Integrated Environmental Control Model

Getting Started

Prepared for the National Energy Technology Laboratory U. S. Department of Energy

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Introduction

The Integrated Environmental Control Model

This Integrated Environmental Control Model (IECM) and Interface were developed for the U. S. Department of Energy's National Energy Technology Laboratory (NETL), formerly known as the Federal Energy Technology Center (FETC), under contract No. DE-AC22-92PC91346 and DE-AC21-92MC29094.

Purpose

The purpose of the model is to calculate the performance, emissions and cost of employing alternative environmental control methods in a coal-fired power plant. The model consists of a base plant and various control technology modules; these modules may be implemented together in any desired combination.

A Graphical User Interface (GUI) facilitates the configuration of the technologies, entry of data, and retrieval of results.

System Requirements

The current model requires the following configuration:

- Intel-based computer running Windows 95 (or better) or Windows NT 4.0 (or better) operating system
- Pentium Processor
- any SVGA (or better) display—at a resolution of 800x600 (or more) pixels¹
- at least 40 Megabytes of free hard disk space
- at least 32 Megabytes of total memory

¹ Smaller screen resolution results in the interface screens being scaled smaller. The taskbar, part of the Windows operating system, reduces the useable resolution of the screen if it is always visible. This may force the IECM interface to be scaled down slightly. To avoid this situation, select the "Auto Hide" option of the Taskbar properties in Windows.

Uncertainty Features

The ability to characterize uncertainties explicitly is a feature unique to this model. As many as one hundred input parameters can be assigned probability distributions. When input parameters are uncertain, an uncertainty distribution of results is returned. Such result distributions give the *likelihood* of a particular value, in contrast to conventional single-value estimates.

The model can run using single deterministic values or uncertainty distributions. The conventional deterministic form using single values for all input parameters and results may be used, or probabilistic analyses may be run—for instance, to analyze advanced technology costs.

Software Used in Development

The underlying engineering models are written in Digital Equipment Corporation's Fortran. Fortran runtime libraries are included with the IECM Interface software. This language provides the flexibility to configure many various power plant designs while also providing the power to conduct probabilistic analyses.

All databases are in Microsoft® Access format and may be viewed in Access, as long as they are not changed. This format is a software industry standard and facilitates sharing and updating of information.

To simplify the use of the model, a Graphical User Interface (GUI) has been added. The interface eliminates the need to master the underlying commands normally required for model operation. The interface is written in Microsoft® Visual C++, a standard software development tool for the Windows environment. Visual C++ runtime libraries are included with the IECM Model software and do not need to be licensed separately.

Wise InstallBuilder was used to generate full and upgrade installer programs. This product was chosen based on its flexibility and its support of Visual Basic runtime libraries and Microsoft Data Access Components (MDAC)². The Visual Basic runtime libraries provide the support needed to run the database file compactor program provided with the IECM. MDAC provides the software support needed to link Microsoft® Access data files to the IECM interface program. Wise InstallBuilder provides the VB and MDAC installation as an option, rather than forcing the user to download it from Microsoft and install it prior to installing the IECM.

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² The current version of MDAC is 2.6. This is installed with the full installer for the IECM. Any update installers provided for upgrading the IECM from a previous version to the current version do not upgrade MDAC unless the user updates MDAC separately.

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User Documentation and Help

Getting Started	
	<i>Getting Started</i> (this document) gives step-by-step instructions for installing the model software and using the interface. It describes navigating the model, using the main program areas, working with sessions, and printing or exporting results.
User Manual	
	The <i>User Manual</i> gives further information on both the interface and the underlying model. It provides detailed descriptions of plant configurations, parameter settings, and result screens. It also describes technical details behind the model's operation and includes an introduction to uncertainty analysis.
Model Tutorial	
	The <i>Model Tutorial</i> is a pictorial introduction to the IECM. It presents a graphical tour of the interface, a case study to follow using the model, and an appendix which reproduces every screen in the model. These tools help any user to quickly become more familiar with the interface and model.
Technical Manu	al
	The <i>Technical manual</i> is a detailed engineering description of the technologies and costing assumptions used in the IECM. This manual is not provided by default with the IECM software; however, it can be downloaded with any web browser from http://www.iecm-online.com/ .
Online Help	
	Online help is provided via a Windows Help File containing the text of <i>Getting Started</i> and the <i>User Manual</i> .

Accessing the IECM Help file:

If you are not running the IECM interface, click the **Help** icon inside the IECM folder on the **Start** menu. This opens the help file to the table of contents.

If you are running the IECM interface, do any one of the following:

- Press the **F1** key. The IECM supports context-sensitive help and will open the help file to the topic associated with the item or screen you are viewing.
- Pull down the <u>H</u>elp menu at the top of the IECM window. Select <u>H</u>elp Topics. This opens the help file to the table of contents. (See "The Help Menu" on page 23.)
- Click the **Context-Sensitive Help** icon on the toolbar on the left side of the IECM window. The IECM supports context-sensitive help and will open the help file to the topic associated with the item or screen you are viewing. (See "The Help Menu" on page 24.)
- Click the **Help Topics** icon on the toolbar on the left side of the IECM window. This opens the help file to the table of contents. If this method does not work, try one of the other options above (See "The Toolbar" on page 24.)

The IECM Help File Contents window will display.

elp Topics: Integrated Environmental Control Model	? >
Contents Find	
Click a book, and then click Open. Or click another tab, such as Index.	
Note that the second se	_
Ser Documentation and Help	
Note: Installing the Model	
🛛 🐤 Windows Conventions	
V Notes State Stat	
🛛 📚 Running the Model	
🛛 🕪 Configuring the Plant	
Setting Parameters	
Setting Results	
🛛 📀 Working with Sessions	
🔷 🕪 Importing and Exporting Data	
🔷 📚 Printing	
🔷 🕪 Installing the Model	
🔹 📚 Configure Plant	
🔷 📚 Set Parameters	-
1 · ·	
Open Print	Cancel

The IECM Help File Topics Window

Installing the Model

What's Included in the Model Package

The IECM package should contain the following items:

Installation Program: All the software is on one installation program in compressed form. This file is provided either on a compact disk (CD) or from the IECM web site (<u>http://www.iecm-online.com/</u>). See "Installation" below for instructions on how to install the program.

Three pieces of documentation: *Getting Started, User Manual*, and *Model Tutorial*, as described in "User Documentation and Help" on page 4.

Note: A Technical Manual is not distributed with the model package, but can be downloaded from the IECM web site.

Installation

To install the IECM, you must use the installation program, SETUP.EXE, provided on the IECM compact disk (CD). Program files must be decompressed and installed in the appropriate directories to run properly through this program.

Copying the contents of the IECM CD to a local hard drive or a network hard drive can speed the installation process, especially over a network. For more information and instructions, see the *User Manual*.

The IECM can also be installed from one installation program that is available on the worldwide web (<u>http://www.iecm-online.com/</u>). The installer and update programs on this web site function similarly to the CD originally shipped with the IECM. This method of installation is described in more detail in the *User Manual*.

Note: Update or upgrade installers are only provided on the worldwide web site. These are used to enhance or correct the full installation of the IECM on your computer. Send electronic mail to <u>iecm-team@lists.andrew.cmu.edu</u> or sign up on our web site if you wish to receive notification of updates.

Installation Steps

Running the Setup Program

- 1. Place IECM compact Disk (CD) in the CD drive.
- 2. Click the **Start** button.
- 3. Choose <u>**R</u>un...** from the Start menu.</u>
- 4. Type "D:\SETUP" (assuming that the CD drive is D:) and press **Enter**.

The installation program will begin.

MDAC Installation

Before the IECM Interface can be installed, Microsoft Data Access Components (MDAC) must be installed. MDAC is provided by Microsoft as a standard installation package used in conjunction with the IECM installer program. If the appropriate MDAC software components are not detected on your computer, you will be notified that MDAC will be installed this by a warning box as shown below. MDAC is not installed if it the same or a more recent version already exists on your computer.

Wise Installation System	×
This installation requires MDAC (Microsoft Data Access Components) to be installed (or re-installed) on your system. The installation of MDAC requires a reboot before the application installation can begin.	
Cancel	

Click the **OK** button to install MDAC.

Once MDAC has been installed, you will be notified that the computer will reboot by a warning box as shown below.



Click the **OK** button to reboot the computer to continue with the installation. The installation of the IECM will resume automatically after the computer has rebooted.

Select Language

The first screen which displays after MDAC is installed is the "Select Language" screen. Although the IECM itself is written in English, the installer provides several languages during the installation process. The figure below shows the "Select Language" screen.

Select Language	×
Please select the language that you would like to use during the installation.	
Die Installation unterstützt verschiedene Sprachen. Wählen Sie eine Sprache aus der unten aufgeführten Liste aus	
U.S. English	
Français Español	
Deutsch Italiano	
OK Cancel	

The "Select Language" installer screen.

After choosing the language, click the **OK** button to continue to the next screen. Click the **Cancel** button at the bottom of the "Choose Language" screen to exit the installer program.

Welcome Screen

The next screen which displays is installed is the "Welcome" screen. It introduces you to the IECM installer and warns you that all Windows programs should be closed before continuing the installation. The figure below shows the "Welcome" screen.



The "Welcome" installer screen.

To quit other programs, you should click the **Cancel** button at the bottom of the "Welcome" screen first and then proceed to quit all other Windows programs. Once other programs are closed, you can restart the installation process.

If there are no other programs running, click the \underline{Next} button to continue to the next screen.

License Agreement

The next screen to appear displays the license agreement. This screen is shown below. Read the license agreement by scrolling down the window. You cannot install and run the IECM without agreeing to the license agreement. If you do not agree, the installer will quit.



The License Agreement screen.

Click the **Next** button to agree to the license and continue to the next screen.

Choose Destination Location

The "Choose Destination Location" installation screen asks you to specify the location of the IECM program on your computer. The default location for installation is "C:\Program Files\IECM_34" as shown in the figure below. This is different than the default used in previous versions; previous versions will co-exist on your computer.

🛃 Choose Destination L	ocation	×
₩ 1 1 1 1 1 1 1 1	Setup will install IECM Interface 3.4 in the following folder. To install into a different folder, click Browse, and select another folder. You can choose not to install IECM Interface 3.4 by clicking Cancel to exit Setup.	
	Destination Folder C:\Program Files\IECM_34	
	< <u>B</u> ack <u>Next</u> Cancel	_

The "Choose Destination Location" screen.

For more information on changing the destination location, please refer to the *User Manual*. Click the <u>Next</u> button to continue to the next screen.

Backup Replaced Files

The "Backup Replaced Files" screen shown below asks if you would like to create backup copies of all files replaced during the installation. This is useful if you are installing a new version of the software over a previous version. You must select **Yes** on this screen to be able to roll back the software to the previous version.



The "Backup Replaced Files" screen

Click the circle next to $\underline{Y}es$ to make backups of replaced files, click the circle next to $N\underline{o}$ to skip this step. Click the <u>Next</u> button to continue to the next screen.

For more information about backing up replaced files and rolling back installations to a previous version, see the *User Manual*.

Select Components

The "Select Components" installation screen asks you to specify which portions of the IECM software to install. This screen is shown below.



The "Select Components" screen.

The four components are:

Microsoft MFC 4.2: This includes the Microsoft Foundation Class runtime libraries. These are required for using the IECM and are installed by a standard Microsoft installation package as part of the IECM installer.

Microsoft Visual Basic 4.0 Runtime: Visual Basic version 4 runtime libraries are required by a database compacting program included with the IECM (compact.exe). These are installed by a standard Microsoft installation package as part of the IECM installer.

Program Files: These are the program and support files needed to run the IECM. They are installed into the location specified during the installation process (the default location is C:\Program Files\IECM).

Documentation: These are the online help files created from the *Getting Started* and *User Manual* printed documents. These can be omitted from the installation. They are not required for running the IECM software.

Uncheck any of the four options by clicking the checkbox next to its description. Only checked boxes are installed when you continue the installation. Unchecked boxes are NOT installed.

The hard disk space required and available for the selected components is shown at the bottom of the screen. If there is insufficient space to install the software, you will need to cancel the installation and either install the software onto another hard drive or clear space on your hard drive. Click the **Next** button to continue to the next screen.

WARNING: If you do not install the Microsoft runtime library packages, you may have difficulty running the IECM. Be sure these library packages are installed by the IECM installer or your computer support group prior to using the IECM.

Select Program Manager Group

The IECM interface icon is installed on the desktop by default. Icons for the interface and help file are also provided in a program folder in all versions of Windows (e.g., in the **Programs** folder in the **Start** menu for Windows 95/98). The "Select Program Manager Group" screen asks you to specify the program folder group which will contain the icons to launch the IECM interface program and the online IECM interface help file.

The default Program Manager Group is "IECM Interface 3.4". You may select another group by clicking on its name in the scroll box to highlight it or create a new group by highlighting the text and typing a new name. Click the **Next** button to continue to the next screen.

🛃 Select Program Manag	jer Group	X
	Enter the name of the Program Manager group to add IECM Interface 3.4 icons to:	
	IECM Interface 3.4	
	Accessories Compilers Database Documentation Editors Games Graphics Models Network Shels StartUp Utilities	_
	< <u>B</u> ack <u>Next></u> Cancel	

The "Select Program Manager Group" screen

Start Installation

The IECM software is now ready to install. The "Start Installation" screen allows you to go back one last time to check the options you have chosen for installation.



The "Start Installation" screen

Click the **<u>Back</u>** button to return to any of the previous screens to check or change the installation options. Click the <u>Next</u> button to continue to install the software.

Installation Progress

The IECM interface setup program now begins copying files onto your hard disk and preparing it for your use. The progress of the activity is shown on the "Installing" screen as shown below.

Installing		X
	Current File Copying file: C:WINDOWS\SYSTEM\VBDB32.DLL	
	< <u>B</u> ack <u>M</u> ext > Cancel	

The Installation Progress screen

The top pane of the screen displays the name of the file being copied and its progress. The bottom pane of the screen displays the progress of the entire installation with an estimate of the time remaining.

Installation Complete

Once the installation program has completed installing the IECM software, the "Installation Complete" screen will display, as shown below.

🛃 Installation Complete		X
	IECM Interface 3.4 has been successfully installed. Press the Finish button to exit this installation.	
	< <u>B</u> ack Finish > Cancel	

The "Installation Complete" screen

Click the **<u>F</u>inish** button to exit the installation program.

Canceling the Installation

You can stop the installation process at any time by clicking the **Cancel** button which appears on each screen, including the Installation Progress screen. Canceling the process stops all activity and exits the setup program.

Errors During Installation

If you receive an error message while running Setup, restart the computer and run the installation again. If Setup still returns an error message, contact technical support by electronic mail (<u>iecm-team@lists.andrew.cmu.edu</u>).

Updating the IECM Software

Updating the IECM software from the original CD, full installation program from the worldwide web site, or update programs downloaded from the worldwide web at some future date can be done in two ways.

- 1. To replace the existing files: Simply install the software as described under "Installation" on page 6. The software will update the necessary files and allow you to make backup files so that the installation can be rolled back to the previous version. This is the recommended method for updating. User files and data are not effected.
- 2. To install a second copy of the IECM software on your hard disk: Follow the instructions given under Installation above, but choose a different directory in which to install the files (described in more detail in the *User Manual*).

NOTE: Maintaining two copies of the IECM requires more disk space and could lead to confusion. It is not recommended.

Removing the IECM Software

To remove the IECM software completely, use the uninstall feature of the Windows 95/98 "Add/Remove Software" control panel.

NOTE: Do not just delete the files in the IECM directory, because there are files elsewhere on your system that should also be cleaned up. Deleting the IECM directory could also cause a subsequent attempt to uninstall the software correctly to fail.

Running the Uninstall Program

- 1. Click the **Start** button.
- 2. Choose <u>Settings</u>, and then <u>Control Panel</u>.
- 3. Double-click Add/Remove Programs in the Control Panel folder.
- 4. Highlight IECM Interface on the list of installed software.
- 5. Click the **Add/Remove...** button.

Follow the instructions on the screen.

Uninstalling the software, as well as rolling back an installation to an earlier version, is described in detail in the *User Manual*.

Windows Conventions

Microsoft® Windows

The Windows operating environment is based on both graphics and text. Although it is designed to be intuitive, a certain amount of learning is required to use it effectively. Please review the documentation on Microsoft® Windows that came with your personal computer if you are new to the Windows environment.

Using the Mouse

Many commands in Windows 95/98/ME and Windows NT/2000 are executed by moving the mouse cursor (see "Cursors" below) to an item and pressing the left or right button on the mouse.

In this documentation, the following terms will be used for mouse operations:

Click - Place the mouse cursor onto a menu, button, field, etc. and press the left button on the mouse.

Right Click - Place the mouse cursor onto a menu, button, field, etc. and press the right button on the mouse.

Double-Click - Place the mouse cursor onto a menu, button, field, etc. and press the left button on the mouse two times rapidly.

Click and Drag - Place the mouse cursor onto a menu, button, field, etc., press the left button on the mouse, and—while holding the button down—move the mouse to another location.

Cursors

The mouse cursor moves on the screen as you move the mouse. The cursor displayed changes as it is placed over different objects, or as the software becomes busy.

The Arrow

The mouse cursor that is most often displayed is the "arrow" cursor, shown at the left. Use this cursor to pull down menus (see "Menu Bar" on page 18), click buttons on the toolbar (see "The Toolbar" on page 24), or navigate through the model using tabs (see "Tabs" on page 25.)

The Cross

If the mouse arrow is moved over an input or result spreadsheet table, it becomes the "cross" cursor, shown at the left. Use this cursor to click a cell and enter data, or select a cell or group of cells (see "Parameters and Results Workspace" on page 28).

The I-Beam

If the mouse cross is placed over an input field and double-clicked, an "I-beam" or editing cursor will display instead of the cross. This cursor is shown at the left. Clicking again places a typing cursor into the field, so that values can be edited instead of replaced (see "Editing values" on page 43).

The Hourglass

Some software processes take some time to perform. When the software is busy for more than a few seconds, an "hourglass" cursor, shown at the left, will display. Further activity will be delayed until the process is complete.

The Arrow and Hourglass

Sometimes a process works in the background. Rather than the hourglass, an "arrow and hourglass" cursor, shown at the left, will display. The arrow may still be used, but the command may be delayed because of the process running in the background.

Keystroke Commands

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Many operations in Windows can be executed by a combination of keystrokes as well as a mouse click. These keystroke combinations involve the **Alt** key and the **Ctrl** key.

NOTE: Once an Alt key combination is active, the Ctrl key combinations will not work. The Ctrl key combinations are meant to bypass menus.

Alt Commands

When the name of an operation appears on the screen with one letter underlined, you may execute that operation by holding down the **Alt** key while pressing the key for the underlined letter at the same time.

Example: <u>File</u> - hold down the Alt key and press the F key to activate the <u>File</u> pull-down menu.

In this documentation, instructions for **Alt** keystrokes are abbreviated in the form "Press **Alt-X**" where X is the letter key. (NOTE: While the capital letter is given in this documentation, do not press the shift key while entering the command.)

Example: "Press **Alt-F** to activate the **<u>File</u>** menu"

Ctrl Commands

Some operations have been assigned specific keystroke combinations involving the **Ctrl** key. You may execute them by holding down the **Ctrl** key while pressing the key for the appropriate letter. Most are listed on the pull-down menu from which the command is normally selected.

In this documentation, instructions for **Ctrl** keystrokes are abbreviated in the form "Press **Ctrl-X**" where X is the letter key. (NOTE: While the capital letter is given in this documentation, do not press the shift key while entering the command.)

Some of the more common **Ctrl** commands are the following:

Ctrl-N – New Session	Ctrl-O – Open Session	Ctrl-S – Save Results				
Ctrl-C – Copy	Ctrl-P – Print	Ctrl-V – Paste				
Ctrl-F4 – Close Session	Ctrl-F6 – Switch to another window					

IECM Conventions

The IECM Window

Once you have started the model, the IECM Window displays. The IECM Window contains all the screens used by the Interface, as well as the tools for control of the software described below.



The IECM Window

The IECM Window is initially sized to fill an 800x600 resolution screen. If your display is set to 800x600 pixels, the IECM window will completely fill the screen.

Menu Bar

The menu bar appears at the top of the IECM window. It consists of four pull-down menus: **<u>File</u>**, **<u>Edit</u>**, **<u>View</u>**, **<u>Window</u>**, and **<u>Help</u>**. These pull-down menus issue commands to the IECM software.

Choosing an Command from a Pull-Down Menu

1. Activate the pull-down menu by doing one of the following:

- Place the mouse arrow on the title of the menu you want to pull down and click.
- Hold down the **Alt** key on the keyboard and press the letter in the menu title which is underlined. Example: To pull down the <u>File</u> menu, press **Alt-F**.

The menu will remain visible and active until you choose a command or move the mouse cursor outside the window.

2. Choose from the menu by doing one of the following:

- Place the mouse arrow on the action you want to perform and click.
- Hold down the **Alt** key again and press the letter in the action title which is underlined. Example: To **<u>Print</u>**, press **Alt-P**.

The File Menu

The **<u>File</u>** menu is the left-most pull-down menu on the Menu bar. The **<u>File</u>** menu is shown below.



The <u>F</u>ile menu

You may choose the following commands from the file menu:

- <u>New Session</u> Creates a new session from model defaults. (See "Creating a New Session" on page 61.)
- **Open Session** Opens a previously created session. (See "Opening an Existing Session" on page 62.)
- <u>Close Session</u> Closes the currently active session. (See "Closing a Session" on page 63.)

Delete Session - Deletes a session. (See "

Deleting a Session" on page 64.)

Unlock Session – Unlocks a session that was not closed normally (e.g. because of a crash or loss of network connectivity. (See "

Unlocking a Session" on page 64.)

- <u>Save Results</u> Saves the results from a session in an external file. (See "Saving a Session's Results" on page 62.)
- Save \underline{As} Saves a session with a different name. (See "Saving a Session with a Different Name" on page 63.)
- **Import** Imports a session from an external database file. (See "Importing a Session" on page 66.)
- **Print** Prints configuration settings, inputs or results. (See "Print Dialog Box" on page 68.)
- Exit Closes the current session and exits the interface. (See "Exiting the Model" on page 34.)

The Edit Menu

The <u>Edit</u> menu is the second pull-down menu on the Menu bar. The <u>Edit</u> menu is shown below.



The <u>E</u>dit Menu

You may choose the following commands from this menu:

Cut – Removes text from a workspace. (See "Cut" on page 67)

- **Copy** Copies text from a workspace. ("Copy" on page 67)
- **<u>Paste</u>** Pastes text into a workspace. (See "Paste" on page 67)

The View Menu

The <u>View</u> menu is the third pull-down menu on the Menu bar. The <u>View</u> menu is shown below.

😻 IECM Interface										
<u>F</u> ile	<u>E</u> dit	⊻iew	<u>W</u> indow	<u>H</u> elp						
ы		✓ 1	olbar							
늬		✓ <u>S</u> t	atus Bar							
		<u>U</u> r	ncertainty 1	ools						
E		ln	put Tools							
		<u>B</u> e	esult Tools							

The <u>V</u>iew Menu

You may choose the following commands from this menu:

Toolbar – Chooses whether or not the Toolbar displays. (See "The Toolbar" on page 24.)

<u>Status Bar</u> – Chooses whether or not the Status Bar displays. (See "The Status Bar" on page 24.)

<u>Uncertainty Tools</u> – Displays the Uncertainty Tools floating palette. (See "

Uncertainty Areas" on page 60.)

- **Input Tools** Displays the Input Tools floating palette. (See "Input Tools" on page 44.)
- <u>Result Tools</u> Displays the Result Tools floating palette. (See "Result Tools" on page 59.)

The Window Menu

The <u>**Window**</u> menu is the fourth pull-down menu on the Menu bar. The <u>**Window**</u> menu is shown below.

😻 IE	😻 IECM Interface										
<u>F</u> ile	<u>E</u> dit	$\underline{V} iew$	$\underline{W}\text{indow}$	<u>H</u> elp							
			<u>C</u> asca Tile <u>H</u> <u>T</u> ile V <u>A</u> rranj	ade Iorizontally 'ertically ge Icons							
			Windows								
6			✓ <u>1</u> Unt	itled							

The Window Menu

You may choose the following commands from this menu:

- <u>Cascade</u> Arranges all open windows in a cascade from the upper left corner of the IECM Window.
- Tile <u>H</u>orizontally Arranges all open windows in a tile from the left to the right of the IECM Window.
- <u>**Tile Vertically**</u> Arranges all open windows in a tile from the top to the bottom of the IECM Window.
- <u>Arrange Icons</u> Arranges all minimized windows in the lower left corner of the IECM Window.
- Windows... Allows you to choose which open window is active.
- $\underline{1}, \underline{2}, \underline{3}$ (etc.) Allows you to choose which open window is active.

The Help Menu

The <u>**Help**</u> menu is the fifth pull-down menu on the Menu bar. The <u>**Help**</u> menu is shown below.

😻 II	😻 IECM Interface											
<u>F</u> ile	<u>E</u> dit	⊻iew	<u>₩</u> indow	Help								
Ы				<u>H</u> elp Topics								
6				About IECM Interface								
				Help Topics								

The <u>H</u>elp Menu

You may choose the following commands from this menu:

Help Topics – Displays online help. (See "Online Help" on page 4.)

<u>About IECM Interface</u> – Displays the Logo Box. (See "Starting the Model" on page 33.)

The Toolbar

The toolbar is a row of buttons which runs down the left side of the IECM Window. Clicking on a button executes a common command. All of the commands can also be executed from pull-down menus. (See "Menu Bar" on page 18.)

□ ☞ 🖻 🖬 🚭 🐰 🖻 🕄 😭 💡 📢

The toolbar buttons: New Session, Open Session, Close Session, Save Results, Print, Cut, Copy, Paste, Import, Help Topics, and Context-Sensitive Help (note that they appear vertical in the model).

When the mouse arrow is held over a toolbar button momentarily, a description of the button's command displays.

You may choose whether or not the toolbar displays. Pull down the <u>View</u> menu and select <u>Toolbar</u>. This is a toggle switch which will toggle between displaying the toolbar and not displaying it. When <u>Toolbar</u> is checked, the toolbar displays, when it is not checked, it does not display.

The Status Bar

The status bar is displayed at the bottom of the window. Messages about the status of the interface appear at the left side of the status bar. Normally, "Ready" is displayed. When the mouse cursor is moved over a toolbar button or pull-down menu item, the name of the command which is associated with the item is displayed.

At the right of the status bar are three boxes which indicate if the Capital Letters Lock, Number Lock, or Scroll Lock are turned "on". If the box is empty, the lock is turned off. If CAPS, NUM, or SCRL display, the lock is turned on.

NUM

Ready

The status bar: The interface is ready, and the Number Lock is set to on.

You may choose whether or not the status bar displays: Pull down the <u>View</u> menu and select <u>Status Bar</u>. This is a toggle switch which will toggle between displaying the status bar and not displaying it. When <u>Status Bar</u> is checked, the toolbar displays, when it is not checked, it does not display.

The Session Window

Once you have opened or created a session, a session window displays for the session you are working with. The session window contains all the screens used by the session. (See "Sessions" on page 61.)

😈 IE File	E)	<mark>M Interface</mark> dit <u>V</u> iew <u>W</u> indow <u>H</u>	lelp				_ 🗆 🗙
	Ē	Untitled				-	
Ø	ľ	<u>C</u> onfigu	ire Plant	Set <u>P</u>	arameters	<u>G</u> et Results	
8		Combustion Co	ontrols		-Plant Diagram		
	III	Furnace Type:	Tangential	<u> </u>			
	III	NOx Control:	In-Furnace Controls	•			
	III	<u>Post-Combusti</u>	on Controls				
 ▶2	III	NOx Control:	Hot-Side SCR	•			
<u>^.</u>	III	Mercury:	Carbon + Water Injec	tion 💌		Inj.	
	III	Particulates:	Cold-Side ESP	•		╘───┲╧──∭───┫──	
	III	SO2 Control:	Wet FGD	F		—— [∞] ¶	
	III	SO2/NOx:	None	V			
	III	Solids Manage	ement			<u> </u>	
	III	Recovery:	None	-			
	III	Fly Ash	mixed w/Landfill				
		Disposal:	Innxed w/Landill	<u> </u>			
	Ľ						

The Session Window

The session window is initially sized to fill the entire IECM Window at a resolution of 800x600 pixels. If additional windows are open in the IECM Window, they will be behind the session window. You may access these windows through the <u>W</u>indow menu on the Menu Bar. (See "The Window Menu" on page 23.)

Tabs

Movement within the interface is accomplished primarily by clicking tabs. Tabs extend above or below the session's workspace. Moving between tabs means moving between program areas, input screens, or result screens.

When a tab is selected, the tab comes forward, its border surrounds the workspace, its color changes, and its text becomes white. Therefore, it is evident which tabs have been selected—or made "active"—and therefore which screen is being displayed. Looking at the tabs above and below the workspace, one can always tell where one is in the model.

	<u>(</u>	Configure Plant	Set	Set Parameters Get Results						ults
Ove P <u>l</u> a	rall nt	Coal <u>B</u> ase P <u>r</u> operties Plant	Emission Constr <u>a</u> ints	<u>N</u> O Cont	lx trol	Mercury Control	Pa (articulate Control	SO2 Conts	ol Solids
		Title	Units	5	Unc	Value	Calc	Min	Max	Default
	1	Gross Electrical Output	MW	g		500.0		100.0	1500	500.0
	2	Steam Cycle Heat Rate	Btu/kV	Vh		7880		6000	1.100e+04	7880
	3	Boiler Efficiency	%			89.36		0.0	100.0	calc
	4	Capacity Factor	%			75.00		0.0	100.0	75.00
	5	Excess Air For Furnace	% stoi	ch.		20.00		0.0	40.00	calc
	6	Leakage Air at Preheater	% stoi	ch.		19.00		0.0	60.00	calc
	7	Gas Temp. Exiting Economizer	deg. l	F		700.0		250.0	1200	700.0
	8	Gas Temp. Exiting Air Preheater	deg. l	F		300.0		150.0	400.0	300.0
	9	Ambient Air Temperature	deg. l	F		80.00		-50.00	130.0	80.00
	10	Ambient Air Pressure	psia			14.70		12.00	15.00	14.70
	11	Ambient Air Humidity	1b H2O/1b	dry air		1.800e-02		0.0	3.000e-02	1.800e-02
	12	Percent Water in Bottom Ash Slui	ice %			39.30		0.0	100.0	calc
	13	Base Plant Energy Requirements	5							
	14	Coal Pulverizer	% MV	Vg		0.6000		0.0	2.000	calc
	15	Steam Cycle Pumps	% MV	Vg		0.6500		0.0	2.000	0.6500
	16	Forced Draft Fans	% MV	Vg		1.500		0.0	4.000	1.500
	17	Cooling System	% MV	Vg		1.800		0.0	2.000	1.800
	18	Miscellaneous	% MV	Vg		1.300		0.0	4.000	1.300

The three sets of tabs are all visible: the Program Area Navigation Tabs (<u>Set Parameters</u> is active), the Technology Navigation Tabs (<u>B</u>ase Plant is active), and the Input/Results Navigation Tabs (<u>1</u> Performance) is active.

Types of Tabs

Three sets of tabs are used in the IECM model:

Program Area Navigation Tabs: These three tabs always display at the top of the current session's window. The active tab is red, the others are gray. They allow movement between the model's main program areas: **Configure Plant**, **Set Parameters**, and **Get Results**.

Technology Navigation Tabs: These tabs display below the Program Area Navigation Tabs and above the workspace in the <u>Set Parameters</u> and <u>Get Results</u> modules. The active tab is dark red, the others are gray. They allow movement between technology input or results screens.

Technology Navigation Tabs display only currently selected technologies. For example, the combined SO2/NOx input and result tabs are only displayed when a combined technology is selected, replacing the SO2 input and results tabs.

Input Navigation Tabs/Results Navigation Tabs: Input Navigation Tabs and Results Navigation Tabs display below the workspace in the **Set Parameters** and **Get Results** modules. The active tab is brown, the others are gray. They allow movement between input or results screens within a technology.

Moving Between Tabs

To move from tab to tab, do one of the following:

- Place the mouse arrow on the tab to which you want to move and click.
- Hold down the **Alt** key on the keyboard and press the letter in the tab title which is underlined. Example: to switch to the <u>Set Parameters</u> tab, press **Alt-S**.

The software remembers which Technology Navigation Tab is active within each Program Area and which Input/Results Navigation Tab is active within each technology. Therefore, when returning to a program area or technology tab, one returns to the same workspace which one left.

Plant Diagrams

In the two program areas where there are Technology Navigation Tabs—<u>Set</u> Parameters and <u>Get Results</u>—the first tab includes a plant diagram.



The Plant Diagram

Using the Plant Diagram

In the <u>Set Parameters</u> and <u>Get Results</u> program areas, the Plant Diagram can be used as an alternate way to move among Technology Navigation tabs. Do one of the following:

- Click the button for the technology for which you would like to provide inputs or get results and it will activate the corresponding tab for that technology.
- Move through the Plant Diagram by pressing the **Tab** key—a box will surround the technology selected. Then press the **Space bar** to activate the corresponding tab for that technology.

Parameters and Results Workspace

In both the <u>Set Parameters</u> and <u>Get Results</u> program areas, information is displayed in a common workspace. The workspace is made up one or more tables which imitate a spreadsheet and can be used like a spreadsheet is used. The workspace displays between the input and result navigation tabs.

Ĵ		Untitled	<u>Yunnow Welb</u>								-	
		1	<u>C</u> onfigure Plant	T	Set <u>P</u> ar	amet	ers			<u>G</u> et Res	sults	
		Overall Plant	Coal <u>B</u> ase Properties Plant	P C	Emission <u>N</u> C onstr <u>a</u> ints Cor)x itro1	Mercury Control	Pe	aticulate Control	SO2 Cont	arol Solid Mgr	is nt
3	I		Title		Units	Unc	Value	Calc	Min	Max	Default	
Į,		1	Construction Time		years		5.000		0.0	10.00	5.000	
		2			<u> </u>	1'					[]	
÷P		3	General Facilities Capital		%PFC		10.00		0.0	20.00	10.00	
–		4	Engineering & Home Office Fe)es	%PFC		6.500		0.0	20.00	6.500	
		5	Project Contingency Cost		%PFC		11.67		0.0	100.0	11.67	
궤		6	Proces Contingency Cost		%PFC		0.3000		0.0	100.0	0.3000	
-11		7	Royalty Fees		%PFC		7.000e-02		0.0	2.000	7.000e-02	
20		8					'					
		9	Pre-Production Costs			'	[']					
Į,		10	Fixed Operating Cost		months		1.000		0.0	12.00	1.000	
		11	Variable Operating Cost		months		1.000		0.0	12.00	1.000	
Į,		12	Misc. Capital Cost		%TPI		2.000		0.0	10.00	2.000	
		13				'						
		14	Inventory Capital		%TPC		6.000e-02		0.0	10.00	6.000e-02	
1		15				<u> </u>						
		16					'					
1		17				<u> </u>						
	JU.	18				'	'					
		Proc	ess Type: Base Plant		7		Costs are	in Cor	stant 1996	ó dollars.		
-P	1F	1. Devel		. 7	2 Einensins	4.7			a		6.0838.0	

The Base Plant-4. Capital Cost input screen workspace

Movement in the Workspace

One may move throughout the spreadsheet by doing any one of the following:

- Moving the mouse cursor (it will be the cross cursor): Move the cursor over a cell and click to select a cell.
- Using the **Enter** key on the keyboard: Pressing **Enter** will select the cell beneath the currently selected cell.
- Using the arrow keys on the keyboard: you may move up (↑), down (↓), left (←), and right (→).

When an individual cell is selected, it is outlined in black.

	Title	Units	Unc	Value	Calc	Min	Max	Default
1	Construction Time	years		5		0	10	5
2								
3	General Facilities Capital	%PFC		10		0	20	10
4	Engineering & Home Office Fees	%PFC		6.5		0	20	6.5
5	Project Contingency Cost	%PFC		11.67	Ĭ	0	100	11.67

The cell selected is in the Value column for the Engineering & Home Office Fees

Selecting Cells

You may select individual cells (see "

Parameters and Results Workspace" on page 28), multiple cells, or entire rows, columns, or tables. Once selected, the contents of the cells may be copied to the windows clipboard for insertion into another application. (See "Windows Copy, Cut, and Paste" on page 66.)

Selecting Multiple Cells

To select multiple cells, do one of the following:

- Click and drag the mouse cursor (it will be the cross cursor) over the cells you would like to select.
- Hold down the shift key and use the arrow keys on the keyboard to select a group of cells.

The first cell selected will be outlined in black, all other selected cells will be reverse video.

	Title	Units	Unc	Value	Calc	Min	Max	Default
1	Construction Time	years		5		0	10	5
2								
3	General Facilities Capital	%PFC		10		0	20	10
4	Engineering & Home Office Fees	%PFC		6.5		0	20	6.5
5	Project Contingency Cost	%PFC		11.67		0	100	11.67

The Values for General Facilities Capital, Engineering & Home Office Fees, and Project Contingency Cost are highlighted

Selecting Entire Rows, Columns, or Tables

To select an entire column: Click the title button (column heading) above the column.

To select an entire row: Click the numbered button (row heading) to the left of the row.

To select an entire table: Click the button in the upper left-hand corner of the spreadsheet.

	Title	Units	Unc	Value	Calc	Min	Max	Default
1	Construction Time	years		5		0	10	5
2								
3	General Facilities Capital	%PFC		10		0	20	10
4	Engineering & Home Office Fees	%PFC		6.5		0	20	6.5
5	Project Contingency Cost	%PFC		11.67		0	100	11.67

The entire row for Engineering & Home Office Fees is selected.
Highlighting

On some parameters and results screens, parameters or results are highlighted to indicate their importance. Parameters are highlighted in blue, results are highlighted in yellow.

😻 IE File	וווווווווווווווווווווווווווווווווווו												
Ē	-	Untitled	·										
	<u>C</u> onfigure Plant					Set <u>P</u> arameters					<u>G</u> et Res	ults	
		Overall P <u>l</u> ant	Coal Properties	<u>B</u> ase Plant	Emission Constr <u>a</u> ints	<u>N</u> C Cont	x trol	Mercury Control	P	ar <u>t</u> iculate Control	SO2 Contr	rol Sol <u>M</u> g	ids mt
9			Tit	tle	Uni	ts	Unc	Value	Calc	Min	Max	Default	
*		1	Gross Electrical O	utput	MV	Vg		500.0		100.0	1500	500.0	
Ba		2	Steam Cycle Heat	Rate	Btu/k	Wh		7880		6000	1.100e+04	7880	
-	Ш	3	Boiler Efficiency		%			89.36	M	0.0	100.0	calc	
-6		4	Capacity Factor		%			75.00		0.0	100.0	75.00	
P	Ш	5	Excess Air For Fu	mace	% sto	oich.		20.00		0.0	40.00	calc	
	Ш	6	Leakage Air at Pre	heater	% sto	oich.		19.00	M	0.0	60.00	calc	
<u>-</u>		7	Gas Temp. Exiting	Economizer	deg	. F		700.0		250.0	1200	700.0	
M		8	Gas Temp. Exiting	Air Preheater	deg	. F		300.0		150.0	400.0	300.0	
	Ш	9	Ambient Air Temp	perature	deg	. F		80.00		-50.00	130.0	80.00	
	Ш	10	Ambient Air Press	sure	psi	ia		14.70		12.00	15.00	14.70	
	Ш	11	Ambient Air Humi	idity	16 H2O/18	o dry air		1.800e-02		0.0	3.000e-02	1.800e-02	
	Ш	12	Percent Water in F	Bottom Ash Slu	ice %			39.30	M	0.0	100.0	calc	
		13	Base Plant Energ	y Requirement:	8								
		14	Coal Pulverizer		% M	Wg		0.6000	Ľ	0.0	2.000	calc	
	1	15	Steam Cycle Pump	s	% M	Wg		0.6500		0.0	2.000	0.6500	
		16	Forced Draft Fans		% M	Wg		1.500		0.0	4.000	1.500	
		17	Cooling System		% M	Wg		1.800		0.0	2.000	1.800	
	1	18	Miscellaneous		% M	Wg		1.300		0.0	4.000	1.300	
		Proc	ess Type: Base	Plant		Ψ.							
		<u>1</u> . Perfe	ormance <u>2</u> . Fur	mace Factors /	<u>3</u> . Financ	ing /	<u>4</u> . F	Retrofit Cost	Κ:	i. Capital C	ost / 🤶	i. O&M Co:	st

The Base Plant—1. Performance input screen

T 🚟 Untitled								
ľ	Configure Plant			Ĩ	Set <u>P</u> ara	ame	ters <u>G</u> et	Results
		Ove Pla	erall F <u>u</u> el ant (Coal) <u>B</u> oiler	<u>A</u> ir Preheater	r Control	Me Co	rcury Particulate <u>S</u> O2 ntrol Control Control	Solids Mgmt Stac <u>k</u>
			Process Area		Direct Capital Costs (M\$)		Process Area	Indirect Capital Costs (M\$)
Ш		1	Steam Generator		119.4	1	Process Facilities Capital	288.4
Ш		2	Turbine Island		86.50	2	General Facilities Capital	28.84
Ш		3	Coal Handling		38.23	3	Eng. & Home Office Fees	18.75
Ш		4	A sh Handling		5.259	4	Project Contingency Cost	33.66
Ш		5	Water Treatment		7.336	5	Process Contingency Cost	0.8652
Ш		6	Auxiliaries		31.73	6	Interest Charges (AFUDC)	48.26
Ш		7	Process Facilities Capital		288.4	7	Royalty Fees	0.2019
Ш		8				8	Preproduction (Startup) Cost	12.98
Ш		9				9	Inventory (Working) Capital	0.2223
Ш		10				10	Total Capital Requirement (TCR)	432.2
		11				11		
1		12				12		
1		13				13		
1		14				14		
		15				15		
		Pr	ocess Type: Tangential Boil	er	7		Costs are in Constant 1996 dolla	rs.

The Boiler—2. Capital Cost Result Screen

Process Type Pull-Down Menus

Your power plant may have more than one technology for some processes (especially NO_x Control). Therefore, at the bottom of most parameters and results screens, there is a pull-down menu which indicates which process is addressed.



The Process Type Pull-Down Menu from the NO_x Control—1. Config input screen

To change the process for which you are entering inputs or viewing results, click on the arrow next to the box and choose the appropriate process.

If there is only one technology selected for that process, it will display in gray text and it will not be possible to change it.

Running the Model

Starting the Model

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A program group called **IECM Interface** is created when the model is installed. It will display in the **Programs** group in the Start Menu. The program group contains several icons—one is for the help file, another for the main program file titled **IECM**. The icon for the IECM model is shown to the left. To start the Model, click this program icon in the Start Menu.

The model will launch, and the IECM Interface Window (see "The IECM Window" on page 18) and Logo Box will display.



The IECM Logo Box

The Logo Box will disappear in 5 seconds, after which the interface will be ready for use. You may also click the **Close** button (\mathbf{x}) in the upper right hand corner of the logo box to begin.

Choosing a Session

To begin using the IECM Interface, you must first choose a session. A session is a complete collection of data—configuration, parameters, and results—which describes one power plant. The model uses the configuration settings and parameters in a session to calculate the results.

The first time you use the software, you will have to create a new session. (See "Creating a New Session" on page 61.)

At subsequent startups, you may create a new session or use a previously saved session. (See "Working with Sessions" on page 61.)

Using the Model

There are eight steps involved in running the model:

- 1. Start the Model. (See "Starting the Model" on page 33.)
- 2. Open a session (existing or new). (See "Creating a New Session" on page 61.)
- 3. Configure the Plant. (See "Configuring the Plant" on page 35.)
- 4. Set Input Parameters. (See "Setting Parameters" on page 38.)
- 5. View Results. (See "Getting Results" on page 50.)
- 6. Print or Export Results (if desired). (See "Printing" on page 68 or "Exporting a Session" on page 66.)
- 7. Save the session results (if desired). (See "Saving a Session's Results" on page 62.)
- 8. Exit the model. (See "Exiting the Model" below.)

Exiting the Model

To quit the model, do one of the following:

- Pull down the **<u>File</u>** pull down menu and select **<u>Exit</u>**.
- Click the **Close** button (**x**) in the upper right hand corner of the IECM window.
- Press Alt-F4.

A dialog box will ask if you want to save results. (See "Saving a Session's Results" on page 62.) To save results, click the **Yes** button. To exit without saving results, click the **No** button. To abandon the procedure, click the **Cancel** button.



The Save Results at Close dialog box

Configuring the Plant

Configure Plant

Configure Plant is the first of the three program areas. When you begin working with a session, the software will display this area. You may also choose this area by clicking on its tab at the top of the screen. You may return to **Configure Plant** and change the configuration settings at any time.

In <u>Configure Plant</u> you choose the technologies implemented by the plant and how they will operate. Available options are presented via pull-down menus. Detailed descriptions of each option is given in the *User Manual*.

Once you have selected the options for the session, you may move on to the <u>Set</u> Parameters or <u>Get Results</u> program areas.

🐨 IE	CM Interface										
Eile	<u>E</u> dit ⊻iew <u>W</u> indow <u>I</u>	<u>H</u> elp									
	Confrome Plant Set Parameters Cat Desults										
	<u>C</u> onfig	ure Plant	Set <u>P</u>	arameters	<u>G</u> et Results						
븨											
	G	(1		W t D '							
×	<u>Compusition</u> C	ontrois		Plant Diagram							
	Furnace Type:	Tangential	<u> </u>								
	NOx Control:	In-Furnace Controls	•								
₫ ¹	Post-Combustion Controls										
?	NOx Control:	Hot-Side SCR	-	T	₽						
<u> </u>	Mercury:	Carbon + Water Inje	tion 🗨		Inj.						
	Particulates:	Cold-Side ESP	•	│ LIL→	I → <mark>™</mark> → <mark>■</mark> ┘ │ │ │						
	SO2 Control:	Wet FGD	-		— <mark>∞</mark> • ₩ T						
	S02/N0x:	None	-								
	Solids Manag	ement		Ļ	1						
	Regovernu	Nene									
	Recovery.	Nune	×								
	Disposal:	mixed w/ Landfill	•								

The Configure Plant Program Area

Configuration Pull-Down Menus

A series of pull-down menus are displayed on the left side of the screen. Each corresponds to a plant configuration setting or technology.

Combustion Controls							
Furnace Type:	Tangential 🗾						
NOx Control:	In-Furnace Controls	•					



Changing Configurations

To change a configuration setting:

Using the Mouse:

1. Click the arrow button to the right of the setting, and the box pulls down to display the options possible for that configuration setting.

SO2 Control:	None
	None
	Wet FGD
	Lime Spray Dryer

2. Click the option you desire and it will be selected and displayed in the box.

Using the Keyboard:

- 1. Move between configuration settings by pressing the **Tab** key to move to the next setting, and **Shift-Tab** to move to the previous setting.
- 2. Change the setting by using the arrow keys: Press the up arrow (\uparrow) key to change the setting to the previous possible option, and the down arrow (\downarrow) key to change the setting to the next possible option.

Invalid Selections

Some combinations of options are not available. Certain settings depend on other configuration settings.

If an option cannot be selected, it will display in gray text and it will not be possible to choose it.

SO2 Control:	Wet FGD	-
\$02/N0x;	None	-

If an SO2 control technology is selected, combined SO_2/NO_x controls are not available

Plant Diagram

A plant at the right side of the screen displays icons for the technology options you have selected for the plant configuration.



The Plant Diagram

Setting Parameters

Set Parameters

The second of the three program areas is **Set Parameters**. Choose this area by clicking its tab at the top of the screen. You may return to **Set Parameters** and change the inputs at any time.

In <u>Set Parameters</u>, you modify the input values for the session. Detailed descriptions of all inputs are given in the *User Manual*.

😈 🛙	♥ IECM Interface ■ ■ × Elle Edit View Window Help										
	F	Untitled									
	Configure Plant Set P					et <u>P</u> aramete	rs	<u>G</u> et Results			
	Overall Coal <u>B</u> ase Emissic Plant Properties Plant Constrai		Emission Constr <u>a</u> ints	<u>N</u> Ox Control	Mercur <u>y</u> Control	Par <u>t</u> iculate Control	SO2 Control	Solids <u>Mg</u> mt			
		Combusti Furnace I NOx Cont <u>Post-Com</u> NOx Cont Mercury: Particulat SO2 Cont SO2/NOx <u>SOlids Ma</u> Recovery: Fly Ash Disposal:	on Control ype: Tange rol: In-Furn Carbo kes: Cold-S rol: Wet F(: None anagement None mixed	tial nace Controls ntrols de SCR n + Water Injec de ESP 3D	tion	Plant	Diagram				

The Overall Plant tab is displayed when Set Parameters is first selected.

The Set Parameters Program Area

Plant Diagram

The first Technology Navigation Tab in the <u>Set Parameters</u> program area is for the **Overall Plant**. This screen displays the plant configuration settings on the left side of the page and a diagram of the plant as configured at the right of the page. (See "Configuring the Plant" on page 35.) No inputs are entered on this screen.



The Plant Diagram

Using the Plant Diagram

The Plant Diagram can be used as an alternate way to move among input Technology Navigation tabs. Do one of the following:

- Click the button for the technology for which you would like to provide inputs and it will activate the corresponding tab for that technology.
- Move through the Plant Diagram by pressing the **Tab** key. A highlighting box will surround the technology selected. Then press the **Space bar** to activate the corresponding tab for that technology.

Set Parameters Workspace

Choosing one of the technology area tabs brings up a workspace for the parameters for that area. The workspace imitates a spreadsheet (see "Parameters and Results Workspace" on page 28) with the following columns: Title, Units, Uncertainty, Value, Calculated, Minimum, Maximum, and Default.

ile I	_M E_dit	Interface View <u>W</u>	<u>√</u> indow <u>H</u> elp											
<u>ר</u> 	 -	Untitled (<u>C</u> onfigure Pla	\square	Set <u>P</u> arameters				Ĩ	<u> </u>				
		Overall Plant	Coal P <u>r</u> operties	<u>B</u> ase Plant	En Con	nission nstr <u>a</u> ints	<u>N</u> O Cont	x rol	Mercury Control	P	ar <u>t</u> iculate Control	<u>S</u> O2 Con	trol M_{ϵ}	ids gmt
è	١ſ		Ti	itle		Units		Unc	Value	Calc	Min	Max	Default	
1	Ш	1	Construction Tim	ie		years			5.000		0.0	10.00	5.000	
	Ш	2												
31	Ш	3	General Facilities	Capital		%PFC			10.00		0.0	20.00	10.00	
	Ш	4	Engineering & H	ome Office Fees	5	%PFC			6.500		0.0	20.00	6.500	
3	Ш	5	Project Continger	ncy Cost		%PFC			11.67		0.0	100.0	11.67	
1	Ш	6	Proces Continger	ncy Cost		%PFC			0.3000		0.0	100.0	0.3000	
	Ш	7	Royalty Fees			%PFC			7.000e-02		0.0	2.000	7.000e-02	
1	Ш	8												
	Ш	9	Pre-Produ	ction Costs										
	Ш	10	Fixed Operating O	Cost		month	s		1.000		0.0	12.00	1.000	
	Ш	11	Variable Operatin	gCost		month	s		1.000		0.0	12.00	1.000	
	Ш	12	Misc. Capital Cos	st.		%TPI			2.000		0.0	10.00	2.000	
	Ш	13												
	Ш	14	Inventory Capital	L		%TPC			6.000e-02		0.0	10.00	6.000e-02	
	Ш	15												
	Ш	16												
		17												
	Ш	18												
		Proc	ess Type: Base	e Plant			~		Costs are	in Cor	ıstant 1990	ó dollars.		
	k	<u>1</u> . Perfe	ormance 🖌 <u>2</u> . Fu	umace Factors	/	3. Financin	3 /	<u>4</u> . F	letrofit Cost	λ	5. Capital C	ost	<u>6</u> . O&M Co:	st /

The Base Plant—4. Capital Cost input screen workspace

When a new session is created, the default values are loaded for each parameter. You may change any or all of the values for any or all of the technologies.

Because default values exist for every parameter, you do not have to visit every screen, or enter parameters in any particular order.

Movement in the Workspace

One may move throughout the spreadsheet by doing any one of the following:

- Moving the mouse cursor (it will be the cross cursor): Move the cursor over a cell and click to select a cell.
- Using the **Enter** key on the keyboard: Pressing **Enter** will select the cell beneath the currently selected cell.
- Using the arrow keys on the keyboard: you may move up (↑), down (↓), left (←), and right (→).

The cell which is selected—and in which the cursor will type—is outlined in black.

	Title	Units	Unc	Value	Calc	Min	Max	Default
1	Construction Time	years		5		0	10	5
2								
3	General Facilities Capital	%PFC		10		0	20	10
4	Engineering & Home Office Fees	%PFC		6.5		0	20	6.5
5	Project Contingency Cost	%PFC		11.67	ĺ	0	100	11.67

The cell selected is in the Value column for the Engineering & Home Office Fees

Title

This column displays the name of the parameter to be set in that row. Titles cannot be changed. Each parameter is described in detail in the *User Manual*.

Units

This column displays the units in which the parameter will be input. Units may be changed for inputs; see "Input Tools" on page 44. (Units may also be changed in results; see "Result Tools" on page 59.)

Uncertainty (Unc)

This button opens the Uncertainty Editor dialog box so that you may input probabilistic values. Entering uncertainty is described in "Uncertain Values" on page 46.

Value

This column displays the current value of the parameter. To change the value, see "

Entering Inputs" on page 43.

Calculated (Calc)

This check-box indicates whether the parameter is entered by the user or calculated by the model using other parameters. If it is checked, the value is calculated, if it is not checked, the value may be changed. Rows with no check box contain static values. See "Calculated Values" on page 44.

Minimum, Maximum, and Default

These columns provide the minimum, maximum, and default values for the parameter. If a value below the minimum or above the maximum is entered, the interface will display a warning, but the value will be used as entered.

Minimum – the lower limit for the value entered in the Value column.

Maximum – the upper limit for the value entered in the Value column.

Default – the default value which was shipped with the IECM software, in case the value must be reset to the default. All parameters have a default value.

Entering Inputs

Input values may be entered, or the current values may be edited. In addition, some values are selected from pull-down boxes.

Entering Values

To enter values:

1. Select the appropriate cell under the **Value** column. The selected cell will be outlined in black.

Unc	Value	Calc
	2500 🖓	
	5694	Í

2. Type the new value. The value entered will replace the current value.

The **Default** column displays the default value which was shipped with the IECM for that parameter, in case the value must be reset to the default.

Editing values

To change a value rather than replacing it:

1. Use the mouse cursor (the cross cursor) and double-click the cell. The value will display at the left, highlighted in blue and the I-Beam mouse cursor will display.

Unc	Value	Calc
	2500]	
	5694	

2. Click again with the cursor next to the number you would like to change. An editing cursor will display. You may now edit the number in the cell.

Unc	Value	Calc
	2500	
	5694	

The **Default** column displays the default value which was shipped with the IECM for that parameter, in case the value must be reset to the default.

Choices in Pull-Down Boxes

Some cells have fixed choices in the form of pull-down boxes.

	Title	Units	Unc	Value
1	Reagent			Limestone
2	Flue Gas Bypass Control			No Bypase 🔻
3				

The SO2 Control—1. Config (Wet FGD) has two values in pull-pull-down boxes

To change the option in a pull-down box:

1. Click the arrow button to the right of the cell, and the box pulls down to display the options possible for that cell.



2. Click the option you desire and it will be selected and displayed in the box.

The **Default** column displays the default choice which was shipped with the IECM for that parameter, in case it must be reset to the default.

Input Tools

Inputs may be entered in either English or Metric units. Use the **Input Tools** floating palette to change the unit system in which inputs will be entered. You may move this floating palette to the side of the screen, change units, and watch how the results are altered as a result. To close the palette, click the **Close** button (\mathbf{x}) in the upper right hand corner of the palette.

More information on various unit options is provided in the User Manual.

Changing the Unit System for Inputs

To change how results are displayed:

1. Pull down the <u>View</u> menu and choose <u>Input Tools</u>. The Input Tools floating palette will display.



The Input Tools Floating Palette

- 2. Choose the unit system desired by clicking the arrow to the right of the pull-down menu and choosing **English** or **Metric**.
- 3. To close the **Input Tools** floating palette, click the **Close** button (**x**) in the upper right hand corner of the palette.

Calculated Values

Values which are calculated by the program are displayed in blue in the Value column and the **Calc** checkbox is checked.

Value	Calc
75.00	

Changing Calculated Values

To change a calculated value:

1. Click the checkbox to remove the check.

Value	Calc
0	

2. The number will be reset to zero and display in black, and you may change the value as described under "

Uncertain Values

Any input parameter may be assigned a probability distribution. When an input parameter is uncertain, an uncertainty distribution of results is returned. Such result distributions give the *likelihood* of a particular value.

Entering Uncertainty

To enter or edit an uncertain or probabilistic value:

- 1. Click the **Unc** button next to the parameter for which you want to enter an uncertain value.
- 2. The Uncertainty Editor dialog box will display.

Uncertainty Editor				×
Plant Parameter	Units	Value	Minimum	Maximum
Capacity Factor	%	75	0	100
Distribution: None	-			
Description:				
No Uncertainty.				
				Cancel
				Done

The Uncertainty Editor Dialog Box

- 3. Select a Distribution type from the Distribution pull-down box. (See "Distribution Types" on page 47.)
- 4. Enter values for the Minimum and Maximum, Mean and Deviation, or whatever values are needed for the particular Distribution.
- 5. Click the **Done** button.

Once you have entered an uncertainty distribution, a question mark displays on the **Unc** button for that parameter on the input screen.

Unc

2



Distribution Types

Distribution types: The distributions are listed in a pull-down box in the uncertainty editor window. **None** is initially selected because the default is for no uncertainty. The following distributions may be used: **Normal**, **Lognormal**, **Uniform**, **Triangular**. Each option is described in more detail in the *User Manual*.

The distribution types **Fractiles**, **Half Normal**, and **Negative Half Normal** will be available at a future date.

Removing Uncertainty

To remove an uncertainty distributions:

- 1. Click the **Unc** button for which you would like to remove uncertainty. The Uncertainty Editor will display.
- 2. Select **None** from the list of distributions.
- 3. Click the **Done** button. This will make the **None** function permanent and close the uncertainty editor window.

The question mark will no longer display on the **Unc** button for that parameter on the input screen.

Input Navigation Tabs

Most technologies have more than one screen of inputs to enter. These are reached via the Input Navigation tabs at the bottom of the screen.

<u>1</u> . Performance	<u>2</u> . Retrofit Cost	<u>3</u> .CapitalCost	4. O&M Cost /

Input navigatio	n tabs from t	he Particulate	Control ir	ıput area
-----------------	---------------	----------------	------------	-----------

Each tab selects a workspace with a spreadsheet for the appropriate inputs.

Coal Properties Parameters

The **Coal Properties—1. Coal Prop.** input screen is unique within the <u>Set</u> **Parameters** program area.

r	C.	. £		C . T		ì	C	-+ Dlt-					
	<u></u> 01	ingure Fia	mt	Set <u>P</u>	arame	ters	0	st Results					
1	Overall Plant	Coal P <u>r</u> operties	<u>B</u> ase Plant	Emission Constr <u>a</u> ints	Emission <u>N</u> Ox Mercury Particulate Constraints Control Control Control								
ШГ	Current	Coal			Fa	vorite Coals –							
	Name:	Default			Na	me: Wyoming I	Powder River Bas	in					
	Rank:	Bituminous			Ra	nk: Sub-Bitum	inous						
	Source:	Default			E	astern Bituminous	s (HS)						
	Composit	ion (wt% as f	äred) and		E	astern Bituminous	s (LS)						
	Higher H	eating Value	(Btu/lb)		M N	yoming Powder F	liver Basin						
	Tot %:	100.0											
		Property	Value	Save As		Property	Value	Browse All					
	1 Heat	ing Value	14.22K	User-Defined	1	Heating Value	8335	Coals					
	2 Cart	on	78.48		- 2	Carbon	47.85						
	3 Hyda	rogen	5.50	Add to		Hydrogen	3.400	Use This					
	4 Oxy	zen	8.00	Favorites	4	Oxygen	10.82	Coal					
	5 Chlo	rine	0.12	Line Defeut		Chlorine	3.000e-02	Barran Suran					
	6 Sulf	ur	0.60	Use Default Ach Proportion	6	Sulfur	0.4800	Remove From					
	7 Nitr	əgen	1.30	Asirriopenes		Nitrogen	0.6200	ravonites					
	8 Ash		3.80	Edit Ash	<u> </u>	Ash	6.400	View Ash					
	9 Mois	ture	2.20	Properties	<u> </u>	Moisture	30.40	Properties					
	10 Cost	.(\$/ton)	32.07		J <u>+</u>	J Cost (\$/ton)	12.46						
	<u> </u>					L							

The Coal Properties—1. Coal Prop. input screen

There are two panes, one for the properties of the **Current Coal**, the other for those of **Favorite Coals**. The current coal is the coal with which the model will conduct its calculations. Favorite coals are those which you use most.

You may use a favorite coal, use a default model coal, or enter a user-defined coal. Working with coals not provided in the model defaults, entering user-defined coals, editing the ash properties, and other options are described in the *User Manual*.

In a future version of the model it will be possible to load external coal databases created in applications other than the interface.

Using a Favorite Coal

To use one of the Favorite Coals:

- 1. Select the name of the coal in the box in the **Favorite Coals** pane.
- 2. Click the Use This Coal button.

Using Model Defaults

To use a coal from the model defaults that is not listed in the Favorite Coals:

1. Click the **Browse All Coals** button. The Browse All Coals dialog box will display.

				×
Select Source:	Select	Coal:		
Model Defaults	Name:	Appalachian	Low Sulfur	•
User-Defined Coal Cleaning Session V External Database V	Rank: 1 Hea 2 Can 3 Hyd 4 Oxy	Appalachiar Appalachiar Eastern Bitu Eastern Bitu Illinois #6 North Dakot WPC Utah Wyoming Po	I Low Sulfur I Medium Sulfu Iminous (HS) Iminous (LS) a Lignite Iwder River Ba:	r
	5 Ch 6 Su	lorine fur	7.000e-02 0.6400	Add to Favorites
	7 Nit	rogen	1.420	View Ash
	9 Mo	isture	5.630	Properties
	10 Cos	rt (\$/ton)	36.94	
	11			Close

The Browse All Coals dialog box

- 2. Choose Model Defaults in the Select Source Pane.
- 3. Choose a coal from the **Select Coal** Pane:
 - a. Click the arrow button to the right of the **Name:** box, and the box displays a list of coal names.

-Select (Coal:
Name:	Appalachian Low Sulfur 📃
	Appalachian Low Sulfur
	Appalachian Medium Sulfur
	Illinois #6
	North Dakota Lignite
	WPC Utah
	Wyoming Power River Basin

The Select Coal Name Pull-Down Menu

- b. Click the coal you want to use and it will be selected and displayed in the box.
- 4. Click the **Use this Coal** button to use the coal and the **Add to Favorites** button to add the coal the list of favorite coals.
- 5. Click the **Close** button.

Default Ash Properties

Each of the default coals has a full set of default ash properties associated with it. The properties associated with a coal selected in the **Favorite Coals** pane can be viewed by clicking the **View Ash Properties** button on the lower right corner of the pane.

Ash properties are associated with every coal specified, whether from the default coal list, an external coal list, or a user-specified coal. In cases where the ash properties are not given directly, representative ash properties are selected by the IECM interface. See the *User Manual* for more information on ash properties and how they can be specified.

Getting Results

Get Results

The third of the three program areas is <u>Get Results</u>. Choose this area by clicking its tab at the top of the screen. You may return to <u>Get Results</u> at any time to look at results.

In <u>Get Results</u> you view the results for this session. The IECM allows you to view results for any individual plant technology or for the power plant as a whole.

The **<u>1</u>**. **Diagram** screen of the **Overall Plant** tab is displayed when you first choose **<u>Get Results</u>**.

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		🐺 Untitled								
		<u>C</u> onfigu	re Plant	Ĩ	Set <u>P</u> ar	ameters	Ì	<u>6</u>	<u>i</u> et Results	
		Overall Fuel Plant (Coa	1 1) <u>B</u> oiler	<u>A</u> ir Preheater	<u>N</u> Ox Control	Mercury Control	Particulate Control	<u>S</u> O2 Control	Solids Mgmt	Stac <u>k</u>
		Combustion C Furnace Type: NOX Control: <u>Post-Combusti</u> NOX Control: Mercury: Particulates: SO2 Control: SO2/NOX: <u>SO2/NOX:</u> <u>SO1ids Manage</u> Recovery: Fly Ash Disposal: <u>1. Diegram</u>	ontrols Tangential In-Furnace Cont ion Controls Hot-Side SCR Carbon + Water Cold-Side ESP Wet FGD None ement None mixed w/ Landfil	rols Injection		Plant Diag	ram	inj. →		

The Overall Plant-1. Diagram Result Screen

Plant Diagram

The first Technology Navigation Tab in the **Get Results** program area is the **Overall Plant**. The **<u>1</u>**. **Diagram** screen displays the plant configuration settings on the left side of the page and a diagram of the plant as configured at the right of the page. (See "Configuring the Plant" on page 35.) No results are returned on this screen.



The Plant Diagram

Using the Plant Diagram

The Plant Diagram can be used as an alternate way to move among result Technology Navigation tabs. Do one of the following:

- Click the button for the technology for which you would like to get results and it will activate the corresponding tab for that technology.
- Move through the Plant Diagram by pressing the **Tab** key—a box will surround the technology selected. Then press the **Space bar** to activate the corresponding tab for that technology.

Viewing Results

Results are displayed in two different kinds of screens: diagrams and spreadsheet screens. Diagrams provide a schematic of and values for the stream flows into and out of that technology. Spreadsheet workspaces operate in the same way as the spreadsheets used in **Set Parameters**. The workspace imitates a spreadsheet (see "

Parameters and Results Workspace" on page 28) with appropriate results for that technology. A detailed description of all results is provided in the *User Manual*.

The table and diagram results are all deterministic values—uncertainties are not taken into consideration. Graphs are probabilistic. This is different from previous versions of the IECM that used Analytica as a calculation engine. Analytica uses the expected value in table and diagram results, which takes into consideration the uncertainties defined.

Results Navigation Tabs

Many technologies have more than one screen of results. These are reached via the Results Navigation tabs at the bottom of the screen. Each tab selects a screen which displays the appropriate results.



Result Navigation Tabs

Diagrams

Each technology result area has a **Diagram** result screen. This screen provides a schematic of and values for the stream flows into and out of that technology.



The Air Preheater—1. Diagram result screen

Capital Cost Summaries

Some of the technology result areas have a **Capital Cost** result screen. This screen displays spreadsheet workspace tables of the direct and indirect capital costs related to implementation of that technology.

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	ſ		<u>[</u>	⊇onfi	igure	Plant		Ĩ	Set Parameters Get Res								sults		
		Ov Pl	erall ent		F <u>u</u> el Coal)	Boil	er	<u>A</u> ir Preheater	<u>N</u> Ox Control	M C	Mercury Particulate <u>S</u> O2 Control Control Control					Solids Mgmt Stac			
					Pro	cess Are	a]	Direct Capital Costs (M\$)			Pr	ocess Are	a		Indi Capita (A	Indirect Capital Costs (M\$)		
B		1	Rea	ctor H	ousing				2.489	1	Proces	s Facilities	Capital			11	.94		
1997	Ш	2	Am	nonia l	Injectio	n			0.1812	2	Genera	1 Facilities	Capital			1.1	194		
	Ш	3	Duc	ts					3.567	3	Eng. &	Home Off	ice Fees			1.1	194		
8	Ш	Air Preheater Modifications ID Fan Differential		3		0.8525	4	Project	Continger	ncy Cost			1.1	194					
N?	Ш	5	4 Air Preheater Modifications 5 ID Fan Differential 6 Structural Support					0.1347	5	Process Contingency Cost						0.7377			
<u> </u>	Ш	6	5 ID Fan Differential 6 Structural Support						1.292	6	6 Interest Charges (AFUDC)					0.4979			
	Ш	7	Mis	c. Equi	ipment				0.4092	7	Royalty Fees				0.0				
	Ш	8	Initi	al Cata	lyst				3.014	8	Prepro	duction (St	tartup) Co	st		0.4	0.4937		
	Ш	9	Proc	ess Fa	cilities	Capital			11.94	9	Inventory (Working) Capital					8.12	9e-02		
	Ш	10								10	Total C	apital Req	puirement (TCR)		17	1.33		
		11								11									
	Ш	12								12									
	Ш	13								13									
	Ш	14	-							14									
	Ш	15	_							15									
		Pr	ocess	Type:	Hot	Side SC	R		•		Cos	sts are in C	Constant l	996 do	llars.				
			<u>1</u> . Di	agram	Δ	<u>2</u> . Capit	al Cost	<u>_</u>	O&M Cost	Κ	l. Total (Cost 🖌	<u>5</u> . Cost	Inputs	<u> </u>	Gas Su	mmary	Ź	

The NO_x Control—2. *Capital Cost result screen*

O&M Cost Summaries

Some of the technology result areas have a **O&M Cost** result screen. This screen displays spreadsheet workspace tables of the variable and fixed operation and maintenance costs involved in implementation of that technology.

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0			<u>C</u>	onfig	gure I	Plant		Ĩ	S	Set Parameters Get Results								s			
		Ov Pl	erall ant	11 Fuel <u>A</u> ir (Coal) <u>B</u> oiler Preheat					er C	r Control Control Control							Solids Mgmt Stac <u>k</u>				
				Va	riable (Cost Co	троне	nt	0&M (M\$	[Cost /yr)			Fixed	Cost (Сонфонені	t	(D&M Co: (M\$/yr)	st		
R		1	Solid	Waste	e Dispo	osal			0.3	403	1	Q	Operating Labo	r				0.2382			
		2	Powe	r					0.3	131	2	1	Maintenance L	abor				1.888e-0	2		
E I		3	Total	Variat	ole Cos	ts			0.6	534	3	1	Maintenance M	Iaterial				2.823e-0	2		
8		4									4	4	Admin. & Supp	ort Lat	oor		1	7.714e-0	2		
N?		5									5	_ 1	Fotal Fixed Cos	its				0.3625			
		6									6								_111		
		$\left \frac{\gamma}{\alpha}\right $							_		7								-100		
		<u></u>									-						_		-10		
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		12									1	2									
		13									1:	3									
		14									1.	L									
	Π	15									1	5 1	Fotal O&M Co	sts				1.016			
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	Ľ		<u>1</u> . Dia	gram	/	<u>2</u> . Cap	ital Cos	st 入	<u>3</u> . O&M	Cost		<u>4</u> .	TotalCost	<u>5</u>	Cost Input	ts /	<u>6</u> . Ga	s Summa	y /		

The Particulate Control—3. O&M Cost result screen (ESP)

Total Cost Summaries

Some of the technology result areas have a **Total Cost** result screen. This screen displays spreadsheet workspace tables of annual variable, fixed, capital, and operation and maintenance costs involved in implementation of that technology.

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3		C	on	figure Plant	Ĩ		Set	Par	ameter	s	Ĩ		<u>(</u>	iet Re	sults	
		Overall Plant	Ĭ	Fuel (Coal) <u>B</u> oiler	Preh	<u>∖</u> ir neater	<u>N</u> C Cont)x trol	Mercu Contre	ny 1	Par <u>t</u> iculat Control	te	<u>S</u> O2 Control	Sol Mg	iids gmt	Stac <u>k</u>
				Cost	Сонфонет	ut		М	\$/yr	\$/1	MWh	\$/ta re	on NO2 moved	Percen	t Total	
			1	Annual Fixed Cost				0	4435	0.1	1486	2	255.3	12.	01	
ill			2	Annual Variable Co	ost			1	459	0	4887	8	39.8	39.	50	
11			3	Total Annual O&N	I Cost			1.	903	0.0	6373 8004		1095 1004	51.	50	
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The NO_x Control—4. *Total Cost result screen*

Cost Inputs Summaries

Some of the technology result areas have a **Cost Inputs** result screen. This screen displays spreadsheet workspace tables of performance and economic inputs used to calculate total cost values.

		5110	C	onfig	ure F	'lant	Ĩ	Set P	arame	ters	Ge	t Resul	lts
		Ove P <u>l</u> a	rall nt	F <u>1</u> (Co	iel Dal)	<u>B</u> oiler	<u>A</u> ir Preheate	r <u>N</u> Ox Control	M Co	ercury ontrol Control	<u>S</u> O2 Control	Solids Mgmt	Stac <u>k</u>
	ſ		Peri	forman	ce İmpu R	its Used for esults	Total Cost	Value		Economic Inputs Re	Used for Total (sults	Cost	Value
		1	N et P	lant Siz	ce (MW	? ?		454.1	1	Fixed Charge Factor	(fraction)		0.1034
i III	Н.	2	Annı	ial Ope	rating I	Hours (hour	s)	6575	2	Variable Cost Leveli	zation Factor (fr	action)	1.000
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	Π.	4							4	Cost Reporting Yea	:		1996
	Н.	5							5				
'	1	6							6				
Ш	П.	7							7	Total Capital Requir	ed (M\$)		1.959
Ш	1	8							8	Total Variable Costs	(M\$/yr)		0.6534
Ш	II.	9							9	Total Fixed Costs (N	/[\$/yr)		0.3625
Ш	ŀ	10							10				
	1	11							11				
	ŀ	12							12				
	ŀ	13							13				
	ŀ	14							14				
	ľ	Pro	cess 1	Гуре:	Cold	-Side ESP		-	15	Costs are in Co	ıstant 1996 doll	ars.	

The Particulate Control—5. Cost Inputs result screen (ESP)

Gas Summaries

Some of the technology result areas have a **Gas Summary** result screen. This screen displays spreadsheet workspace tables of major flue gas components before and after passing through the technology.

V IEC File B	C M E d	i Interface fit ⊻iew W	indo	w Help						
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6		<u> </u>	on	figure Plant	Set	: <u>P</u> arameter	's	<u>(</u>	<u>i</u> et Results	Ĭ
		Overall Plant	Ĭ	Fuel (Coal) <u>B</u> oiler I	<u>A</u> ir <u>N</u> C Preheater Con)x Mercu trol Contr	ry Particulat ol Control	e <u>S</u> O2 Control	Solids Mgmt	Stac <u>k</u>
5) X				Major Flue Gas C	omponents	Flue Gas In (moles/hr)	Flue Gas Out (moles/hr)	Flue Gas In (ton/hr)	Flue Gas Out (ton/hr)	
2	l		1	Nitrogen (N2)		1.244e+05	1.244e+05	1743	1743	
яII	Ι		2	Oxygen (O2)		9247	9230	148.0	147.7	
	Ι		3	Water Vapor (H2O)		1.386e+04	2.931e+04	124.9	264.1	
<u></u>	Ι		4	Carbon Dioxide (CO2)		2.027e+04	2.031e+04	446.0	446.8	
?	Ι		5	Carbon Monoxide (CO)		0.0	0.0	0.0	0.0	
	Ι		7	Hydrochloric Acid (HCI)		10.50	1.050	0.1913	1.9130-02	
	Ι		9	Sulfur Dioxide (SO2)	502)	0.2000	0.1444	1.700	6 790e-02	
	Ι		0	Nitric Oride (NO)	505)	10.91	10.91	0.1637	0.1637	
	Ι		10	Nitrogen Dioxide (NO2)		0.5744	0.5744	1.321e-02	1.321e-02	
	Ι		11	Total		1.679e+05	1.833e+05	2464	2602	
	Ι		12							
	Ι		13							
	Ι		14							
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		Process	Туре	Wet FGD	*					
		<u>1</u> . Dia	igrar	m 🖌 2. Capital Cost	<u>3</u> .0&MCo	st <u>4</u> . T	otalCost 🖌	<u>5</u> . Cost Input	s <u> 6</u> . Gas Si	ummary

The SO₂ Control—6. Gas Summary result screen

Graphs

Clicking any result value brings up a graph for that value. While all of the values displayed in diagrams and tables are deterministic, some have uncertainty in their calculation. If there is no uncertainty in the value's calculation, the graph will display a vertical line.

If uncertainty is present, the graph will display a curve of all possible values.



Boiler Flue Gas Solids Flow Graph (Deterministic Result)



ESP Flue Gas Out Solids Flow Graph (Uncertain Result)

The new IECM plots all samples on the CDF graph. The Analytica results in the Macintosh IECM version only displayed every fourth value (a value that could be

adjusted within the model). By eliminating all but every fourth value, the Mac version of the IECM "smoothed" the graph.

When you first bring up a graph, there will be a short delay as all result graphs are drawn. Once all the graphs are drawn, there should be little more than a split second delay when you choose another graph. (However, if you change the plant configuration or input values and then return to **<u>Get Results</u>**, the graphs will have to be redrawn, causing another delay.)

More information on graphs is provided in the User Manual.

Result Tools

Results may be displayed according to different rules. Use the **Result Tools** floating palette to change the type of results displayed, the units in which results are displayed, or the type of cost results displayed. You may move this floating palette to the side of the screen, change units, and watch how the results are altered as a result. To close the palette, click the **Close** button (\mathbf{x}) in the upper right hand corner of the palette.

More information on various unit options is provided in the User Manual.

Changing How Results are Displayed

To change how results are displayed:

1. Pull down the <u>View</u> menu and choose <u>Result Tools</u>. The Result Tools floating palette will display.

Result Tools: Untitled	x
Result Type:	Deterministic
	<u>Units</u>
Unit System:	English
Time Period:	Max Hourly
Perf. Table:	Default
Cost Table:	M\$(Cap), M\$/yr(O&M)
	<u>Revenue</u>
Cost Year:	1996 💌
Inflation Ctrl:	Constant

The Result Tools Floating Palette

- 2. Choose the options desired by clicking the appropriate pull-down menus.
- 3. To close the **Result Tools** floating palette, click the **Close** button (**x**) in the upper right hand corner of the palette.

Uncertainty Areas

Uncertainty may be entered in any or all input parameters (see "Uncertain Values" on page 46). However, there may be times that you would like to exclude uncertainty from results for a technology.

You may choose the technologies for which uncertain values are displayed in results from the **Uncertainty Tools** floating palette. You may move this floating palette to the side of the screen, change settings, and watch how the results are altered as a result. To close the palette, click the **Close** button (\mathbf{X}) in the upper right hand corner of the palette.

More information on running a Probabilistic analysis is provided in the *User Manual*.

Choosing Uncertainty Areas

To Choose Uncertainty Areas:

1. Pull down the <u>View</u> menu and choose <u>Uncertainty Tools</u>. The Uncertainty Tools floating palette will display.

Uncertai	nty Tools: Unti	itled			×
	<u>U</u> 1	ncerta	inty .	Areas	
🔽 Bas	e Plant		v	NOx Control	
🔽 Air	Preheater		I 🗹	Particulate Contro	1
🔽 Soli	d Waste Mg	mt.		SO2 Control	
				SO2/NOx Control	
	Select A	11		Select None	
Graph	Size:	50			
Sample	Size:	50			
Sampli	ng Method:	Media	n LHS	1	•

The Uncertainty Tools floating palette

- 2. Choose the technology or technologies for which you would like results with uncertain values by clicking the check box to the left of each technology.
- 3. You may select all or none by clicking the buttons at the bottom of the palette.
- 4. To close the Uncertainty Tools floating palette, click the Close button (x) in the upper right hand corner of the palette.

Working with Sessions

Sessions

A session is a complete collection of data—configuration settings, and input parameters—which describes one power plant. The model uses the configuration settings and parameters in a session to calculate the results.

You may run multiple power plant sessions at the same time in order to compare configurations, results, etc.

NOTE:

A future version of the IECM will enable the user to specify multiple types of sessions. The current version only supports one power plant simulation. Future versions will add optimization (optimizing specified parameters for a given plant flow sheet to optimize an objective such as cost) and synthesis (optimizing a flow sheet with specified parameters to optimize an objective).

Creating a New Session

To create a new session, do any one of the following:

- Pull down the **File** menu and select **New Session...**.
- Click the **New Session** button on the toolbar on the left side of the IECM window. (See "The Toolbar" on page 24.)
- Press Ctrl-N.

The **New Session** dialog box will display. Type in the name of the new session and click the **Ok** button.



The New Session dialog box

Opening an Existing Session

To open an existing session, do any one of the following:

- Pull down the File menu and select Open Session....
- Click the **Open Session** button on the toolbar on the left side of the IECM window. (See "The Toolbar" on page 24.)
- Press Ctrl-O.

The **Open Session** dialog box will display.

Open Session	×
Please choose a session:	Ok
Untitled	
	Cancel

The Open Session dialog box

In the **Open Session** dialog box:

- 1. Choose the session you would like to open from the list.
- 2. Click the **Ok** button.

Sessions that are currently open will display in gray and cannot be opened again.

Saving a Session's Results

The information stored in a session—configuration settings and input parameters—is saved as you choose the settings and input data. Results are calculated from that information and initially stored in memory.

Sometimes it is important to save the session's results to disk. At this time it is only necessary if you have multiple sessions open and are comparing results, or if you want to view results outside the interface. If you only ever run one session at a time, you may skip this procedure.

To save a session's results, do any one of the following:

- Pull down the **File** menu and select **Save session**.
- Click the **Save results** button on the toolbar on the left side of the IECM window.
- Press Ctrl-S.

A dialog box will display which informs you that the process is time-consuming and often unnecessary. To save results, click the **Yes** button. To abandon the procedure, click the **No** button.



The Save Results dialog box.

Saving a Session with a Different Name

To save a session you are working on with a different name, pull down the <u>File</u> menu and select **Save** <u>As...</u>. The **Save Session** As dialog box will display.

In the Save Session As dialog box,

- 1. Type the name of the session in the box next to File <u>n</u>ame.
- 2. Click the **Save** button.

Once you have saved a session with a different name, all subsequent <u>Save</u> commands will save the session with the new name.

Closing a Session

To close a session you are working on, do any one of the following:

- Pull down the <u>File</u> menu and select <u>Close Session</u>.
- Click the **Close this session** button on the toolbar on the left side of the IECM window.
- Click the **Close** button (**x**) in the upper right hand corner of the session window.
- Press Ctrl-F4.

A dialog box will display which asks if you want to save results. It will inform you that saving results is time-consuming and often unnecessary. (See "Saving a Session's Results" on page 62.) To save results, click the **Yes** button. To close without saving results, click the **No** button. To abandon the procedure, click the **Cancel** button.

IECM Int	erface 🛛
?	Do you want to save results for session "Untitled"? (This may take several minutes and is not necessary unless you want to view your results outside the interface.)
and a second sec	Yes <u>No</u> Cancel <u>H</u> elp

The Save Results at Close dialog box

Deleting a Session

To delete an existing session, do one of the following:

- Pull down the **<u>File</u>** menu and select **<u>D</u>elete Session**.
- Click the **Delete Session** button on the toolbar on the left side of the IECM window. (See "The Toolbar" on page 24.)

The **Delete Session** dialog box will display.

Delete Session	×
Please choose a session:	OK
Untitled	
	Cancel

The Delete Session dialog box

In the **Delete Session** dialog box:

- 1. Choose the session you would like to delete from the list.
- 2. Click the **Ok** button.

To exit the Delete Session dialog box without deleting a session, click the **Cancel** button or press the **Esc** key.

Sessions that are currently open will display in gray and cannot be deleted until they are closed.

NOTE: Once you delete a session, it can no longer be accessed. Use caution when deleting sessions.

Unlocking a Session

This command allows you to unlock a session that was not closed normally because of a system problem such as a crash, a loss of network connection, or another cause. You cannot open such sessions when you start the IECM again because the software believes that they are already open. Unlocking the session enables you to open the session again.

NOTE: Choose this command only if you the session was not closed normally the last time you used it. Do not unlock a session that **actually** is in use, as it may cause unpredictable results.

To unlock a session, pull down the File menu and select Unlock Session.

A warning box will display.



The Unlock Session Warning Box

Click the <u>Y</u>es button to proceed.

The Unlock Session dialog box will display.

on 🛛	nlock Session
a session: Ok	lease choose a session:
	Untitled
Cancel	

The Unlock Session dialog box

In the Unlock Session dialog box,

- 1. Choose the session you would like to unlock.
- 2. Click the **Ok** button.

You may then open the session. See "Opening an Existing Session" on page 62.

To exit the Unlock Session dialog box without unlocking a session, click the **Cancel** button or press the **Esc** key.

Sessions that are not currently open **or** locked by the system will display in gray and cannot be unlocked.

Importing and Exporting Data

Importing a Session

The **Import** function is not yet available. At a future date, you will be able to import a database of session data into the interface. Thus, you will be able to exchange data with other users, load older archive data, and use data assembled in other ways than by using the interface.

Therefore, the **Import** option on the **File** menu and the **Import** button on the toolbar are not yet active. Watch for updates of the interface for details about importing.

Exporting a Session

The **Export** function is not yet available. At a future date, you will be able to export session data in a standard database format. Thus, you will be able to exchange data with other users, save older data to archives, and use model data in other ways than by using the interface.

An **Export** option will be added to the **<u>File</u>** menu and an **Export** button will be added to the toolbar. Watch for updates of the interface for details about exporting.

Print Screen

Pressing the **Print Screen** key at the top of the keyboard copies a snapshot of the entire IECM Window to the clipboard. This snapshot may then be pasted into any windows application.

Windows Copy, Cut, and Paste

As has been noted, the input and results screens function like spreadsheets (see "
Parameters and Results Workspace" on page 28). Data can be copied from the cells or pasted into them using the Windows **Copy**, **Cut**, and **Paste** commands.

For information about copying graphs, see the User Manual.

Сору

To copy data from an input or results screen:

- 1. Select the cells that you want to copy (see "Selecting Cells" on page 29).
- 2. Do any one of the following:
 - Pull down the **Edit** menu and select **Copy**.
 - Click the **Copy** button on the toolbar on the left side of the IECM window. (See "The Toolbar" on page 24.)
 - Press Ctrl-C.

Cut

The windows **Cut** command will remove data that is not static—i.e. only data on input screens in the Value column which is not calculated. If static data (data in other columns or calculated values) is highlighted and cut, it will be copied—and thus can be pasted—but it will not be removed from the workspace.

To cut data from an input or results screen:

- 1. Select the cells that you want to copy (see "Selecting Cells" on page 29).
- 2. Do one of the following:
 - Pull down the Edit menu and select Cut.
 - Click the Cut button on the toolbar on the left side of the IECM window. (See "The Toolbar" on page 24.)
 - Press Ctrl-X.

Paste

To paste data from a spreadsheet or database into an input screen:

- 1. Make sure that the data is in exactly the same format as the input screen accepts. You will only be able to paste data into cells that accept inputs (i.e. cells in the Value column that are not calculated).
- 2. Select the cells that you want to paste data into (see "Selecting Cells" on page 29).
- 3. Do any one of the following:
 - Pull down the Edit menu and select Paste.
 - Click the Paste button on the toolbar on the left side of the IECM window. (See "The Toolbar" on page 24.)
 - Press Ctrl-V.

Printing

Print Dialog Box

The IECM has a print option so that you may print the pertinent information from the screen which is currently displayed. If you are in Configure Plant, the IECM will print a summary of the plant configuration options you have selected. If you are in Set Paramters, the IECM will print the input values from the screen which is displayed. If you are in Get Results, the IECM will print the results values from the screen which is displayed.

To print data, do any one of the following:

- Pull down the <u>File</u> menu and select <u>Print</u>. (See "The File Menu" on page 19.)
- Click the **Print** button on the toolbar on the left side of the IECM window. (See "The Toolbar" on page 24.)
- Press Ctrl-P.

The **Print** dialog box will display.

Print				?
Printer —				
<u>N</u> ame:	HP DeskJet			<u>P</u> roperties
Status:	Ready			
Type:	HP DeskJet			
Where:	LPT1:			
Comment:				Fint to file
Print range			Copies	
• <u>A</u> II			Number of <u>co</u>	opies: 1 📩
C Pages	from: 0	to: 0		
C Select	ion			
			OK	Cancel

The Print Dialog Box

To Print, click the **OK** button.

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