PNNL-14376

Pacific Northwest
National Laboratory
Operated by Battelle for the
U.S. Department of Energy

Energy Efficient and Affordable Small Commercial and Residential Buildings Research Program

Instructions for Installation of the Whole-Building Diagnostician Software Release 2.10-162

Project 2.6 – Enhancement of the Whole-Building Diagnostician

Task 2.6.3 – Installation Instructions

T. Carlon
N. Bauman

August 2003

Prepared for the U.S. Department of Energy
under Contract DE-AC06-76RL01830

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor Battelle Memorial Institute, nor any of their employees, makes **any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights**. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof, or Battelle Memorial Institute. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

PACIFIC NORTHWEST NATIONAL LABORATORY
operated by
BATTELLE
for the
UNITED STATES DEPARTMENT OF ENERGY
under Contract DE-AC06-76RL01830

Printed in the United States of America

Available to DOE and DOE contractors from the
Office of Scientific and Technical Information,
P.O. Box 62, Oak Ridge, TN 37831-0062;
ph: (865) 576-8401
fax: (865) 576-5728
email: reports@adonis.osti.gov

Available to the public from the National Technical Information Service,
U.S. Department of Commerce, 5285 Port Royal Rd., Springfield, VA 22161
ph: (800) 553-6847
fax: (703) 605-6900
email: orders@ntis.fedworld.gov
online ordering: http://www.ntis.gov/ordering.htm


This document was printed on recycled paper.
(8/00)

Energy Efficient and Affordable Small Commercial and Residential Buildings Research Program

Instructions for Installation of the Whole-Building Diagnostician Software Release 2.10-162

Project 2.6 – Enhancement of the Whole-Building Diagnostician

Task 2.6.3 – Installation Instructions

Teresa A. Carlon
Nathan N. Bauman

August 2003

Prepared for
the U.S. Department of Energy
Office of Energy Efficiency and
Renewable Energy
under Contract DE-AC06-76RL01830

Pacific Northwest National Laboratory
Richland, Washington 99352

Installation and Configuration Instructions for the Whole-Building Diagnostician Software Release 2.10-162

Welcome to the Whole-Building Diagnostician™ (WBD) Software tool developed by a U.S. Department of Energy (DOE) team led by Pacific Northwest National Laboratory [1] (PNNL) and enhanced under funding from the California Energy Commission (CEC) and the U.S. Department of Energy. The WBD is modular diagnostic software that detects and diagnoses common problems associated with heating, ventilating, and air-conditioning (HVAC) systems and equipment. The software has two modules--one to monitor whole-building energy use (the whole-building energy module or WBE) and one to detect and diagnose problems associated with outdoor-air control and economizer operation in air-handling units (AHUs) (the outdoor air and economizer module or OAE).

The CD for the Enhanced Version contains an executable version of the WBD 2.10-162 software plus a database for viewing a set of representative WBE results. This version includes new features of the WBE module developed as part of the Energy Efficient Buildings Research Program of the California Energy Commission.

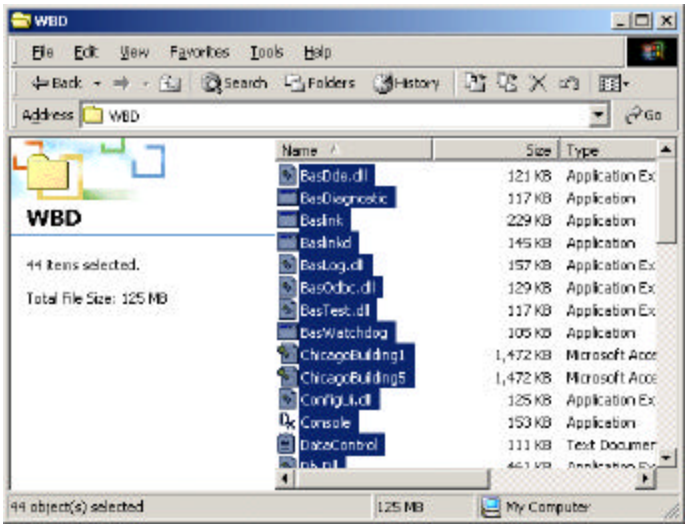
This instruction document describes how to install the WBD and the Microsoft Data Access Object® (DAO) components, how to view the results in the demo database, and the new features of the WBE. If you are upgrading or reinstalling the WBD, you do not need to install Microsoft DAO but should follow the instructions for *Preparing to Install the Enhanced WBD, Release 2.10-162*.

Preparing to Install the Enhanced WBD, Release 2.10-162

Because Build 162 of the WBD incorporates changes to the underlying WBD database, it is easiest to delete previous versions of the WBD from your computer before installing this version.

1. To remove earlier versions of the WBD, navigate to the C:/Programs/WBD subfolder on your hard disk (if you used the default directory when installing the WBD previously) or the alternate folder in which you installed previous versions of the WBD.

2. Highlight all files in this directory using your mouse and then push the “Delete” key.



[1] Operated for U.S. DOE by Battelle.

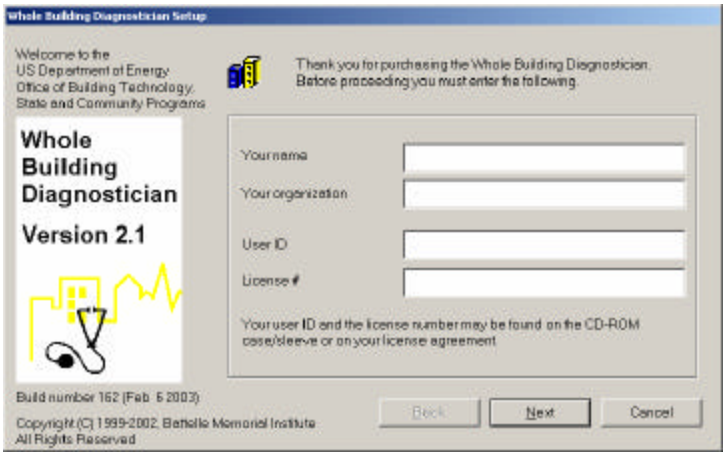
3. The dialog box at right will appear. Click "**Yes**." This should delete all files for previously installed versions of the WBD. You are now ready to install Release 2.10-162.

Installation Instructions for the Whole-Building Diagnostician Software

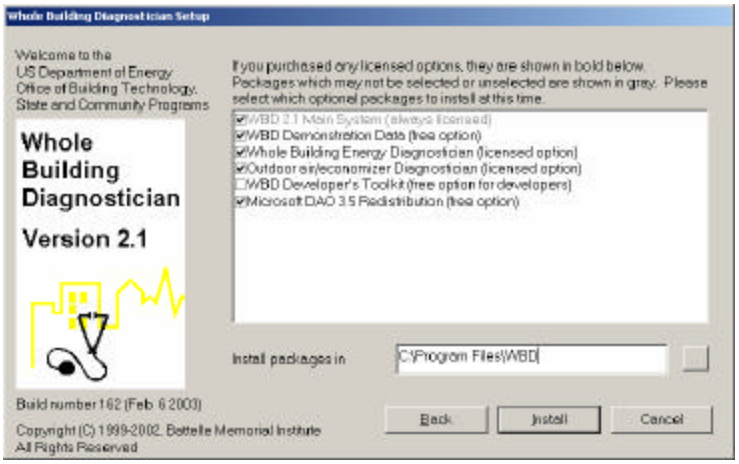
4. To install the Whole-Building Diagnostician (WBD) software, insert the WBD 2.10-162 installation CD into your CD-ROM drive. The setup program should run automatically. If the setup program fails to run automatically, use the Windows Explorer (in Windows 95) or My Computer (in Windows 98 or higher) to navigate to the CD-ROM drive on your computer, find the program "**setup.exe**," and double click on it. This will start the installation process.

Whole-Building Diagnostician

5. Follow the steps provided by the installation wizard. You will need to provide your User ID and License number, which can be found on the back of the CD case. Click "**Next**" when finished.



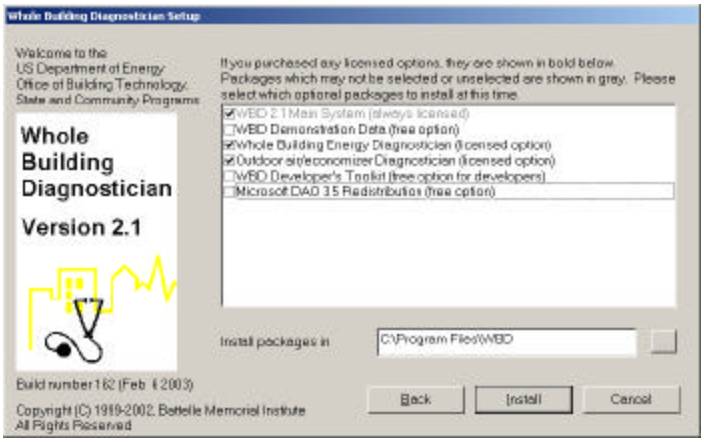
6. Next the installation wizard will give you several "component installation" choices. The components available are based on your software license. Select the components you wish to install now by clicking on them (you should then see a check mark before each component selected).



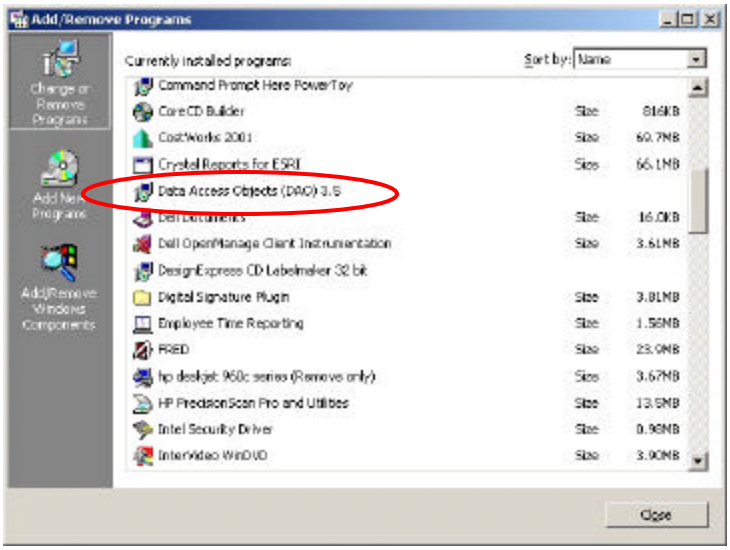
By default, the WBD will be installed in "C:\Program Files\WBD." Typing a new directory name and path in the white area near the bottom of the page will change this directory.

The WBD software (executable, dynamic link library, and ancillary files) needs less than 10 Mbytes of space on your hard disk. The demonstration databases,

however, need approximately 100 Mbytes of disk space, so the total required for initial installation of the WBD plus demonstration databases is about 110 Mbytes. These files must all be installed in the same directory.

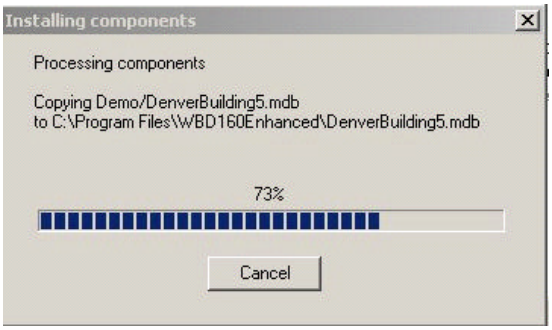


7. The WBD requires Microsoft DAO 3.5 installed on your computer in order to run. If you already have DAO 3.5 installed, you do not need to install it again. To determine if you have it installed, do the following: from the Start button, select "Settings" and then "Control Panel." On the "Control Panel", double click on the "**Add/Remove Programs**" icon. The dialog box at right (or one very much like it in Windows NT or XP) will appear. If this dialog box is not already showing, select the "Install/Uninstall" tab (or "Change or Remove Programs" in Windows 2000). Check the list of programs installed. If Data Access Object 3.5 is not on the list, you will need to install it; proceed to step 10. If DAO 3.5 is on the list (already installed), continue to step 8.

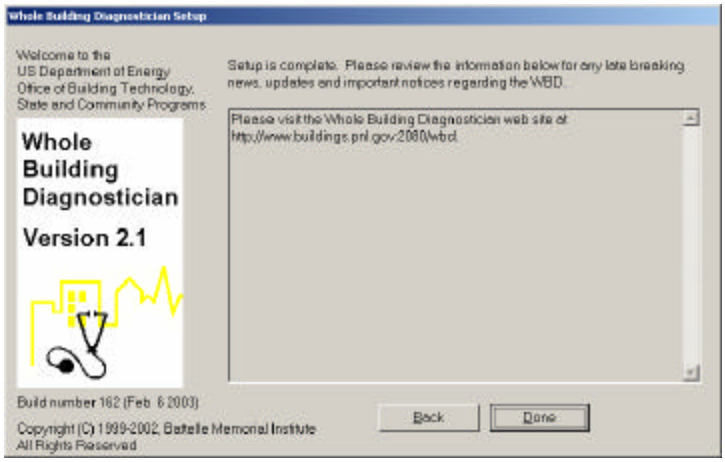


8. After selecting the components and installation directory, click on the "**Install**" button to begin copying files.

   You will see the progress window at right during installation.



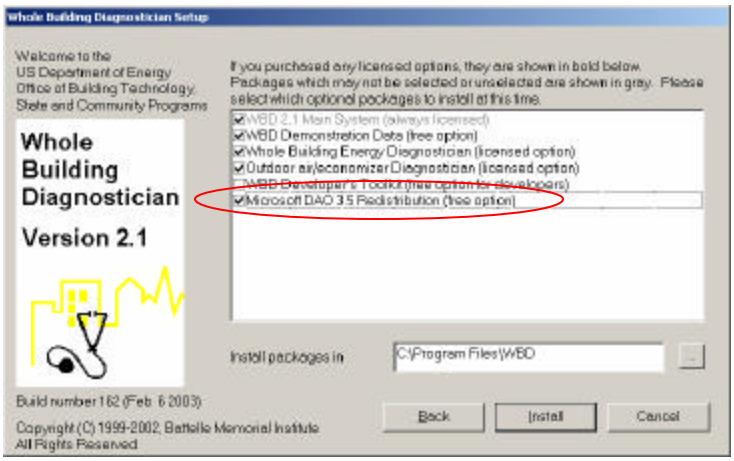
9. The screen at right will display when installation is complete. Click on the "**Done**" button to leave the installation program. You are now ready to start using the WBD. For instructions, please refer to the "Viewing the Demonstration Database" and "Exploring the Enhanced WBE Features" sections later in this document. Skip to step 14, *Viewing the Demonstration Database.*



Installation Instructions for Microsoft DAO

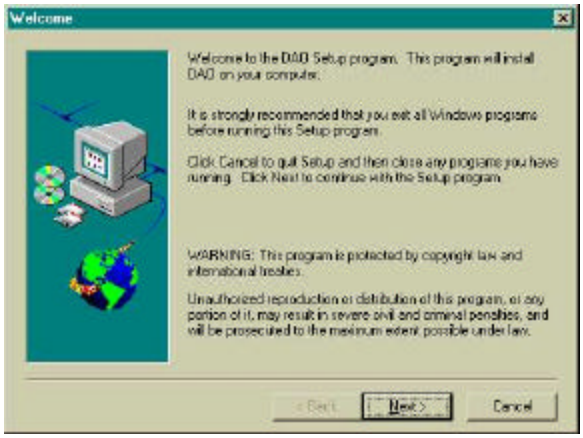
These instructions should be followed, only if in step 7 you found that you do not have Microsoft DAO 3.5 already installed.

10. On the component selection screen, make sure you select the “Microsoft DAO 3.5” box. After selection, a check mark should appear in the box. After you have selected all licensed components that you want to install now (see step 6 for additional guidance), click on “**Install**.”

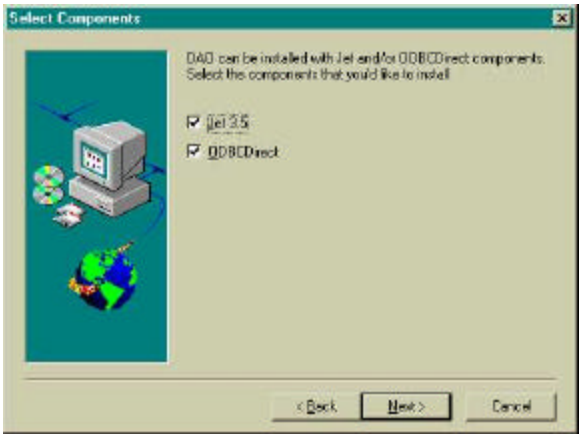


11. During the DAO installation, a sequence of dialog boxes will appear in the “Data Access Objects (DAO) Setup” window. Do not change any entries in these dialog boxes. Simply click the “**Next**” button to reveal the next dialog box. If any additional dialogs appear during installation, click “**OK**” or “**Next**” to continue installation.

Click "**Next**"



Click "**Next**"

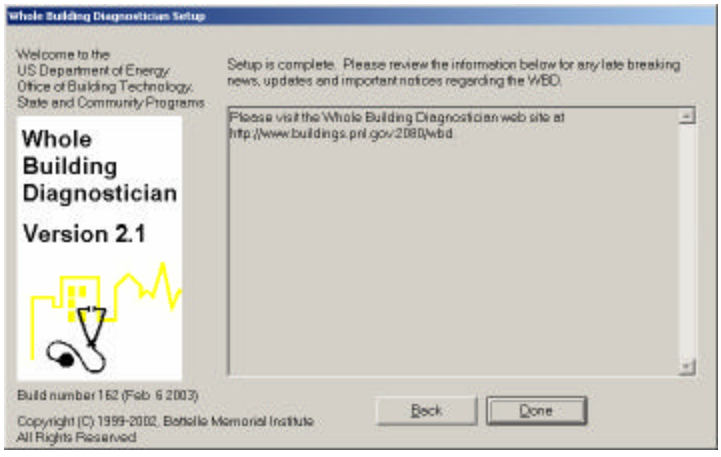


Click "**Next**"

Click "**Next**"

12. After clicking “Next” on the last dialog, a progress indicator will appear in the “Data Access Objects (DAO) Setup” window. If any additional dialogs appear during installation, click “**OK**” or “**Next**” to continue installation. When installation of the DAO is complete, a Windows information box will appear with the message “Data Access Objects (DAO) successfully installed.” Click on the “**OK**” button.

13. The WBD installation program will then display the window at right indicating that installation is complete. Click on the “**Done**” button to leave the installation program. You are now ready to start using the WBD. Please refer to the “Viewing the Demonstration Database” and “Exploring the Enhanced WBE Features” sections of this document, which follow.

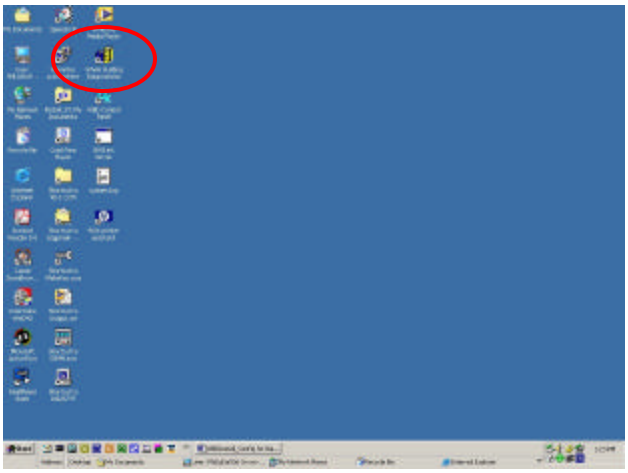


Viewing the Demonstration Database

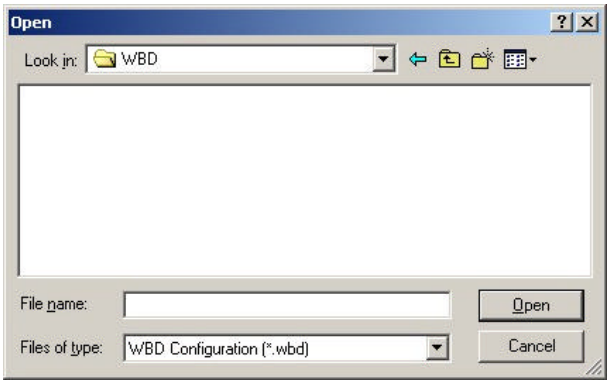
The enhanced version of the WBE contains a database for viewing a set of representative results and examining the new features of the WBE module developed as part of the Energy-Efficient Buildings Research Program of the Energy Commission. To create a new database, see the companion document *Instructions for Configuration of the Whole-Building Diagnostician Software Release 2.10-162*.

After successfully installing the WBD and the Microsoft DAO®, the WBD can be used to process new data or view processed results. These instructions will help you start exploring the enhanced version of the WBE.

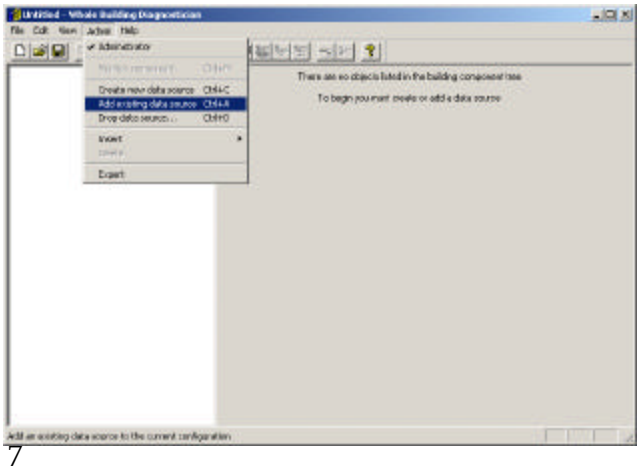
14. To run the WBD, double-click on the **WBD** shortcut icon on your desktop. You may also launch the WBD by navigating to the directory in which the WBD was installed and double clicking on the file named "WBD."



15. Once the WBD is launched, the dialog box shown to the right should appear. Click "**Cancel**."

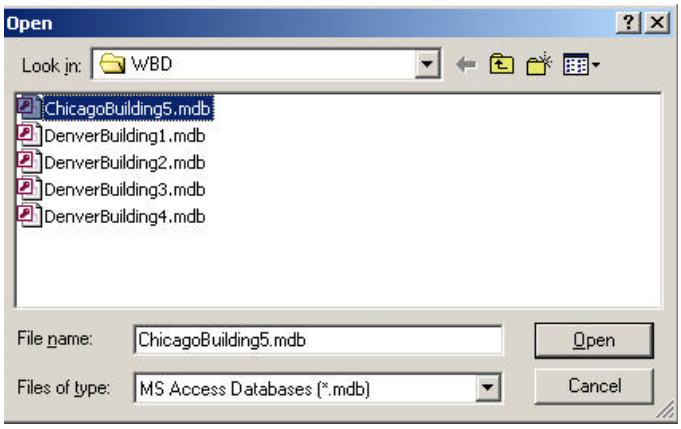


16. The window at right will appear. On the "**Admin**" pull down menu, click on "**Add existing data source**."

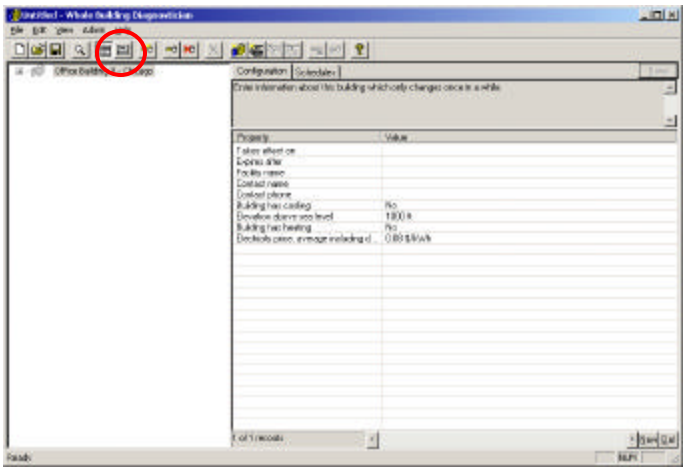


17. The “Open” dialog box will appear. This will list all the Microsoft Access® databases that are present in the WBD installation directory. For the WBE demonstration, click on the database name **ChicagoBuilding5.mdb** to highlight it. Then click “**Open**.”

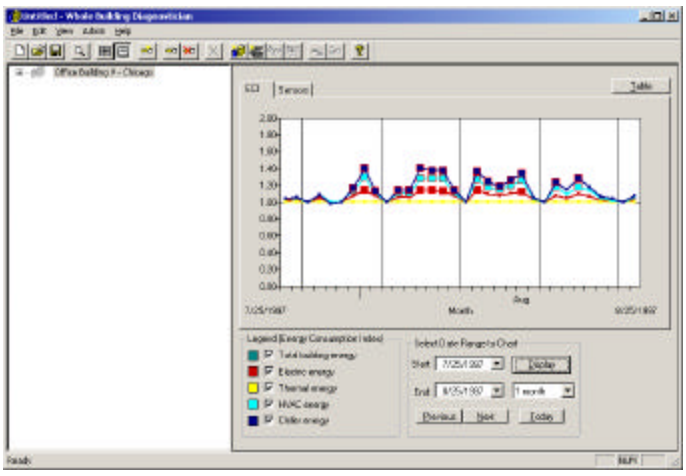
    If the demonstration database is installed in a directory other than the WBD installation directory, including the case where it was not installed but is on your CD-ROM, navigate to that directory (as you would normally to explore files). If using demo data from the CD, select the "Demo" subdirectory on the CD. To select the demonstration database, click on its name, then click "**Open**."



18. After selecting the database, a window like the one to the right will appear. This window is a WBD setup screen, which is used for configuring the software for a new building or equipment that will be monitored with the WBD. Click on the icon identified by the red circle, “**View diagnostic results**”.

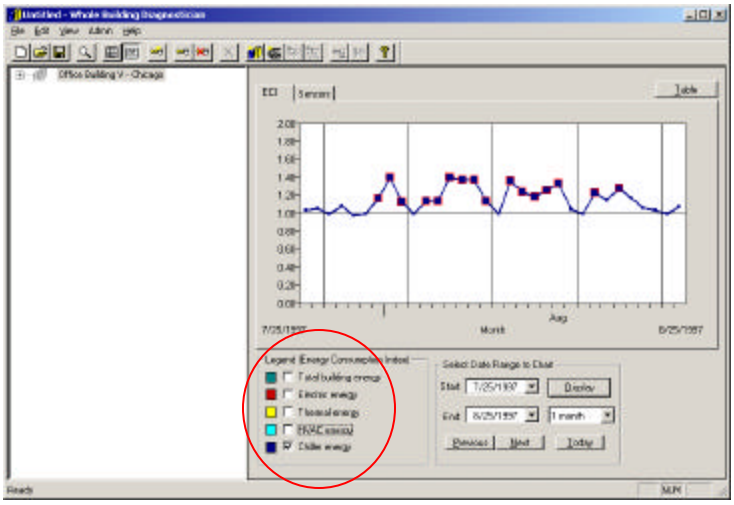


19. This will change the window to the one displayed on the right. The left panel of this window provides a tree of all buildings and equipment identified in the databases selected, in this case only the WBE Demo building. The right panel of the window shown here is the graphic display for the WBE module. If the data shown in the graph at right do not display, click on all of the check boxes in the Legend. The data will then display. You are now ready to explore features of the WBE.



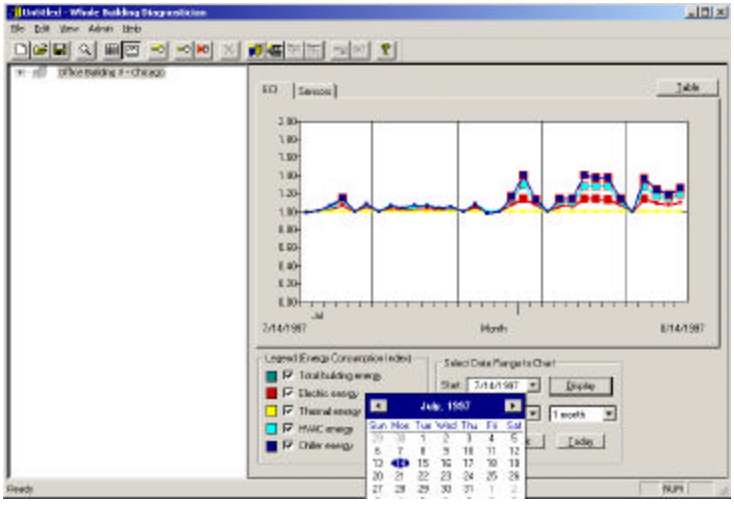
The graph shows values of the Energy Consumption Index (ECI) for each day of the time period displayed. A separate ECI is shown for each of the five energy uses, which are identified by color coding in the Legend. The ECI is the ratio of actual energy use to the expected energy use. The expected energy use is determined by an empirical model in the WBE software for each tracked energy use. A value of each of the ECIs is shown for each day in the range displayed. Values of the ECI around 1.0 indicate that the building and its energy systems are performing as expected. Values substantially different than 1.0 indicate an energy-use anomaly.

20. The specific energy uses for which ECIs are displayed can be changed by clicking on the check boxes in the Legend to select and deselect energy uses. As an example, the window at the right shows only the chiller energy.



The squares appearing on the graph are used to identify when a statistically significant aberration in energy consumption (high or low) has occurred. For the chiller energy use in this plot, 16 days had high values of chiller energy use.

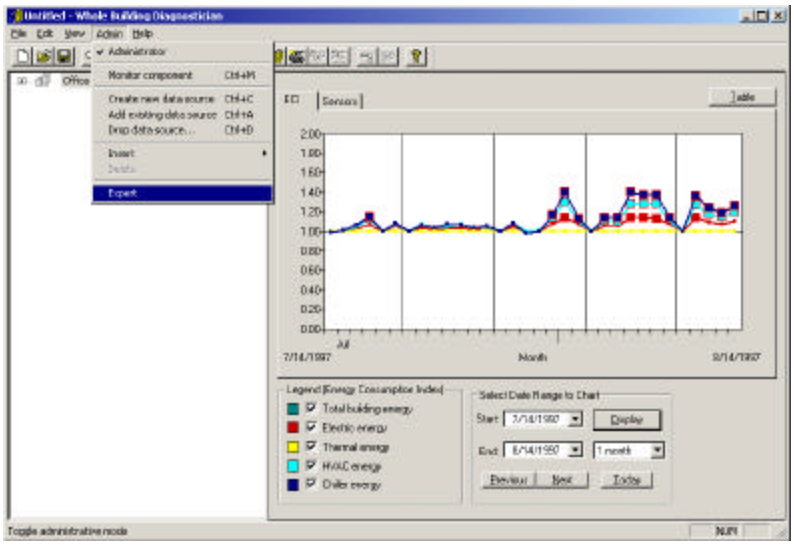
21. The dates for which data are displayed can be changed simply by clicking on the "**Previous**" or "**Next**" buttons in the "Select Data Range to Chart" panel below the graph. The length of the time period displayed can be changed by clicking on the arrow appearing immediately after "1 month" (in the current display) and then selecting the desired time-period length from the drop-down menu. Specific Start and End dates for the data range can also be selected, as shown in the figure at the right. Click on the arrow to the right of the start date. A calendar box will appear. Click on July 14 to select it as the new start date.



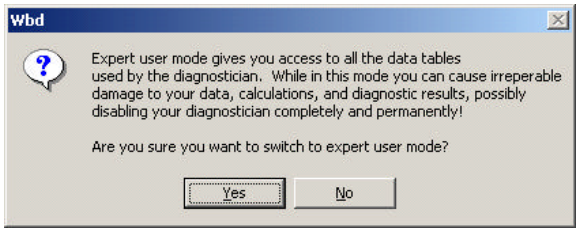
Exploring the Enhanced WBE Features

To examine the enhanced modeling features of the WBE module, peform the following steps.

22. Click on "**Admin**" on the menu bar and then select "**Expert**" from the drop-down menu.

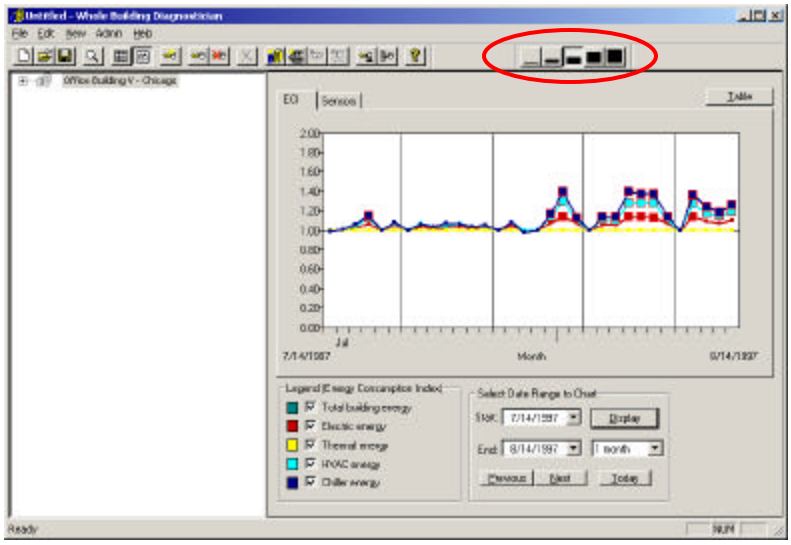


23. The dialog box shown at right will appear. Click "**Yes**." You will then be in the Expert mode, which can only be assigned by an Admin. Ordinary users do not have Admin privileges, unless assigned by someone who already has Admin privileges. Generally, a site would have only one or two Admin users who would administer the system by selecting and changing (when desired) general settings, specifying the empirical models, setting time periods for baseline data, and performing other administrative functions, which would then apply for all users at the site.

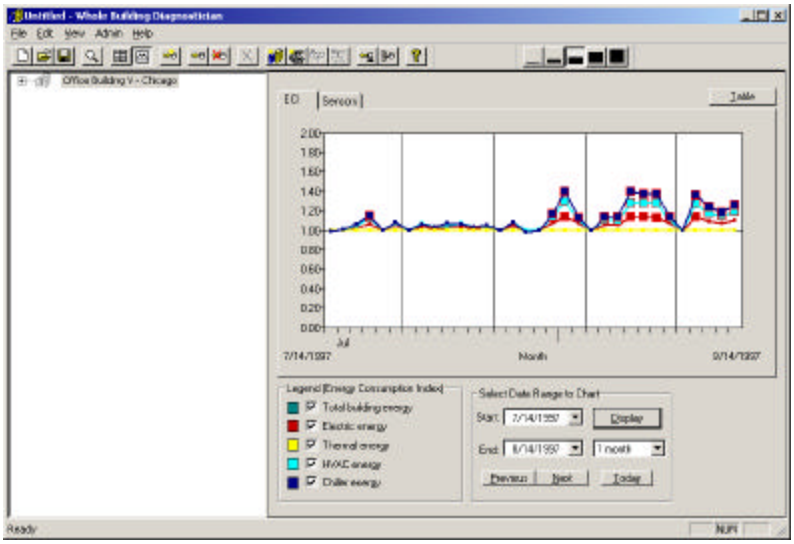


The features added as part of the Energy Commission project to enhance the WBE are some of those available to an Admin user who has selected to enter the "Expert" user mode. This demonstration software has been distributed to you with Admin privileges so you can examine the enhanced modeling features of the WBE.

24. When you entered "Expert" mode, you should have noticed a small rectangle with five buttons in it, appearing somewhere on your screen. This box is circled in the figure on the right. Click on this box, hold the mouse button, and drag the box to the position on the tool bar shown at right. Release the mouse button, and the small box will become part of the tool bar, as shown.



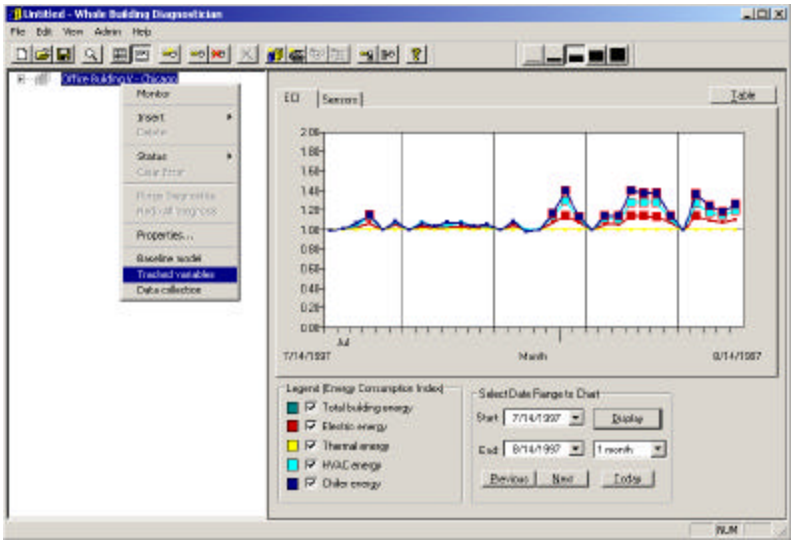
25. The buttons in the box are diagnostic sensitivity controls. The left-most button makes the WBE least sensitive, and the right-most button assigns it the maximum sensitivity. Click on the right-most button and observe the increase in the number of "alarm" boxes appearing on the graph. The sensitivity of the system to energy consumption anomalies has increased, and the WBE now detects more problems from the same data. Click on the center button to return the system to normal sensitivity.



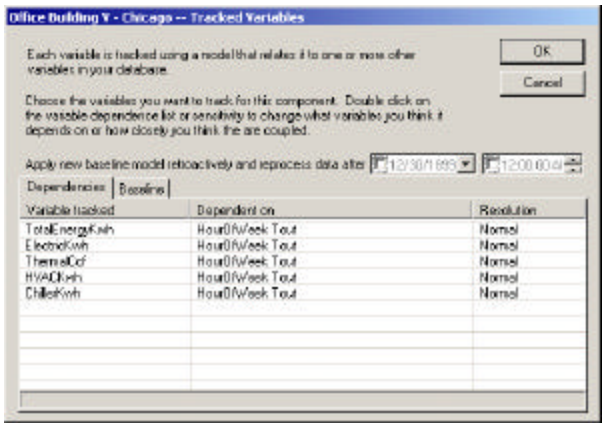
You might wonder why we don't just set the system to the highest sensitivity. The sensitivity is something we recommend be set by the user (Admin) based on experience observing WBD results. Although increasing the sensitivity increases the number of problems detected, it also increases the probability of false alarms, which are not desirable. Each building, its equipment, sensors, and control systems are different; therefore, we recommend developing some experience with the WBD, then re-setting the sensitivity, if needed, based on that experience.

The sensitivity control is not one of the enhanced features added as part of the Energy Commission project, but this is a convenient place to introduce it.

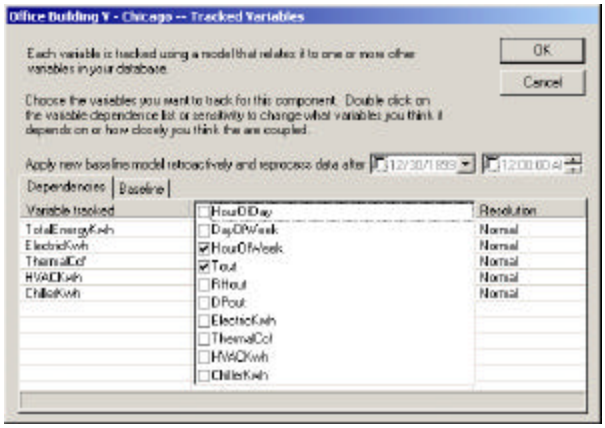
26. Now place your cursor over “WBE Demo” in the configuration tree and click the right mouse button to reveal a drop-down menu. Select “**Tracked variables**” from this menu by clicking the left mouse button on it.



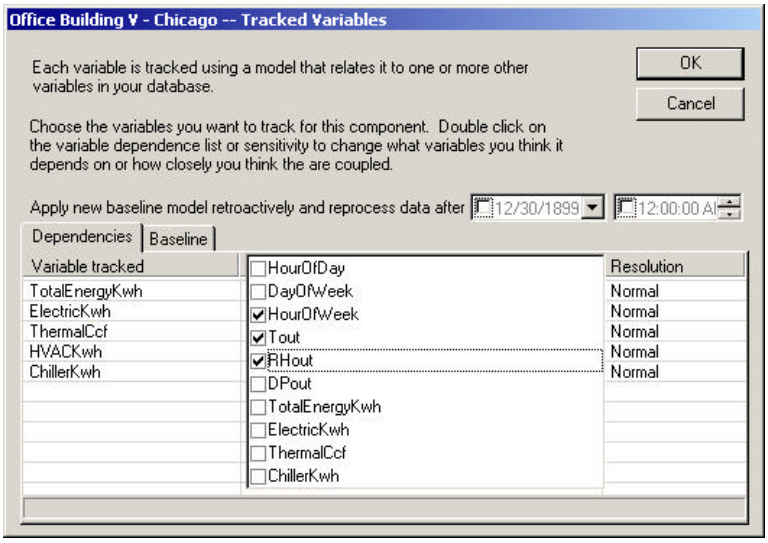
27. The dialog at right will appear. This dialog is used to select the variables to be tracked by the WBE and the independent variables upon which the model of each tracked variable is based (listed in the “Dependent on” column).



28. To explore the ability to select the specific independent variables for a model, double click on the “**Dependent on**” entry for the HVACKwh variable. A list of all possible dependent variables will appear, as shown at right. This list includes all variables currently in the WBE database. If additional variables were included in the database, they would appear in this list. Those variables could include anything for which data could be collected and entered into the database (e.g., hamburgers sold or number of hotel guests registered).

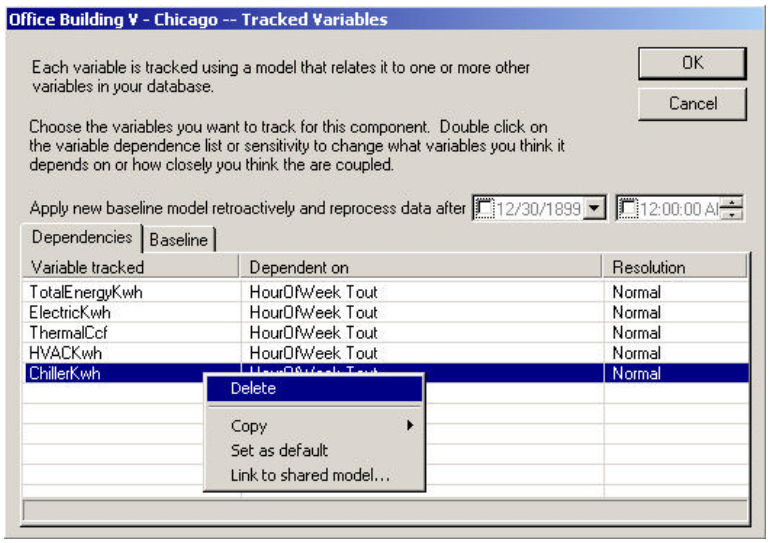


29. Select a variable from the list such as outdoor relative humidity (**RHout**) by clicking on the check box before the variable name. Then click anywhere on the dialog box outside the drop-down variable list. Notice that the new variable has been added to the list of "Dependent on" for HVACKwh. The next time this tracked variable is displayed the system will automatically recalculate the values to display on the graph based on this new model.



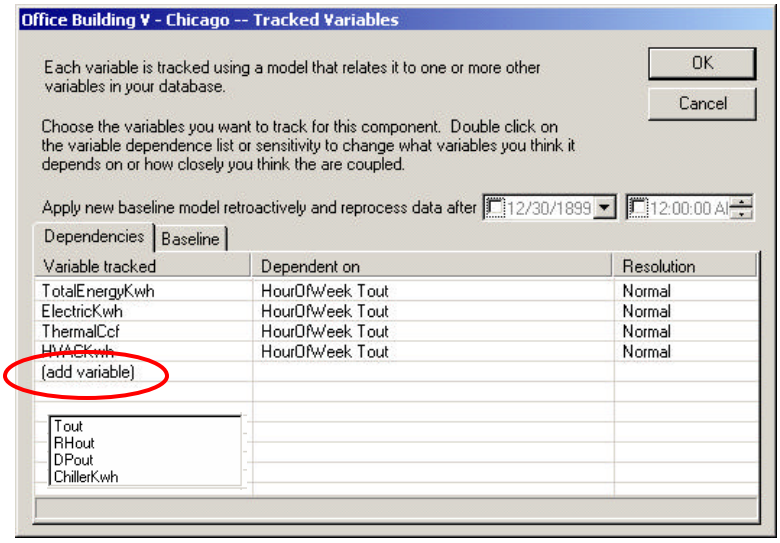
Dates for which to apply this new model can be selected from the date and time boxes that appear at the end of the line "Apply new baseline model…" Clicking on the check boxes before the date and time will bring up 12:00 AM on the current date, which will be the date and time for which the new model(s) will apply. If you would like the new model(s) to apply to data already collected, you need only specify the date and time for which you would like the new model(s) to first be used.

30. The specific variables tracked can also be specified by the Admin user subject to some limitations. A maximum of five (5) energy variables may be tracked by the WBE at one time for a single building- level entry in the configuration tree. If five variables are currently tracked, as in the case shown, one or more tracked variables must be deleted before new ones can be added.

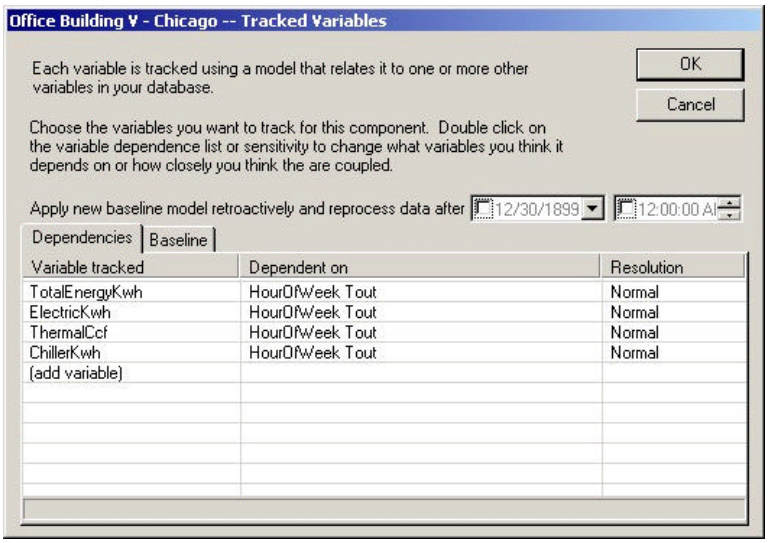


To explore this, right click on "**ChillerKwh**." A drop down menu will appear. Select "**Delete**" from the menu to delete ChillerKwh from the list of tracked variables. Now there are only four tracked variables and a new one can be added.

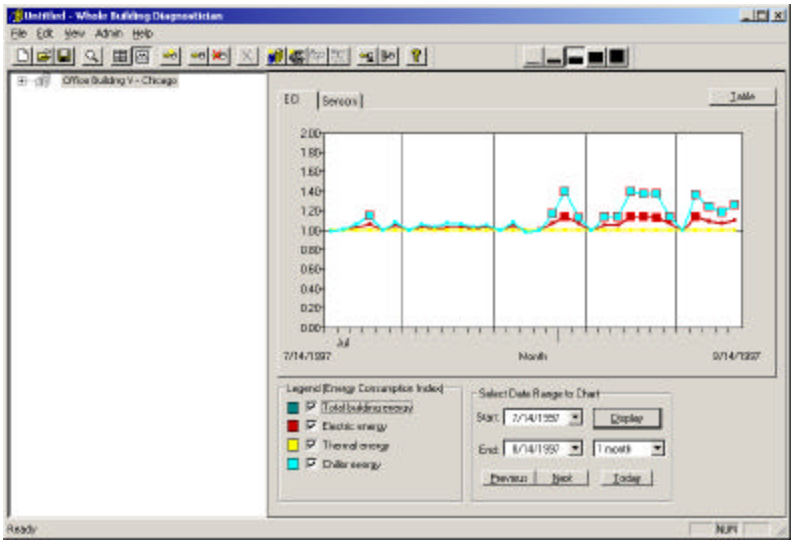
31. Double click on "(**add variable**)" listed in the "Variable tracked" column. This will reveal a drop-down list of variables that appear in the WBE database and are not already tracked. Any of the listed variables can be selected to track. Now let's also delete "**HVACKwh**" from the list of Variables tracked by right clicking on it and then selecting "**Delete**."



Add ChillerKwh back on the row where HVACKwh was listed before we deleted it. Accomplish this by double clicking on the first "(**add variable**)," selecting "**ChillerKwh**" from the drop-down menu, and then clicking elsewhere on the dialog box. This will add ChillerKwh to the list of Variables tracked. Notice though that no "dependent on" variables are yet selected for the ChillerKwh model. To select variables for the model, double click on the space in the ChillerKwh row under the "Dependent on" column to reveal the variables available, and then follow the same procedure used in step 29 above to add variables to the model.



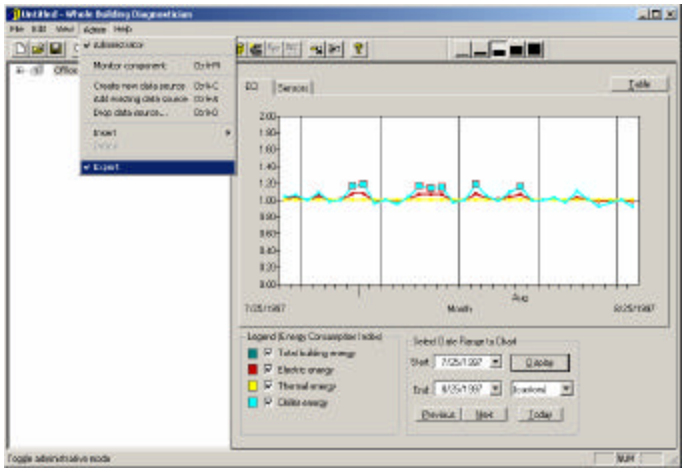
In order for the change to affect the current diagnostic display, change the date to "Apply new baseline model …" to July 1, 1997. To do this click on the check box before the date. Then click on the down arrow immediately following the date. A calendar will appear. Use the back arrow to navigate to July 1997. Then click on July 1.



Click "**OK**" to return to the main WBE display. Notice in the Legend that "Chiller energy" has been added in place of "HVAC energy" and only four tracked variables now appear. If this change does not display, click on the ***Display*** button. This will refresh the display, and the change will appear. Note that the display refreshes automatically once per minute. If you wait until the next automatic refresh, the interface will change the display without you pushing the **Display** button.

Closing the WBD

32. When you are done exploring these features, click on "**Admin**" on the menu bar. Then click on "**Expert**" in the drop-down menu to move out of Expert mode, as a precaution to prevent accidentally damaging the WBD database.



33. You may now close the WBD simply by clicking "**File**" on the menu bar and selecting "**Exit**" from the drop-down menu. A dialog box will then appear asking whether you would like to "Save Changes to Untitled?" If you would like to delete your WBD configuration, simply click "**No**," and the WBD will close. If you would like to save your current WBD configuration, click "**Yes**" (note the .wbd file extension). The "Save As" dialog box at right will appear. Type your selected file name in the white space after "File name:" and click "**Save**." The file will be saved for future use, and the WBD will close.