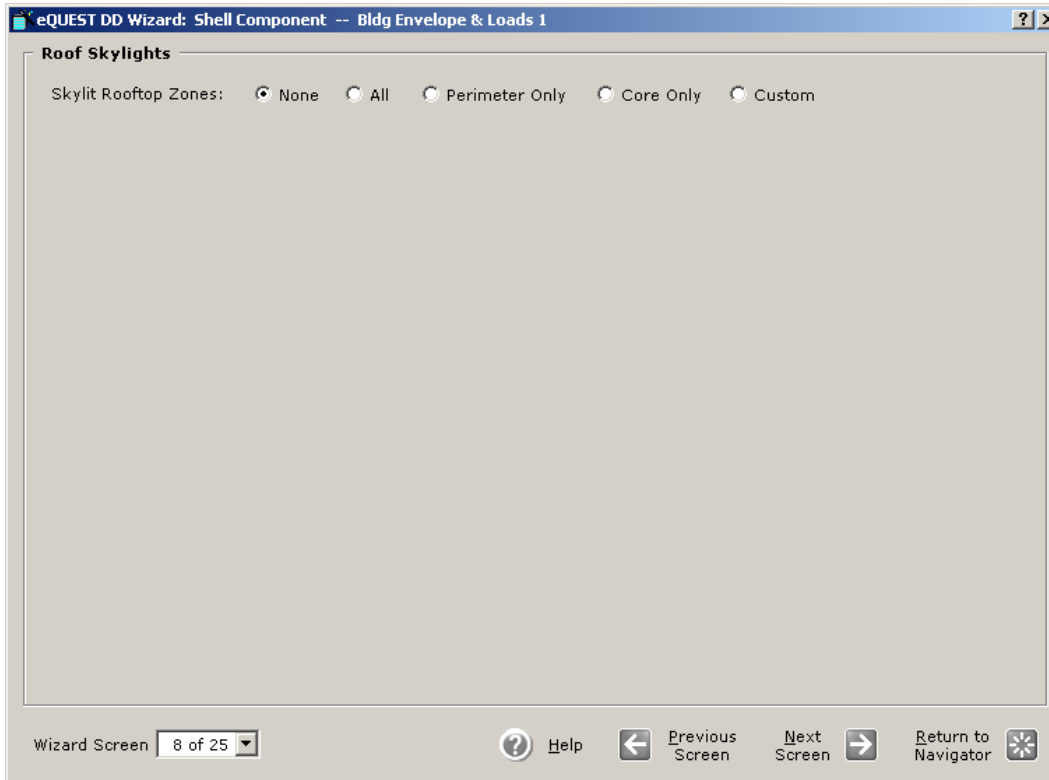
Fins:

Window Blinds/Drapes

Type:

Wizard Screen

EXAMPLE



eQUEST DD Wizard: Shell Component -- Bldg Envelope & Loads 1

Activity Areas Allocation

Area Type	Percent Area (%)	Design Max Occup (sf/person)	Design Ventilation (CFM/per)	Assign First To... Floor(s):	
				1st	Top
1: Office (Executive/Private)	70.0	200	20.00	<input type="checkbox"/>	<input type="checkbox"/>
2: Corridor	10.0	1,000	50.00	<input type="checkbox"/>	<input type="checkbox"/>
3: Lobby (Office Reception/Waiting)	5.0	100	15.00	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4: Restrooms	5.0	300	50.00	<input type="checkbox"/>	<input type="checkbox"/>
5: Conference Room	4.0	50	20.00	<input type="checkbox"/>	<input type="checkbox"/>
6: Mechanical/Electrical Room	4.0	2,000	100.00	<input checked="" type="checkbox"/>	<input type="checkbox"/>
7: Copy Room (photocopying equipment)	2.0	200	100.00	<input type="checkbox"/>	<input type="checkbox"/>
8: - select another -					

Percent Area Sum: 100.0 81 0.082 Show Zone Group Screen

Occupancy Profiles by Season: Entire Year
 EL1 Occup Profile (S1)

Wizard Screen 13 of 25 Help Previous Screen Next Screen Return to Navigator

EXAMPLE

eQUEST DD Wizard: Shell Component -- Bldg Envelope & Loads 1

Zone Group Definitions

Select Zone Group to View/Edit:

- Ground Floor Core
- Ground Floor Perimeter
- Top Floor Core
- Top Floor Perimeter

Create Zone Grp Delete Zone Grp

	Activity Area Type	Percent (%)	Area (ft2)	Bldg Pc (%)
1	Office (Executive/Private)		0	70.0
2	Corridor		0	4.0
3	Lobby (Office Reception/Waiting)		0	5.0
4	Restrooms		0	0.0
5	Conference Room		0	0.0

Conditioned
 HVAC System: [] Zone Group Details...

Ground Floor Top Floor

This Zone Group Other Zone Group(s) Not Assigned to Any Zone Group

Wizard Screen 14 of 25 Help Previous Screen Next Screen Return to Navigator

EXAMPLE

eQUEST DD Wizard: Shell Component -- Bldg Envelope & Loads 1

Non-HVAC Enduses to Model

Interior Enduses (contributing to space loads)

- Interior (ambient) Lighting
- Interior (task) Lighting
- Office Equipment
- Cooking Equipment
- Miscellaneous Equipment
- Self-Contained Refrigeration
- Process Loads
- Motors
- Air Compressors

Exterior Enduses (not contributing to space loads)

- Exterior Lighting Connected Intensity and Monthly Single Day Profiles
- Remote Refrigeration
- Domestic Hot Water Model DHW Equipment with Seasonal Profiles

Wizard Screen 15 of 25

Help Previous Screen Next Screen Return to Navigator

eQUEST DD Wizard: Shell Component -- Bldg Envelope & Loads 1

Interior Lighting Loads and Profiles

Area Type	Percent Area (%)	Lighting (W/SqFt)
1: Office (Executive/Private)	70.0	1.49
2: Corridor	10.0	0.57
3: Lobby (Office Reception/Waiting)	5.0	1.52
4: Restrooms	5.0	0.77
5: Conference Room	4.0	0.92
6: Mechanical/Electrical Room	4.0	0.81
7: Copy Room (photocopying equipment)	2.0	1.64

Multipliers on above intensities: 1.00

Interior Lighting Hourly Profiles by Season

Entire Year

Ambient: EL1 InsLtg Profile (S1)

Wizard Screen 16 of 25

Help Previous Screen Next Screen Return to Navigator

eQUEST DD Wizard: Shell Component -- Bldg Envelope & Loads 1

Office Equipment Loads and Profiles

Area Type	Percent Area (%)	Office Eq (W/SqFt)
1: Office (Executive/Private)	70.0	0.00
2: Corridor	10.0	0.00
3: Lobby (Office Reception/Waiting)	5.0	0.00
4: Restrooms	5.0	0.00
5: Conference Room	4.0	0.00
6: Mechanical/Electrical Room	4.0	0.00
7: Copy Room (photocopying equipment)	2.0	0.30

Office Equipment Hourly Profiles by Season
 Entire Year
 EL1 OffEq Profile (S1)

Wizard Screen 17 of 25

Help Previous Screen Next Screen Return to Navigator

EXAMPLE

eQUEST DD Wizard: Shell Component -- Bldg Envelope & Loads 1

Miscellaneous Loads and Profiles

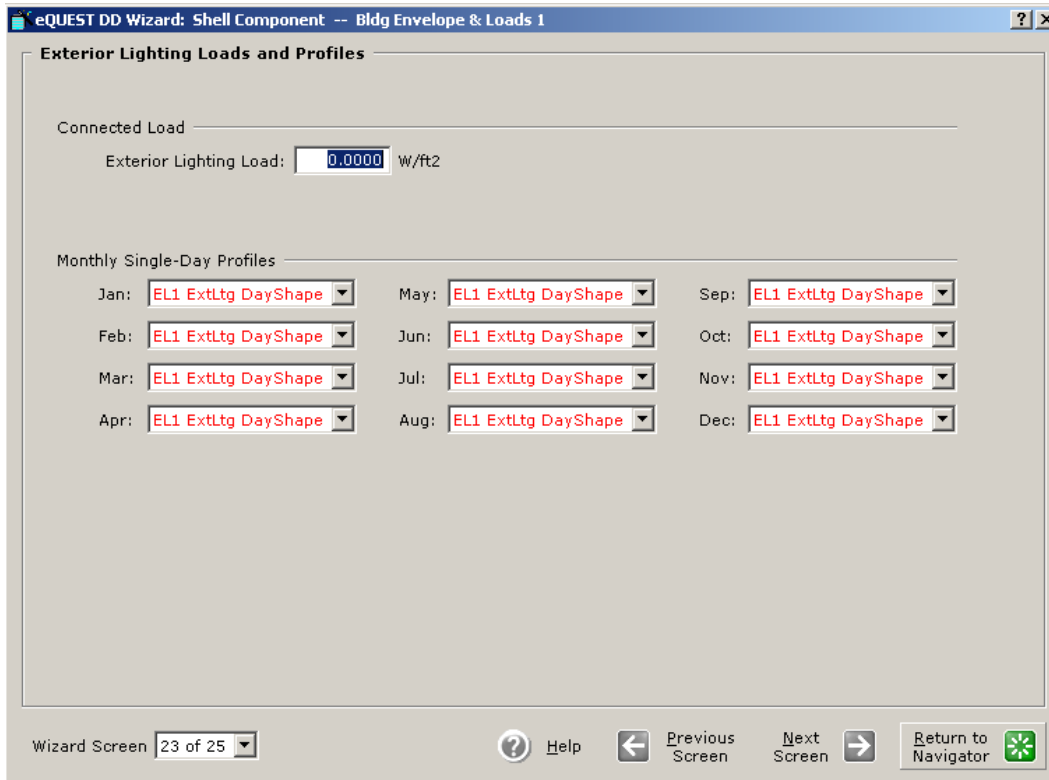
Area Type	Percent Area (%)	----- Electric -----		---- Natural Gas ----	
		Load (W/SqFt)	Sensible Ht (frac)	Load (Btuh/SF)	Sensible Ht (frac)
1: Office (Executive/Private)	70.0	0.75	1.00	0.00	1.00
2: Corridor	10.0	0.00	1.00	0.00	1.00
3: Lobby (Office Reception/Waiting)	5.0	0.25	1.00	0.00	1.00
4: Restrooms	5.0	0.10	1.00	0.00	1.00
5: Conference Room	4.0	0.10	1.00	0.00	1.00
6: Mechanical/Electrical Room	4.0	0.10	1.00	0.00	1.00
7: Copy Room (photocopying equipment)	2.0	0.70	1.00	0.00	1.00

Miscellaneous Equipment Hourly Profiles by Season
 Entire Year
 EL1 Misc Profile (S1)

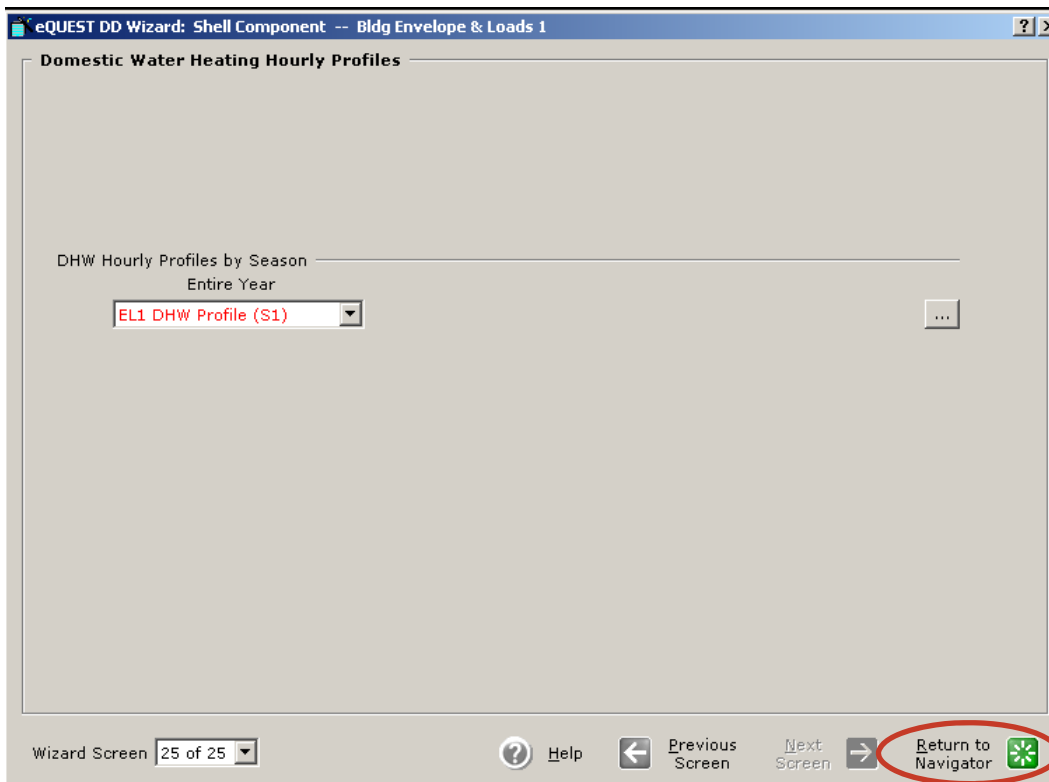
Wizard Screen 20 of 25

Help Previous Screen Next Screen Return to Navigator

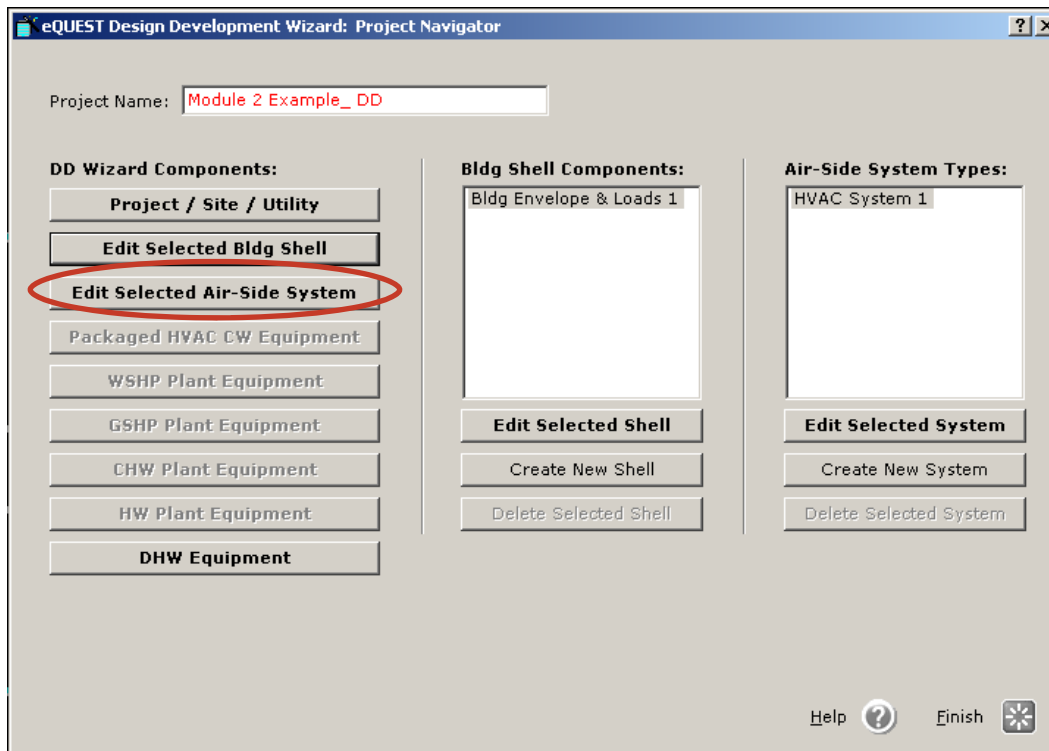
EXAMPLE



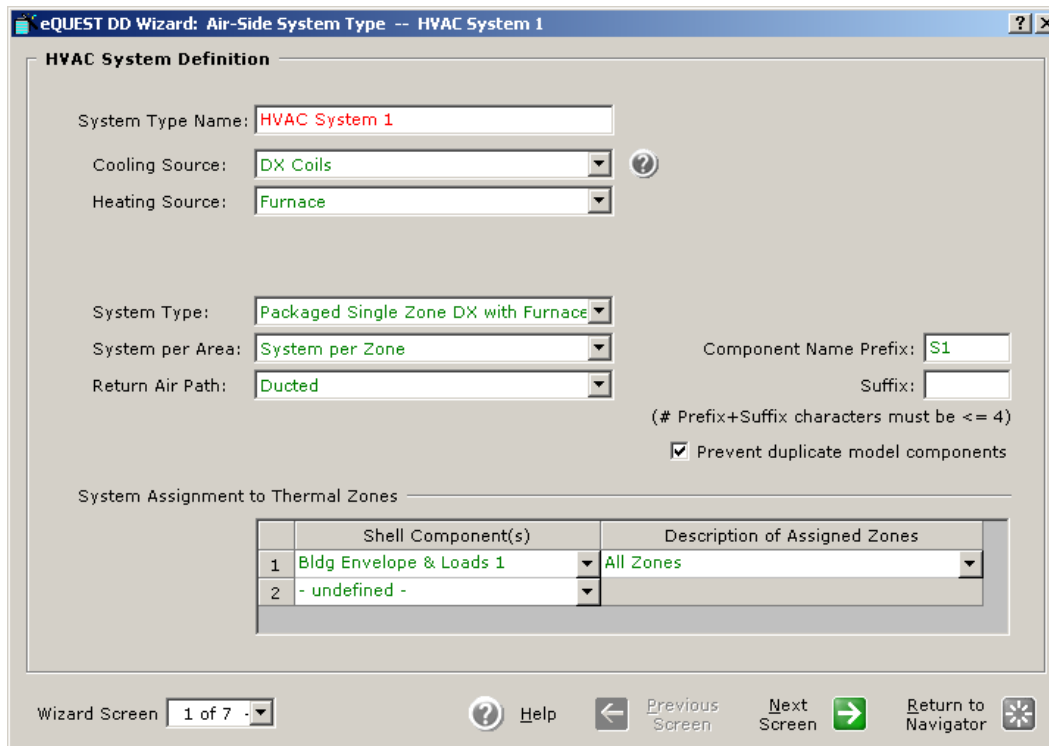
- Click Return to Navigator



- Continue to **Edit Selected Air-Side System**



EXAMPLE



EXAMPLE

eQUEST DD Wizard: Air-Side System Type -- HVAC System 1

HVAC Zones: Temperatures and Air Flows

System(s): 1: Packaged Sgl Zone DX, Furnace

Seasonal Thermostat Setpoints

Occupied (°F)		Unoccupied (°F)	
Cool	Heat	Cool	Heat
76.0	70.0	82.0	64.0

Design Temperatures

	Indoor	Supply
Cooling Design Temp:	75.0 °F	55.0 °F
Heating Design Temp:	72.0 °F	120.0 °F

Air Flows

Minimum Design Flow: 0.50 cfm/ft2

Wizard Screen 2 of 7

Help Previous Screen Next Screen Return to Navigator

eQUEST DD Wizard: Air-Side System Type -- HVAC System 1

Packaged HVAC Equipment

HVAC System 1: Packaged Sgl Zone DX, Furnace

Cooling

Overall Size: Auto-size

Typical Unit Size: 135-240 kBtuh or 11.25-20 tons

Condenser Type: Air-Cooled

Efficiency: EER 8.500

Allow Crankcase Heating

Heating

Size: Auto-size

Typical Unit Size: >= 225 kBtuh

Efficiency: Efficiency 0.806

Wizard Screen 3 of 7

Help Previous Screen Next Screen Return to Navigator

eQUEST DD Wizard: Air-Side System Type -- HVAC System 1

HVAC System Fans

System(s): 1: Packaged Sgl Zone DX, Furnace
16,760 SqFt Served (all perimeter)

Supply Fans _____

Power & Mtr Eff:

Fan Flow & OSA:

Wizard Screen

Help Previous Screen Next Screen Return to Navigator

EXAMPLE

eQUEST DD Wizard: Air-Side System Type -- HVAC System 1

HVAC System #1 Fan Schedules

HVAC System 1: Packaged Sgl Zone DX, Furnace

Cycle Fans at Night:

Operate fans hours before open and hours after close. Fan 'On' Mode:

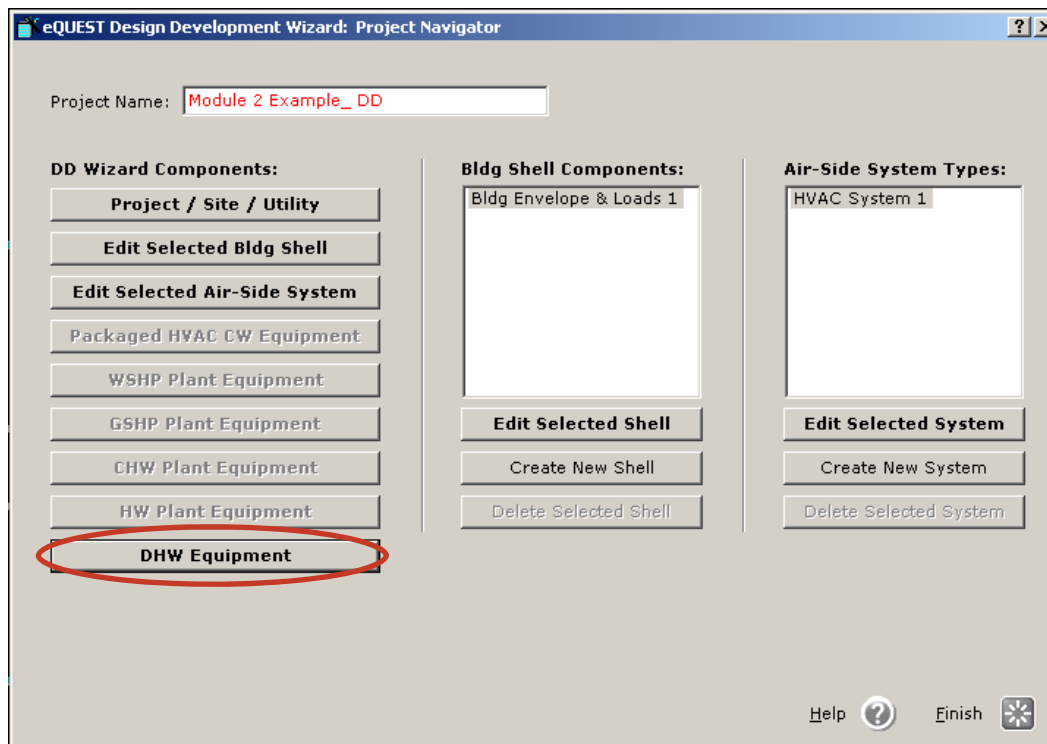
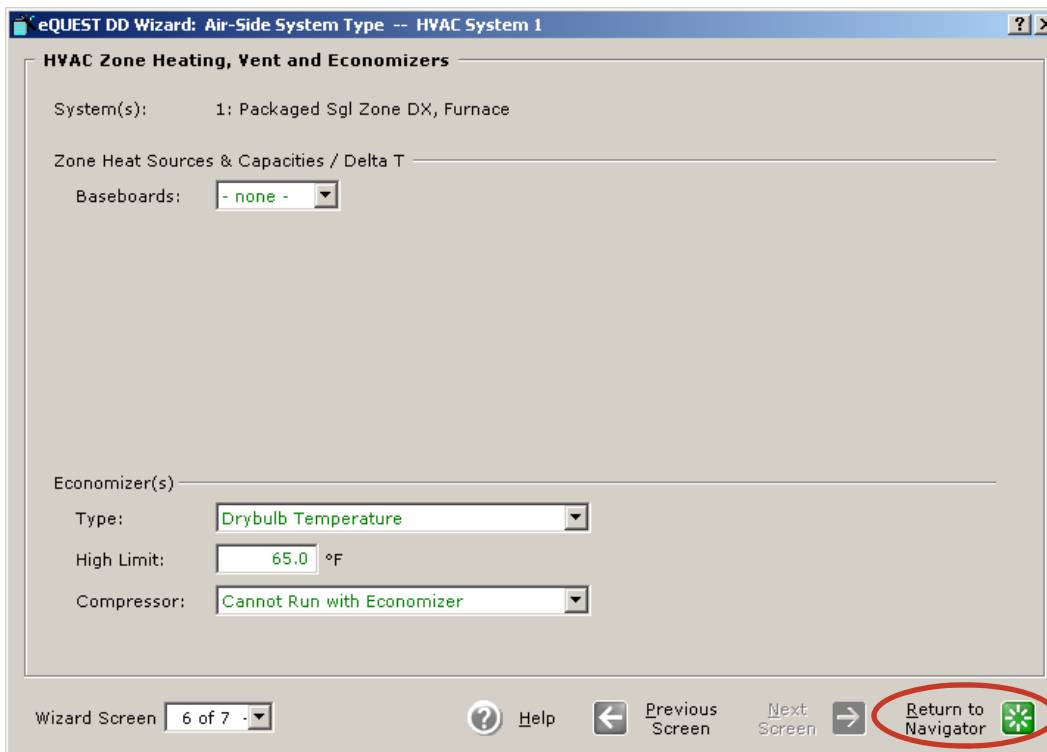
Entire Year
1/1-12/31

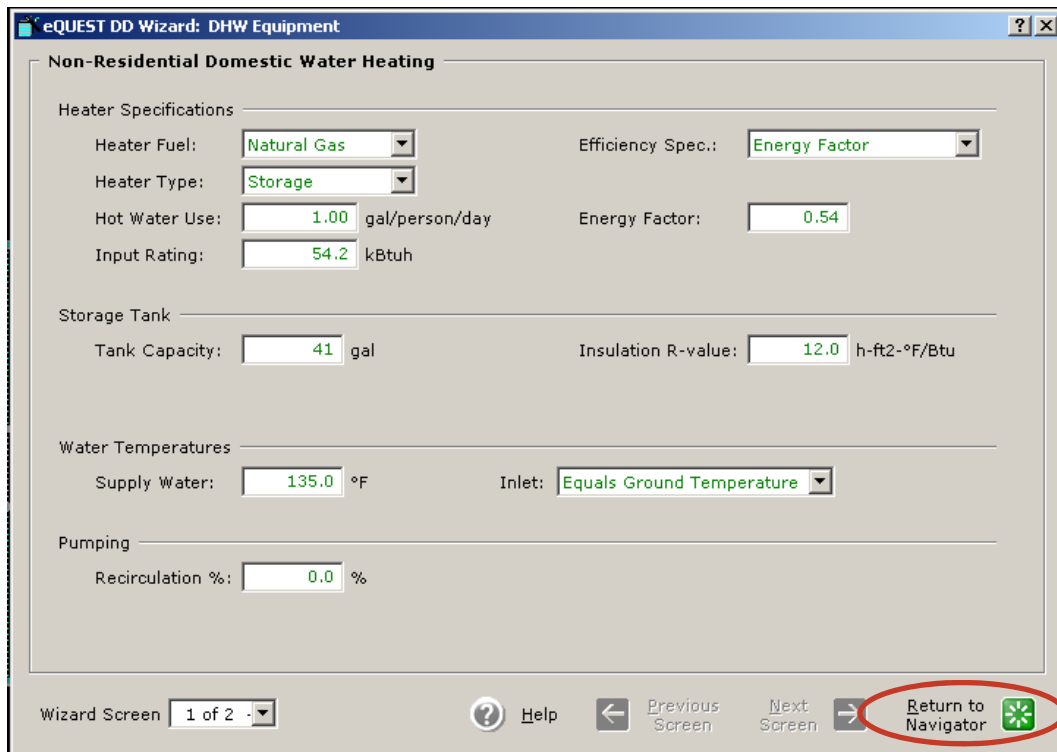
	On At	Off At
Mon:	<input type="text" value="7 am"/>	<input type="text" value="6 pm"/>
Tue:	<input type="text" value="7 am"/>	<input type="text" value="6 pm"/>
Wed:	<input type="text" value="7 am"/>	<input type="text" value="6 pm"/>
Thu:	<input type="text" value="7 am"/>	<input type="text" value="6 pm"/>
Fri:	<input type="text" value="7 am"/>	<input type="text" value="6 pm"/>
Sat:	<input type="text" value="Off"/>	
Sun:	<input type="text" value="Off"/>	
Hol:	<input type="text" value="Off"/>	

Wizard Screen

Help Previous Screen Next Screen Return to Navigator

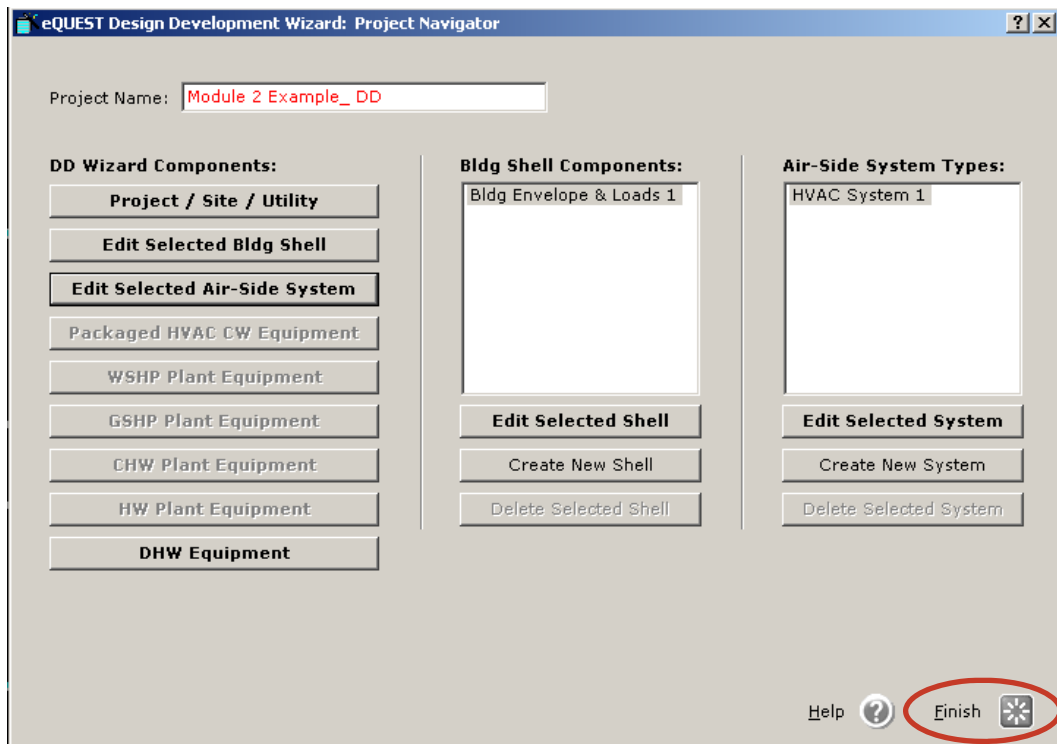
EXAMPLE



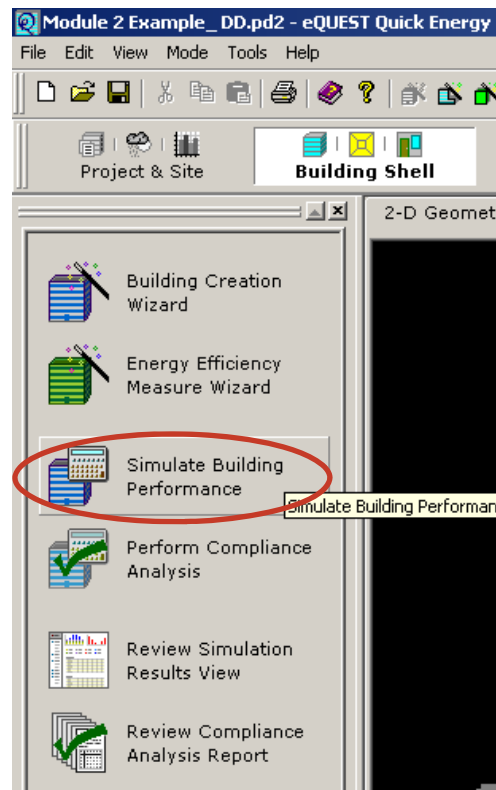


EXAMPLE

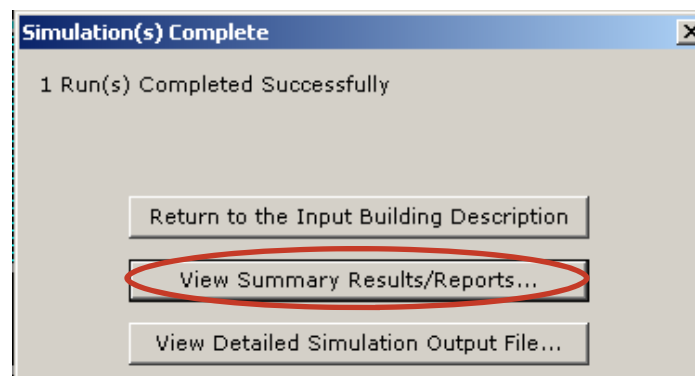
- When finished detailing DD Wizard Components click **Finish**



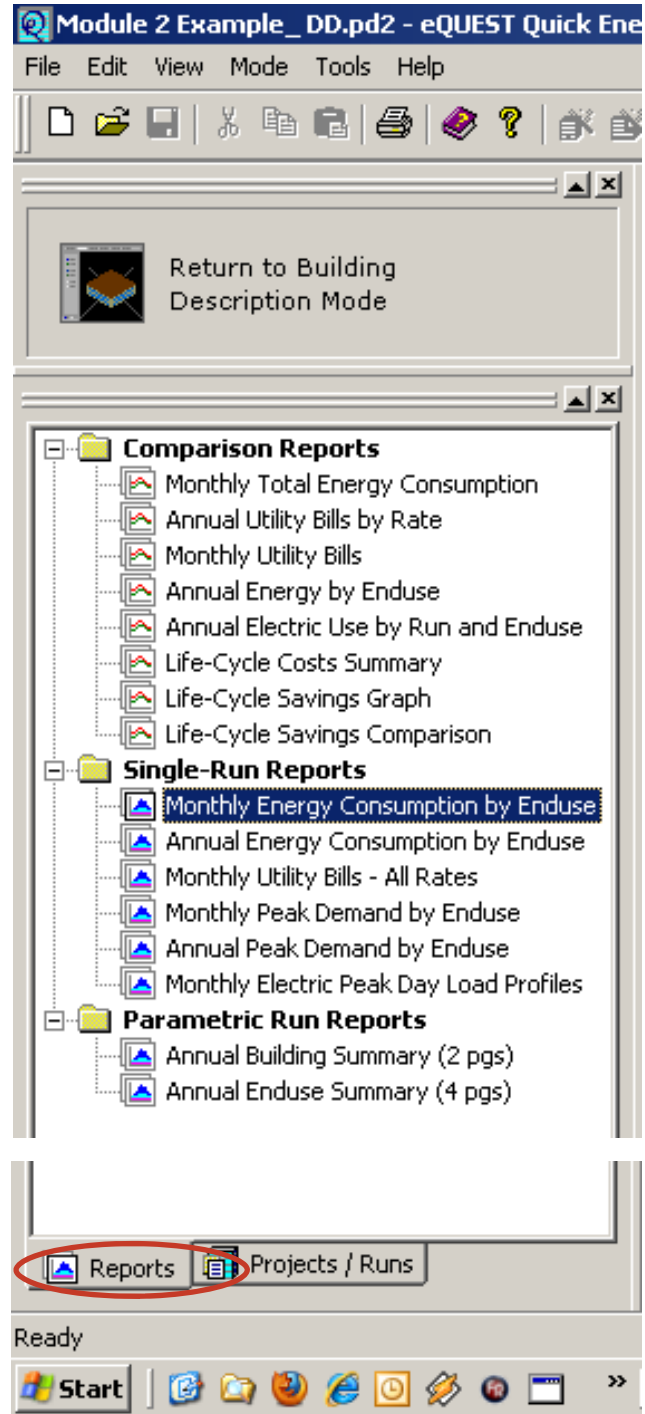
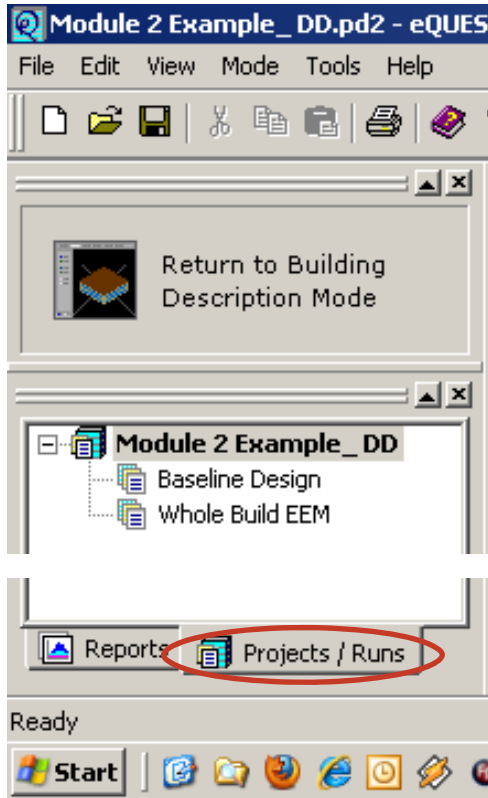
- Click **Simulate Building Performance**



- Click **View Summary Results/Reports...**



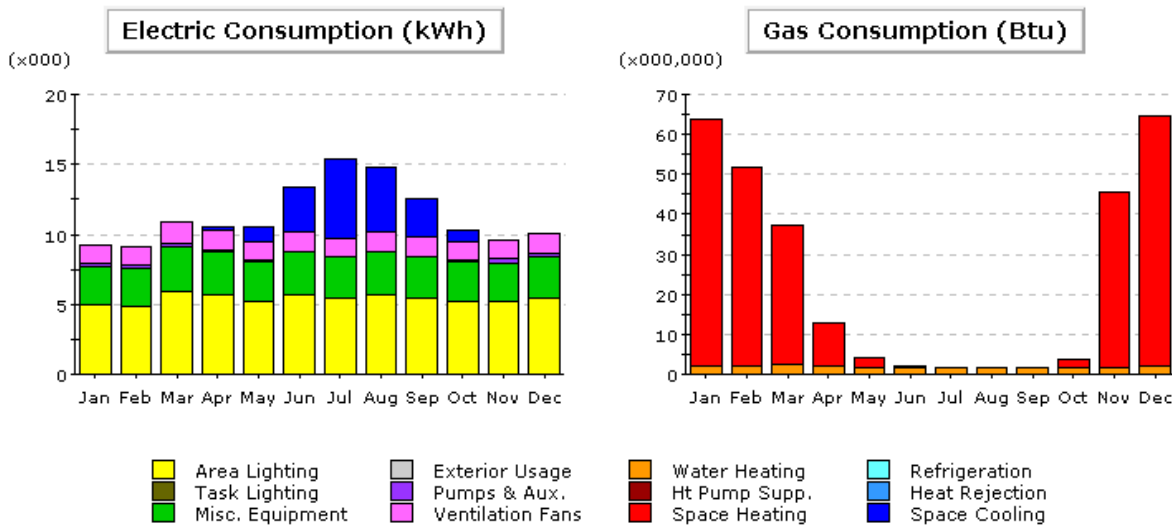
- 4. After the results and reports are done loading these two menus will be available. Click on the corresponding tab to view results



EXAMPLE

Monthly Energy Consumption by Enduse

In Module 1 we showed you the reports for one energy model. In this Module we will show you comparison report. This report breaks down the loads in our energy model into categories and shows which fuel type is used for each load category. As you can see here, our building uses gas to heat (red) in the winter and electricity to cool (dark blue) in the summer. A lot of electricity is used for area lighting (yellow), most likely because the building is not specified as daylight. Remember not to compare electricity and gas directly because they are presented in different units and at different scales in this report.



Electric Consumption (kWh x000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	0.23	1.11	3.12	5.65	4.60	2.77	0.86	-	-	18.34
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	-	-	-	-	-	-	-	-	-	-	-	-	-
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	1.25	1.25	1.51	1.44	1.31	1.44	1.38	1.44	1.38	1.31	1.31	1.38	16.41
Pumps & Aux.	0.29	0.27	0.28	0.18	0.13	0.04	0.00	0.01	0.03	0.15	0.27	0.30	1.94
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	2.72	2.67	3.19	3.05	2.84	3.05	2.95	3.07	2.94	2.83	2.82	2.95	35.08
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	4.93	4.91	5.92	5.66	5.18	5.66	5.42	5.67	5.42	5.18	5.17	5.43	64.56
Total	9.19	9.09	10.89	10.57	10.57	13.32	15.41	14.80	12.53	10.33	9.57	10.05	136.32

Gas Consumption (Btu x000,000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	61.92	49.74	34.88	10.69	2.26	0.19	-	0.01	-	2.29	43.95	62.52	268.45
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	1.89	1.93	2.31	2.17	1.86	1.86	1.66	1.66	1.58	1.59	1.71	1.94	22.17
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	63.82	51.67	37.19	12.86	4.12	2.05	1.66	1.67	1.58	3.88	45.66	64.45	290.62

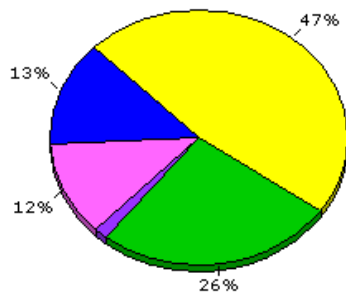
Annual Energy Consumption by Enduse

This report looks at annual loads in our energy model based on the same categories as in the Monthly Energy Consumption by Enduse report. It helps us see overall where the most fuel consumption is. As we can see here, area lighting (yellow) consumes the most electricity in the building, just as space heating (red) consumes the most gas. Remember that gas and electricity cannot be directly compared because of their units.

Annual Energy Consumption by Enduse

	Electricity kWh (x000)	Natural Gas MBtu	Steam Btu	Chilled Water Btu
Space Cool	18.34	-	-	-
Heat Reject.	-	-	-	-
Refrigeration	-	-	-	-
Space Heat	-	268.45	-	-
HP Supp.	-	-	-	-
Hot Water	-	22.17	-	-
Vent. Fans	16.41	-	-	-
Pumps & Aux.	1.94	-	-	-
Ext. Usage	-	-	-	-
Misc. Equip.	35.08	-	-	-
Task Lights	-	-	-	-
Area Lights	64.56	-	-	-
Total	136.32	290.62	-	-

- Area Lighting
- Exterior Usage
- Water Heating
- Refrigeration
- Task Lighting
- Pumps & Aux.
- Ht Pump Supp.
- Heat Rejection
- Misc. Equipment
- Ventilation Fans
- Space Heating
- Space Cooling



Electricity



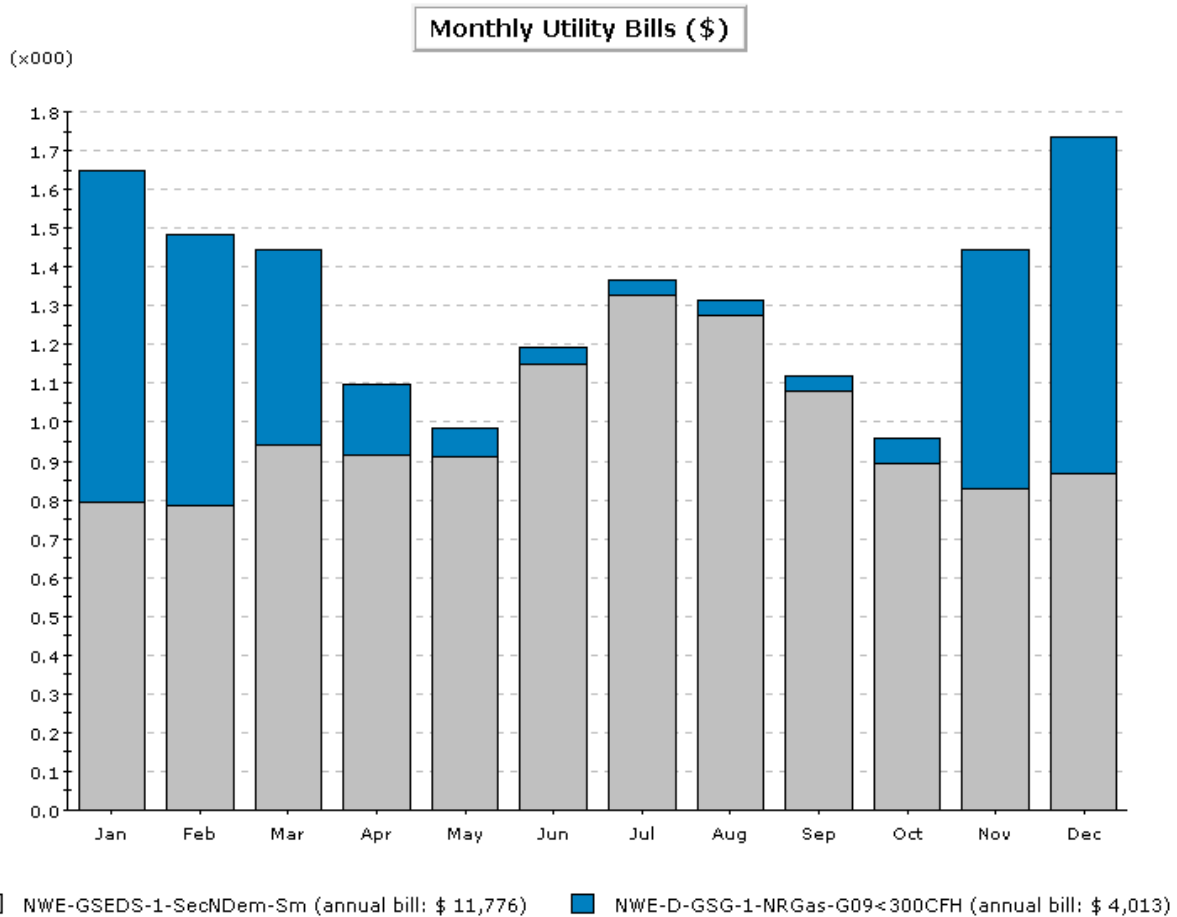
Natural Gas

EXAMPLE

Monthly Utility Bills—All Rates

This graph shows the monthly cost of each fuel over the period of a year. As you can see for our building, we are spending more overall in electricity (grey), especially in the summer when we are cooling the space. In the winter we use more gas (blue) for space heating. The utility rates for Montana sites are provided by NorthWestern Energy.

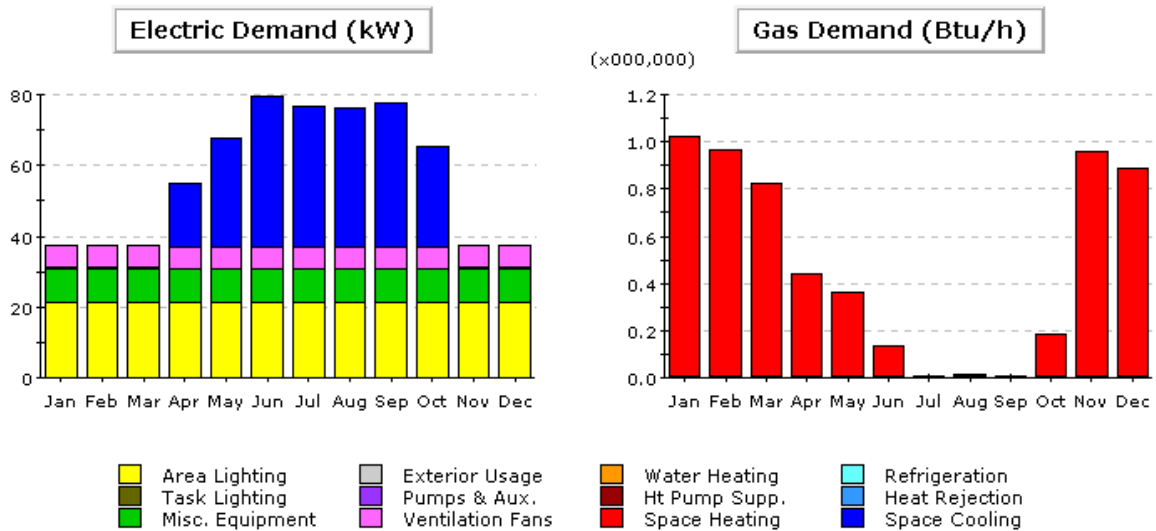
EXAMPLE



Total Annual Bill Across All Rates: \$ 15,789

Monthly Peak Demand by Enduse

This report shows the anticipated monthly peak demands for each load category. We can interpret from this report that our energy model is anticipated to have peak demands for heating (red) and cooling (dark blue) during the cold and hot months of the year, respectively. There is not a comparison report for Monthly Peak Demand by Enduse. Remember to pay attention to the units and scales of each graph and chart.



Electric Demand (kW)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	18.21	30.65	42.73	39.85	39.42	40.66	28.48	-	-	240.00
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	-	-	-	-	-	-	-	-	-	-	-	-	-
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	5.97	5.97	5.97	5.97	5.97	5.97	5.97	5.97	5.97	5.97	5.97	5.97	71.60
Pumps & Aux.	0.40	0.40	0.40	-	-	-	-	-	-	-	0.40	0.40	2.00
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	9.74	9.74	9.74	9.74	9.74	9.74	9.74	9.74	9.74	9.74	9.74	9.74	116.93
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	21.22	21.22	21.22	21.22	21.22	21.22	21.22	21.22	21.22	21.22	21.22	21.22	254.61
Total	37.33	37.33	37.33	55.14	67.58	79.66	76.78	76.34	77.59	65.41	37.33	37.33	685.14

Gas Demand (Btu/h x000,000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	1.01	0.96	0.81	0.43	0.36	0.13	-	0.01	-	0.18	0.95	0.88	5.74
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.06
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	1.02	0.96	0.82	0.44	0.36	0.13	0.01	0.02	0.01	0.18	0.96	0.89	5.80

EXAMPLE

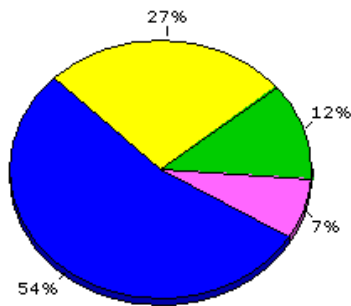
Annual Peak Demand by Enduse

Similar to the previous report, this report shows estimated annual peak demands for load categories. Once again space cooling (dark blue) and space heating (red) are the largest peak demand issues, due to the varying weather.

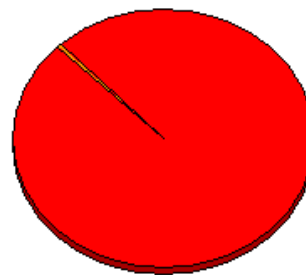
Annual Peak Demand by Enduse

	Electricity kW	Natural Gas Btu/h (x000)	Steam Btu/h	Chilled Water Btu/h
Space Cool	42.73	-	-	-
Heat Reject.	-	-	-	-
Refrigeration	-	-	-	-
Space Heat	-	1,014.9	-	-
HP Supp.	-	-	-	-
Hot Water	-	5.2	-	-
Vent. Fans	5.97	-	-	-
Pumps & Aux.	-	-	-	-
Ext. Usage	-	-	-	-
Misc. Equip.	9.74	-	-	-
Task Lights	-	-	-	-
Area Lights	21.22	-	-	-
Total	79.66	1,020.2	-	-

- Area Lighting
- Exterior Usage
- Water Heating
- Refrigeration
- Task Lighting
- Pumps & Aux.
- Ht Pump Supp.
- Heat Rejection
- Misc. Equipment
- Ventilation Fans
- Space Heating
- Space Cooling



Electricity

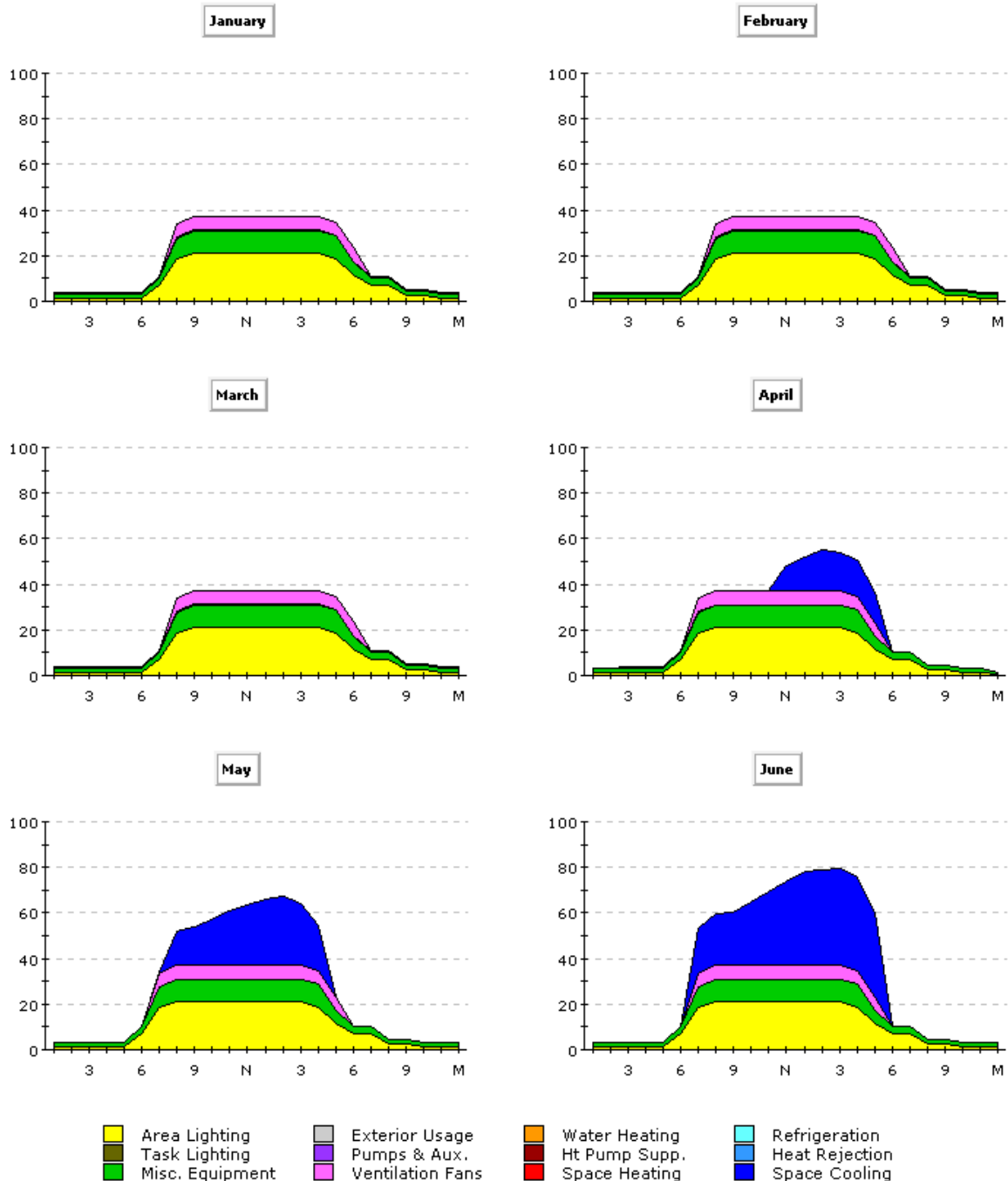


Natural Gas

EXAMPLE

Monthly Electric Peak Day Load Profiles

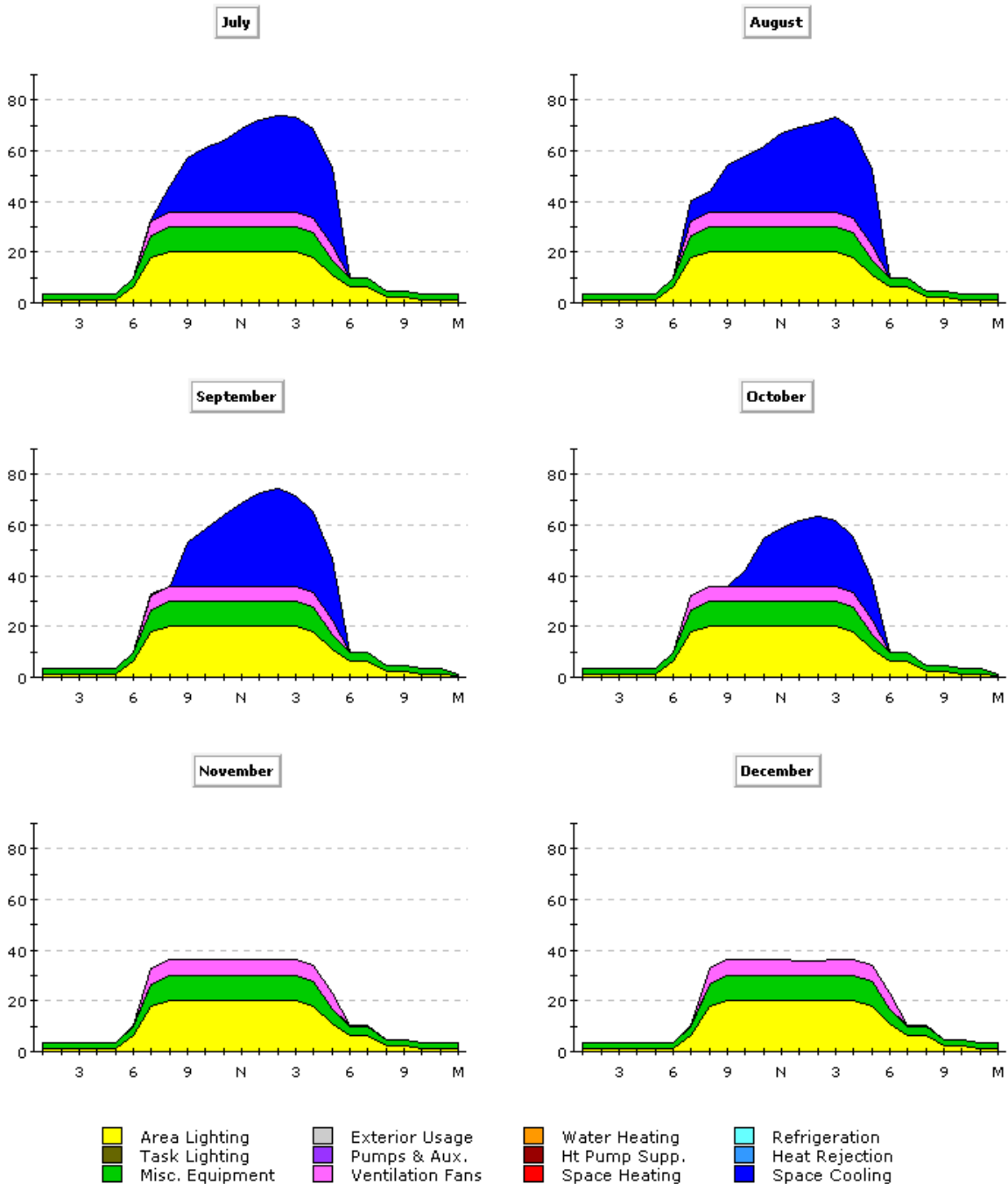
We triggered this report by selecting Hourly Enduse Profile on screen one of the DD wizard. This series of graphs shows electricity loads for the peak day in every month of the year. As you can see, our model has a large consistent cooling load (dark blue) during the summer months.



EXAMPLE

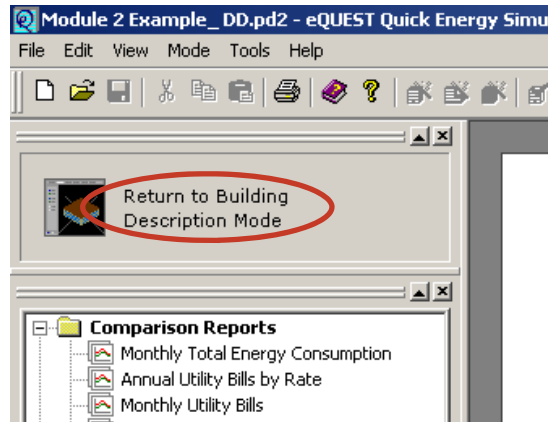
However, April, May, and October also have afternoon cooling spikes that potentially could be addressed in the design with such strategies as shading systems. Remember that you can toggle between the two pages of the report using the icons on the Floating Toolbar in the Main Results Viewport. (Page 31 of the Module Text shows these icons.)

EXAMPLE

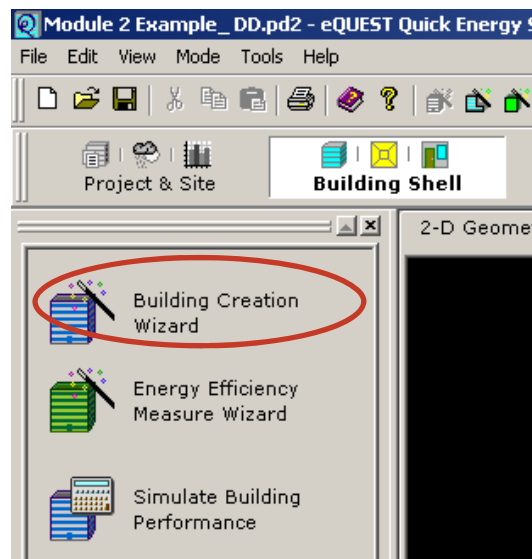


5. Make changes if necessary.

- Return to the Main eQUEST Window by clicking **Return to Building Description Mode**.



- Reenter the DD Wizard by clicking **Building Creation Wizard**.



- In the DD Wizard return to the screens that you need to adjust and make the necessary changes.
- Remember to work linearly as you make changes so as to not lose data. When you are finished, click **Return to Navigator**.
- Click **Finish**
- Click **Simulate Building Performance** and view the results again.
- Remember to **save** when you are done.


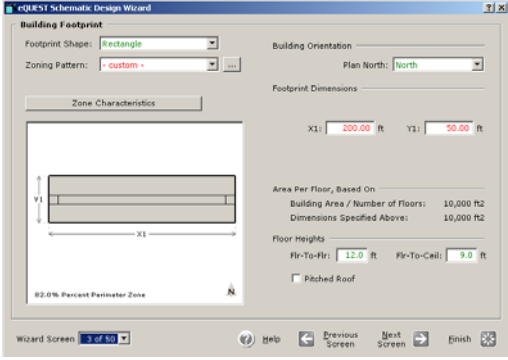
eQUEST Design Development Wizard Form

Building Shell Component

PROJECT: Module 2 Example
 DATE:

Building Shell Component

Screen 1	General Shell Information
Shell Name:	Module 2 Example
Building Type:	2-Story office Building
Shell Location: (only 2+ shells)	Billings, MT (45.78 N, 108.5 W)
Coordinates:	X: 0 Y: 0 Z: 0
Building Area:	20,000 sf
Floors:	2 floors above ground
Other Data:	

Screen 2	Building Footprint
Footprint Shape and Notes:	 <p>Rectangle X1 = 200' Y1 = 50'</p>
Zoning Pattern & Notes	<p>Custom Zone Depth = 20' (North / South) Zone Depth = 10' (East / West) Perimeter = 82%</p> 
Area per Floor:	10,000 sf
Floor Heights & Roof Pitch:	defaults

EXAMPLE

eQUEST Design Development Wizard Form

Building Shell Component

PROJECT: Module 2 Example

DATE:

Screen 3	Building Envelope Constructions
Roof Surfaces:	Metal Frame, >24 in. o.c. Roof, built-up, 'medium'(abs .6) 3 in. polyurethane (R-18) no batt or rad barrier
Above Grade Walls:	6 in CMU CMU (no ext finish) 'Medium' (abs=.6) no board insulation perlite filled R-6 wd furred insul
Ground Floor:	Earth Contact 6 in concrete vinyl tile finish no perimeter insulation
Below Grade Walls:	N/A
Infiltration:	perim: .038 CFM/ft2 core: .001 CFM/ft2

Screen 4	Building Interior Constructions
Top Floor Ceiling (below attic):	lay-in acoustic tile no ceiling insulation
Ceilings:	same
Vertical Walls:	none
Floors:	vinyl tile finish, 6 in concrete, no concrete cap, no board insulation

Screen 5	Exterior Doors
Door Types:	Glass one on each side of building
Door Construction:	7x6, single clear tint 1/4in (1001), alum w/o brk, frame width 3in

EXAMPLE

eQUEST Design Development Wizard Form

Building Shell Component

PROJECT: Module 2 Example

DATE:

Screen 6	Exterior Windows
Specification:	percent of gross wall area (floor or floor)
Window Types:	Double clr/tint, 1/4in, 1/2in air (2004), alum w/o brk, fixed, frame width 1.3in
Window Construction:	window ht 5.22ft sill ht, 3ft 40% north 40% south
Placement:	default
Gross % / Net %	flr-to-flr 32%, flr-to-ceil 42.7%

Screen 7	Exterior Window Shades and Blinds
Overhangs:	none
Fins:	none
Window Blinds/ Drapes:	none

Screen 8	Roof Skylights
Zones:	none
Amount:	
Dimensions:	
Glazing Type:	
Light Well:	
Custom Zones: (from image)	

eQUEST Design Development Wizard Form

Building Shell Component

PROJECT: Module 2 Example

DATE:

E

Screen 9	Ground Floor Daylight Zoning
Daylit From:	N/A
Photosensors: (appears only when Daylit Area is Simplified)	
Lighting control Method:	
Custom Zones: (from image)	

Screen 10	Typical (Middle) Floor Daylight Zoning
Daylit From:	N/A
Photosensors: (appears only when Daylit Area is Simplified)	
Lighting Control Method:	
Custom Zones: (from image)	

Screen 11	Top Floor Daylighting Zone
Daylit From:	N/A
Photosensors: (appears only when Daylit Area is Simplified)	
Lighting Control Method:	
Custom Zones: (from image)	

EXAMPLE

eQUEST Design Development Wizard Form

Building Shell Component

PROJECT: Module 2 Example
DATE:

Screen 12	Building Operation Schedule
Describe Settings:	defaults

Screen 13	Activity Areas Allocation
Describe Settings:	defaults

Screen 14	Zone Group Definitions
Describe Settings:	defaults

EXAMPLE

eQUEST Design Development Wizard Form

Building Shell Component

PROJECT: Module 2 Example

DATE:

Screen 15	Non-HVAC Enduse to Model
Describe Settings:	defaults

Screen 16	Interior Lighting Loads and Profiles
Describe Settings:	defaults

Screen 17	Office Equipment Loads and Profiles
Describe Settings:	defaults

Screen 18	Cooking Loads and Profiles
Describe Settings:	defaults

Screen 19	Self-Contained Refrig Loads and Profiles
Describe Settings:	defaults

Screen 20	Miscellaneous Loads and Profiles
Describe Settings:	defaults

Screen 21	Process Loads and Profiles
Describe Settings:	defaults

eQUEST Design Development Wizard Form

Building Shell Component

PROJECT: Module 2 Example

DATE

Screen 22	Motor and Air Compressor Loads and Profiles
Describe Settings:	none

Screen 23	Exterior Lighting Loads and Profiles
Describe Settings:	defaults

Screen 24	Remote Refrigeration Loads and Profiles
Describe Settings:	defaults

Screen 25	Domestic Water Heating Hourly Profiles
Describe Settings:	defaults

[Screens]	Other Notes

EXAMPLE

eQUEST Design Development Wizard Form

Air-Side System

PROJECT: Module 2 Example

DATE:

Air-Side System

Screen 1	HVAC System Definition
System Type Name:	HVAC System 1
Cooling Source:	DX Coils
Heating Source:	Furnace
Describe Settings:	Packaged Single Zone DX with Furnace System per zone Return air path: ducted
System Assignment to Thermal Zones:	Bldg Envelope & Loads 1 to All Zones

Screen 2	HVAC Zones: Temperatures and Air Flows
System(s):	Packaged Single Zone DX, Furnace
Seasonal Thermostat Setpoints:	Occupied: Cool 76F, Heat 70F Unoccupied: Cool 82F, Heat 64F
Design Temperatures:	Cooling: Indoor 75F, Supply 55F Heating: Indoor 72F, Supply 120F
Air Flows:	Min design flow 0.5cfm/ft2

Screen 3	Packaged HVAC Equipment
System:	Packaged Single Zone DX, Furnace
Cooling Settings:	Auto-size 135-240 kBtuh or 11.25-20 tons Air-Cooled Efficiency: EER 8.5 Allow Crankcase Heating
Heating Settings:	Auto-Size >=225 Kbtuh Efficiency .806

eQUEST Design Development Wizard Form

Air-Side System

PROJECT: Module 2 Example

DATE:

Screen 4	HVAC System Fans
Describe Settings:	Supply Fans Power & Mtr eff: 1.25 in. WG High Fan flow & OSA: Auto-size (with 1.15 safety factor)

Screen 5	HVAC System #1 Fan Schedules
Describe Settings:	No fan night cycling operate fans 1 hour before open and 1 hour after close Fan mode on Continuous Mon-Fri 7am-6pm Sat, Sun, Holidays: off

Screen 6	HVAC Zone Heating, Vent, and Economizers
Zone Heat Sources & Capacities:	Baseboards: none
Economizer(s):	Type: Drybulb Temp High limit: 65F Compressor: cannot run with economizer

Screen 7	HVAC System Hot/Cold Deck Resents
System:	defaults
Cold Deck Reset(s):	
Hot Deck Reset(s):	

EXAMPLE

eQUEST Design Development Wizard Form

DHW Equipment

PROJECT: Module 2 Example
 DATE:

DHW Equipment

Screen 1	Non-Residential Domestic Water Heating
Heater Type:	Storage
Heater Specifications:	Natural Gas, 1.0 gal/per/day, 54.2 kBtuh, Energy Factor, .54
Storage Tank:	Capacity: 41 gal, R-value 12.0
Water Temperatures:	supply water: 135 F, inlet equals ground temp
Pumping	0.0%

Screen 2	Residential Domestic Water Heating
Heater Type:	Default
Heater Specifications:	Default
Storage Tank:	Default
Water Temperatures:	Default
Pumping	Default

EXAMPLE

USING THE EEM WIZARD

Now that we have worked through the DD Wizard, we are going to add Energy Efficiency Measure (EEM) runs. By doing this we will be able to compare multiple strategies that affect energy efficiency.

This time we will be creating a rectangular two-story office building that is elongated on the east-west axis. We will use the EEM Wizard to create runs that explore the effects of better Building Envelope and daylighting properties in the model.

The following is a list of the basic steps for using the EEM Wizard. We will use the current DD Wizard model to perform then runs and then walk through these steps:

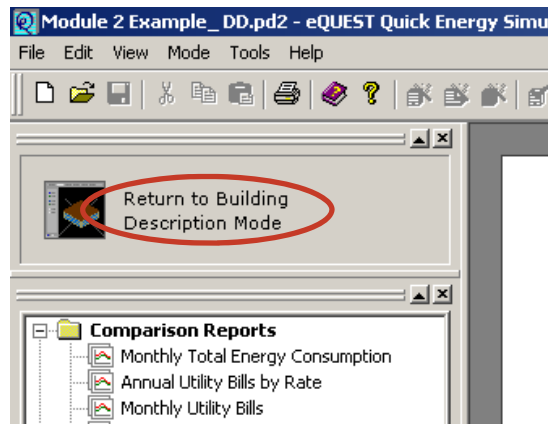
1. Decide which energy efficiency measures to investigate.
2. Open the EEM Wizard and select the basic run information.
3. Modify the run details.
4. Add more EEM runs if desired.
5. Close the EEM Wizard and simulate the building.
6. Review the results.
7. Make changes if necessary.

Have your DD forms so you know which changes you can make. You will then need the **EEM & LCC Runs Form**, found in the forms section of this module, in order to track the EEM runs as we create them.

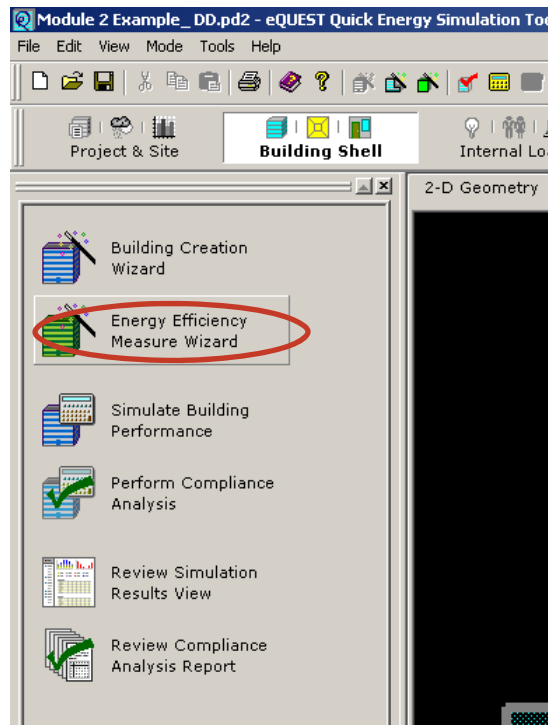
BEGIN THE EEM

Now that we have completed our baseline energy model we will build some comparison runs using the EEM Wizard.

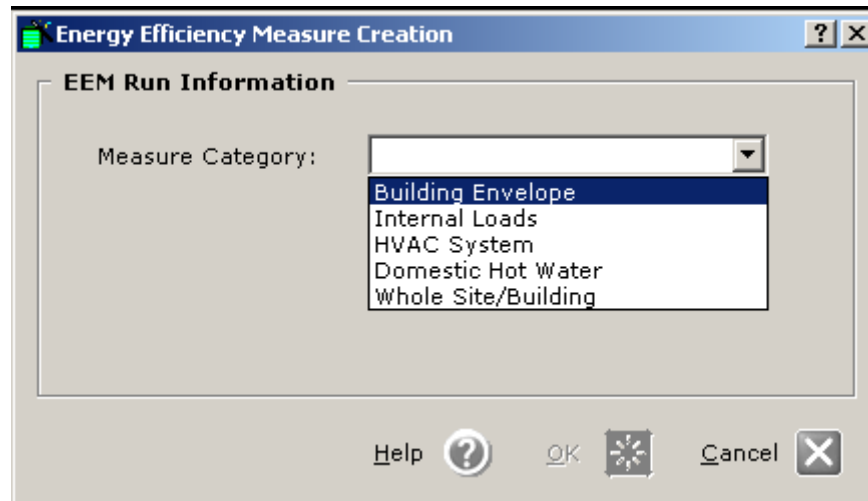
1. Click **Return to Building Description Mode** in the action tool bar.



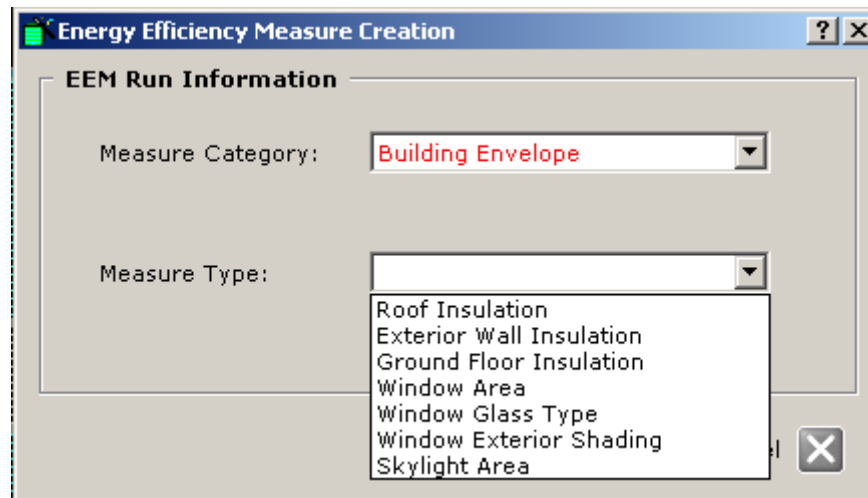
2. Open the EEM Wizard and select the basic run information.
 - In the Main eQUEST Window select **Energy Efficiency Measure Wizard**.
 - Select the desired Measure Category and Measure Type and click **OK**. For this example we will start with the Building Envelope.



- Select desired Measure Category. For this example we will choose Building Envelope

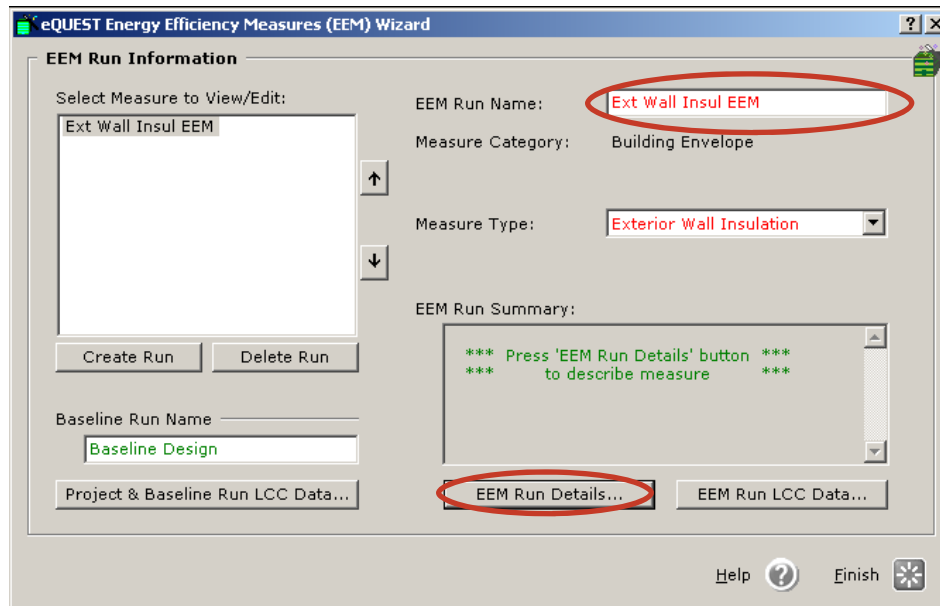


- Select desired Measure Type. Then click OK at bottom of dialog.

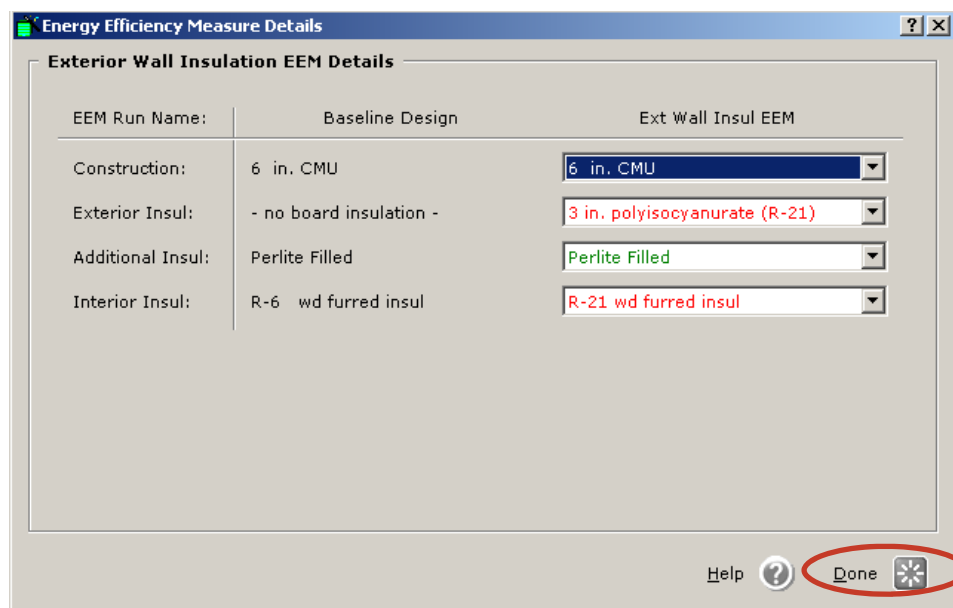


3. Modify the run details.

- Change the **EEM Run Name** if desired.
- Click **EEM Run Details...**

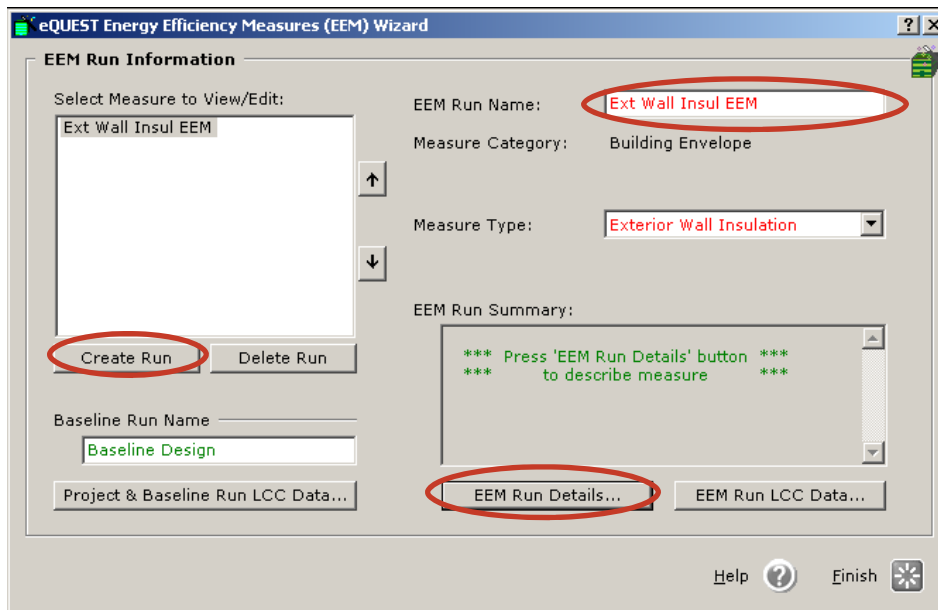


- Make desired changes and click **Done**.

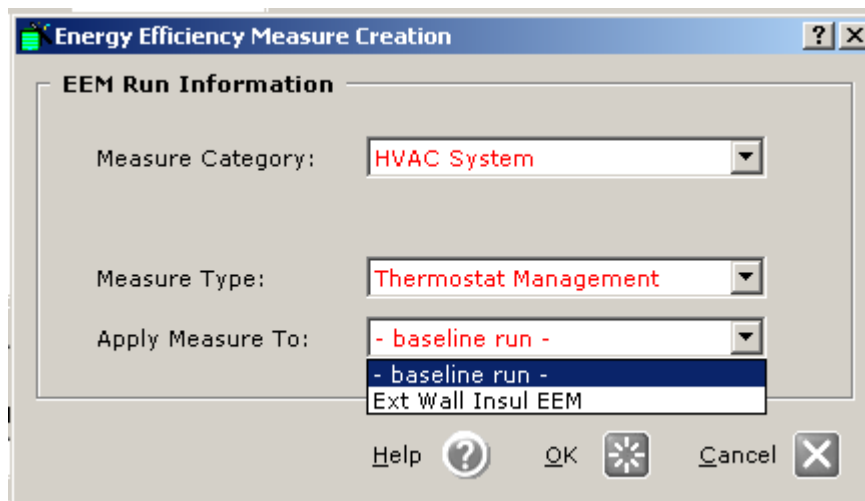


4. Adding more EEM runs.

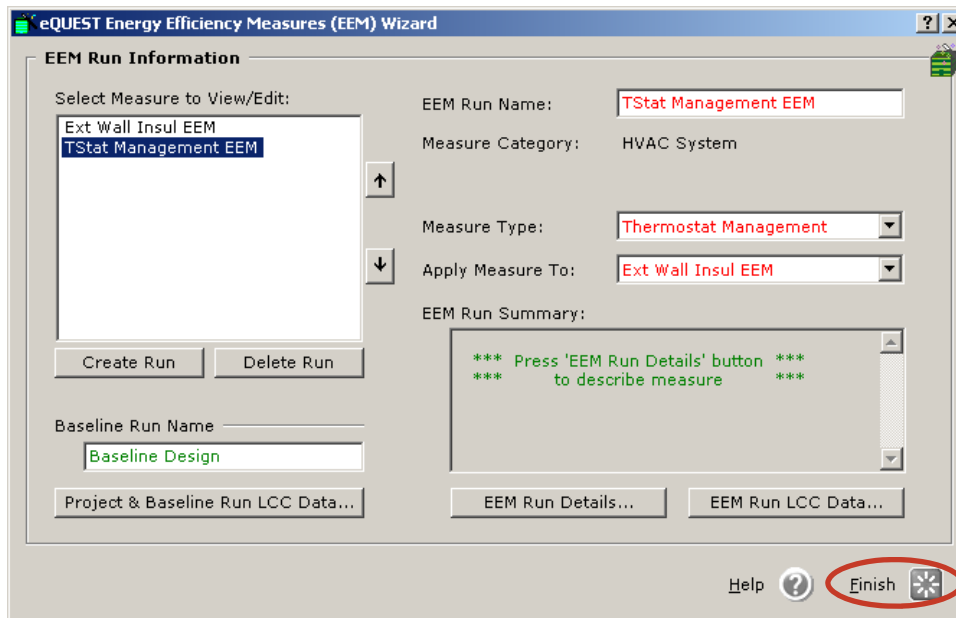
- Now we will add an EEM Run for the HVAC System. Select **Create Run**.
- Change the **EEM Run Name** if desired
- Select **EEM Run Details...**
- Make the desired changes.
- The run(s) you have already done will be listed under **Select Measure to View/Edit**



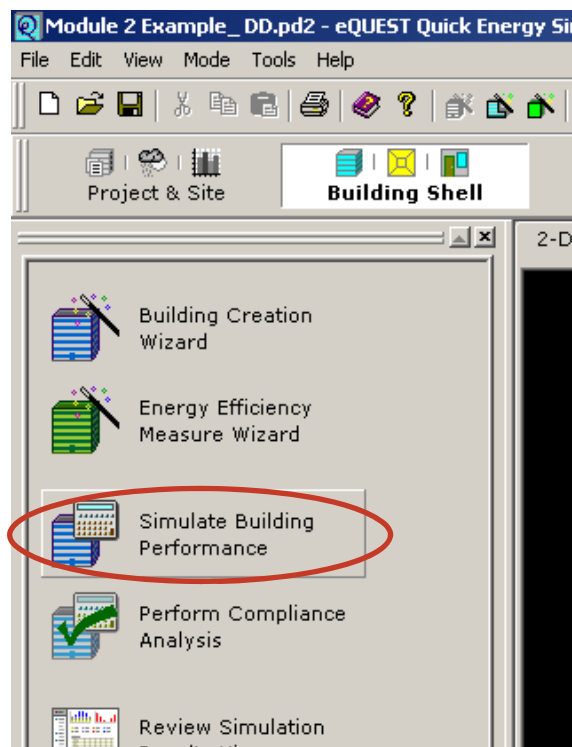
- Select an option from the **Apply Measure To** list. Choosing –baseline run– will compare this EEM run to the baseline model. Choosing Ext Wall Insul EEM or whichever EEM run is available will include previous runs in its reports.
- Create as many runs as you would like.



5. Close the EEM Wizard and simulate the building.
 - Click **Finish**.

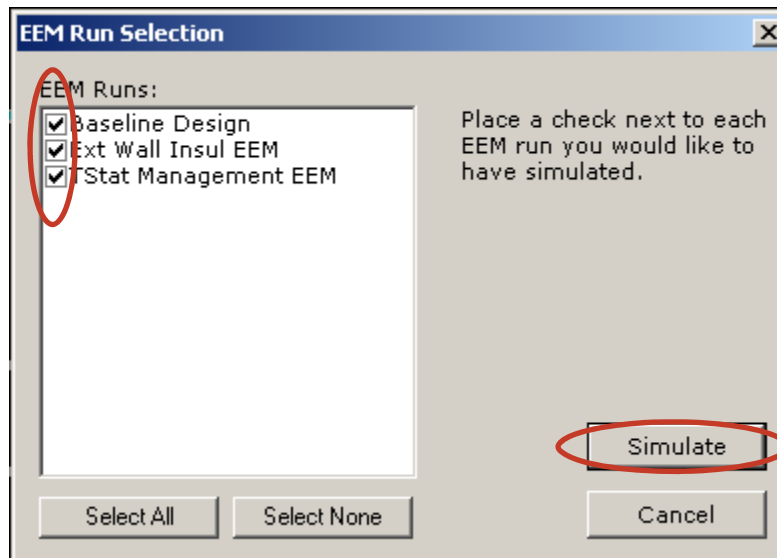


- Click **Simulate Building Performance**.

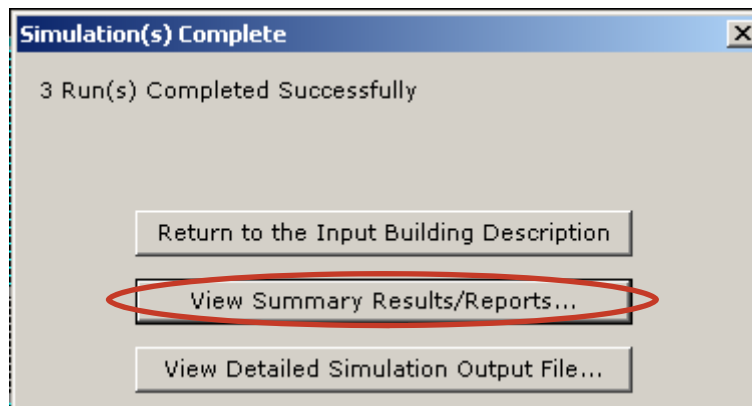


EXAMPLE

- Select all of the EEM Runs and click **Simulate**. (If eQUEST prompts you to save the file, save it!)

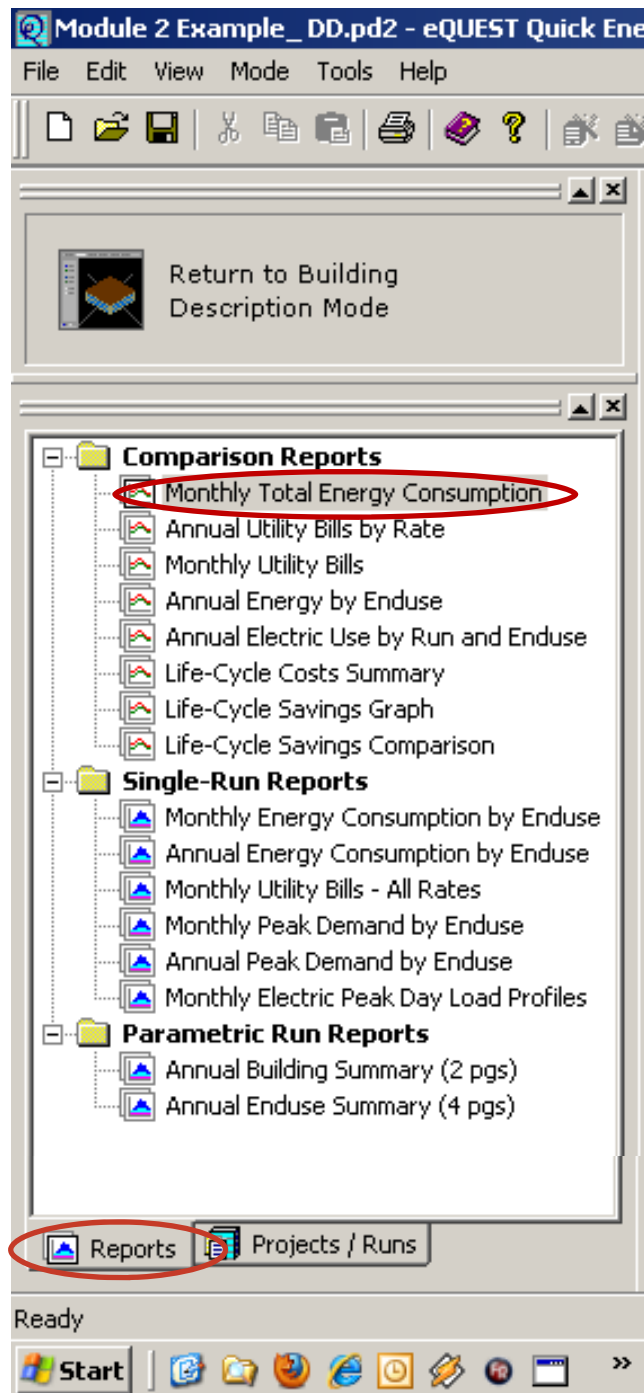


- Click **View Summary Results/Reports**



6. Review the Results.

- Click the **Reports** tab at the bottom of the screen.
- Select the **Monthly Total Energy Consumption Report** from the **Comparison Reports** list.
- Return to the **Projects/Runs** tab.



- Pages E52-E57 discuss the **Comparison Reports** and highlight what some of the results mean.
- Page E58 shows the EEM form for this example.

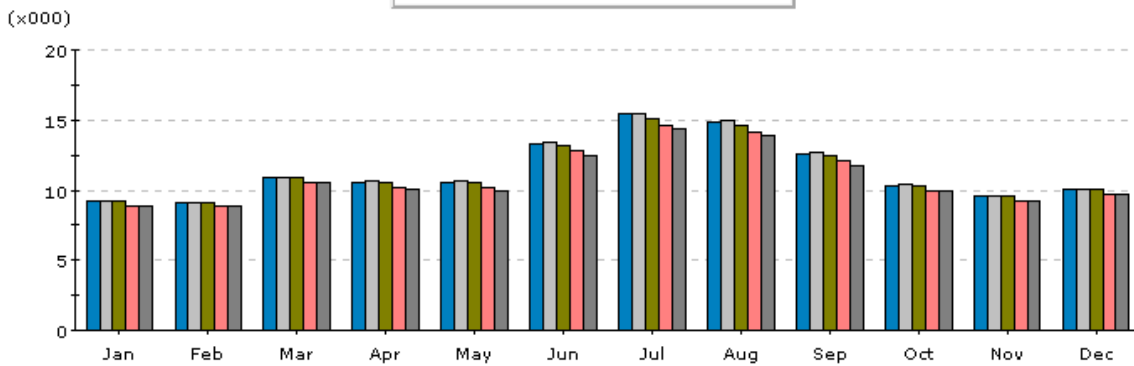
Monthly Total Energy Consumption

This report (shown on the next page) compares the electric and gas consumption of each baseline and EEM run. As with the Single Run Reports, you need to pay attention to the units and scales of the graphs so that you are not comparing fuel types inaccurately.

As you can see, eQUEST assigns each run a certain color. These colors will remain consistent throughout these types of reports UNLESS YOU CHANGE THE ORDER OF THE RUNS. For example, the run assigned "1" will always be medium blue, "2" will always be grey, etc. Keep this in mind as you are comparing report data.

EXAMPLE

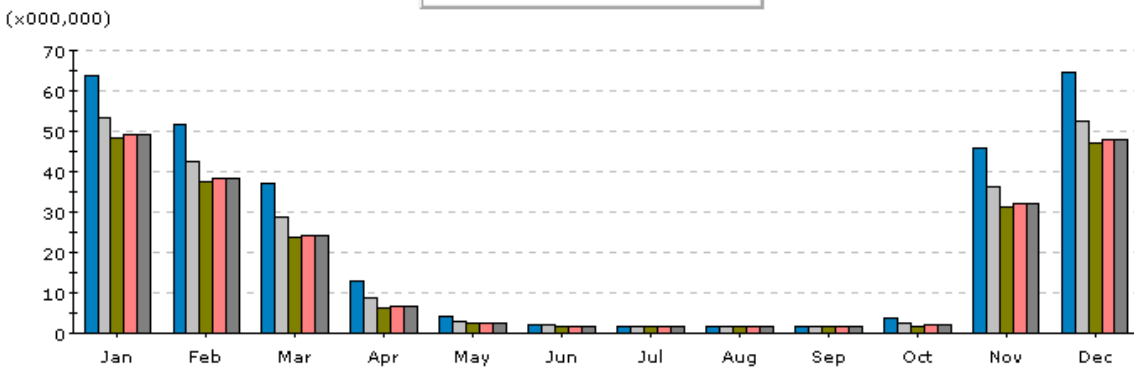
Electric Consumption (kWh)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Run 1.	9.19	9.09	10.89	10.57	10.57	13.32	15.41	14.80	12.53	10.33	9.57	10.05	136.32
Run 2.	9.19	9.10	10.90	10.61	10.63	13.40	15.49	14.92	12.67	10.44	9.58	10.06	137.00
Run 3.	9.19	9.10	10.90	10.57	10.54	13.17	15.05	14.58	12.44	10.28	9.58	10.06	135.46
Run 4.	8.90	8.81	10.55	10.22	10.21	12.78	14.65	14.18	12.08	9.94	9.27	9.74	131.33
Run 5.	8.90	8.81	10.55	10.10	9.95	12.45	14.41	13.93	11.68	9.88	9.27	9.74	129.66

- 1. Module 2 Example_DD - Baseline Design (10/14/10 @ 15:01)
- 2. Module 2 Example_DD - Ext Wall Insul EEM (10/14/10 @ 15:01)
- 3. Module 2 Example_DD - TStat Management EEM (10/14/10 @ 15:01)
- 4. Module 2 Example_
- 5. Module 2 Example_

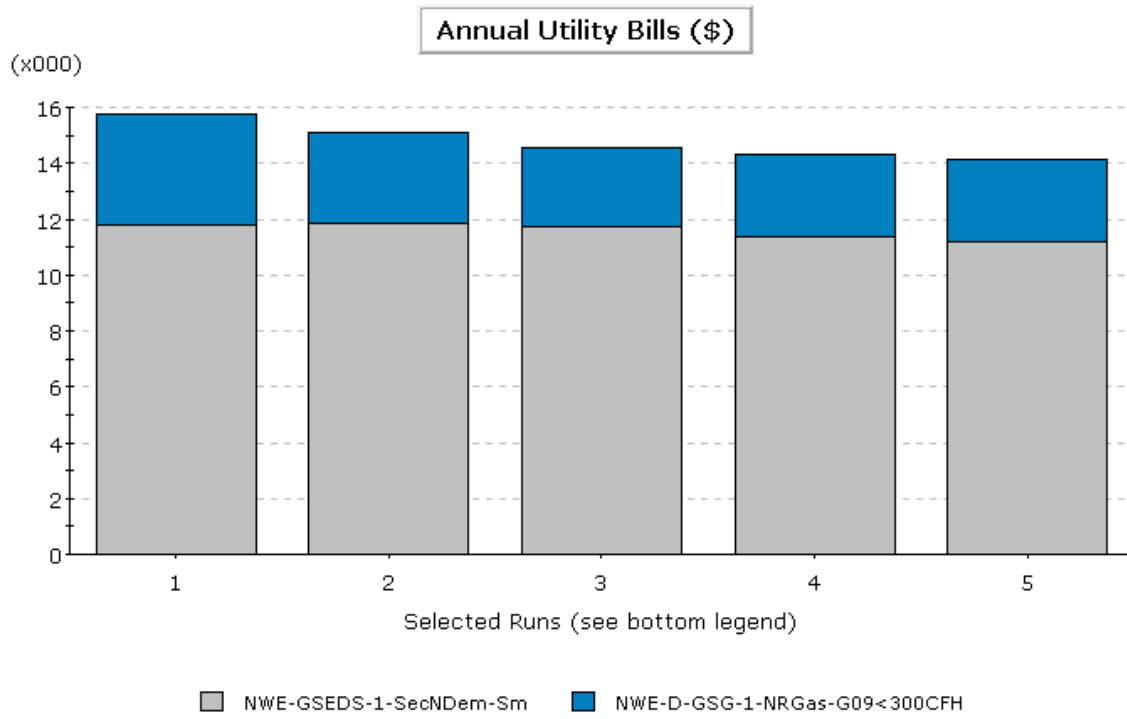
Gas Consumption (Btu)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Run 1.	63.82	51.67	37.19	12.86	4.12	2.05	1.66	1.67	1.58	3.88	45.66	64.45	290.62
Run 2.	53.24	42.31	28.64	8.92	3.05	1.89	1.66	1.66	1.58	2.65	36.19	52.41	234.20
Run 3.	48.15	37.40	23.55	6.19	2.32	1.86	1.66	1.65	1.58	1.87	31.36	46.89	204.49
Run 4.	48.96	38.20	24.30	6.52	2.37	1.86	1.66	1.65	1.58	1.90	32.08	47.84	208.93
Run 5.	48.96	38.20	24.30	6.52	2.37	1.86	1.66	1.65	1.58	1.90	32.08	47.84	208.93

Annual Utility Bills by Rate

This report shows the annual cost in dollars of the energy usage in the different EEM runs. The baseline design is the most expensive because, while is an appropriate shape and orientation for its building type, it does not take advantage of any other sustainable strategies, such as increased building envelope insulation.

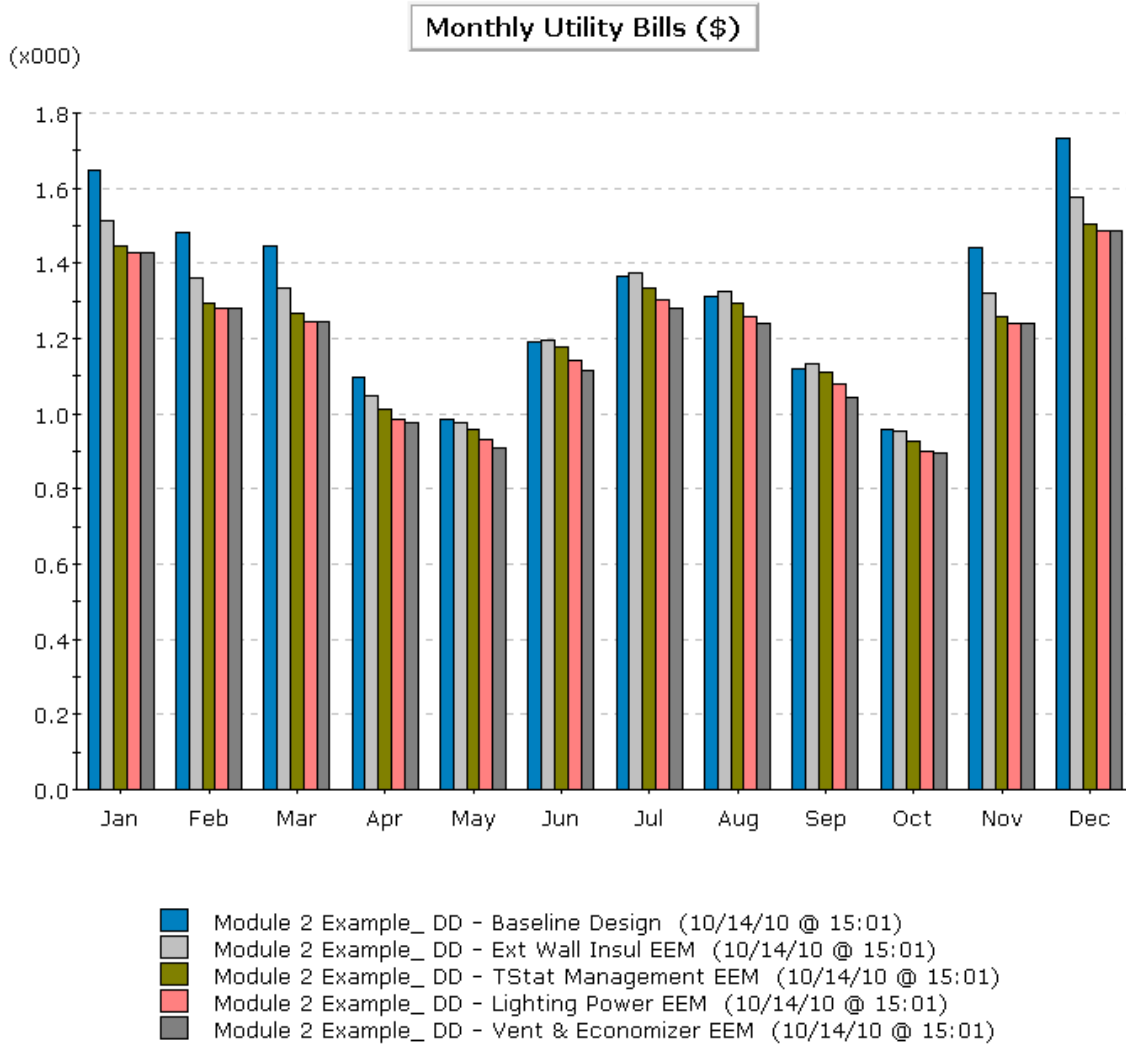


- 1. Module 2 Example_DD - Baseline Design (10/14/10 @ 15:01) (annual bill: \$ 15,789)
- 2. Module 2 Example_DD - Ext Wall Insul EEM (10/14/10 @ 15:01) (annual bill: \$ 15,104)
- 3. Module 2 Example_DD - TStat Management EEM (10/14/10 @ 15:01) (annual bill: \$ 14,581)
- 4. Module 2 Example_DD - Lighting Power EEM (10/14/10 @ 15:01) (annual bill: \$ 14,286)
- 5. Module 2 Example_DD - Vent & Economizer EEM (10/14/10 @ 15:01) (annual bill: \$ 14,143)

EXAMPLE

Monthly Utility Bills

Like the annual utility bills, this report shows the utility costs for each design according to month. There are greater costs in the winter months when heating loads increase.

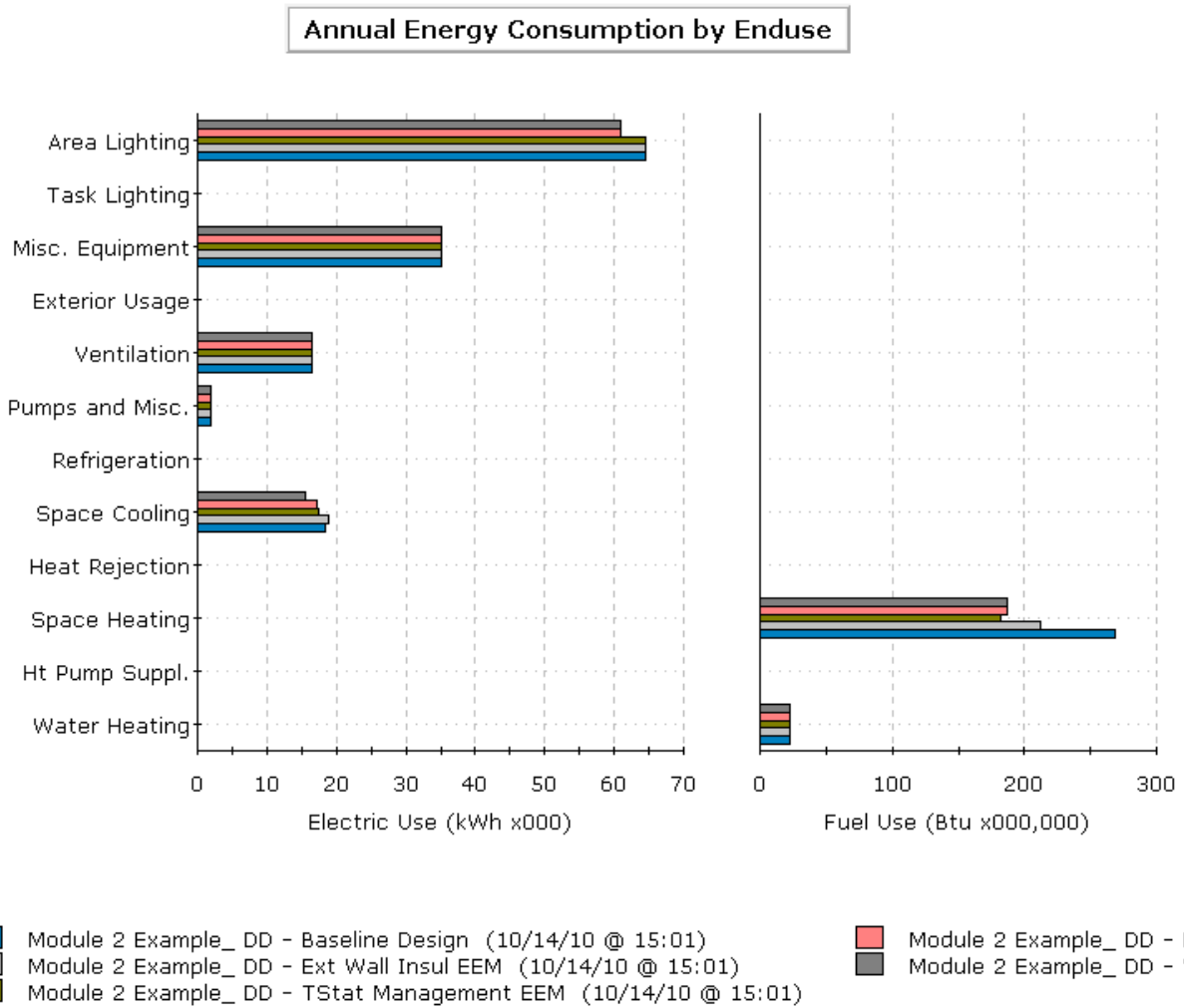


- Module 2 Example_DD - Baseline Design (10/14/10 @ 15:01)
- Module 2 Example_DD - Ext Wall Insul EEM (10/14/10 @ 15:01)
- Module 2 Example_DD - TStat Management EEM (10/14/10 @ 15:01)
- Module 2 Example_DD - Lighting Power EEM (10/14/10 @ 15:01)
- Module 2 Example_DD - Vent & Economizer EEM (10/14/10 @ 15:01)

EXAMPLE

Annual Energy by Enduse

This report helps us identify which loads are increasing and decreasing for each alternative.



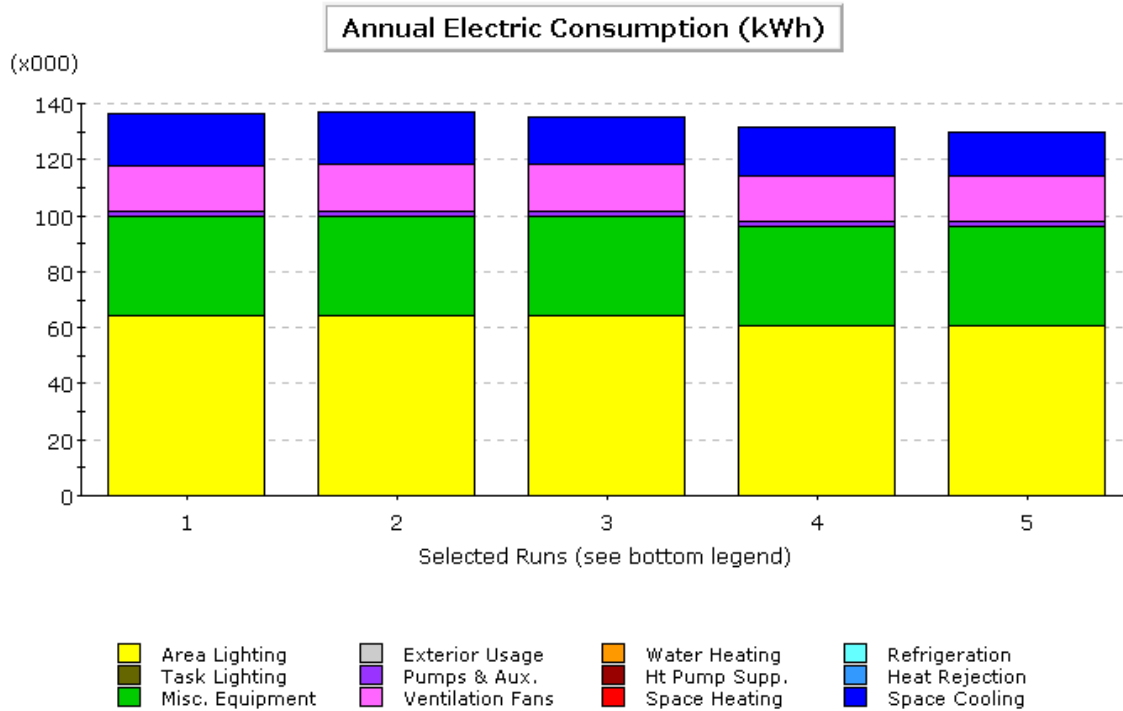
EXAMPLE

Annual Energy by Enduse

As you can see in this report, the need for space heating in the stacked run (dark gray) is reduced as compared to the run that only added daylighting.

Annual Electric Use by Run and Enduse

This final report explores the annual electricity load usage for each alternative.



1. Module 2 Example_DD - Baseline Design (10/14/10 @ 15:01)
2. Module 2 Example_DD - Ext Wall Insul EEM (10/14/10 @ 15:01)
3. Module 2 Example_DD - TStat Management EEM (10/14/10 @ 15:01)
4. Module 2 Example_DD - Lighting Power EEM (10/14/10 @ 15:01)
5. Module 2 Example_DD - Vent & Economizer EEM (10/14/10 @ 15:01)

EXAMPLE

7. Make changes if necessary.

- Click **Return to Building Description Mode**.
- Click **Energy Efficiency Measure Wizard**.
- In the wizard, click **Create Run**.
- Create another run
- Click **OK**.
- Change the **EEM Run Name**
- Click **EEM Run Details...**
- Click **Done**.
- Click **Finish** in the EEM Wizard.
- Simulate the building again by clicking **Simulate Building Performance**.
- Select all of the runs and click **Simulate**.
- When the simulation is finished, select **View Summary Results/Reports...**
- Return to the **Projects/Runs** tab

FINISHING THE EXERCISE

At this point, you can save the project and close eQUEST or continue to experiment with the project. If at any time you have questions, please refer to the module text for more in-depth explanations.

eQUEST EEM Runs and Life-Cycle Cost Analysis Forms

PROJECT: Module 2 Example

EEM RUN:	Building Envelope			
Measure Type:	Exterior Wall Insulation			
Apply Measure To:	Baseline Run			
Describe EEM Changes Made:				
- added 3 in. polyisocyanurate (r-21) - perlite filled - R-21 wd furred insulation				
LCC DATA	First Cost:		Annual Maint. Cost:	
	INVESTMENT-RELATED COSTS		OPERATIONS-RELATED COSTS	
YEAR	DESCRIPTION	COSTS	DESCRIPTION	COSTS

EXAMPLE

EEM Run:	Module 2 Example			
Measure Type:	HVAC System			
Apply Measure To:	Baseline Run			
Describe EEM Changes Made:				
Thermostat Managment				
LCC DATA	First Cost:		Annual Maint. Cost:	
	INVESTMENT-RELATED COSTS		OPERATIONS-RELATED COSTS	
YEAR	DESCRIPTION	COSTS	DESCRIPTION	COSTS

eQUEST FORMS



PROJECT:

DATE:

Building Shell Component

Screen 1	General Shell Information		
Shell Name:			
Building Type:			
Shell Location: (only 2+ shells)			
Coordinates:	X:	Y:	Z:
Building Area:			
Floors:			
Other Data:			

Screen 2	Building Footprint		
Footprint Shape and Notes:			
Zoning Pattern & Notes			
Area per Floor:			
Floor Heights & Roof Pitch:			

FORMS

PROJECT:
DATE:

Screen 3	Building Envelope Constructions
Roof Surfaces:	
Above Grade Walls:	
Ground Floor:	
Below Grade Walls:	
Infiltration:	

Screen 4	Building Interior Constructions
Top Floor Ceiling (below attic):	
Ceilings:	
Vertical Walls:	
Floors:	

Screen 5	Exterior Doors
Door Types:	
Door Construction:	

FORMS

PROJECT:
DATE:

Screen 6	Exterior Windows
Specification:	
Window Types:	
Window Construction:	
Placement:	
Gross % / Net %	

Screen 7	Exterior Window Shades and Blinds
Overhangs:	
Fins:	
Window Blinds/ Drapes:	

Screen 8	Roof Skylights
Zones:	
Amount:	
Dimensions:	
Glazing Type:	
Light Well:	
Custom Zones: (from image)	

PROJECT:
DATE:

Screen 9	Ground Floor Daylight Zoning
Daylit From:	
Photosensors: (appears only when Daylit Area is <i>Simplified</i>)	
Lighting control Method:	
Custom Zones: (from image)	

Screen 10	Typical (Middle) Floor Daylight Zoning
Daylit From:	
Photosensors: (appears only when Daylit Area is <i>Simplified</i>)	
Lighting Control Method:	
Custom Zones: (from image)	

Screen 11	Top Floor Daylighting Zone
Daylit From:	
Photosensors: (appears only when Daylit Area is <i>Simplified</i>)	
Lighting Control Method:	
Custom Zones: (from image)	

FORMS

PROJECT:

DATE:

Screen 12	Building Operation Schedule
Describe Settings:	

Screen 13	Activity Areas Allocation
Describe Settings:	

Screen 14	Zone Group Definitions
Describe Settings:	

PROJECT:
DATE:

Screen 15	Non-HVAC Enduse to Model
Describe Settings:	

Screen 16	Interior Lighting Loads and Profiles
Describe Settings:	

Screen 17	Office Equipment Loads and Profiles
Describe Settings:	

Screen 18	Cooking Loads and Profiles
Describe Settings:	

Screen 19	Self-Contained Refrig Loads and Profiles
Describe Settings:	

Screen 20	Miscellaneous Loads and Profiles
Describe Settings:	

Screen 21	Process Loads and Profiles
Describe Settings:	

FORMS

PROJECT:

DATE:

Screen 22	Motor and Air Compressor Loads and Profiles
Describe Settings:	

Screen 23	Exterior Lighting Loads and Profiles
Describe Settings:	

Screen 24	Remote Refrigeration Loads and Profiles
Describe Settings:	

Screen 25	Domestic Water Heating Hourly Profiles
Describe Settings:	

[Screens]	Other Notes

FORMS

PROJECT:
DATE:

Project / Site / Utility

Screen 1	General Information
Project Name:	
Building Type:	
Location and Jurisdiction:	
Utilities and Rates:	Electric:
	Gas:
Analysis Year:	

Screen 3	Season Definitions
Description:	
Season 1:	
Season 2:	
Season 3:	
Holiday Changes:	

Screen 4	Electric Utility Charges
Rate Name:	
Type:	
Block Type:	
Season 1	
Season 2	

PROJECT:

DATE:

Screen 6	Fuel Utility Charges
Rate Name:	
Type:	
Block Type:	
Season 1	
Season 2	

Screen 7	Project Information
Building Location:	
Building Owner:	

DD WIZARD CHECKLIST	
Project / Site / Utility	
Bldg. Shells (list)	
Air-Side Systems (list)	
Package HVAC Plant Equipment	
WSHP Plant Equipment	
GSHP Plant Equipment	
CHW Plant Equipment	
HW Plant Equipment	
DHW Plant Equipment	

PROJECT:
DATE:

CHW Plant Equipment

Screen 1	Cooling Primary Equipment
Chilled Water System:	
Describe Up To 2 Chillers:	

Screen 2	Primary Equipment Heat Rejection
Water-Cooled Condenser / Cooling Tower	
Remote Evaporatively-Cooled Chiller Condenser	

Screen 3	Chilled Water System Control and Schedule
Setpoint is:	
Setpoint Value:	
Operation:	
Typical Use:	
Season #2:	
Season #3:	

PROJECT:

DATE:

DHW Equipment

Screen 1	Non-Residential Domestic Water Heating
Heater Type:	
Heater Specifications:	
Storage Tank:	
Water Temperatures:	
Pumping	

Screen 2	Residential Domestic Water Heating
Heater Type:	
Heater Specifications:	
Storage Tank:	
Water Temperatures:	
Pumping	

PROJECT:
DATE:

GSHP Plant Equipment

Screen 1	Ground-Source Heat Pump Equipment
Water Loop Properties:	
Soil Thermal Properties & History:	

WSHP Plant Equipment

Screen 1	Water-Source Heat Pump Equipment
Water-Source HP System:	
Water-Cooled Condenser / Cooling Tower:	
Boiler and Boiler Pump:	

FORMS

PROJECT:

DATE:

HW Plant Equipment

Screen 1	Heating Primary Equipment
Hot Water System:	
Describe Up To 2 Boilers:	

Screen 2	Hot Water System Control and Schedule
Setpoint is:	
Setpoint Value:	
Operation:	
Typical Use:	
Season #2:	
Season #3:	

[Screens]	Other Notes