# 11 Specify Analysis

# 11 SPECIFY ANALYSIS

## 11.1 Introduction

After all the input data files have been created, you next specify the analyses. This step tells ASEAM3.0 which files are to be used in the calculations and which method of calculation is to be used. The algorithms used are the same in all cases, but the input screens and output reports vary. You may specify one or many sets of calculations to be performed.

To access the Specify Analyses segment of ASEAM3.0, select "Specify Analyses" from the Main Menu or "Main Menu - Specify Analyses - Run Calcs" from any exit menu. The correct data subdirectory should be verified *before* you select "Specify Analyses" because the filenames on the data subdirectory are read to generate a list of acceptable input files to use.

ASEAM3.0 can perform calculations in five different modes:

1. Single Run Mode
2. Batch Run Mode
3. Parametric Run Mode
4. Single ECO Run Mode
5. Multiple ECO Run Mode

Each of these modes and their relative advantages and disadvantages are discussed in Section 11.2. Refer to Section 11.3 for instructions on how to complete the input screens for all modes.

A new ASEAM3.0 program, AS3CPIP, is described in section 11.5. This stand-alone program writes coordinated parametric input files in which several input variables may be changed simultaneously. This ASEAM3.0 program was completed in 1991.

## 11.2 Modes of Calculation: Descriptions, Advantages, Disadvantages

The five modes of calculation have several features in common. All require that the pertinent input data, weather, and solar files be on the data and weather subdirectories. This includes Loads, Systems, Plant, Economic, and ECO input files, if analyses are to be done for these segments. In addition, if you are using floppy diskettes for the data subdirectory, they must have sufficient space for the output reports that will be created while the calculations are being performed. (*Note:* If the diskette fills up in the middle of a run, ASEAM3.0 will issue a message that the diskette is full (error #61) and will abort. The calculations must be restarted.)

ASEAM3.0 can run unattended in any mode. Once you have specified the analyses and the calculations have begun, all specified calculations will be performed. The program automatically moves from one analysis to the next. You could "stack up" many runs, start the calculations, go home, and come back the next morning to look at the output files. If you have specified that a printer is available, some reports will be printed, depending on the calculation mode. All specified output reports will also be stored in files. (Note: Again, make sure that you have sufficient space for all outputs specified if you are using floppy diskettes for the data subdirectory.)

Samples of the output reports can be found in Chapter 12. Refer to the table in

Section 2.4 for a listing of the types of reports for each calculation mode.

### 11.2.1 Single Run Mode

The Single Run Mode is the most basic ASEAM3.0 calculation mode. In this mode, you specify which calculations are to be done (Loads only; Systems and Plant only; Plant only; or Loads, Systems, and Plant), the input data files to be used, and the output reports to be generated. If an LCC input file is specified, an LCC report also will be generated.

The Single Run and batch run modes provides the widest variety of output reports. You can select from among 39 output reports. These include the BEPS report, peak loads report, and numerous hourly loads reports and systems and plant bin reports. Most of the reports are LOTUS-compatible. See Chapter 12 for a discussion of output reports and formats. You do not have the option of specifying these reports in the Parametric and ECO Modes. If you require detailed information on hourly or bin calculations, the Single or Batch Run Mode is recommended.

### 11.2.2 Batch Run Mode

The Batch Run Mode is several Single Runs linked together. You specify the input files and output reports for up to 20 individual runs. The program performs the calculations in sequence and automatically moves from one analysis to the next.

The advantages and disadvantages of the Batch Run Mode are the same as those for the Single Run Mode.

### 11.2.3 Parametric Run Mode

The Parametric Run Mode permits you to easily change selected variables in the input data files without having to create new data files. You specify which variables are to be changed and the new values (either as a percentage of their original value or as a replacement value). Complete Loads, Systems, and Plant calculations are performed for all runs. In addition, if an LCC input file is specified, ASEAM3.0 will perform an LCC analysis and store the results.

*WARNING: A major limitation to the parametric processor is that any changed input variable applies to all zones or systems. Thus, if you change the wall U-factor for example, this value is changed in all zones. Another limitation is that there is no error checking on the input values you enter.*

*Note: A recent (1991) program was added to ASEAM3.0. This program, AS3CPIP, allows for coordinated or simultaneous changes in parametric input values. The use of this program is described in section 11.5. Several examples of the use of the parametric processor are also given in this section. You are advised to review section 11.5 for further information concerning ASEAM3.0's parametric processor.*

The output report from the parametric processor consists of several files of annual values for output parameters that you specify. Thus, you determine which output variables you are interested in, and these are written to an output file. Monthly energy consumption of peak loads and LCC output files are also available, if specified.

The Parametric Run Mode is very useful for considering design alternatives. Input parameters can be changed very quickly. You can examine several different values for one parameter. The cumulative effects of changes in parameters also are easily studied. For example, you could specify wall insulations of R-5, R-10, and R-20 and thermostat setpoints of 74 and 68 degrees. The parametric processor would calculate all possible combinations of these inputs.

If you require hourly or bin output, you must use either the Single or Batch Run Mode. The Parametric Run Mode can have any output variable you specify in the output report, but only on an annual basis.

### 11.2.4 Single ECO Run Mode

The Single ECO Run Mode is used to examine the impact of a single ECO (Energy Conservation Opportunity) on existing buildings. Like the Parametric Run Mode, the ECO Run Mode makes modifications to an existing set of input files so that you do not need to create complete new input data files.

ECO files must be created in advance by using the ECO Input program (see Chapter 8). You may also use different complete loads, systems, or plant input files in the analysis. These files must also be on the data subdirectory. You select those files (either ECO files or complete input files) to be used to modify the base-case files.

The outputs from the ECO run are the monthly energy consumption, BEPS and LCC reports (optional). These reports are stored for both the base case and the modified (with ECO) case. After each ECO analysis, the two annual energy end-use summaries are compared, and an LCC comparison may also be generated if specified. This is very useful if you want to see how much energy or money a given ECO will save.

If you require more specific output than the BEPS report, you should use either Single or Batch modes of calculation. If you want to look at the cumulative effects of many ECOs, use the Multiple ECO Run Mode.

### 11.2.5 Multiple ECO Run Mode

The Multiple ECO Run Mode is used to model the cumulative effects of more than one ECO. It is like the Single ECO Run Mode except that more than one ECO file is used to modify the original input files. All ECO files must be on the data subdirectory.

The output from the Multiple ECO Run Mode is the same as that from the Single ECO Run Mode.

## 11.3 Specify Analyses: Screens

Each mode of calculation has its own set of input screens. The screens for each mode are described below.

After you select "Specify Analyses," the file names stored in the data subdirectory will be read. When you are asked to select input files to be used in the analyses, your entry will be compared against valid file names from this list. You can use the default key (F8) to select from the available files. Therefore, make sure that the correct data subdirectory is in use before you "Specify Analyses." If you need to change subdirectorys because the correct files were not on the subdirectory, you will need to Exit, edit 'Input Data - Drives', and then reenter the Specify Analyses program.

After you complete all the Specify Analyses screens, the Main Menu will appear. You must start the calculations by selecting "Run Calcs." The data from Specify Analyses are saved in a file when you select Run Calcs from the Main Menu, not when you exit from Specify Analyses. Therefore, you should always select Run Calcs after completing a Specify Analyses segment. Run Calcs will always use the Specify Analyses instructions immediately preceding it.

### 11.3.1 Configuration Screen

The first screen that appears after you select Specify Analyses is a configuration screen. Here you specify whether you have a printer and what mode of calculation you will use. If you have a printer, the monthly energy consumption, BEPS report and Peak Loads reports (if specified) will automatically be printed in Single or Batch Run Modes. If you do not have a printer, they will be stored in files, if so specified.

You also specify a name for the runfile. The runfile contains all the data specified on the following screens. You should *always* use the F8 default key to retrieve existing runfiles or create new ones. The runfile is named so that later you can access it without having to enter all the Specify Analysis data again. The program identifies the runfile type (calculation mode) by extension, so you can use the same file name for different types of calculation modes. Do not specify the extensions. The program automatically uses the following extensions:

.SRC - Single Run Calculation
.BRC - Batch Run Calculation
.PRC - Parametric Run Calculations
.ERC - Single ECO Run Calculations
.MRC - Multiple ECO Run Calculations

```
ANALYSIS SPECIFICATIONS
----------------------------------------------------------------------------
Hardware Specifications
  Printer Available (Y/N)                              _

Calculation Mode                                       _
  S = Single Run   B = Batch Mode   P = Parametric Mode
  E = ECO Runs (Single ECO)   M = Multiple ECO Runs (Combination)
                                                  ________
Runfile for Analysis (Use F8 for Listing)
```

Select the calculation mode. The mode selected here determines which screens follow.

Select a runfile name by pressing F8 and selecting from the list of files displayed at the bottom of the screen. If you have not previously defined a runfile, or wish to create a new runfile, select "New File" from the list of runfiles, and enter a valid file name.

### 11.3.2 Single-Run Mode

There are three screens for the Single Run Mode. On the first screen, shown below, you specify the input files to be used for the analysis. Whenever you are to specify a input data file, press the F8 key, and then use the cursor control keys to select a file from the list. Also select the weather files to be used.

In all the calculation modes, the first two entries allow you to specify a title for this analysis, which will be printed on many reports.

The Single Run and Batch Run modes are the only modes that allow you to start the calculations from other parts of the program. For example, if you are investigating changes in chiller parameters, you may decide to start the analysis with the plant calculations, eliminating the unnecessary loads and systems calculations. *Note, however, that the intermediate results of the most recent ASEAM3.0 loads and systems analysis (before the one being specified) will be used.*

```
|ANALYSES SPECIFICATIONS                                        |
|Analysis Number  1                                             |
|---------------------------------------------------------------|
|Report Output Titles                                           |
|Line 1 ('999' to end)   ______________________________________ |
|Line 2                  ______________________________________ |
|                                                               |
|Analysis Type                                        _         |
|  1=All  2=Loads Only   3=Systems & Plant   4=Plant Only       |
|                                                               |
|Input Files for Analysis (Use F8 for Listing)                  |
|  Load Input File                                   ________   |
|  System Input File                                 ________   |
|  Plant Input File                                  ________   |
|  LCC Input File (if appl)                          ________   |
|                                                               |
|Weather Files                                                  |
|  Type of bin weather data                           _         |
|    1=ASHRAE   2=Battelle   3=DOD                              |
|                                                               |
|  Weather station filename (Use F8 for Listing)     ________   |
|  Solar station filename (Use F8 for Listing)       ________   |
|                                                               |
```

ASEAM3.0 will not allow you to enter either invalid file names or those not stored in your data subdirectory. If you wish to use input files that are not listed by using the F8 key, you should press the F10 key to abort and return to the main menu. Select 'Input Data' and 'Drives' to change the data subdirectory. All of the input data files for all analyses *must* be in the data subdirectory when you specify analysis.

The following two screens are used to select which output reports are to be generated. Remember that there must be sufficient space in the data subdirectory for all output reports. The first of these screens is for Loads reports and the second is for Systems and Plant reports. Refer to Chapter 12 for samples of these reports.

Identify the output file name with a four-character prefix. This prefix is your only way to identify the output report. Enter only valid file-name characters (consult your DOS manual if necessary). The last four letters of the output file name and the file name extension are automatically inserted by ASEAM3.0. The extensions for many output files are .PRN so that they can be imported directly into LOTUS. If, for example, you specify a `Y' for the `LB' report, and you have three zones, three new output files will be created and stored in the data subdirectory during the loads calculations. In the following examples, `xxxx' is the four-character prefix you specified; `LB' is the report type; and `01', `02', etc. are the zone numbers:

xxxxLB01.PRN
xxxxLB02.PRN
xxxxLB03.PRN

Three of the reports you may specify below are not standard LOTUS-compatible files:

1. `LA' is a peak loads data file containing numbers.
2. `BEPS' is the building energy end-use data file.

   Note: These two reports contain only numbers that are associated with peak-load components or end-use components. Therefore, these two reports must be formatted with the Miscellaneous Output Reports command from the Main Menu- Print Reports.
3. `LCCO' is an ASCII text file output that can be read by a word processor.

```
OUTPUT SPECIFICATIONS (LOADS OUTPUTS - SCREEN 1)
Analysis Number  1
---------------------------------------------------------------------------
Output File Name Prefix (4 Characters)         ____

Select Loads Outputs - Enter 'Y' or 'N' ('blank' = 'N')

  LA - Peak Loads Summary    _     LM - Divrs Equipment                _
  LB - Peak Total            _     LN - Daylighting (Overcast - F1)    _
  LC - Diversified Total     _     LO - Daylighting (Overcast - F2)    _
  LD - Peak Opaque CLTD      _     LP - Daylighting (Overcast - F3)    _
  LE - Peak Glass Solar      _     LQ - Daylighting (Clear    - F1)    _
  LF - Peak Lighting         _     LR - Daylighting (Clear    - F2)    _
  LG - Divrs Lighting        _     LS - Daylighting (Clear    - F3)    _
  LH - Peak Plenum           _     LT - Wall CLTD                      _
  LI - Divrs Plenum          _     LU - Roof CLTD                      _
  LJ - Peak People           _     LV - Direct Solar on Glass          _
  LK - Divrs People          _     LW - Shaded Solar on Glass          _
  LL - Peak Equipment        _
```

```
OUTPUT SPECIFICATIONS (SCREEN 2)
Analysis Number  1
---------------------------------------------------------------------------
Enter 'Y' or 'N'  ('blank' = 'N') for each Output Report
Systems Outputs ('.PRN' - Bin)
  SA - System Loads (Zone Loads on System)                        _
  SB - System Energy Requirements (System Loads on Plant)         _
  SC - System Psychrometrics (Central Systems)                    _
  SD - System Psychrometrics (Unitary Systems)                    _
Plant Outputs ('.PRN' - Bin)
  SLDS - Plant Loads (Composite System Loads on Plant)            _
  PDHW - Domestic Hot Water                                       _
  PCEN - Centrifugal Chiller                                      _
  PABS - Absorption Chiller                                       _
  PDBC - Double Bundle Chiller                                    _
  PREC - Reciprocating Chiller                                    _
  PDBH - Double Bundle Heating                                    _
```

```
        │ PBLR - Boiler                               _          │
       │ PTOW - Cooling Tower                          _          │
       │Energy End Use/LCC                                        │
     │ BEPS - Building Energy End Use Report              _          │
     │ MCON - Monthly Energy Consumption                  _          │
      │ LCCO - Life Cycle Costs Report                   _          │
      │ Stand Alone Report Program                       _          │
└──────────────────────────────────────────────────────────────────────┘
```

### 11.3.3 Batch Run Mode

The Batch Run Mode screens are exactly the same as those for Single Run Mode. The same three screens will keep appearing, in sequence, so that as many as 20 runs can be "stacked up." Again, all the input files must be in the data subdirectory. To terminate the input sequence, enter `999' for the report output title on the first line of the first screen.

Note that the four-character prefix must be unique for each run; otherwise a later run's output files will overwrite an earlier run's output files.

### 11.3.4 Parametric Run Mode

*Note: A recent (1991) program was added to ASEAM3.0. This program, AS3CPIP, allows for coordinated or simultaneous changes in parametric input values. The use of this program is described in section 11.5. Several examples of the use of the parametric processor are also given in this section. You are advised to review section 11.5 for further information concerning ASEAM3.0's parametric processor.*

On the first screen of the Parametric Run Mode, shown below, you specify the base-case data files and weather files. These are the files that will be used originally; any modifications will be to the variables in these files.

You also choose the method of changing the input variables: either all possible combinations of variables or single changes. Choosing "all possible combinations" means that calculations will be performed for every combination of each value for each parametric input variable. Single changes will perform the calculation once for each value of each parametric variable (all other parametric variables remain unchanged).

Always be aware of how many runs you are requesting, especially if you designate "all possible combinations." On the following screens you will specify both the number of variables to be changed or investigated and the number of iterations for each variable. If four different variables were selected, and there were 3, 4, 5, and 6 iterations on the respective variables, the following number of ASEAM3.0 runs would be investigated:

Run singularly: 3 + 4 + 5 + 6 = 18 (plus one for base case)

All possible combinations: 3 * 4 * 5 * 6 = 360 (plus one for base case)

```
┌──────────────────────────────────────────────────────────────────────┐
         │PARAMETRIC ANALYSES SPECIFICATIONS                    │
             │---------------------------------------------------------------------------│
               │                                            │
         │Parametric Input Files for Analysis (Use F8 for Listing)       │
            │ Load Input File                             ________ │
```

```
System Input File                                        ________
Plant Input File                                         ________
Base Case LCC File (if appl)                             ________

Weather Files
Type of bin weather data                                 _
  1=ASHRAE   2=Battelle   3=DOD

Weather station filename (Use F8 for Listing)            ________
Solar station filename (Use F8 for Listing)              ________

Method of Changing Input Variables                       _
  1 = All Possible Combinations
  2 = Run Singularly
```

In the next screen, you select which variables are to be included in the output reports. For each parameter selected (such as electricity consumption) the annual value will be shown for every parametric input combination.

In the output report, each run will have one line, each column will contain a different parametric output variable. Note that output variable 35 generates the Peak Loads Summaries for all zones. First, enter the total number of columns in the output report. Then, enter which variables are to appear in which columns. Refer to the list below for parametric output variables.

```
PARAMETRIC OUTPUT SPECIFICATIONS

--------------------------------------------------------------------------
   Enter Parametric Output Variable Numbers for each Output Column
                 (See Reference Manual for Listing)

Number of Parametric Output Columns                                 __

Output Variable - Col #1   __     Output Variable - Col #11   __
Output Variable - Col #2   __     Output Variable - Col #12   __
Output Variable - Col #3   __     Output Variable - Col #13   __
Output Variable - Col #4   __     Output Variable - Col #14   __
Output Variable - Col #5   __     Output Variable - Col #15   __
Output Variable - Col #6   __     Output Variable - Col #16   __
Output Variable - Col #7   __     Output Variable - Col #17   __
Output Variable - Col #8   __     Output Variable - Col #18   __
Output Variable - Col #9   __     Output Variable - Col #19   __
Output Variable - Col #10  __     Output Variable - Col #20   __
```

On the next screen, you select the variables to be included in the output reports. For each parameter selected (such as annual electricity consumption), the annual value will be shown for every parametric input combination.

In the output report, the results of each run will be stored on one line, and each number in the line (column) will contain a different parametric output variable. Note that output variables numbers 30 to 35 generates separate parametric output files for monthly energy consumption and peak loads. First, enter the total number of columns in the output report. Then enter which variables are to appear in which columns. Refer to the list on the next page for parametric output variables.

Parametric Output Variables

| OUTPUT VARIABLE NUMBER | VARIABLE TYPE | DESCRIPTION OF VARIABLE | UNITS |
|---|---|---|---|
| 1 | Heating Energy | Electric Resistance | KWH |
| 2 | Heating Energy | Heat Pump | KWH |
| 3 | Heating Energy | Gas Boiler | therms |
| 4 | Heating Energy | Oil Boiler | gal |
| 5 | Heating Energy | Electric Boiler | KWH |
| 6 | Heating Energy | District Heating | MBTU |
| 7 | Heating Energy | Gas Furnace | therms |
| 8 | Heating Energy | Oil Furnace | gal |
| 9 | Heating Energy | Electric Furnace | KWH |
| 10 | Cooling Energy | Direct Expansion | KWH |
| 11 | Cooling Energy | Centrifugal Chiller | KWH |
| 12 | Cooling Energy | Absorption Chiller | KWH |
| 13 | Cooling Energy | District Cooling | MBTU |
| 14 | Cooling Energy | Double Bundle Chiller | KWH |
| 15 | Cooling Energy | Reciprocating Chiller | KWH |
| 16 | Cooling Energy | Window A/C Units | KWH |
| 17 | Cooling Energy | Heat Pump | KWH |
| 18 | DHW Energy | Domestic HW Heater | therms |
| 19 | DHW Energy | Domestic HW Heater | gal |
| 20 | DHW Energy | Domestic HW Heater | KWH |
| 21 | DHW Energy | Domestic HW Heater | MBTU |
| 22 | Building Misc. | Lights | KWH |
| 23 | Building Misc. | Equipment | KWH |
| 24 | Not Assigned | | |
| 25 | System Misc. | Fans | KWH |
| 26 | Not Assigned | | |
| 27 | Plant Misc. | Cooling Tower | KWH |
| 28 | Plant Misc. | Pumping | KWH |
| 29 | Not Assigned | | |
| | (See Note Below for Variables 30 to 35) | | |
| 30 | Monthly | Gas Consumption | therms |
| 31 | Monthly | Oil Consumption | gallons |
| 32 | Monthly | Electric Consumption | KWH |
| 33 | Monthly | Dist. Heating Consumption | MBTU |
| 34 | Monthly | Dist. Cooling Consumption | MBTU |
| 35 | Peak Loads Report | | |

Parametric Output Variables

| OUTPUT VARIABLE NUMBER | VARIABLE TYPE | DESCRIPTION OF VARIABLE | UNITS |
|---|---|---|---|
| 36 | Not Assigned | | |
| 37 | Not Assigned | | |
| 38 | Not Assigned | | |
| 39 | Not Assigned | | |
| 40 | | Total Gas Consumption | therms |
| 41 | | Total Oil Consumption | gal |
| 42 | | Total Electrical Cons | KWH |
| 43 | | Total District Heating | MBTU |
| 44 | | Total District Cooling | MBTU |
| 45 | Not Assigned | | |
| 46 | Not Assigned | | |
| 47 | Not Assigned | | |
| 48 | Not Assigned | | |
| 49 | Not Assigned | | |
| 50 | | Total Energy Cost | $ |
| 51 | Not Assigned | | |
| 52 | Not Assigned | | |
| 53 | Not Assigned | | |
| 54 | Not Assigned | | |
| 55 | | Total Site Energy | MBTU |
| 56 | Not Assigned | | |
| 57 | Not Assigned | | |
| 58 | Not Assigned | | |
| 59 | Not Assigned | | |
| 60 | | Total Source Energy | MBTU |

*Note: Output variable numbers 30 to 35 generate separate parametric output files for monthly energy consumption and zone peak loads. These files can be imported into LOTUS (see Chapter 12).*

On the following screen, enter the number of the parametric variable to be changed. Refer to the list (below) of parametric input variables. Also enter the method of change, either a decimal percent change or a new value. (Note: Some input values, such as changing the weather file or orientation, only accept new values.)

Then enter the number of values (up to 10) for this parameter. Finally, enter the values desired and the cost for each. An entry of `999' should be used if the value of the variable in the base case file is not to be changed.

```
PARAMETRIC VARIABLE SPECIFICATIONS
Parametric Variable Number  1
--------------------------------------------------------------------------
Parametric Variable Number  (Enter '0' to end)            ___
  (See Reference Manual for Listing)

Method of Parametric Change (1 or 2)                      _
  1 - Decimal Percent Change (0-1)
  2 - New Value Entered

Number of Values for this Variable                        __

Changed Value #1  ________      $ Cost for Change ________
Changed Value #2  ________      $ Cost for Change ________
Changed Value #3  ________      $ Cost for Change ________
Changed Value #4  ________      $ Cost for Change ________
Changed Value #5  ________      $ Cost for Change ________
Changed Value #6  ________      $ Cost for Change ________
Changed Value #7  ________      $ Cost for Change ________
Changed Value #8  ________      $ Cost for Change ________
Changed Value #9  ________      $ Cost for Change ________
Changed Value #10 ________      $ Cost for Change ________
            (USE '999' FOR NO CHANGE IN VALUE)
```

The above screen can be repeated up to 20 times. When you have entered all values for all parameters, enter a `0' for the Parametric Variable number and you will be returned to the Main Menu.

*Warning*: The maximum number of runs you could specify is 20 variables with 10 values each. This comprises ten to the twentieth runs, which would take several years to run! If you choose to perform runs for all combinations of variables, keep track of how many total runs this is. You may want to "time" a typical run first. If, for example, each run takes 5 minutes, about 180 runs could be performed between 5 p.m. and 8 a.m. (12 runs/hour times 15 hours). Note that the results are stored at the end of each calculation, and you can stop the calculations (using the F2 key) to investigate the completed runs.

Table 11.2  Parametric Input Variable List

| Input Variable Number | Variable Type | Description of Variable | Notes Number | Entry Type | Remarks |
|---|---|---|---|---|---|
| 1 | Loads | Orientation Adjustment | 1 | N2 | See Notes |
| 2 | Loads | Weather Data Type | 2 | N2 | See Notes |
| 3 | Loads | Weather Data Filename | 3 | C | See Notes |
| 4 | Loads | Solar Data Filename | 3 | C | See Notes |
| 5 | Loads | Starting Hour for Occupancy | 4 | N2 | (1 to 24) |
| 6 | Loads | Occupied Hours/Day | 5 | N2 | See Notes |
| 7 | Loads | Summer Stat Start Month # | | N2 | (1 to 12) |
| 8 | Loads | Summer Stat Ending Month # | | N2 | (1 to 12) |
| 9 | | NOT ASSIGNED | | | |
| 10 | | NOT ASSIGNED | | | |
| 11 | Loads | Summer Stat Setpoint | | N | (deg F) |
| 12 | Loads | Winter Stat Setpoint (OCC) | | N | (deg F) |
| 13 | Loads | Winter Stat Setpoint (UNOCC) | | N | (deg F) |
| 14 | | NOT ASSIGNED | | | |
| 15 | Loads | Wall U-Factor | | N | |
| 16 | | NOT ASSIGNED | | | |
| 17 | Loads | Roof U-Factor | | N | |
| 18 | | NOT ASSIGNED | | | |
| 19 | Loads | Window U-Factor | | N | |
| 20 | Loads | Window Shading Coef | | N | (0 to 1) |
| 21 | Loads | Window Leak Coefficient | | N | |
| 22 | Loads | Window Shading Model # | 6 | N2 | (1,2,3) |
| 23 | | NOT ASSIGNED | | | |
| 24 | Loads | Daylighting Glass Transmittance | 6 | N | (percent) |
| 25 | Loads | Daylighting Wall Reflectance | 6 | N | (percent) |
| 26 | Loads | Daylighting Present FC | 6 | N | |
| 27 | Loads | Daylighting Design FC | 6 | N | |
| 28 | Loads | Daylighting Sensor Location | 6 | N2 | (1,2,3) |
| 29 | Loads | Daylighting Control Type | 6 | C | D or S |
| 30 | | NOT ASSIGNED | | | |
| 31 | | NOT ASSIGNED | | | |
| 32 | Loads | Daylighting Min FC Maintained | 6 | N | |
| 33 | Loads | Daylighting Min % Power at Min FC | 6 | N | (percent) |
| 34 | | NOT ASSIGNED | | | |
| 35 | | NOT ASSIGNED | | | |
| 36 | Loads | Div Factor - People (OCC) | 7 | N | (to 100) |

Table 11.2 - *Continued*
Parametric Input Variable List

| Input Variable Number | Variable Type | Description of Variable | Notes Number | Entry Type | Remarks |
|---|---|---|---|---|---|
| 37 | Loads | Div Factor - Lights 1 (OCC) | 7 | N | (to 100) |
| 38 | Loads | Div Factor - Lights 2 (OCC) | 7 | N | (to 100) |
| 39 | Loads | Div Factor - Lights 3 (OCC) | 7 | N | (to 100) |
| 40 | Loads | Div Factor - Lights 4 (OCC) | 7 | N | (to 100) |
| 41 | Loads | Div Factor - Equip 1 (OCC) | 7 | N | (to 100) |
| 42 | Loads | Div Factor - Equip 2 (OCC) | 7 | N | (to 100) |
| 43 | Loads | Div Factor - Misc Sens 1 (OCC) | 7 | N | (to 100) |
| 44 | Loads | Div Factor - Misc Sens 2 (OCC) | 7 | N | (to 100) |
| 45 | Loads | Div Factor - People (UNOCC) | 7 | N | (to 100) |
| 46 | Loads | Div Factor - Lights 1 (UNOCC) | 7 | N | (to 100) |
| 47 | Loads | Div Factor - Lights 2 (UNOCC) | 7 | N | (to 100) |
| 48 | Loads | Div Factor - Lights 3 (UNOCC) | 7 | N | (to 100) |
| 49 | Loads | Div Factor - Lights 4 (UNOCC) | 7 | N | (to 100) |
| 50 | Loads | Div Factor - Equip 1 (UNOCC) | 7 | N | (to 100) |
| 51 | Loads | Div Factor - Equip 2 (UNOCC) | 7 | N | (to 100) |
| 52 | Loads | Div Factor - Misc Sens 1 (UNOCC) | 7 | N | (to 100) |
| 53 | Loads | Div Factor - Misc Sens 2 (UNOCC) | 7 | N | (to 100) |
| 54 | | NOT ASSIGNED | | | |
| 55 | Loads | Door U-Factor | | N | |
| 56 | Loads | Door Leak Coef | | N | |
| 57 | | NOT ASSIGNED | | | |
| 58 | Loads | Occupied Air Change Rate | 8 | N | See Notes |
| 59 | Loads | Unoccupied Air Change Rate | 8 | N | See Notes |
| 60 | | NOT ASSIGNED | | | |
| 61 | Loads | Misc Cond U-Factor | | N | |
| 62 | Loads | Misc Cond Ref Temp at Des Sum | | N | (deg F) |
| 63 | Loads | Misc Cond Ref Temp at Des Win | | N | (deg F) |
| 64 | | NOT ASSIGNED | | | |
| 65 | Loads | Lighting - Total Watts | | N | |
| 66 | Loads | Lighting - Watts/ft2 | | N | |
| 67 | Loads | Lighting - Percent Heat to Space | | N | (percent) |
| 68 | | NOT ASSIGNED | | | |
| 69 | Loads | Number of People | | N | |
| 70 | Loads | Square Feet per person | | N | |
| 71 | | NOT ASSIGNED | | | |
| 72 | Loads | Misc Elect - Total Watts | | N | |

Table 11.2 - *Continued*
Parametric Input Variable List

| Input Variable Number | Variable Type | Description of Variable | Notes Number | Entry Type | Remarks |
|---|---|---|---|---|---|
| 73 | Loads | Misc Elect - Watts/ft2 | | N | |
| 74 | | NOT ASSIGNED | | | |
| 75 | Loads | Misc Sensible - Total BTUH | 9 | N | |
| 76 | Loads | Misc Sensible - BTUH/ft2 | | N | |
| 77 | | NOT ASSIGNED | | | |
| 78 | Loads | Ext Shading - Overhang depth | 10 | N | See Notes |
| 79 | Loads | Ext Shading - Recess depth | 11 | N | See Notes |
| 80 | | NOT ASSIGNED | | | |
| 81 | | NOT ASSIGNED | | | |
| 82 | | NOT ASSIGNED | | | |
| 83 | | NOT ASSIGNED | | | |
| 84 | | NOT ASSIGNED | | | |
| 85 | Systems | TOA Heating Off | | N | (deg F) |
| 86 | Systems | Maximum Heating Temp | | N | (deg F) |
| 87 | Systems | Discriminator Control-HTG (DDMZ) | 12 | C | Y or N |
| 88 | Systems | TOA at Maximum Hot Deck Temp (DDMZ) | | N | (deg F) |
| 89 | Systems | Maximum Hot Deck Temp (DDMZ) | | N | (deg F) |
| 90 | Systems | TOA at Minimum Hot Deck Temp (DDMZ) | | N | (deg F) |
| 91 | Systems | Minimum Hot Deck Temp (DDMZ) | | N | (deg F) |
| 92 | | NOT ASSIGNED | | | |
| 93 | Systems | TOA Cooling On | | N | (deg F) |
| 94 | Systems | Minimum Supply Temp CLG | 13 | N | See Notes |
| 95 | Systems | Discriminator Control - Cooling | 12 | C | Y or N |
| 96 | Systems | Max Cooling Supply Temp (Disc) | 14 | N | (deg F) |
| 97 | | NOT ASSIGNED | | | |
| 98 | Systems | TOA Preheat Off | | N | (deg F) |
| 99 | Systems | Design Preheat Discharge Temp | | N | (deg F) |
| 100 | | NOT ASSIGNED | | | |
| 101 | Systems | TOA Humidification Off (OCC) | | N | (deg F) |
| 102 | Systems | Winter Relative Humidity (%) | | N | (percent) |
| 103 | | NOT ASSIGNED | | | |
| 104 | Systems | TOA Baseboard Off | | N | (deg F) |
| 105 | Systems | Baseboard Control Method | 15 | N2 | See Notes |
| 106 | Systems | Percent Load Satisfied - Des Win | | N | (percent) |
| 107 | Systems | Percent Load Satisfied - Min Load | | N | (percent) |
| 108 | | NOT ASSIGNED | | | |

Table 11.2 - *Continued*
Parametric Input Variable List

| Input Variable Number | Variable Type | Description of Variable | Notes Number | Entry Type | Remarks |
|---|---|---|---|---|---|
| 109 | Systems | Total Supply Fan KW | 16 | N | |
| 110 | Systems | Supply Fan KW/1000 CFM | | N | |
| 111 | Systems | Supply Fan Heat | | N | (deg F) |
| 112 | Systems | Total Return Fan KW | 16 | N | |
| 113 | Systems | Return Fan KW/1000 CFM | | N | |
| 114 | Systems | Return Fan Heat | | N | (deg F) |
| 115 | Systems | Minimum Percent Flow (VAV) | | N | (percent) |
| 116 | Systems | Fan Control Method (VAV) | 17 | N2 | See Notes |
| 117 | Systems | Fan Operating Method (OCC) | 18 | N2 | See Notes |
| 118 | Systems | Fan Operating Method (UNOCC) | 19 | N2 | See Notes |
| 119 | | NOT ASSIGNED | | | |
| 120 | Systems | Outside Air Control Method (OCC) | 20 | N2 | See Notes |
| 121 | Systems | Min Percent Outside Air (OCC) | | N | (percent) |
| 122 | Systems | Dry Bulb Switchover Temp (OCC) | | N | (deg F) |
| 123 | Systems | Outside Air Control Method (UNOCC) | 20 | N | See Notes |
| 124 | Systems | Min Percent Outside Air (UNOCC) | | N | (percent) |
| 125 | Systems | Dry Bulb Switchover Temp (UNOCC) | | N | (deg F) |
| 126 | | NOT ASSIGNED | | | |
| 127 | | NOT ASSIGNED | | | |
| 128 | Systems | Furnace Capacity (KBTUH) | 21 | N | |
| 129 | Systems | Furnace % Load Satisfied (auto) | 22 | N | (percent) |
| 130 | Systems | Furnace Efficiency (%) | | N | (percent) |
| 131 | Systems | Furnace Off Loss - % at Des Win | | N | (percent) |
| 132 | Systems | Furnace Off Loss - % at Min Load | | N | (percent) |
| 133 | Systems | Furnace Pilot Consumption (therms) | | N | annual # |
| 134 | | NOT ASSIGNED | | | |
| 135 | | NOT ASSIGNED | | | |
| 136 | Systems | HP/WAC - % Total Load Satisfied | 22 | N | (percent) |
| 137 | Systems | HP/WAC - % Sensible Load Satisfied | 22 | N | (percent) |
| 138 | Systems | HP/WAC - COP Cooling | | N | |
| 139 | Systems | WSHP - TOA at Min Fluid Temp | | N | (deg F) |
| 140 | Systems | WSHP - Min Fluid Temp | | N | (deg F) |
| 141 | Systems | WSHP - TOA at Max Fluid Temp | | N | (deg F) |
| 142 | Systems | WSHP - Max Fluid Temp | | N | (deg F) |
| 143 | | NOT ASSIGNED | | | |
| 144 | | NOT ASSIGNED | | | |

Table 11.2 - *Continued*
Parametric Input Variable List

| Input Variable Number | Variable Type | Description of Variable | Notes Number | Entry Type | Remarks |
|---|---|---|---|---|---|
| 145 | Systems | HP - % Heating Load Satisfied | 22 | N | (percent) |
| 146 | Systems | HP - TOA Heat Pump HTG Off (AAHP) | 23 | N | (deg F) |
| 147 | Systems | HP - % Load Satisfied - Backup HTG | 22 | N | (percent) |
| 148 | Systems | HP - COP (Heating) | | N | |
| 149 | | NOT ASSIGNED | | | |
| 150 | Systems | Percent Design Air Flow (Central) | 22 | N | (percent) |
| 151 | Systems | Percent Design Zonal Fan KW (Unit) | 22 | N | (percent) |
| 152 | | NOT ASSIGNED | | | |
| 153 | Systems | DX - % Total CLG Load Satisfied | 22 | N | (percent) |
| 154 | Systems | DX - COP | | N | |
| 155 | Systems | DX - Minimum Unloading Ratio | | N | (percent) |
| 156 | Systems | DX - Min Hot Gas Bypass Ratio | | N | (percent) |
| 157 | Systems | DX - Condenser Fan KW | | N | |
| 158 | Systems | DX - TOA Condenser Fan Off | | N | (deg F) |
| 159 | Plant | DHW Capacity | | N | (KBTUH) |
| 160 | Plant | DHW Occupied Cycle Average Usage | | N | (Gal/Hr) |
| 161 | Plant | DHW Unoccupied Cycle Average Usage | | N | (Gal/Hr) |
| 162 | Plant | DHW Efficiency (percent) | | N | (percent) |
| 163 | Plant | DHW Occupied Cycle Losses | | N | (BTUH) |
| 164 | Plant | DHW Unoccupied Cycle Losses | | N | (BTUH) |
| 165 | Plant | Chiller Cooling Capacity (tons) | 24 | N | |
| 166 | Plant | Chiller % Max Load Satisfied | 25 | N | (percent) |
| 167 | Plant | Chiller COP | | N | |
| 168 | Plant | Chiller Unloading Ratio | | N | (percent) |
| 169 | Plant | Chiller Min Part Load Ratio | | N | (percent) |
| 170 | Plant | Chiller Unloading Ratio (Heating-DB) | | N | (percent) |
| 171 | Plant | Chiller Design Heat Rec Temp (DB) | | N | (deg F) |
| 172 | | NOT ASSIGNED | | | |
| 173 | | NOT ASSIGNED | | | |
| 174 | | NOT ASSIGNED | | | |
| 175 | Plant | Cooling Tower - % Load Satisfied | 25 | N | (percent) |
| 176 | Plant | Cooling Tower - Number Cells | | N2 | |
| 177 | Plant | Cooling Tower - # Fan Speeds | | N2 | |
| 178 | | NOT ASSIGNED | | | |
| 179 | | NOT ASSIGNED | | | |
| 180 | Plant | Boiler - Heat Capacity (KBTUH) | 24 | N | |

Table 11.2 - *Continued*
Parametric Input Variable List

| Input Variable Number | Variable Type | Description of Variable | Notes Number | Entry Type | Remarks |
|---|---|---|---|---|---|
| 181 | Plant | Boiler - % Heat Load Satisfied | 25 | N | (percent) |
| 182 | Plant | Boiler - Efficiency | | N | (percent) |
| 183 | Plant | Boiler - Combustion Air Temp | | N | (deg F) |
| 184 | Plant | Boiler - Stack Temp | | N | (deg F) |
| 185 | Plant | Boiler - Air-Fuel Ratio | | N | |
| 186 | Plant | Boiler - Min Unloading Ratio | | N | (percent) |
| 187 | | NOT ASSIGNED | | | |
| 188 | | NOT ASSIGNED | | | |
| 189 | | NOT ASSIGNED | | | |
| 190 | | NOT ASSIGNED | | | |
| 191 | Loads | Building Latitude | | N2 | (deg N) |
| 192 | Loads | Building Longitude | | N2 | (deg W) |
| 193 | Loads | Time Zone Number | | N2 | (1 to 24) |
| 194 | Loads | Daylight Savings Time | 12 | C | (Y or N) |
| 195 | | NOT ASSIGNED | | | |
| 196 | | NOT ASSIGNED | | | |
| 197 | | Loads Input Filename (Use F8 for listing) | | C | |
| 198 | | Systems Input Filename (Use F8 for listing) | | C | |
| 199 | | Plant Input Filename (Use F8 for listing) | | C | |
| 200 | | LCC Input Filename (Use F8 for listing) | | C | |

Notes

Entry type: `N' represents a numeric input.
`N2' represents a numeric input using the `new value' method for changing variables.
`C' represents a character input.

*WARNING: THERE ARE NO ERROR CHECKS FOR VALID INPUT VALUES.*

1. Orientation Adjustment: Enter a number from 1 to 7 that corresponds to the amount of clockwise rotation in increments of 45 degrees. For example, if you enter "2" (indicating a 90 degree rotation), all south orientations entered in the base input file will become west orientations for the calculations. If no rotation is desired, enter either 0 or 8.

2. Weather Data Type: Enter one of the following:
   1 - ASHRAE Bin Weather (file name extension `.awd')
   2 - Battelle Bin Weather (file name extension `.bwd')
   3 - DOD Bin Weather (file name extension `.dwd')

3. Bin and Solar Weather File Names: Enter the eight-character weather file name. These data files must also be stored in your data subdirectory. See also note 2 above.

4. Starting Hour for Occupancy: Enter a number value from 1 to 24

5. Occupied Hours/Day: Enter one of the following: 8, 10, 12, 14, or 16. Any other entry is invalid.

6. Daylighting: Note that all three daylighting functions will be changed by this entry.

   The sensor location should be one of the following:

   1 - Max location (closest to window)
   2 - Mid location
   3 - Min location (farthest from window)

   The daylighting control type should be entered as either `D' for dimming or `S' for stepped control. Capital letters should be used.

7. Diversity Factors: Diversity factors of all zones will be changed. This entry should be in percent (e.g., 70, not .7).

8. Infiltration Air Change Rate: Because the parametric processor changes all zones to this value, you may want to select the first method (multiply base value by percent) for changing this variable. By using this method, the interior zones (assuming no infiltration) would not be changed.

9. Miscellaneous Loads: The BTUH value is positive for heat gains and negative for heat losses.

10. Overhang depth: Make this entry in inches. See note 11 below. All three exterior shading models will be changed.

11. Recess depth: Make this entry in inches. This will change three base-case entries simultaneously - the left, right, and overhang depth.

12. Discriminator Control: Enter either `Y' or `N'. Capital letters must be used.

13. Minimum Supply Temperature: If you have selected `autosizing' for the system air flow, changing this value may change the system sizing.

14. Maximum Cooling Supply Temperature: Used only if discriminator control is used in the cooling mode.

15. Baseboard Control Method: Enter one of the following:

   1 - Thermostatic control
   2 - Baseboard heating reset by outside air temperature

16. Fan KW: This entry has precedence over the `KW/1000 CFM' entry.

17. Fan Control Method (VAV): Use one of the following:

   1 - Variable Speed
   2 - Discharge Dampers
   3 - Inlet Vanes

Any other entry is invalid.

18. Fan Operating Method (Occupied Cycle only): This entry applies only to "zonal" systems (systems that normally cycle day and night). It does not affect the central systems such as CVRH, DDMZ, VAV, HV, SZRH. Use one of the following:

    1 - On Continuously
    2 - Cycles with Load

19. Fan Operating Method (Unoccupied Cycle only): This entry applies to all systems. Use the 1 or 2 code described in note 18 above.

20. Outside Air Control Method: Use one of the following codes:

    1 - No Outside Air
    2 - Fixed Percent Outside Air
    3 - Dry-Bulb Economizer
    4 - Enthalpy Economizer

21. Entered Capacity: This entry has precedence over the autosizing option.

22. Autosizing: Only used if autosizing is selected.

23. TOA Heat Pump Heating Off (for Air-to-Air Heat Pump only): When the outside air temperature is below this value, backup heating is used.

24. Plant Capacity: Enter value per unit (e.g., if two chillers or boilers are specified in the base file, enter the capacity of each chiller or boiler, not the combined capacity).

25. Plant Capacity (autosizing): Enter percent of maximum load per unit (e.g., if two chillers or boilers are specified in the base file, enter the percent capacity of each chiller or boiler, not the combined capacity).

### 11.3.5 Single ECO Run Mode

The first screen for Single ECO Run Mode defines the base-case files. These are the files to which all ECOs will be compared. An output file name for the base case is also entered. At the end of each calculation, an ASCII text file will be created to store the results.

The example below shows the form of the file name for your output results. In the example, `xxxx' is the four-character file-name prefix you specify; `SECO' is automatically added by ASEAM3.0 (Single ECO); and `.y' is the ECO run number, where `y' is `1' for the base case, `2' for the first ECO run, `3' for the second ECO run, etc.

xxxxSECO.y

where
`XXXX' is the four character filename prefix you specify
`SECO' is automatically added by ASEAM3.0 (Single ECO)
` .Y ' is the ECO run number where `Y' is
`1' for the base case
`2' for the first ECO run
`3' for the second ECO run, etc.

```
ANALYSES SPECIFICATIONS
Base Case Information
---------------------------------------------------------------------------
Base Case Definition Output Titles
Line 1  ____________________________________________________
Line 2  ____________________________________________________

Base Case Input Files for Analysis (Use F8 for Listing)
   Load Input File                                   ________
   System Input File                                 ________
   Plant Input File                                  ________
   LCC Input File                                    ________

Weather Files
   Type of bin weather data                          _
   1=ASHRAE   2=Battelle   3=DOD

Weather station filename (Use F8 for Listing)        ________
Solar station filename (Use F8 for Listing)          ________

File Name for Output (4 characters)                  ____
```

The following screen defines one ECO. You specify the type of ECO (Loads, Loads Batch, Systems, Systems Batch, Plant, or Plant Batch) to be modeled. Note that `Batch' refers to complete input files created with the input programs. Use the F8 key to display a list of the files for this ECO type, and choose one from the list. Note that the ECO files must have been created previously using the ECO input program and stored in the data subdirectory. You also enter the type of economic analysis to be performed, the cost of the ECO, and, if appropriate, the LCC input file name. Finally, you select the four-letter prefix of the output file name. This four character matrix should be descriptive of the ECO (e.g. wall, lite, etc.).

This screen will be repeated for as many as 40 ECOs. After you have input data for each ECO, enter `999' for the ECO description on the first line of the screen, and you will be returned to the Main Menu, ready to Run Calcs.

The calculations will be performed once for each ECO specified. Each ECO will be compared to the base-case file. No multiple ECOs are considered.

```
ANALYSES SPECIFICATIONS
ECO Number 1
------------------------------------------------------------------------------
ECO Description
Line 1 ('999' to end)   ____________________________________________
Line 2                  ____________________________________________

ECO Type                                                   _
  1=Loads ECO         2=Systems ECO         3=Plant ECO
  4=Loads (Batch)     5=Systems (Batch)     6=Plant (Batch)

ECO Files for Analysis (Use F8 for Listing)
  Load ECO File    ________     Loads Input File    ________
  System ECO File  ________     Systems Input File  ________
  Plant ECO File   ________     Plant Input File    ________

Economic Analysis                                          _
  0=None (Energy Only)   1=Simplified (SPB)   2=Detailed LCC

Cost of ECO Alteration (Dollars)                   ________
LCC Input File                                     ________

File Name for Output (4 characters)                ____
```

### 11.3.6 Multiple ECO Run Mode

The first screen for the Multiple ECO Run Mode is the same as that for the Single ECO Run Mode. Specify the base-case files and weather files to be used. Press the F8 key to access a list of input files; use the cursor control keys to highlight the file you want, and then press CR. The results of the calculations with these files will be used as the basis for comparisons with the ECO modified files.

```
ANALYSES SPECIFICATIONS
Base Case Information
----------------------------------------------------------------------------
Base Case Definition Output Titles
Line 1  ________________________________________________________
Line 2  ________________________________________________________

Base Case Input Files for Analysis (Use F8 for Listing)
  Load Input File                                          ________
  System Input File                                        ________
  Plant Input File                                         ________
  LCC Input File                                           ________

Weather Files
  Type of bin weather data                                 _
    1=ASHRAE   2=Battelle   3=DOD

  Weather station filename (Use F8 for Listing)            ________
  Solar station filename (Use F8 for Listing)              ________

  File Name for Output (4 characters)                      ____
```

The next two Multiple ECO Run Mode screens define the ECOs to be modeled together in one run, allowing for calculation of the cumulative effects of more than one ECO.

These two screens will be repeated until data has been entered for all runs to be performed (up to 20). When you have completed the data input for all ECOs, enter `999' as the Combined ECO description, and you will be returned to the Main Menu, ready to Run Calcs.

The first of these screens defines the batch ECOs to be modeled. "Batch" ECOs are complete loads, systems, or plant input files that are used to model ECO's. If no batch ECOs are to be modeled, enter only the ECO description, economic analysis method, the LCC input file if required, and the output file name four-character prefix. The example below shows the form for the file name for your output results. In the example, `xxxx' is the four-character file- name prefix you specify; `MECO' is automatically added by ASEAM3.0 (Multiple ECO); and `y' is the ECO run number, where `y' is `1' for the base case, `2' for the first ECO run, `3' for the second ECO run, etc.

xxxxMECO.y

where
`XXXX' is the four character filename prefix you specify
`MECO' is automatically added by ASEAM3.0 (Multiple ECO)
` .Y ' is the ECO run number where `Y' is
`1' for the base case
`2' for the first ECO run
`3' for the second ECO run, etc.

```
MULTIPLE ECO SPECIFICATIONS
Combination ECO Number 1
---------------------------------------------------------------------------
Combined ECO Description (for ALL)
Line 1 ('999' to end)   ________________________________________
Line 2                  ________________________________________

ECO Batch Files for Analysis (If Applicable)
  Load Input File    (Use F8 for Listing)          ________
  System Input File  (Use F8 for Listing)          ________
  Plant Input File   (Use F8 for Listing)          ________

Economic Analysis                                  _
   0=None (Energy Only)   1=Simplified (SPB)   2=Detailed LCC

Cost of ECO Alteration (Dollars)                   ________

LCC Input File for ECO                             ________

File Name for Output (4 characters)                ____
```

On the following screen, you specify all ECOs that are to be considered together in one run. First, enter the number of Loads, Systems, and Plant ECOs. Next, using the F8 key to access the ECO files of each type in the data subdirectory, specify which ECOs are to be modeled. Up to 12 ECOs of each type may be modeled. Note that two ECOs of the same type (e.g., two wall ECOs) cannot be modeled simultaneously.

```
MULTIPLE ECO FILE SPECIFICATIONS
Combination ECO Number 1
---------------------------------------------------------------------------
ECO Files
  Number of Loads ECO                              __
  Number of Systems ECO                            __
  Number of Plant ECO                              __

USE F8 FOR LISTING

Loads ECO  1  ________   Systems ECO  1  ________   Plant ECO  1  ________
Loads ECO  2  ________   Systems ECO  2  ________   Plant ECO  2  ________
Loads ECO  3  ________   Systems ECO  3  ________   Plant ECO  3  ________
Loads ECO  4  ________   Systems ECO  4  ________   Plant ECO  4  ________
Loads ECO  5  ________   Systems ECO  5  ________   Plant ECO  5  ________
Loads ECO  6  ________   Systems ECO  6  ________   Plant ECO  6  ________
Loads ECO  7  ________   Systems ECO  7  ________   Plant ECO  7  ________
Loads ECO  8  ________   Systems ECO  8  ________   Plant ECO  8  ________
Loads ECO  9  ________   Systems ECO  9  ________   Plant ECO  9  ________
Loads ECO 10  ________   Systems ECO 10  ________   Plant ECO 10  ________
Loads ECO 11  ________   Systems ECO 11  ________   Plant ECO 11  ________
Loads ECO 12  ________   Systems ECO 12  ________   Plant ECO 12  ________
```

## 11.4 Run Calcs

When the specify analyses data input for all calculations has been entered, you will be returned to the Main Menu. In Single Run Mode, this occurs automatically after you have completed the data entry for the run. In all other modes, you indicate that you have finished specifying analyses by entering `999' for the run description, or `O' for the parametric input variables number.

To begin the calculations, use the cursor control keys to highlight "Run Calcs" on the Main Menu and press CR.

Run Calcs first writes the Specify Analyses data to a file. These data will be available to retrieve later, should you wish to rerun these calculations or modify the runfile. Note that the runfile is not written when you exit from Specify Analyses. Therefore, if you have completed the Specify Analyses program but do not want to run the calculations immediately, select the Run Calcs command, wait until the calculations have begun, and then break the program (using the F2 key). This ensures that the runfile will be written to the data subdirectory, and that you will not have to reenter all the Specify Analyses data.

The calculations always use the latest version of Specify Analyses. You cannot begin ASEAM3.0 with the Run Calcs command. If you have previously completed the Specify Analyses program, select Specify Analyses again, retrieve the runfile you want to use, and move through the screens until the ASEAM3.0 Main Menu appears. Enter the Run Calcs command and the calculations will commence.

ASEAM3.0 can run unattended in any mode. The only limitation to the number of runs is the hard disk subdirectory space. Especially in Single and Batch Run Modes, make sure that the output files specified will all fit on a disk, if you are using a diskette for the data subdirectory. If the data subdirectory or diskette fills up, ASEAM3.0 will abort, printing error #61 occurred (subdirectory full).

While ASEAM3.0 is performing the calculations, you can view them either in graphic or tabular form on the screen. This slows the calculations down greatly, so you should use this feature only when you are actually looking at the screen (i.e., do not turn on the screen graphics and then let the program run unattended). Runtime screen displays are discussed in Chapter 12.

All output reports specified are saved in the data subdirectory. The reports and their formats are described in Chapter 12.

## 11.5 Coordinated Parametric Input Program (AS3CPIP)

One limitation of ASEAM2.1's parametric processor was it's inability to effectively account for "coordinated" inputs. That is, it was formerly not possible to have a <u>set</u> of several input variables change at the same time.

An example will illustrate this point: Suppose you wish to investigate changing the envelope parameters of a building. Adding insulation to either the wall or roof only affects the U-Factor of that component. However, replacement windows can vary not only in the U-Factor, but also in the shading coefficient and window leakage coefficient (for crack method infiltration). If two different replacement windows were to be compared with the base case window, a total of three different <u>sets</u> of input variables would be required:

| Input Variable | U-Factor | Shading Coefficient | Window Leakage Coefficient |
|---|---|---|---|
| Base Case Window | 1.1 | 1 | 6 (leaky) |
| Replacement Window #1 | 0.57 | .8 | 2 (average) |
| Replacement Window #2 | 0.33 | .6 | 2 (average) |

Originally, users could not specify the two "coordinated" variables (shading coefficient and leakage coefficient) to be associated with the U-Factor variable. Formerly, the above set of window input was impossible to specify in just three runs.

Other coordinated parametric examples include changing the location of the building. The set of variables to be changed would include: building latitude, longitude, time zone, and weather filenames. Quite possibly coordinated variables for building location would also include U-Factors (more insulation in the northern climates), window shading coefficient, etc.

The new ASEAM3.0 Coordinated Parametric Input Program (AS3CPIP) allows users to specify up to 10 coordinated input variables for any one parametric input variables. In the above window example, you would specify three cases (1.1, 0.57, and 0.33) for the parametric variable "window U-Factor", and also two coordinated inputs (shading coefficient and leakage coefficient with values of 1, .8, and .6, and 6, 2, and 2 respectively).

### 11.5.1 AS3CPIP

The new AS3CPIP program is a separate stand-alone program that is not linked to the rest of ASEAM3.0. That is, this program executes from DOS and is not accessed through any of the ASEAM3.0 menus. Since AS3CPIP can also start the calculations after the analyses are specified, it has been copied alread in the ASEAM3.0 subdirectory.

#### Running AS3CPIP

To execute the program, first insure that your ASEAM3.0 subdirectory is the default directory Then type **AS3CPIP** (press enter)

The program will then load in and, like other ASEAM3.0 input programs, display the main menu with the following five options:

*Get Parametric File* Allows you to select from the parametric files on your data subdirectory. Retrieves data in the selected file and starts data entry. Once data entry is complete, the data is stored and you are returned to the main menu again.

*Enter New Data* Starts data entry. Once data entry is complete, the data is stored and you are returned to the main menu again.

*Change Drives* Allows you to change the subdirectory names for storing input data and weather data. Returns you to the main menu again.

*Start Calcs* Uses the last set of data entry values entered and starts the ASEAM calculations.

*Exit DOS* Exits the AS3CPIP program to the DOS.

### 11.5.2 Data Entry for AS3CPIP

The input screens used to specify the parametric analysis for the new AS3CPIP program are nearly identical to those in the original program. Only those screens dealing with the specification of the parametric analysis are contained in this program.

**Specifying Base Case Information**

The first screen of AS3CPIP specifies the base-case data files and weather files. These inputs are identical to those in section 11.3.4.

```
PARAMETRIC ANALYSES SPECIFICATIONS
--------------------------------------------------------------------------

Parametric Input Files for Analysis (Use F8 for Listing)
  Load Input File                     ________
  System Input File                   ________
  Plant Input File                    ________
  Base Case LCC File (if appl)        ________

  Weather station filename (Use F8 for Listing)  ________

  Method of Changing Input Variables  _
    1 = All Possible Combinations
    2 = Run Singularly
```

**Specifying Outputs**

On the second input screen, you select the variables to be included in the output reports. This screen also is identical to the normal parametric processor described in section 11.3.4.

To complete the parametric output specifications screen you first enter the total number of output variables desired. Then enter the number of the output variables in the order in which they are to appear. Refer to the list in section 11.3.4 for parametric output variables.

```
PARAMETRIC OUTPUT SPECIFICATIONS

--------------------------------------------------------------------------
Enter Parametric Output Variable Numbers for each Output Column
                (See Reference Manual for Listing)
```

Number of Parametric Output Columns __

| | | | |
|---|---|---|---|
| Output Variable - Col #1 | __ | Output Variable - Col #11 | __ |
| Output Variable - Col #2 | __ | Output Variable - Col #12 | __ |
| Output Variable - Col #3 | __ | Output Variable - Col #13 | __ |
| Output Variable - Col #4 | __ | Output Variable - Col #14 | __ |
| Output Variable - Col #5 | __ | Output Variable - Col #15 | __ |
| Output Variable - Col #6 | __ | Output Variable - Col #16 | __ |
| Output Variable - Col #7 | __ | Output Variable - Col #17 | __ |
| Output Variable - Col #8 | __ | Output Variable - Col #18 | __ |
| Output Variable - Col #9 | __ | Output Variable - Col #19 | __ |
| Output Variable - Col #10 | __ | Output Variable - Col #20 | __ |

In the output report, all the results of each run will be stored on one line, and each number or resultant value in the line (each in a separate column) will contain a different parametric output variable. Note that output variables numbers 30 to 35 generates separate parametric output files for monthly energy consumption and peak loads. Figure 1 shows a sample parametric input file and output results. Figures 2 and 3 show parametric results for the same input data. The output results for these three figures are contained in five separate files.

Figure 1. Sample Parametric Output Report - Input and Output Variables

Input Variables | Output Variables

| Run Num | Wall U-Fact | Roof U-Fact | Window U-Fact | Light Watts/ft2 | Total Cost | Boiler therms | Dir Exp KWH | Lights KWH | Fans KWH | Tot Gas therms | Tot Elec KWH | Tot $ $ | Site MBTU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.15 | 0.15 | 1.1 | 2.25 | 0 | 1,924 | 20,484 | 29,953 | 20,551 | 1,924 | 75,478 | 4,736 | 450 |
| 2 | 0.15 | 0.15 | 1.1 | 1.5 | 5000 | 2,060 | 19,279 | 19,969 | 19,443 | 2,060 | 63,212 | 4,191 | 422 |
| 3 | 0.15 | 0.15 | 0.57 | 2.25 | 3000 | 1,556 | 19,302 | 29,953 | 18,970 | 1,556 | 72,549 | 4,406 | 403 |
| 4 | 0.15 | 0.15 | 0.57 | 1.5 | 8000 | 1,692 | 18,091 | 19,969 | 17,859 | 1,692 | 60,270 | 3,859 | 375 |
| 5 | 0.15 | 0.15 | 0.33 | 2.25 | 5000 | 1,391 | 18,777 | 29,953 | 18,258 | 1,391 | 71,235 | 4,257 | 382 |
| 6 | 0.15 | 0.15 | 0.33 | 1.5 | 10000 | 1,526 | 17,559 | 19,969 | 17,143 | 1,526 | 58,947 | 3,710 | 354 |
| 7 | 0.15 | 0.1 | 1.1 | 2.25 | 1600 | 1,737 | 18,917 | 29,953 | 18,845 | 1,737 | 72,064 | 4,472 | 420 |
| 8 | 0.15 | 0.1 | 1.1 | 1.5 | 6600 | 1,849 | 17,689 | 19,969 | 17,695 | 1,849 | 59,733 | 3,911 | 389 |
| 9 | 0.15 | 0.1 | 0.57 | 2.25 | 4600 | 1,371 | 17,734 | 29,953 | 17,268 | 1,371 | 69,138 | 4,142 | 373 |
| 10 | 0.15 | 0.1 | 0.57 | 1.5 | 9600 | 1,482 | 16,497 | 19,969 | 16,114 | 1,482 | 56,789 | 3,580 | 342 |

Figure 2. Sample Parametric Output Report - Zone Peak Loads and Life Cycle Cost

Zone Peak Loads | LCC Present Value Costs

| Run Num | Zone 1 Cooling | Zone 2 Cooling | Zone 3 Cooling | Zone 4 Cooling | Zone 1 Heating | Zone 2 Heating | Zone 3 Heating | Zone 4 Heating | Energy Dollars | Total Dollars | Net Savings Dollars |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 43,930 | 24,621 | 34,122 | 19,406 | (49,347) | (23,642) | (49,347) | (23,642) | 78,632 | 244,502 | 0 |
| 2 | 42,020 | 23,750 | 32,164 | 18,567 | (49,347) | (23,642) | (49,347) | (23,642) | 70,045 | 240,915 | 3,587 |
| 3 | 41,121 | 23,288 | 31,457 | 18,247 | (42,722) | (20,330) | (42,722) | (20,330) | 72,842 | 241,712 | 2,790 |
| 4 | 39,211 | 22,418 | 29,499 | 17,541 | (42,722) | (20,330) | (42,722) | (20,330) | 64,237 | 238,107 | 6,395 |
| 5 | 39,849 | 22,684 | 30,250 | 17,826 | (39,722) | (18,830) | (39,722) | (18,830) | 70,243 | 241,113 | 3,389 |
| 6 | 37,939 | 21,814 | 28,291 | 17,119 | (39,722) | (18,830) | (39,722) | (18,830) | 61,626 | 237,496 | 7,006 |
| 7 | 41,938 | 23,443 | 31,471 | 18,807 | (46,535) | (22,392) | (46,535) | (22,392) | 74,141 | 241,611 | 2,891 |
| 8 | 40,072 | 22,572 | 29,513 | 18,100 | (46,535) | (22,392) | (46,535) | (22,392) | 65,279 | 237,749 | 6,753 |
| 9 | 39,367 | 22,110 | 28,806 | 17,876 | (39,910) | (19,080) | (39,910) | (19,080) | 68,371 | 238,841 | 5,661 |
| 10 | 37,457 | 21,239 | 26,848 | 17,170 | (39,910) | (19,080) | (39,910) | (19,080) | 59,479 | 234,949 | 9,553 |

Figure 3. Sample Parametric Output Report - Monthly Electric Consumption

| Run Num | kWh January | kWh February | kWh March | kWh April | kWh May | kWh June | kWh July | kWh August | kWh September | kWh October | kWh November | kWh December |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 6,298 | 5,688 | 6,294 | 6,071 | 7,730 | 9,127 | 10,239 | 9,971 | 8,013 | 6,281 | 6,093 | 6,298 |
| 2 | 5,264 | 4,754 | 5,259 | 5,070 | 6,562 | 7,899 | 8,919 | 8,661 | 6,856 | 5,247 | 5,092 | 5,264 |
| 3 | 6,036 | 5,452 | 6,032 | 5,820 | 7,430 | 8,751 | 9,816 | 9,560 | 7,681 | 6,021 | 5,839 | 6,036 |
| 4 | 5,002 | 4,518 | 4,998 | 4,819 | 6,262 | 7,523 | 8,497 | 8,251 | 6,524 | 4,987 | 4,839 | 5,002 |
| 5 | 5,918 | 5,345 | 5,914 | 5,706 | 7,295 | 8,581 | 9,625 | 9,374 | 7,531 | 5,903 | 5,725 | 5,918 |
| 6 | 4,883 | 4,411 | 4,880 | 4,706 | 6,127 | 7,353 | 8,305 | 8,066 | 6,374 | 4,869 | 4,724 | 4,883 |
| 7 | 5,992 | 5,412 | 5,988 | 5,777 | 7,317 | 8,579 | 9,598 | 9,379 | 7,589 | 5,977 | 5,797 | 5,992 |
| 8 | 4,958 | 4,478 | 4,954 | 4,777 | 6,149 | 7,351 | 8,279 | 8,071 | 6,433 | 4,943 | 4,796 | 4,958 |
| 9 | 5,730 | 5,176 | 5,727 | 5,526 | 7,018 | 8,203 | 9,176 | 8,969 | 7,257 | 5,717 | 5,544 | 5,730 |
| 10 | 4,696 | 4,242 | 4,693 | 4,526 | 5,850 | 6,975 | 7,857 | 7,661 | 6,101 | 4,683 | 4,543 | 4,696 |

## <u>Specifying Parametric Input Variables</u>

On the next AS3CPIP screen, enter the number of the parametric variable to be changed. Refer to the list of parametric input variables in section 11.3.4. Also enter the method of change, either a decimal percent change or a new value. (*Note:* Some input values, such as changing the weather file or change in building orientation, only accept new values.)

Next, you enter the number of iterations or cases (up to 10) for this parameter. Be sure to include a "base case" value. That is, if you want to investigate <u>changes</u> in a variable, then at least two iterations are required (base case and alternative case). It is also advisable to enter the discrete input variables first (such as weather files names, orientation changes). This will make the subsequent analysis of results much easier.

Next, a new AS3CPIP input question appears asking the number of coordinated inputs to be associated with this particular parametric input variable. Enter a value from 0 to 10. A new screen, discussed below, will appear for each coordinated variable.

Finally, enter the values desired and the cost for each case or iteration. An entry of `999' should be used if the value of the variable in the base case file is <u>not</u> to be changed.

**<u>WARNING: THERE ARE NO ERROR CHECKS PERFORMED ON THE VALUES ENTERED! INSURE YOUR DATA IS REASONABLE!</u>**

```
PARAMETRIC VARIABLE SPECIFICATIONS
Parametric Variable Number  1
--------------------------------------------------------------------------
Parametric Variable Number  (Enter '0' to end)          ___
  (See Reference Manual for Listing)
Method of Parametric Change (1 or 2)                      _
  1 - Decimal Percent Change (0-1)
  2 - New Value Entered
Number of Values for this Variable                       __
```

```
|Number of Coordinated Variables                              __     |
|--------------------------------------------------------------------|
|                                                                    |
| Changed Value #1  ________      $ Cost for Change ________         |
| Changed Value #2  ________      $ Cost for Change ________         |
| Changed Value #3  ________      $ Cost for Change ________         |
| Changed Value #4  ________      $ Cost for Change ________         |
| Changed Value #5  ________      $ Cost for Change ________         |
| Changed Value #6  ________      $ Cost for Change ________         |
| Changed Value #7  ________      $ Cost for Change ________         |
| Changed Value #8  ________      $ Cost for Change ________         |
| Changed Value #9  ________      $ Cost for Change ________         |
| Changed Value #10 ________      $ Cost for Change ________         |
|              (USE '999' FOR NO CHANGE IN VALUE)                    |
|F3-Del Entry  F4-Del Run  F5-Ins Run  F6-Copy Run  F8-Deflt  F9-Help  F10-Menu |
└────────────────────────────────────────────────────────────────────┘
```

The above screen, along with the 'Coordinated Parametric Variable Specification' screen below, can be repeated up to 20 times. When you have entered all values for all parameters, enter a `0' for the first question (Parametric Variable Number) and you will be returned to the Main Menu.

## Specifying Coordinated Parametric Input Variables

If coordinated parametric variables were requested on the previous screen, the following new screen appears for each coordinated variable. The screen is very similar to the last input screen. The number of changed values required in this screen is identical to the number of cases or iterations in the previous screen. Each of the input questions have the same meaning as before. Note that the total cost for a particular parametric variable must be entered in the previous screen.

```
┌────────────────────────────────────────────────────────────────────┐
|COORDINATED PARAMETRIC VARIABLE SPECIFICATIONS                      |
|Coordinated Parametric Variable Number  1 for Parametric Variable  2 |
|--------------------------------------------------------------------|
|Coordinated Parametric Variable Number                      ___     |
|  (See Reference Manual for Listing)                                |
|                                                                    |
|Method of Parametric Change (1 or 2)                        _       |
|  1 - Decimal Percent Change (0-1)                                  |
|  2 - New Value Entered                                             |
|                                                                    |
|--------------------------------------------------------------------|
|                                                                    |
| Changed Value #1  ________                                         |
| Changed Value #2  ________                                         |
| Changed Value #3  ________                                         |
| Changed Value #4  ________                                         |
| Changed Value #5  ________                                         |
| Changed Value #6  ________                                         |
| Changed Value #7  ________                                         |
| Changed Value #8  ________                                         |
| Changed Value #9  ________                                         |
| Changed Value #10 ________                                         |
|              (USE '999' FOR NO CHANGE IN VALUE)                    |
|F3-Del Entry  F4-Del Run  F5-Ins Run  F6-Copy Run  F8-Deflt  F9-Help  F10-Menu |
└────────────────────────────────────────────────────────────────────┘
```

**Saving the Parametric Specification**

Once the data entry is completed, the AS3CPIP program prompts you to enter the four character prefix to be used on all the parametric files. This four character prefix is employed on several input and output files. You will need to remember this prefix to retrieve your output results after the calculations are completed.

After the files are saved, you are returned to be main menu. If you then select "Start Calcs" at the main menu, the parametic specifications just entered will be used in the calculations.

### 11.5.3 Retrieving Your ASEAM Output

The output results from the parametric calculations consists of several files of monthly and annual values for output parameters that you specify. The parametric run mode creates a maximum of nine output files. The first two are always created:

xxxxPRIN.PRN (contains the input variables)
xxxxPROU.PRN (contains the output variables and results)

The following seven files are created only if you selected them as parametric output variables:

xxxxPRMG.PRN (monthly gas consumption, output #30)
xxxxPRMO.PRN (monthly oil consumption, output #31)
xxxxPRME.PRN (monthly electricity consumption, output #32)
xxxxPRMH.PRN (monthly district heating consumption, output #33)
xxxxPRMC.PRN (monthly district cooling consumption, output #34)
xxxxPRPL.PRN (peak loads summaries, output #35)
xxxxPRLC.PRN (LCC summaries; if a base case LCC file is specified)

**NOTE: The 'xxxx' refers to the four character filename prefix you specify.**

The ASEAM3.0 software includes a LOTUS worksheet template file consisting of many "macros" for formatting LOTUS-compatible output files, including parametric results. This file is named "AS3TEMPL.WK1". Instructions are included in the file and will be visible when the file is imported into LOTUS.

To retrieve and format the results of a parametric analysis, follow these steps:

1. After the calculations are complete, get into LOTUS 1-2-3.

2. Once you are in LOTUS 1-2-3, retrieve the file AS3TEMPL.WK1 from your ASEAM3.0 subdirectory using the **/** '**F**'ile '**R**'etrive command.

3. Immediately after retrieving the AS3TEMPL template, change the default directory to the subdirectory storing your parametric data (your data subdirectory). Use the **/** '**F**'ile '**D**'irectory command, followed by the name of your subdirectory.

4. Move the cursor to the right of the instructions (e.g. cell K5) to avoid importing the parametric data on top of the macro.

5. Press the 'Alt' and 'P' keys simultaneously. This invokes a macro that will automatically format your parametric report. You only have to select which files to import.

The Alt-P macro, in short, always imports the parametric input file ('xxxxprin.prn') and the parametric output file ('xxxxprou,prn'). After these files are imported, the cursor moves to the right of the area containing the output data and then displays a menu. Use the appropriate macro key (Alt-Q to Alt-W) to import optional output results stored in separate files (e.g. monthly gas consumption or peak loads). If you inadvertently request to format a report that has no data file, press the 'ctrl' and 'Break' keys simultaneously to interrupt the macro.

### 11.5.4 Applications

As a simple practical example, let us assume you want to investigate five different ECOs on the 'Demo' building supplied on your ASEAM3.0 data disk. These measures include:

1. Reduce the infiltration during the unoccupied cycle from 1.0 to 0.5 air changes per hour.

2. Add roof insulation, changing the roof U-Factor from 0.1 to 0.05 BTUH/ft2-deg.

3. Replace the existing leaky single pane clear windows with tight fitting tinted double pane windows.

   NOTE: This is an example of a coordinated inputs since there are only two cases we want to study, yet there are three variables that change. In this case there is one parametric variable and two coordinated variables. It does not matter which of the three variables you choose to be the coordinated variables - the important fact is that three variables are changing at one time:

   The window U-Factor changes from 1.1 to 0.57 BTUH/ft2-deg
   The shading coefficient changes from 1.0 to 0.7
   The window leakage coefficient changes from 6 to 2.

4. The lighting watts changes from 2.5 to 2.0 watts per square foot.

5. The minimum percent outside air intake on the HVAC system is changed from 20% to 10%.

Since there are five variables, each with two cases (a base and alternative case), there are a total of 32 runs ($2^5$) if we investigate each possible combination of these variables.

Let us use the 'Demo' files provided on the ASEAM data diskette, along with Chicago weather data. The first input screen would be completed with the following data:

```
┌──────────────────────────────────────────────────────────────┐
        │PARAMETRIC ANALYSES SPECIFICATIONS                    │
            │----------------------------------------------------------------------------│
              │                                                   │
        │Parametric Input Files for Analysis (Use F8 for Listing)     │
```

```
│ Load Input File                                   DEMO____  │
│ System Input File                                 DEMO____  │
│ Plant Input File                                  DEMO____  │
│ Base Case LCC File (if appl)                      ________  │
│                                                             │
│Weather Files                                                │
│ Type of bin weather data                          1         │
│   1=ASHRAE   2=Battelle   3=DOD                             │
│                                                             │
│ Weather station filename (Use F8 for Listing)     CHICGOIL  │
│ Solar station filename (Use F8 for Listing)       CHICGOIL  │
│                                                             │
│ Method of Changing Input Variables                1         │
│    1 = All Possible Combinations                            │
│    2 = Run Singularly                                       │
└─────────────────────────────────────────────────────────────┘
```

Let us further assume that we want to report the annual heating energy (gas boiler), cooling energy (recip chiller), lighting energy usage, annual and monthly gas and electric consumption and the annual dollars, site MBTU, and source MBTU. To specify these outputs, the output screen would contain the following data:

```
┌─────────────────────────────────────────────────────────────┐
│PARAMETRIC OUTPUT SPECIFICATIONS                             │
│                                                             │
│-------------------------------------------------------------│
│   Enter Parametric Output Variable Numbers for each Output Column   │
│                 (See Reference Manual for Listing)          │
│                                                             │
│Number of Parametric Output Columns                10        │
│                                                             │
│ Output Variable - Col #1   3_      Output Variable - Col #11   __  │
│ Output Variable - Col #2   15      Output Variable - Col #12   __  │
│ Output Variable - Col #3   22      Output Variable - Col #13   __  │
│ Output Variable - Col #4   40      Output Variable - Col #14   __  │
│ Output Variable - Col #5   42      Output Variable - Col #15   __  │
│ Output Variable - Col #6   30      Output Variable - Col #16   __  │
│ Output Variable - Col #7   32      Output Variable - Col #17   __  │
│ Output Variable - Col #8   50      Output Variable - Col #18   __  │
│ Output Variable - Col #9   55      Output Variable - Col #19   __  │
│ Output Variable - Col #10  60      Output Variable - Col #20   __  │
└─────────────────────────────────────────────────────────────┘
```

Finally, we need to specify the parametric input variables. Starting with the first measure and proceeding to the last or fifth measure, the next eight input screens would indicate:

Changing Unoccupied Cycle Infiltration Rate (parametric variable #59)

```
┌─────────────────────────────────────────────────────────────┐
│PARAMETRIC VARIABLE SPECIFICATIONS                           │
│Parametric Variable Number  1                                │
│-------------------------------------------------------------│
│Parametric Variable Number  (Enter '0' to end)     59_       │
│  (See Reference Manual for Listing)                         │
│Method of Parametric Change (1 or 2)               2         │
│  1 - Decimal Percent Change (0-1)                           │
│  2 - New Value Entered                                      │
│Number of Values for this Variable                 2_        │
│Number of Coordinated Variables                    0_        │
```

```
|---------------------------------------------------------------------------|
|                                                                          |
| Changed Value #1  1.0_____      $ Cost for Change 0_______              |
| Changed Value #2  0.5_____      $ Cost for Change 0_______              |
| Changed Value #3  ________      $ Cost for Change ________              |
| Changed Value #4  ________      $ Cost for Change ________              |
| Changed Value #5  ________      $ Cost for Change ________              |
| Changed Value #6  ________      $ Cost for Change ________              |
| Changed Value #7  ________      $ Cost for Change ________              |
| Changed Value #8  ________      $ Cost for Change ________              |
| Changed Value #9  ________      $ Cost for Change ________              |
| Changed Value #10 ________      $ Cost for Change ________              |
|              (USE '999' FOR NO CHANGE IN VALUE)                          |
|F3-Del Entry  F4-Del Run  F5-Ins Run  F6-Copy Run  F8-Deflt  F9-Help  F10-Menu |
└──────────────────────────────────────────────────────────────────────────┘
```

Changing Roof U-Factor (parametric variable #17)

```
┌──────────────────────────────────────────────────────────────────────────┐
|PARAMETRIC VARIABLE SPECIFICATIONS                                        |
|Parametric Variable Number  2                                             |
|---------------------------------------------------------------------------|
|Parametric Variable Number  (Enter '0' to end)                 17_        |
|  (See Reference Manual for Listing)                                      |
|Method of Parametric Change (1 or 2)                           2          |
|  1 - Decimal Percent Change (0-1)                                        |
|  2 - New Value Entered                                                   |
|Number of Values for this Variable                             2_         |
|Number of Coordinated Variables                                0_         |
|---------------------------------------------------------------------------|
|                                                                          |
| Changed Value #1  .10_____      $ Cost for Change 0_______              |
| Changed Value #2  .05_____      $ Cost for Change 0_______              |
| Changed Value #3  ________      $ Cost for Change ________              |
| Changed Value #4  ________      $ Cost for Change ________              |
| Changed Value #5  ________      $ Cost for Change ________              |
| Changed Value #6  ________      $ Cost for Change ________              |
| Changed Value #7  ________      $ Cost for Change ________              |
| Changed Value #8  ________      $ Cost for Change ________              |
| Changed Value #9  ________      $ Cost for Change ________              |
| Changed Value #10 ________      $ Cost for Change ________              |
|              (USE '999' FOR NO CHANGE IN VALUE)                          |
|F3-Del Entry  F4-Del Run  F5-Ins Run  F6-Copy Run  F8-Deflt  F9-Help  F10-Menu |
└──────────────────────────────────────────────────────────────────────────┘
```

Changing Window U-Factor (parametric variable #19)

```
┌──────────────────────────────────────────────────────────────────────────┐
|PARAMETRIC VARIABLE SPECIFICATIONS                                        |
|Parametric Variable Number  3                                             |
|---------------------------------------------------------------------------|
|Parametric Variable Number  (Enter '0' to end)                 19_        |
|  (See Reference Manual for Listing)                                      |
|Method of Parametric Change (1 or 2)                           2          |
|  1 - Decimal Percent Change (0-1)                                        |
|  2 - New Value Entered                                                   |
|Number of Values for this Variable                             2_         |
|Number of Coordinated Variables                                2_         |
|---------------------------------------------------------------------------|
|                                                                          |
| Changed Value #1  1.1_____      $ Cost for Change 0_______              |
| Changed Value #2  0.57____      $ Cost for Change 0_______              |
| Changed Value #3  ________      $ Cost for Change ________              |
| Changed Value #4  ________      $ Cost for Change ________              |
```

```
│ Changed Value #5  ________        $ Cost for Change ________ │
│ Changed Value #6  ________        $ Cost for Change ________ │
│ Changed Value #7  ________        $ Cost for Change ________ │
│ Changed Value #8  ________        $ Cost for Change ________ │
│ Changed Value #9  ________        $ Cost for Change ________ │
│ Changed Value #10 ________        $ Cost for Change ________ │
│              (USE '999' FOR NO CHANGE IN VALUE)              │
│F3-Del Entry  F4-Del Run  F5-Ins Run  F6-Copy Run  F8-Deflt  F9-Help  F10-Menu │
└──────────────────────────────────────────────────────────────┘
```

Changing Window Shading Coefficient (parametric variable #20)

```
┌──────────────────────────────────────────────────────────────┐
│COORDINATED PARAMETRIC VARIABLE SPECIFICATIONS                │
│Coordinated Parametric Variable Number  1 for Parametric Variable  3 │
│--------------------------------------------------------------│
│Coordinated Parametric Variable Number               20_      │
│  (See Reference Manual for Listing)                          │
│                                                              │
│Method of Parametric Change (1 or 2)                 2        │
│  1 - Decimal Percent Change (0-1)                            │
│  2 - New Value Entered                                       │
│                                                              │
│--------------------------------------------------------------│
│                                                              │
│  Changed Value #1  1.0_____                                  │
│  Changed Value #2  0.7_____                                  │
│  Changed Value #3  ________                                  │
│  Changed Value #4  ________                                  │
│  Changed Value #5  ________                                  │
│  Changed Value #6  ________                                  │
│  Changed Value #7  ________                                  │
│  Changed Value #8  ________                                  │
│  Changed Value #9  ________                                  │
│  Changed Value #10 ________                                  │
│              (USE '999' FOR NO CHANGE IN VALUE)              │
│F3 - Delete Entry     F8 - Default     F9 - Help     F10 - Menu │
└──────────────────────────────────────────────────────────────┘
```

Changing Window Leakage Coefficient (parametric variable #21)

```
┌──────────────────────────────────────────────────────────────┐
│COORDINATED PARAMETRIC VARIABLE SPECIFICATIONS                │
│Coordinated Parametric Variable Number  2 for Parametric Variable  3 │
│--------------------------------------------------------------│
│Coordinated Parametric Variable Number               21_      │
│  (See Reference Manual for Listing)                          │
│                                                              │
│Method of Parametric Change (1 or 2)                 2        │
│  1 - Decimal Percent Change (0-1)                            │
│  2 - New Value Entered                                       │
│                                                              │
│--------------------------------------------------------------│
│                                                              │
│  Changed Value #1  6_______                                  │
│  Changed Value #2  2_______                                  │
│  Changed Value #3  ________                                  │
│  Changed Value #4  ________                                  │
│  Changed Value #5  ________                                  │
│  Changed Value #6  ________                                  │
│  Changed Value #7  ________                                  │
│  Changed Value #8  ________                                  │
```

```
 Changed Value #9  ________
 Changed Value #10 ________
                  (USE '999' FOR NO CHANGE IN VALUE)
F3 - Delete Entry      F8 - Default      F9 - Help      F10 - Menu
```

Changing Lighting Watts per Ft2 (parametric variable #66)

```
PARAMETRIC VARIABLE SPECIFICATIONS
Parametric Variable Number  4
--------------------------------------------------------------------------
Parametric Variable Number  (Enter '0' to end)                 66_
  (See Reference Manual for Listing)
Method of Parametric Change (1 or 2)                           2
  1 - Decimal Percent Change (0-1)
  2 - New Value Entered
Number of Values for this Variable                             2_
Number of Coordinated Variables                                0_
--------------------------------------------------------------------------

 Changed Value #1  2.5_____       $ Cost for Change 0_______
 Changed Value #2  2.0_____       $ Cost for Change 0_______
 Changed Value #3  ________       $ Cost for Change ________
 Changed Value #4  ________       $ Cost for Change ________
 Changed Value #5  ________       $ Cost for Change ________
 Changed Value #6  ________       $ Cost for Change ________
 Changed Value #7  ________       $ Cost for Change ________
 Changed Value #8  ________       $ Cost for Change ________
 Changed Value #9  ________       $ Cost for Change ________
 Changed Value #10 ________       $ Cost for Change ________
                  (USE '999' FOR NO CHANGE IN VALUE)
F3-Del Entry  F4-Del Run  F5-Ins Run  F6-Copy Run  F8-Deflt  F9-Help  F10-Menu
```

Changing Minimum Percent Outside Air (parametric variable #121)

```
PARAMETRIC VARIABLE SPECIFICATIONS
Parametric Variable Number  5
--------------------------------------------------------------------------
Parametric Variable Number  (Enter '0' to end)                 121
  (See Reference Manual for Listing)
Method of Parametric Change (1 or 2)                           2
  1 - Decimal Percent Change (0-1)
  2 - New Value Entered
Number of Values for this Variable                             2_
Number of Coordinated Variables                                0_
--------------------------------------------------------------------------

 Changed Value #1  20______       $ Cost for Change 0_______
 Changed Value #2  10______       $ Cost for Change 0_______
 Changed Value #3  ________       $ Cost for Change ________
 Changed Value #4  ________       $ Cost for Change ________
 Changed Value #5  ________       $ Cost for Change ________
 Changed Value #6  ________       $ Cost for Change ________
 Changed Value #7  ________       $ Cost for Change ________
 Changed Value #8  ________       $ Cost for Change ________
 Changed Value #9  ________       $ Cost for Change ________
 Changed Value #10 ________       $ Cost for Change ________
                  (USE '999' FOR NO CHANGE IN VALUE)
F3-Del Entry  F4-Del Run  F5-Ins Run  F6-Copy Run  F8-Deflt  F9-Help  F10-Menu
```

Ending the selection of parametric input variables (enter '0')

```
|PARAMETRIC VARIABLE SPECIFICATIONS
|Parametric Variable Number  6
|---------------------------------------------------------------------------|
|Parametric Variable Number  (Enter '0' to end)          0__
|  (See Reference Manual for Listing)
|Method of Parametric Change (1 or 2)                    _
|  1 - Decimal Percent Change (0-1)
|  2 - New Value Entered
|Number of Values for this Variable                      __
|Number of Coordinated Variables                         __
|---------------------------------------------------------------------------|

|  Changed Value #1  ________      $ Cost for Change ________
|  Changed Value #2  ________      $ Cost for Change ________
|  Changed Value #3  ________      $ Cost for Change ________
|  Changed Value #4  ________      $ Cost for Change ________
|  Changed Value #5  ________      $ Cost for Change ________
|  Changed Value #6  ________      $ Cost for Change ________
|  Changed Value #7  ________      $ Cost for Change ________
|  Changed Value #8  ________      $ Cost for Change ________
|  Changed Value #9  ________      $ Cost for Change ________
|  Changed Value #10 ________      $ Cost for Change ________
|             (USE '999' FOR NO CHANGE IN VALUE)
|F3-Del Entry  F4-Del Run  F5-Ins Run  F6-Copy Run  F8-Deflt  F9-Help  F10-Menu |
```

Given the above data, the following input and output files would result. The above example is stored on the enclosed disk with the four character prefix of 'SAMP'. You may wish to retrieve this data and look at the input specifications and the output results.

<----------- Input Variables ----------> <--------- Output Variables -------->

Run UNO-Inf Roof Window Window Window Light Min % Boiler Rec Chil Lights Tot Gas Tot Elec Tot $ Site Source

Num A C Rate U-Fact U-Fact Shad Coef Leak Coef Watts/ft2 OA OCC therms KWH KWH therms KWH $ MBTU MBTU

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0.1 | 1.1 | 1 | 6 | 2.5 | 20 | 10,634 | 18,395 | 26,883 | 10,944 | 102,501 | 10,597 | 1,444 | 2,283 |
| 2 | 1 | 0.1 | 1.1 | 1 | 6 | 2.5 | 10 | 10,634 | 18,395 | 26,883 | 10,944 | 102,501 | 10,597 | 1,444 | 2,283 |
| 3 | 1 | 0.1 | 1.1 | 1 | 6 | 2 | 20 | 10,699 | 17,636 | 21,506 | 11,010 | 94,884 | 10,249 | 1,425 | 2,202 |
| 4 | 1 | 0.1 | 1.1 | 1 | 6 | 2 | 10 | 10,699 | 17,636 | 21,506 | 11,010 | 94,884 | 10,249 | 1,425 | 2,202 |
| 5 | 1 | 0.1 | 0.57 | 0.7 | 2 | 2.5 | 20 | 7,835 | 15,486 | 26,883 | 8,145 | 89,416 | 8,543 | 1,120 | 1,852 |
| 6 | 1 | 0.1 | 0.57 | 0.7 | 2 | 2.5 | 10 | 7,835 | 15,486 | 26,883 | 8,145 | 89,416 | 8,543 | 1,120 | 1,852 |
| 7 | 1 | 0.1 | 0.57 | 0.7 | 2 | 2 | 20 | 7,895 | 14,727 | 21,506 | 8,205 | 81,823 | 8,194 | 1,100 | 1,770 |
| 8 | 1 | 0.1 | 0.57 | 0.7 | 2 | 2 | 10 | 7,895 | 14,727 | 21,506 | 8,205 | 81,823 | 8,194 | 1,100 | 1,770 |
| 9 | 1 | 0.05 | 1.1 | 1 | 6 | 2.5 | 20 | 9,585 | 17,042 | 26,883 | 9,895 | 97,069 | 9,801 | 1,321 | 2,116 |
| 10 | 1 | 0.05 | 1.1 | 1 | 6 | 2.5 | 10 | 9,585 | 17,042 | 26,883 | 9,895 | 97,069 | 9,801 | 1,321 | 2,116 |
| 11 | 1 | 0.05 | 1.1 | 1 | 6 | 2 | 20 | 9,650 | 16,263 | 21,506 | 9,960 | 89,502 | 9,455 | 1,302 | 2,034 |
| 12 | 1 | 0.05 | 1.1 | 1 | 6 | 2 | 10 | 9,650 | 16,263 | 21,506 | 9,960 | 89,502 | 9,455 | 1,302 | 2,034 |
| 13 | 1 | 0.05 | 0.57 | 0.7 | 2 | 2.5 | 20 | 6,786 | 14,133 | 26,883 | 7,096 | 83,958 | 7,746 | 996 | 1,684 |
| 14 | 1 | 0.05 | 0.57 | 0.7 | 2 | 2.5 | 10 | 6,786 | 14,133 | 26,883 | 7,096 | 83,958 | 7,746 | 996 | 1,684 |
| 15 | 1 | 0.05 | 0.57 | 0.7 | 2 | 2 | 20 | 6,846 | 13,357 | 21,506 | 7,156 | 76,406 | 7,398 | 976 | 1,602 |
| 16 | 1 | 0.05 | 0.57 | 0.7 | 2 | 2 | 10 | 6,846 | 13,357 | 21,506 | 7,156 | 76,406 | 7,398 | 976 | 1,602 |
| 17 | 0.5 | 0.1 | 1.1 | 1 | 6 | 2.5 | 20 | 9,389 | 17,826 | 26,883 | 9,700 | 98,639 | 9,782 | 1,307 | 2,114 |
| 18 | 0.5 | 0.1 | 1.1 | 1 | 6 | 2.5 | 10 | 9,389 | 17,826 | 26,883 | 9,700 | 98,639 | 9,782 | 1,307 | 2,114 |
| 19 | 0.5 | 0.1 | 1.1 | 1 | 6 | 2 | 20 | 9,449 | 17,040 | 21,506 | 9,759 | 91,117 | 9,435 | 1,287 | 2,033 |
| 20 | 0.5 | 0.1 | 1.1 | 1 | 6 | 2 | 10 | 9,449 | 17,040 | 21,506 | 9,759 | 91,117 | 9,435 | 1,287 | 2,033 |
| 21 | 0.5 | 0.1 | 0.57 | 0.7 | 2 | 2.5 | 20 | 6,591 | 14,914 | 26,883 | 6,901 | 85,540 | 7,727 | 982 | 1,682 |
| 22 | 0.5 | 0.1 | 0.57 | 0.7 | 2 | 2.5 | 10 | 6,591 | 14,914 | 26,883 | 6,901 | 85,540 | 7,727 | 982 | 1,682 |
| 23 | 0.5 | 0.1 | 0.57 | 0.7 | 2 | 2 | 20 | 6,645 | 14,126 | 21,506 | 6,955 | 77,998 | 7,377 | 962 | 1,600 |
| 24 | 0.5 | 0.1 | 0.57 | 0.7 | 2 | 2 | 10 | 6,645 | 14,126 | 21,506 | 6,955 | 77,998 | 7,377 | 962 | 1,600 |
| 25 | 0.5 | 0.05 | 1.1 | 1 | 6 | 2.5 | 20 | 8,347 | 16,496 | 26,883 | 8,657 | 93,108 | 8,984 | 1,183 | 1,946 |
| 26 | 0.5 | 0.05 | 1.1 | 1 | 6 | 2.5 | 10 | 8,347 | 16,496 | 26,883 | 8,657 | 93,108 | 8,984 | 1,183 | 1,946 |
| 27 | 0.5 | 0.05 | 1.1 | 1 | 6 | 2 | 20 | 8,400 | 15,703 | 21,506 | 8,710 | 85,618 | 8,636 | 1,163 | 1,864 |
| 28 | 0.5 | 0.05 | 1.1 | 1 | 6 | 2 | 10 | 8,400 | 15,703 | 21,506 | 8,710 | 85,618 | 8,636 | 1,163 | 1,864 |
| 29 | 0.5 | 0.05 | 0.57 | 0.7 | 2 | 2.5 | 20 | 5,559 | 13,599 | 26,883 | 5,869 | 80,096 | 6,939 | 860 | 1,516 |
| 30 | 0.5 | 0.05 | 0.57 | 0.7 | 2 | 2.5 | 10 | 5,559 | 13,599 | 26,883 | 5,869 | 80,096 | 6,939 | 860 | 1,516 |
| 31 | 0.5 | 0.05 | 0.57 | 0.7 | 2 | 2 | 20 | 5,614 | 12,805 | 21,506 | 5,925 | 72,606 | 6,593 | 840 | 1,435 |
| 32 | 0.5 | 0.05 | 0.57 | 0.7 | 2 | 2 | 10 | 5,614 | 12,805 | 21,506 | 5,925 | 72,606 | 6,593 | 840 | 1,435 |

<----------- Input Variables ----------> <-------------- Output Variables -------------->

| Run Num | UNO-Inf A C Rate | Roof U-Fact | Window U-Fact | Window Shad Coef | Window Leak Coef | Light Watts/ft2 | Min % OA OCC | Gas Therms Jan | Gas Therms Feb | Gas Therms Mar | Gas Therms Apr | Gas Therms May | Gas Therms June | Gas Therms July | Gas Therms Aug | Gas Therms Sept | Gas Therms Oct | Gas Therms Nov | Gas Therms Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0.1 | 1.1 | 1 | 6 | 2.5 | 20 | 1,870 | 1,638 | 1,434 | 785 | 861 | 29 | 32 | 32 | 30 | 1,266 | 1,218 | 1,750 |
| 2 | 1 | 0.1 | 1.1 | 1 | 6 | 2.5 | 10 | 1,870 | 1,638 | 1,434 | 785 | 861 | 29 | 32 | 32 | 30 | 1,266 | 1,218 | 1,750 |
| 3 | 1 | 0.1 | 1.1 | 1 | 6 | 2 | 20 | 1,879 | 1,645 | 1,443 | 793 | 865 | 29 | 32 | 32 | 30 | 1,269 | 1,232 | 1,761 |
| 4 | 1 | 0.1 | 1.1 | 1 | 6 | 2 | 10 | 1,879 | 1,645 | 1,443 | 793 | 865 | 29 | 32 | 32 | 30 | 1,269 | 1,232 | 1,761 |
| 5 | 1 | 0.1 | 0.57 | 0.7 | 2 | 2.5 | 20 | 1,390 | 1,211 | 1,051 | 565 | 642 | 29 | 32 | 32 | 30 | 962 | 899 | 1,301 |
| 6 | 1 | 0.1 | 0.57 | 0.7 | 2 | 2.5 | 10 | 1,390 | 1,211 | 1,051 | 565 | 642 | 29 | 32 | 32 | 30 | 962 | 899 | 1,301 |
| 7 | 1 | 0.1 | 0.57 | 0.7 | 2 | 2 | 20 | 1,399 | 1,218 | 1,060 | 573 | 646 | 29 | 32 | 32 | 30 | 965 | 910 | 1,311 |
| 8 | 1 | 0.1 | 0.57 | 0.7 | 2 | 2 | 10 | 1,399 | 1,218 | 1,060 | 573 | 646 | 29 | 32 | 32 | 30 | 965 | 910 | 1,311 |
| 9 | 1 | 0.05 | 1.1 | 1 | 6 | 2.5 | 20 | 1,680 | 1,477 | 1,298 | 715 | 797 | 29 | 32 | 32 | 30 | 1,147 | 1,088 | 1,570 |
| 10 | 1 | 0.05 | 1.1 | 1 | 6 | 2.5 | 10 | 1,680 | 1,477 | 1,298 | 715 | 797 | 29 | 32 | 32 | 30 | 1,147 | 1,088 | 1,570 |
| 11 | 1 | 0.05 | 1.1 | 1 | 6 | 2 | 20 | 1,689 | 1,484 | 1,306 | 723 | 801 | 29 | 32 | 32 | 30 | 1,150 | 1,103 | 1,581 |
| 12 | 1 | 0.05 | 1.1 | 1 | 6 | 2 | 10 | 1,689 | 1,484 | 1,306 | 723 | 801 | 29 | 32 | 32 | 30 | 1,150 | 1,103 | 1,581 |
| 13 | 1 | 0.05 | 0.57 | 0.7 | 2 | 2.5 | 20 | 1,201 | 1,051 | 915 | 496 | 577 | 29 | 32 | 32 | 30 | 842 | 770 | 1,121 |
| 14 | 1 | 0.05 | 0.57 | 0.7 | 2 | 2.5 | 10 | 1,201 | 1,051 | 915 | 496 | 577 | 29 | 32 | 32 | 30 | 842 | 770 | 1,121 |
| 15 | 1 | 0.05 | 0.57 | 0.7 | 2 | 2 | 20 | 1,210 | 1,058 | 924 | 503 | 581 | 29 | 32 | 32 | 30 | 845 | 781 | 1,131 |
| 16 | 1 | 0.05 | 0.57 | 0.7 | 2 | 2 | 10 | 1,210 | 1,058 | 924 | 503 | 581 | 29 | 32 | 32 | 30 | 845 | 781 | 1,131 |
| 17 | 0.5 | 0.1 | 1.1 | 1 | 6 | 2.5 | 20 | 1,661 | 1,454 | 1,266 | 688 | 755 | 29 | 32 | 32 | 30 | 1,113 | 1,082 | 1,558 |
| 18 | 0.5 | 0.1 | 1.1 | 1 | 6 | 2.5 | 10 | 1,661 | 1,454 | 1,266 | 688 | 755 | 29 | 32 | 32 | 30 | 1,113 | 1,082 | 1,558 |
| 19 | 0.5 | 0.1 | 1.1 | 1 | 6 | 2 | 20 | 1,670 | 1,462 | 1,274 | 696 | 757 | 29 | 32 | 32 | 30 | 1,115 | 1,093 | 1,569 |
| 20 | 0.5 | 0.1 | 1.1 | 1 | 6 | 2 | 10 | 1,670 | 1,462 | 1,274 | 696 | 757 | 29 | 32 | 32 | 30 | 1,115 | 1,093 | 1,569 |
| 21 | 0.5 | 0.1 | 0.57 | 0.7 | 2 | 2.5 | 20 | 1,181 | 1,028 | 884 | 465 | 537 | 29 | 32 | 32 | 30 | 810 | 764 | 1,109 |
| 22 | 0.5 | 0.1 | 0.57 | 0.7 | 2 | 2.5 | 10 | 1,181 | 1,028 | 884 | 465 | 537 | 29 | 32 | 32 | 30 | 810 | 764 | 1,109 |
| 23 | 0.5 | 0.1 | 0.57 | 0.7 | 2 | 2 | 20 | 1,190 | 1,035 | 892 | 472 | 539 | 29 | 32 | 32 | 30 | 812 | 774 | 1,119 |
| 24 | 0.5 | 0.1 | 0.57 | 0.7 | 2 | 2 | 10 | 1,190 | 1,035 | 892 | 472 | 539 | 29 | 32 | 32 | 30 | 812 | 774 | 1,119 |
| 25 | 0.5 | 0.05 | 1.1 | 1 | 6 | 2.5 | 20 | 1,472 | 1,294 | 1,130 | 620 | 691 | 29 | 32 | 32 | 30 | 995 | 953 | 1,379 |
| 26 | 0.5 | 0.05 | 1.1 | 1 | 6 | 2.5 | 10 | 1,472 | 1,294 | 1,130 | 620 | 691 | 29 | 32 | 32 | 30 | 995 | 953 | 1,379 |
| 27 | 0.5 | 0.05 | 1.1 | 1 | 6 | 2 | 20 | 1,480 | 1,301 | 1,138 | 627 | 692 | 29 | 32 | 32 | 30 | 996 | 964 | 1,388 |
| 28 | 0.5 | 0.05 | 1.1 | 1 | 6 | 2 | 10 | 1,480 | 1,301 | 1,138 | 627 | 692 | 29 | 32 | 32 | 30 | 996 | 964 | 1,388 |
| 29 | 0.5 | 0.05 | 0.57 | 0.7 | 2 | 2.5 | 20 | 993 | 869 | 750 | 398 | 474 | 29 | 32 | 32 | 30 | 693 | 638 | 931 |
| 30 | 0.5 | 0.05 | 0.57 | 0.7 | 2 | 2.5 | 10 | 993 | 869 | 750 | 398 | 474 | 29 | 32 | 32 | 30 | 693 | 638 | 931 |
| 31 | 0.5 | 0.05 | 0.57 | 0.7 | 2 | 2 | 20 | 1,002 | 876 | 758 | 409 | 475 | 29 | 32 | 32 | 30 | 694 | 647 | 941 |
| 32 | 0.5 | 0.05 | 0.57 | 0.7 | 2 | 2 | 10 | 1,002 | 876 | 758 | 409 | 475 | 29 | 32 | 32 | 30 | 694 | 647 | 941 |

<----------- Input Variables ----------> <-------------- Output Variables -------------->

Electric
Run UNO-Inf Roof Window Window Window Light Min % KWH KWH KWH KWH KWH KWH KWH KWH KWH KWH KWH KWH
Num A C Rate U-Fact U-Fact Shad Coef Leak Coef Watts/ft2 OA OCC Jan Feb Mar Apr May June July Aug Sept Oct Nov Dec

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0.1 | 1.1 | 1 | 6 | 2.5 | 20 | 7,042 | 6,329 | 6,879 | 6,485 | 9,293 | 10,745 | 12,311 | 12,065 | 9,174 | 8,294 | 6,797 | 7,088 |
| 2 | 1 | 0.1 | 1.1 | 1 | 6 | 2.5 | 10 | 7,042 | 6,329 | 6,879 | 6,485 | 9,293 | 10,745 | 12,311 | 12,065 | 9,174 | 8,294 | 6,797 | 7,088 |
| 3 | 1 | 0.1 | 1.1 | 1 | 6 | 2 | 20 | 6,451 | 5,805 | 6,318 | 5,960 | 8,594 | 10,007 | 11,539 | 11,271 | 8,538 | 7,671 | 6,239 | 6,490 |
| 4 | 1 | 0.1 | 1.1 | 1 | 6 | 2 | 10 | 6,451 | 5,805 | 6,318 | 5,960 | 8,594 | 10,007 | 11,539 | 11,271 | 8,538 | 7,671 | 6,239 | 6,490 |
| 5 | 1 | 0.1 | 0.57 | 0.7 | 2 | 2.5 | 20 | 6,224 | 5,590 | 6,063 | 5,717 | 8,082 | 9,271 | 10,590 | 10,381 | 7,973 | 7,246 | 6,008 | 6,270 |
| 6 | 1 | 0.1 | 0.57 | 0.7 | 2 | 2.5 | 10 | 6,224 | 5,590 | 6,063 | 5,717 | 8,082 | 9,271 | 10,590 | 10,381 | 7,973 | 7,246 | 6,008 | 6,270 |
| 7 | 1 | 0.1 | 0.57 | 0.7 | 2 | 2 | 20 | 5,633 | 5,066 | 5,503 | 5,192 | 7,393 | 8,546 | 9,825 | 9,599 | 7,336 | 6,621 | 5,438 | 5,670 |
| 8 | 1 | 0.1 | 0.57 | 0.7 | 2 | 2 | 10 | 5,633 | 5,066 | 5,503 | 5,192 | 7,393 | 8,546 | 9,825 | 9,599 | 7,336 | 6,621 | 5,438 | 5,670 |
| 9 | 1 | 0.05 | 1.1 | 1 | 6 | 2.5 | 20 | 6,702 | 6,022 | 6,540 | 6,166 | 8,772 | 10,081 | 11,522 | 11,336 | 8,753 | 7,955 | 6,470 | 6,748 |
| 10 | 1 | 0.05 | 1.1 | 1 | 6 | 2.5 | 10 | 6,702 | 6,022 | 6,540 | 6,166 | 8,772 | 10,081 | 11,522 | 11,336 | 8,753 | 7,955 | 6,470 | 6,748 |
| 11 | 1 | 0.05 | 1.1 | 1 | 6 | 2 | 20 | 6,111 | 5,498 | 5,980 | 5,642 | 8,128 | 9,403 | 10,782 | 10,591 | 8,041 | 7,265 | 5,911 | 6,150 |
| 12 | 1 | 0.05 | 1.1 | 1 | 6 | 2 | 10 | 6,111 | 5,498 | 5,980 | 5,642 | 8,128 | 9,403 | 10,782 | 10,591 | 8,041 | 7,265 | 5,911 | 6,150 |
| 13 | 1 | 0.05 | 0.57 | 0.7 | 2 | 2.5 | 20 | 5,884 | 5,283 | 5,725 | 5,399 | 7,561 | 8,608 | 9,802 | 9,652 | 7,537 | 6,896 | 5,681 | 5,931 |
| 14 | 1 | 0.05 | 0.57 | 0.7 | 2 | 2.5 | 10 | 5,884 | 5,283 | 5,725 | 5,399 | 7,561 | 8,608 | 9,802 | 9,652 | 7,537 | 6,896 | 5,681 | 5,931 |
| 15 | 1 | 0.05 | 0.57 | 0.7 | 2 | 2 | 20 | 5,293 | 4,759 | 5,164 | 4,874 | 6,916 | 7,931 | 9,063 | 8,909 | 6,838 | 6,217 | 5,111 | 5,330 |
| 16 | 1 | 0.05 | 0.57 | 0.7 | 2 | 2 | 10 | 5,293 | 4,759 | 5,164 | 4,874 | 6,916 | 7,931 | 9,063 | 8,909 | 6,838 | 6,217 | 5,111 | 5,330 |
| 17 | 0.5 | 0.1 | 1.1 | 1 | 6 | 2.5 | 20 | 6,766 | 6,079 | 6,604 | 6,224 | 8,936 | 10,332 | 11,826 | 11,603 | 8,898 | 8,027 | 6,531 | 6,812 |
| 18 | 0.5 | 0.1 | 1.1 | 1 | 6 | 2.5 | 10 | 6,766 | 6,079 | 6,604 | 6,224 | 8,936 | 10,332 | 11,826 | 11,603 | 8,898 | 8,027 | 6,531 | 6,812 |
| 19 | 0.5 | 0.1 | 1.1 | 1 | 6 | 2 | 20 | 6,175 | 5,555 | 6,043 | 5,700 | 8,290 | 9,655 | 11,087 | 10,858 | 8,247 | 7,331 | 5,961 | 6,214 |
| 20 | 0.5 | 0.1 | 1.1 | 1 | 6 | 2 | 10 | 6,175 | 5,555 | 6,043 | 5,700 | 8,290 | 9,655 | 11,087 | 10,858 | 8,247 | 7,331 | 5,961 | 6,214 |
| 21 | 0.5 | 0.1 | 0.57 | 0.7 | 2 | 2.5 | 20 | 5,950 | 5,343 | 5,791 | 5,444 | 7,729 | 8,860 | 10,107 | 9,920 | 7,685 | 6,971 | 5,744 | 5,997 |
| 22 | 0.5 | 0.1 | 0.57 | 0.7 | 2 | 2.5 | 10 | 5,950 | 5,343 | 5,791 | 5,444 | 7,729 | 8,860 | 10,107 | 9,920 | 7,685 | 6,971 | 5,744 | 5,997 |
| 23 | 0.5 | 0.1 | 0.57 | 0.7 | 2 | 2 | 20 | 5,357 | 4,816 | 5,228 | 4,918 | 7,080 | 8,180 | 9,365 | 9,173 | 7,033 | 6,282 | 5,172 | 5,394 |
| 24 | 0.5 | 0.1 | 0.57 | 0.7 | 2 | 2 | 10 | 5,357 | 4,816 | 5,228 | 4,918 | 7,080 | 8,180 | 9,365 | 9,173 | 7,033 | 6,282 | 5,172 | 5,394 |
| 25 | 0.5 | 0.05 | 1.1 | 1 | 6 | 2.5 | 20 | 6,428 | 5,774 | 6,267 | 5,908 | 8,416 | 9,671 | 11,040 | 10,877 | 8,411 | 7,636 | 6,206 | 6,474 |
| 26 | 0.5 | 0.05 | 1.1 | 1 | 6 | 2.5 | 10 | 6,428 | 5,774 | 6,267 | 5,908 | 8,416 | 9,671 | 11,040 | 10,877 | 8,411 | 7,636 | 6,206 | 6,474 |
| 27 | 0.5 | 0.05 | 1.1 | 1 | 6 | 2 | 20 | 5,835 | 5,248 | 5,705 | 5,382 | 7,768 | 8,991 | 10,297 | 10,129 | 7,760 | 6,997 | 5,634 | 5,872 |
| 28 | 0.5 | 0.05 | 1.1 | 1 | 6 | 2 | 10 | 5,835 | 5,248 | 5,705 | 5,382 | 7,768 | 8,991 | 10,297 | 10,129 | 7,760 | 6,997 | 5,634 | 5,872 |
| 29 | 0.5 | 0.05 | 0.57 | 0.7 | 2 | 2.5 | 20 | 5,618 | 5,043 | 5,460 | 5,135 | 7,217 | 8,207 | 9,331 | 9,203 | 7,205 | 6,589 | 5,424 | 5,665 |
| 30 | 0.5 | 0.05 | 0.57 | 0.7 | 2 | 2.5 | 10 | 5,618 | 5,043 | 5,460 | 5,135 | 7,217 | 8,207 | 9,331 | 9,203 | 7,205 | 6,589 | 5,424 | 5,665 |
| 31 | 0.5 | 0.05 | 0.57 | 0.7 | 2 | 2 | 20 | 5,025 | 4,516 | 4,896 | 4,621 | 6,567 | 7,527 | 8,588 | 8,455 | 6,552 | 5,946 | 4,852 | 5,062 |
| 32 | 0.5 | 0.05 | 0.57 | 0.7 | 2 | 2 | 10 | 5,025 | 4,516 | 4,896 | 4,621 | 6,567 | 7,527 | 8,588 | 8,455 | 6,552 | 5,946 | 4,852 | 5,062 |

Another practical use for the parametric processor is to perform a sensitivity analysis. In the case partially shown below, the parametric processor was used to help calibrate a model to known energy data. Instead of replacing the data for these variables (new value entered), a scaler multiplier was applied to the existing values for each variable, using the decimal percent change method of parametric change. The variables selected are termed "soft" inputs since their base values rely substantially on engineering judgement. Each of these values could be in error realistically by as much as 25 percent. For this reason, all six variables were studied with three values - decreasing the base value by 25%, not changing the value, and increasing the value by 25%. This was accomplished by multiplying the base values by 0.75, 1.0 and 1.25 respectively. In total, 729 runs were performed ($3^6$).

| Run Num | Window Shad Coef | Window Leak Coef | DF-OCC Lights | DF-OCC Equip | Occ | Infiltration Air Changes Unocc | Total Misc Eq KWH | Total Fans KWH | Total D Htg MBTU | Total D Clg MBTU | Dollars $ | Site MBTU | Source MBTU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 50 | 355 | 1.435 | 2.411 | $83.97 | 6.953 | 14.965 |
| 2 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 1.00 | 50 | 356 | 1.547 | 2.421 | $85.27 | 7.081 | 15.149 |
| 3 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 1.25 | 50 | 358 | 1.661 | 2.431 | $86.59 | 7.210 | 15.337 |
| 4 | 0.75 | 0.75 | 0.75 | 0.75 | 1.00 | 0.75 | 50 | 358 | 1.457 | 2.423 | $84.44 | 6.996 | 15.039 |
| 5 | 0.75 | 0.75 | 0.75 | 0.75 | 1.00 | 1.00 | 50 | 359 | 1.569 | 2.433 | $85.74 | 7.123 | 15.223 |
| 6 | 0.75 | 0.75 | 0.75 | 0.75 | 1.00 | 1.25 | 50 | 361 | 1.682 | 2.443 | $87.07 | 7.253 | 15.410 |
| 7 | 0.75 | 0.75 | 0.75 | 0.75 | 1.25 | 0.75 | 50 | 360 | 1.481 | 2.435 | $84.94 | 7.041 | 15.116 |
| 8 | 0.75 | 0.75 | 0.75 | 0.75 | 1.25 | 1.00 | 50 | 362 | 1.593 | 2.445 | $86.24 | 7.169 | 15.300 |
| 9 | 0.75 | 0.75 | 0.75 | 0.75 | 1.25 | 1.25 | 50 | 364 | 1.707 | 2.455 | $87.56 | 7.298 | 15.488 |
| 10 | 0.75 | 0.75 | 0.75 | 1.00 | 0.75 | 0.75 | 65 | 355 | 1.423 | 2.430 | $84.76 | 7.009 | 15.133 |

### 11.5.6 Post Analysis

The output results of a parametric analysis is often a large matrix of numbers that can be intimidating to analyze. The usefulness of any parametric analysis is only as good as your ability to analyze the results. Obviously, your ability to manipulate the results with a spreadsheet is important. In this section, two different spreadsheet (LOTUS 1-2-3) approaches are presented.

#### <u>Equation Fitting</u>

One method of consolidating the enormous volume of numbers is to fit equations to the data. The following pages contain the results of a simple parametric analysis on shell or envelope measures and lighting. In all, 54 ASEAM runs were executed, investigating the changes in the energy consumption due to changes in wall U-Factor, roof U-Factor, window U-Factor, and lighting watts per ft2.

The following four pages shows the input and output results of the parametric study.

| Run Num | Wall U-Fact | Roof U-Fact | Window U-Fact | Light Watts/ft2 | Total Cost | Boiler therms | Dir Exp KWH | Lights KWH | Fans KWH | Tot Gas therms | Tot Elec KWH | Tot $ $ | Site MBTU | Source MBTU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.15 | 0.15 | 1.1 | 2.25 | 0 | 1,924 | 20,484 | 29,953 | 20,551 | 1,924 | 75,478 | 4,736 | 450 | 1,068 |
| 2 | 0.15 | 0.15 | 1.1 | 1.5 | 5000 | 2,060 | 19,279 | 19,969 | 19,443 | 2,060 | 63,212 | 4,191 | 422 | 939 |
| 3 | 0.15 | 0.15 | 0.57 | 2.25 | 3000 | 1,556 | 19,302 | 29,953 | 18,970 | 1,556 | 72,549 | 4,406 | 403 | 997 |
| 4 | 0.15 | 0.15 | 0.57 | 1.5 | 8000 | 1,692 | 18,091 | 19,969 | 17,859 | 1,692 | 60,270 | 3,859 | 375 | 868 |
| 5 | 0.15 | 0.15 | 0.33 | 2.25 | 5000 | 1,391 | 18,777 | 29,953 | 18,258 | 1,391 | 71,235 | 4,257 | 382 | 965 |
| 6 | 0.15 | 0.15 | 0.33 | 1.5 | 10000 | 1,526 | 17,559 | 19,969 | 17,143 | 1,526 | 58,947 | 3,710 | 354 | 836 |
| 7 | 0.15 | 0.1 | 1.1 | 2.25 | 1600 | 1,737 | 18,917 | 29,953 | 18,845 | 1,737 | 72,064 | 4,472 | 420 | 1,010 |
| 8 | 0.15 | 0.1 | 1.1 | 1.5 | 6600 | 1,849 | 17,689 | 19,969 | 17,695 | 1,849 | 59,733 | 3,911 | 389 | 878 |
| 9 | 0.15 | 0.1 | 0.57 | 2.25 | 4600 | 1,371 | 17,734 | 29,953 | 17,268 | 1,371 | 69,138 | 4,142 | 373 | 939 |
| 10 | 0.15 | 0.1 | 0.57 | 1.5 | 9600 | 1,482 | 16,497 | 19,969 | 16,114 | 1,482 | 56,789 | 3,580 | 342 | 807 |
| 11 | 0.15 | 0.1 | 0.33 | 2.25 | 6600 | 1,208 | 17,210 | 29,953 | 16,558 | 1,208 | 67,828 | 3,995 | 352 | 908 |
| 12 | 0.15 | 0.1 | 0.33 | 1.5 | 11600 | 1,316 | 15,965 | 19,969 | 15,401 | 1,316 | 55,469 | 3,431 | 321 | 775 |
| 13 | 0.15 | 0.05 | 1.1 | 2.25 | 2200 | 1,557 | 17,408 | 29,953 | 17,363 | 1,557 | 68,934 | 4,225 | 391 | 955 |
| 14 | 0.15 | 0.05 | 1.1 | 1.5 | 7200 | 1,671 | 16,145 | 19,969 | 16,057 | 1,671 | 56,410 | 3,656 | 360 | 821 |
| 15 | 0.15 | 0.05 | 0.57 | 2.25 | 5200 | 1,196 | 16,222 | 29,953 | 15,792 | 1,196 | 66,013 | 3,899 | 345 | 885 |
| 16 | 0.15 | 0.05 | 0.57 | 1.5 | 10200 | 1,305 | 14,949 | 19,969 | 14,480 | 1,305 | 53,466 | 3,326 | 313 | 751 |
| 17 | 0.15 | 0.05 | 0.33 | 2.25 | 7200 | 1,037 | 15,698 | 29,953 | 15,087 | 1,037 | 64,707 | 3,754 | 324 | 854 |
| 18 | 0.15 | 0.05 | 0.33 | 1.5 | 12200 | 1,142 | 14,416 | 19,969 | 13,769 | 1,142 | 52,148 | 3,178 | 292 | 719 |
| 19 | 0.1 | 0.15 | 1.1 | 2.25 | 1200 | 1,802 | 19,870 | 29,953 | 19,820 | 1,802 | 74,069 | 4,605 | 433 | 1,039 |
| 20 | 0.1 | 0.15 | 1.1 | 1.5 | 6200 | 1,939 | 18,664 | 19,969 | 18,711 | 1,939 | 61,800 | 4,060 | 405 | 911 |
| 21 | 0.1 | 0.15 | 0.57 | 2.25 | 4200 | 1,435 | 18,692 | 29,953 | 18,240 | 1,435 | 71,143 | 4,275 | 386 | 969 |
| 22 | 0.1 | 0.15 | 0.57 | 1.5 | 9200 | 1,570 | 17,477 | 19,969 | 17,127 | 1,570 | 58,859 | 3,728 | 358 | 840 |
| 23 | 0.1 | 0.15 | 0.33 | 2.25 | 6200 | 1,271 | 18,170 | 29,953 | 17,529 | 1,271 | 69,828 | 4,127 | 365 | 937 |
| 24 | 0.1 | 0.15 | 0.33 | 1.5 | 11200 | 1,405 | 16,949 | 19,969 | 16,413 | 1,405 | 57,540 | 3,579 | 337 | 808 |
| 25 | 0.1 | 0.1 | 1.1 | 2.25 | 2800 | 1,616 | 18,303 | 29,953 | 18,114 | 1,616 | 70,653 | 4,341 | 403 | 981 |
| 26 | 0.1 | 0.1 | 1.1 | 1.5 | 7800 | 1,728 | 17,072 | 19,969 | 16,964 | 1,728 | 58,320 | 3,780 | 372 | 849 |
| 27 | 0.1 | 0.1 | 0.57 | 2.25 | 5800 | 1,251 | 17,124 | 29,953 | 16,539 | 1,251 | 67,733 | 4,012 | 356 | 911 |
| 28 | 0.1 | 0.1 | 0.57 | 1.5 | 10800 | 1,360 | 15,882 | 19,969 | 15,383 | 1,360 | 55,379 | 3,449 | 325 | 778 |
| 29 | 0.1 | 0.1 | 0.33 | 2.25 | 7800 | 1,090 | 16,603 | 29,953 | 15,831 | 1,090 | 66,423 | 3,866 | 336 | 880 |
| 30 | 0.1 | 0.1 | 0.33 | 1.5 | 12800 | 1,195 | 15,354 | 19,969 | 14,672 | 1,195 | 54,063 | 3,301 | 304 | 747 |
| 31 | 0.1 | 0.05 | 1.1 | 2.25 | 3400 | 1,437 | 16,791 | 29,953 | 16,634 | 1,437 | 67,524 | 4,095 | 374 | 927 |
| 32 | 0.1 | 0.05 | 1.1 | 1.5 | 8400 | 1,550 | 15,527 | 19,969 | 15,326 | 1,550 | 54,995 | 3,525 | 343 | 793 |
| 33 | 0.1 | 0.05 | 0.57 | 2.25 | 6400 | 1,079 | 15,611 | 29,953 | 15,066 | 1,079 | 64,612 | 3,770 | 328 | 857 |
| 34 | 0.1 | 0.05 | 0.57 | 1.5 | 11400 | 1,185 | 14,332 | 19,969 | 13,750 | 1,185 | 52,056 | 3,195 | 296 | 722 |
| 35 | 0.1 | 0.05 | 0.33 | 2.25 | 8400 | 922 | 15,091 | 29,953 | 14,363 | 922 | 63,313 | 3,627 | 308 | 827 |
| 36 | 0.1 | 0.05 | 0.33 | 1.5 | 13400 | 1,024 | 13,804 | 19,969 | 13,042 | 1,024 | 50,745 | 3,049 | 276 | 691 |
| 37 | 0.05 | 0.15 | 1.1 | 2.25 | 1600 | 1,681 | 19,257 | 29,953 | 19,089 | 1,681 | 72,658 | 4,473 | 416 | 1,011 |
| 38 | 0.05 | 0.15 | 1.1 | 1.5 | 6600 | 1,818 | 18,049 | 19,969 | 17,979 | 1,818 | 60,389 | 3,928 | 388 | 882 |
| 39 | 0.05 | 0.15 | 0.57 | 2.25 | 4600 | 1,314 | 18,084 | 29,953 | 17,510 | 1,314 | 69,740 | 4,144 | 369 | 940 |
| 40 | 0.05 | 0.15 | 0.57 | 1.5 | 9600 | 1,449 | 16,865 | 19,969 | 16,396 | 1,449 | 57,452 | 3,597 | 341 | 811 |
| 41 | 0.05 | 0.15 | 0.33 | 2.25 | 6600 | 1,153 | 17,565 | 29,953 | 16,801 | 1,153 | 68,431 | 3,998 | 349 | 909 |
| 42 | 0.05 | 0.15 | 0.33 | 1.5 | 11600 | 1,284 | 16,341 | 19,969 | 15,683 | 1,284 | 56,138 | 3,449 | 320 | 780 |

| Run Num | Wall U-Fact | Roof U-Fact | Window U-Fact | Light Watts/ft2 | Total Cost | Boiler therms | Dir Exp KWH | Lights KWH | Fans KWH | Tot Gas therms | Tot Elec KWH | Tot $ $ | Site MBTU | Source MBTU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 43 | 0.05 | 0.1 | 1.1 | 2.25 | 3200 | 1,495 | 17,688 | 29,953 | 17,384 | 1,495 | 69,244 | 4,210 | 386 | 953 |
| 44 | 0.05 | 0.1 | 1.1 | 1.5 | 8200 | 1,607 | 16,455 | 19,969 | 16,232 | 1,607 | 56,907 | 3,649 | 355 | 821 |
| 45 | 0.05 | 0.1 | 0.57 | 2.25 | 6200 | 1,133 | 16,515 | 29,953 | 15,811 | 1,133 | 66,332 | 3,883 | 340 | 883 |
| 46 | 0.05 | 0.1 | 0.57 | 1.5 | 11200 | 1,239 | 15,269 | 19,969 | 14,653 | 1,239 | 53,972 | 3,318 | 308 | 750 |
| 47 | 0.05 | 0.1 | 0.33 | 2.25 | 8200 | 973 | 15,997 | 29,953 | 15,105 | 973 | 65,028 | 3,738 | 319 | 852 |
| 48 | 0.05 | 0.1 | 0.33 | 1.5 | 13200 | 1,076 | 14,745 | 19,969 | 13,943 | 1,076 | 52,662 | 3,171 | 287 | 718 |
| 49 | 0.05 | 0.05 | 1.1 | 2.25 | 3800 | 1,317 | 16,175 | 29,953 | 15,906 | 1,317 | 66,116 | 3,964 | 357 | 899 |
| 50 | 0.05 | 0.05 | 1.1 | 1.5 | 8800 | 1,430 | 14,908 | 19,969 | 14,596 | 1,430 | 53,582 | 3,394 | 326 | 765 |
| 51 | 0.05 | 0.05 | 0.57 | 2.25 | 6800 | 963 | 15,002 | 29,953 | 14,341 | 963 | 63,212 | 3,642 | 312 | 830 |
| 52 | 0.05 | 0.05 | 0.57 | 1.5 | 11800 | 1,066 | 13,718 | 19,969 | 13,022 | 1,066 | 50,649 | 3,066 | 279 | 694 |
| 53 | 0.05 | 0.05 | 0.33 | 2.25 | 8800 | 811 | 14,485 | 29,953 | 13,643 | 811 | 61,918 | 3,501 | 292 | 799 |
| 54 | 0.05 | 0.05 | 0.33 | 1.5 | 13800 | 906 | 13,194 | 19,969 | 12,316 | 906 | 49,343 | 2,920 | 259 | 663 |

Peak Cooling and Heating Loads

| Run Num | Zone 1 Cooling | Zone 2 Cooling | Zone 3 Cooling | Zone 4 Cooling | Zone 5 Cooling | Zone 1 Heating | Zone 2 Heating | Zone 3 Heating | Zone 4 Heating | Zone 5 Heating | P.V. LCC Init Inv Dollars | P.V. LCC Energy Dollars | P.V. LCC Total Dollars | P.V. LCC Net Saving Dollars | Benefit Cost Ratio |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 43,930 | 24,621 | 34,122 | 19,406 | 41,992 | (49,347) | (23,642) | (49,347) | (23,642) | (22,500) | 149,000 | 78,632 | 244,502 | 0 | 0.00 |
| 2 | 42,020 | 23,750 | 32,164 | 18,567 | 36,770 | (49,347) | (23,642) | (49,347) | (23,642) | (22,500) | 154,000 | 70,045 | 240,915 | 3,587 | 1.72 |
| 3 | 41,121 | 23,288 | 31,457 | 18,247 | 41,992 | (42,722) | (20,330) | (42,722) | (20,330) | (22,500) | 152,000 | 72,842 | 241,712 | 2,790 | 1.93 |
| 4 | 39,211 | 22,418 | 29,499 | 17,541 | 36,770 | (42,722) | (20,330) | (42,722) | (20,330) | (22,500) | 157,000 | 64,237 | 238,107 | 6,395 | 1.80 |
| 5 | 39,849 | 22,684 | 30,250 | 17,826 | 41,992 | (39,722) | (18,830) | (39,722) | (18,830) | (22,500) | 154,000 | 70,243 | 241,113 | 3,389 | 1.68 |
| 6 | 37,939 | 21,814 | 28,291 | 17,119 | 36,770 | (39,722) | (18,830) | (39,722) | (18,830) | (22,500) | 159,000 | 61,626 | 237,496 | 7,006 | 1.70 |
| 7 | 41,938 | 23,443 | 31,471 | 18,807 | 34,922 | (46,535) | (22,392) | (46,535) | (22,392) | (15,000) | 150,600 | 74,141 | 241,611 | 2,891 | 2.81 |
| 8 | 40,072 | 22,572 | 29,513 | 18,100 | 29,700 | (46,535) | (22,392) | (46,535) | (22,392) | (15,000) | 155,600 | 65,279 | 237,749 | 6,753 | 2.02 |
| 9 | 39,367 | 22,110 | 28,806 | 17,876 | 34,922 | (39,910) | (19,080) | (39,910) | (19,080) | (15,000) | 153,600 | 68,371 | 238,841 | 5,661 | 2.23 |
| 10 | 37,457 | 21,239 | 26,848 | 17,170 | 29,700 | (39,910) | (19,080) | (39,910) | (19,080) | (15,000) | 158,600 | 59,479 | 234,949 | 9,553 | 2.00 |
| 11 | 38,362 | 21,506 | 27,599 | 17,455 | 34,922 | (36,910) | (17,580) | (36,910) | (17,580) | (15,000) | 155,600 | 65,796 | 238,266 | 6,236 | 1.94 |
| 12 | 36,452 | 20,636 | 25,641 | 16,748 | 29,700 | (36,910) | (17,580) | (36,910) | (17,580) | (15,000) | 160,600 | 56,871 | 234,340 | 10,162 | 1.88 |
| 13 | 40,168 | 22,264 | 28,820 | 18,435 | 27,853 | (43,722) | (21,142) | (43,722) | (21,142) | (7,500) | 151,200 | 69,948 | 238,018 | 6,484 | 3.95 |
| 14 | 38,258 | 21,394 | 26,862 | 17,729 | 22,631 | (43,722) | (21,142) | (43,722) | (21,142) | (7,500) | 156,200 | 60,942 | 234,012 | 10,490 | 2.46 |
| 15 | 37,949 | 20,932 | 26,155 | 17,505 | 27,853 | (37,097) | (17,830) | (37,097) | (17,830) | (7,500) | 154,200 | 64,228 | 235,298 | 9,204 | 2.77 |
| 16 | 36,039 | 20,061 | 24,197 | 16,798 | 22,631 | (37,097) | (17,830) | (37,097) | (17,830) | (7,500) | 159,200 | 55,161 | 231,231 | 13,271 | 2.30 |
| 17 | 36,944 | 20,328 | 24,948 | 17,084 | 27,853 | (34,097) | (16,330) | (34,097) | (16,330) | (7,500) | 156,200 | 61,689 | 234,758 | 9,744 | 2.35 |
| 18 | 35,035 | 19,458 | 22,990 | 16,377 | 22,631 | (34,097) | (16,330) | (34,097) | (16,330) | (7,500) | 161,200 | 52,574 | 230,644 | 13,858 | 2.14 |
| 19 | 42,539 | 23,913 | 33,120 | 18,592 | 41,992 | (46,847) | (22,392) | (46,847) | (22,392) | (22,500) | 150,200 | 76,363 | 243,432 | 1,070 | 1.89 |
| 20 | 40,657 | 23,043 | 31,162 | 17,886 | 36,770 | (46,847) | (22,392) | (46,847) | (22,392) | (22,500) | 155,200 | 67,779 | 239,848 | 4,654 | 1.75 |
| 21 | 39,783 | 22,581 | 30,454 | 17,662 | 41,992 | (40,222) | (19,080) | (40,222) | (19,080) | (22,500) | 153,200 | 70,580 | 240,649 | 3,853 | 1.92 |
| 22 | 37,917 | 21,710 | 28,496 | 16,955 | 36,770 | (40,222) | (19,080) | (40,222) | (19,080) | (22,500) | 158,200 | 61,972 | 237,042 | 7,460 | 1.81 |
| 23 | 38,542 | 21,977 | 29,247 | 17,241 | 41,992 | (37,222) | (17,580) | (37,222) | (17,580) | (22,500) | 155,200 | 67,994 | 240,064 | 4,438 | 1.72 |
| 24 | 36,676 | 21,107 | 27,289 | 16,534 | 36,770 | (37,222) | (17,580) | (37,222) | (17,580) | (22,500) | 160,200 | 59,363 | 236,433 | 8,069 | 1.72 |
| 25 | 40,680 | 22,735 | 30,469 | 18,221 | 34,922 | (44,035) | (21,142) | (44,035) | (21,142) | (15,000) | 151,800 | 71,878 | 240,547 | 3,955 | 2.41 |
| 26 | 38,814 | 21,865 | 28,511 | 17,515 | 29,700 | (44,035) | (21,142) | (44,035) | (21,142) | (15,000) | 156,800 | 63,012 | 236,682 | 7,820 | 2.00 |
| 27 | 38,099 | 21,402 | 27,803 | 17,291 | 34,922 | (37,410) | (17,830) | (37,410) | (17,830) | (15,000) | 154,800 | 66,123 | 237,792 | 6,710 | 2.16 |
| 28 | 36,189 | 20,532 | 25,845 | 16,584 | 29,700 | (37,410) | (17,830) | (37,410) | (17,830) | (15,000) | 159,800 | 57,213 | 233,883 | 10,619 | 1.98 |
| 29 | 37,094 | 20,799 | 26,596 | 16,869 | 34,922 | (34,410) | (16,330) | (34,410) | (16,330) | (15,000) | 156,800 | 63,568 | 237,237 | 7,265 | 1.93 |
| 30 | 35,185 | 19,929 | 24,638 | 16,163 | 29,700 | (34,410) | (16,330) | (34,410) | (16,330) | (15,000) | 161,800 | 54,614 | 233,283 | 11,219 | 1.88 |
| 31 | 38,900 | 21,557 | 27,818 | 17,850 | 27,853 | (41,222) | (19,892) | (41,222) | (19,892) | (7,500) | 152,400 | 67,690 | 236,960 | 7,542 | 3.22 |
| 32 | 36,990 | 20,687 | 25,860 | 17,144 | 22,631 | (41,222) | (19,892) | (41,222) | (19,892) | (7,500) | 157,400 | 58,678 | 232,947 | 11,555 | 2.38 |
| 33 | 36,681 | 20,224 | 25,152 | 16,920 | 27,853 | (34,597) | (16,580) | (34,597) | (16,580) | (7,500) | 155,400 | 62,005 | 234,275 | 10,227 | 2.60 |
| 34 | 34,771 | 19,354 | 23,194 | 16,213 | 22,631 | (34,597) | (16,580) | (34,597) | (16,580) | (7,500) | 160,400 | 52,905 | 230,175 | 14,327 | 2.26 |
| 35 | 35,677 | 19,621 | 23,945 | 16,498 | 27,853 | (31,597) | (15,080) | (31,597) | (15,080) | (7,500) | 157,400 | 59,502 | 233,772 | 10,730 | 2.28 |
| 36 | 33,767 | 18,750 | 21,987 | 15,792 | 22,631 | (31,597) | (15,080) | (31,597) | (15,080) | (7,500) | 162,400 | 50,345 | 229,615 | 14,887 | 2.11 |
| 37 | 41,265 | 23,206 | 32,117 | 18,007 | 41,992 | (44,347) | (21,142) | (44,347) | (21,142) | (22,500) | 150,600 | 74,095 | 241,565 | 2,937 | 2.84 |
| 38 | 39,399 | 22,336 | 30,159 | 17,301 | 36,770 | (44,347) | (21,142) | (44,347) | (21,142) | (22,500) | 155,600 | 65,512 | 237,982 | 6,520 | 1.99 |
| 39 | 38,525 | 21,873 | 29,452 | 17,077 | 41,992 | (37,722) | (17,830) | (37,722) | (17,830) | (22,500) | 153,600 | 68,327 | 238,797 | 5,705 | 2.24 |
| 40 | 36,659 | 21,003 | 27,493 | 16,370 | 36,770 | (37,722) | (17,830) | (37,722) | (17,830) | (22,500) | 158,600 | 59,708 | 235,178 | 9,324 | 1.97 |
| 41 | 37,284 | 21,270 | 28,244 | 16,655 | 41,992 | (34,722) | (16,330) | (34,722) | (16,330) | (22,500) | 155,600 | 65,770 | 238,240 | 6,262 | 1.95 |
| 42 | 35,418 | 20,399 | 26,286 | 15,949 | 36,770 | (34,722) | (16,330) | (34,722) | (16,330) | (22,500) | 160,600 | 57,108 | 234,577 | 9,925 | 1.86 |

| | Peak Cooling and Heating Loads | | | | | | | | | | P.V. LCC | P.V. LCC | P.V. LCC | P.V. LCC | Benefit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Run Num | Zone 1 Cooling | Zone 2 Cooling | Zone 3 Cooling | Zone 4 Cooling | Zone 5 Cooling | Zone 1 Heating | Zone 2 Heating | Zone 3 Heating | Zone 4 Heating | Zone 5 Heating | Init Inv Dollars | Energy Dollars | Total Dollars | Net Saving Dollars | Cost Ratio |
| 43 | 39,422 | 22,028 | 29,466 | 17,636 | 34,922 | (41,535) | (19,892) | (41,535) | (19,892) | (15,000) | 152,200 | 69,612 | 238,682 | 5,820 | 2.82 |
| 44 | 37,555 | 21,158 | 27,508 | 16,930 | 29,700 | (41,535) | (19,892) | (41,535) | (19,892) | (15,000) | 157,200 | 60,743 | 234,813 | 9,689 | 2.18 |
| 45 | 36,831 | 20,695 | 26,801 | 16,706 | 34,922 | (34,910) | (16,580) | (34,910) | (16,580) | (15,000) | 155,200 | 63,891 | 235,961 | 8,541 | 2.38 |
| 46 | 34,921 | 19,825 | 24,842 | 15,999 | 29,700 | (34,910) | (16,580) | (34,910) | (16,580) | (15,000) | 160,200 | 54,952 | 232,022 | 12,480 | 2.11 |
| 47 | 35,827 | 20,092 | 25,594 | 16,284 | 34,922 | (31,910) | (15,080) | (31,910) | (15,080) | (15,000) | 157,200 | 61,354 | 235,424 | 9,078 | 2.11 |
| 48 | 33,917 | 19,221 | 23,635 | 15,578 | 29,700 | (31,910) | (15,080) | (31,910) | (15,080) | (15,000) | 162,200 | 52,375 | 231,444 | 13,058 | 1.99 |
| 49 | 37,632 | 20,850 | 26,815 | 17,265 | 27,853 | (38,722) | (18,642) | (38,722) | (18,642) | (7,500) | 152,800 | 65,438 | 235,108 | 9,394 | 3.47 |
| 50 | 35,722 | 19,979 | 24,857 | 16,558 | 22,631 | (38,722) | (18,642) | (38,722) | (18,642) | (7,500) | 157,800 | 56,416 | 231,085 | 13,417 | 2.52 |
| 51 | 35,414 | 19,517 | 24,150 | 16,334 | 27,853 | (32,097) | (15,330) | (32,097) | (15,330) | (7,500) | 155,800 | 59,797 | 232,467 | 12,035 | 2.77 |
| 52 | 33,504 | 18,647 | 22,191 | 15,628 | 22,631 | (32,097) | (15,330) | (32,097) | (15,330) | (7,500) | 160,800 | 50,667 | 228,336 | 16,166 | 2.37 |
| 53 | 34,409 | 18,913 | 22,943 | 15,913 | 27,853 | (29,097) | (13,830) | (29,097) | (13,830) | (7,500) | 157,800 | 57,341 | 232,010 | 12,492 | 2.42 |
| 54 | 32,499 | 18,043 | 20,984 | 15,206 | 22,631 | (29,097) | (13,830) | (29,097) | (13,830) | (7,500) | 162,800 | 48,122 | 227,792 | 16,710 | 2.21 |

On the next page, the data regression feature of LOTUS was used to generate equations relating the output results to the input variables studied. The R Squared values are all high, since the data came from a model and multiple linear relationships are expected.

These simple multiple linear equations can be used, as shown on the right of the next page, to accurately estimate the results. The left column is the actual ASEAM results for the Site MBTU. The second column uses the curve fit equation to estimate the Site MBTU:

$$\text{Site MBTU} = 122.2173 + 335.1456 * \text{Wall U-Factor} + 598.2407 * \text{Roof U-Factor} + 87.35021 * \text{Window U-Factor} + 40.81883 * \text{Lighting Watts / ft2}$$

Note that there are some obvious advantages to using equations. The main advantage is that you are not limited solely to the values used for the independent variables. For example, you can determine the savings for a wall U-Factor of 0.075, roof U-Factor of 0.075, etc., even though ASEAM was not run with these conditions. Others advantages of using equations are discussed in the paper contained in the appendix.

An extension of fitting equations to the data is to use a spreadsheet that allows users to enter the values for the input variables and also to use the equations to estimate the results. An example of a spreadsheet post-processor using the parametric analysis shown above is contained on the enclosed diskette. Access LOTUS and retrieve the file DOGRAPH.WK1. In it you will see the fitted equations stored to the right of the outputs (cells J3 through N15).

Users enter input data in cells B3 through D6. Once the data is entered or changed, the fitted equations are used to calculate the results on the right side of the spreadsheet.

| | A | B | C | D | E | F | G | H | I |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | Design Options Analysis | | | | | |
| 2 | | Base | Option | Cost | | | Base | Option | Savings |
| 3 | U-Wall | 0.15 | 0.1 | $5,000 | Boiler | therms | 1,562 | 1,209 | 353 |
| 4 | U-Roof | 0.15 | 0.1 | $2,500 | DX | kwh | 19,315 | 15,370 | 3,945 |
| 5 | U-Glass | 0.57 | 0.33 | $2,500 | Site | MBtu | 404 | 306 | 98 |
| 6 | Watts/ft2 | 2.25 | 1.5 | $4,000 | Annual | Dollars | $4,410 | $3,310 | $1,099 |
| 7 | | | | | | | | | |
| 8 | Option | $0 | $14,000 | | Pk Clg 1 | Btuh | 41,117 | 35,194 | 5,923 |
| 9 | Cost | | | | Pk Clg 2 | Btuh | 23,288 | 19,929 | 3,359 |
| 10 | | | | | Pk Clg 3 | Btuh | 31,457 | 24,638 | 6,819 |
| 11 | Cost per | | | | Pk Clg 4 | Btuh | 18,271 | 16,158 | 2,113 |
| 12 | Ton | $400 | $400 | | | | | | |
| 13 | HP | $250 | $250 | | Pk Htg 1 | Btuh | (42,722) | (34,410) | (8,312) |

Equipment PV LCC Energy $72,914 $54,788 $18,126
Cooling $3,804 $3,197 $607 Total LCC Cost $72,914 $68,788 $4,126
Heating $1,068 $860 $208 (energy + option cost)

SPB (yrs) 12.7 12.0 Total LCC Cost $77,786 $72,845 $4,941
SIR 1.35 1.37 with Equipment

| Regression Output: | Boiler | | | |
|---|---|---|---|---|
| Constant | 606.655995 | | | |
| Std Err of Y Est | 9.56973345 | | | |
| R Squared | 0.99901724 | | | |
| No. of Observations | 54 | | | |
| Degrees of Freedom | 49 | | | |
| X Coefficient(s) | 2391.72722 | 3707.12672 | 685.447637 | -155.80996 |
| Std Err of Coef. | 31.8991115 | 31.8991115 | 4.04814536 | 3.47273539 |
| **Regression Output:** | **DX Cooling** | | | |
| Constant | 7814.51513 | | | |
| Std Err of Y Est | 19.4380575 | | | |
| R Squared | 0.99987581 | | | |
| No. of Observations | 54 | | | |
| Degrees of Freedom | 49 | | | |
| X Coefficient(s) | 12240.3777 | 31111.9333 | 2221.52285 | 1658.36098 |
| Std Err of Coef. | 64.7935252 | 64.7935252 | 8.22259920 | 7.05382557 |
| **Regression Output:** | **Annual kWh** | | | |
| Constant | 18034.5184 | | | |
| Std Err of Y Est | 82.1582947 | | | |
| R Squared | 0.99987816 | | | |
| No. of Observations | 54 | | | |
| Degrees of Freedom | 49 | | | |
| X Coefficient(s) | 28119.7555 | 66665.1444 | 5509.94781 | 16524.9985 |
| Std Err of Coef. | 273.860982 | 273.860982 | 34.7542302 | 29.8142074 |
| **Regression Output:** | **Site MBTU** | | | |
| Constant | 122.217377 | | | |
| Std Err of Y Est | 1.19876446 | | | |
| R Squared | 0.99927914 | | | |
| No. of Observations | 54 | | | |
| Degrees of Freedom | 49 | | | |
| X Coefficient(s) | 335.145611 | 598.240777 | 87.3502195 | 40.8188345 |
| Std Err of Coef. | 3.99588156 | 3.99588156 | 0.50709592 | 0.43501648 |
| **Regression Output:** | **Annual Energy Dollars** | | | |
| Constant | 1205.05357 | | | |
| Std Err of Y Est | 8.49654324 | | | |
| R Squared | 0.99962458 | | | |

| Actual Site MBTU | Equation Site MBTU | Percent Difference |
|---|---|---|
| 450.018 | 450.153 | 0.03% |
| 421.783 | 419.539 | -0.53% |
| 403.223 | 403.857 | 0.16% |
| 374.859 | 373.243 | -0.43% |
| 382.205 | 382.893 | 0.18% |
| 353.765 | 352.279 | -0.42% |
| 419.658 | 420.241 | 0.14% |
| 388.812 | 389.627 | 0.21% |
| 373.056 | 373.945 | 0.24% |
| 341.985 | 343.331 | 0.39% |
| 352.281 | 352.981 | 0.20% |
| 320.903 | 322.367 | 0.46% |
| 391.007 | 390.329 | -0.17% |
| 359.625 | 359.715 | 0.03% |
| 344.920 | 344.033 | -0.26% |
| 313.002 | 313.419 | 0.13% |
| 324.499 | 323.069 | -0.44% |
| 292.143 | 292.455 | 0.11% |
| 433.028 | 433.396 | 0.08% |
| 404.843 | 402.782 | -0.51% |
| 386.294 | 387.100 | 0.21% |
| 357.930 | 356.486 | -0.40% |
| 365.432 | 366.136 | 0.19% |
| 336.837 | 335.522 | -0.39% |
| 402.737 | 403.484 | 0.19% |
| 371.869 | 372.870 | 0.27% |
| 356.272 | 357.188 | 0.26% |
| 325.042 | 326.574 | 0.47% |
| 335.710 | 336.224 | 0.15% |
| 304.031 | 305.610 | 0.52% |
| 374.148 | 373.572 | -0.15% |
| 342.722 | 342.957 | 0.07% |
| 328.386 | 327.276 | -0.34% |
| 296.163 | 296.662 | 0.17% |
| 308.323 | 306.312 | -0.65% |
| 275.557 | 275.698 | 0.05% |
| 416.071 | 416.638 | 0.14% |
| 387.901 | 386.024 | -0.48% |
| 369.454 | 370.343 | 0.24% |
| 340.993 | 339.729 | -0.37% |
| 348.870 | 349.379 | 0.15% |
| 319.968 | 318.765 | -0.38% |
| 385.796 | 386.726 | 0.24% |
| 354.913 | 356.112 | 0.34% |

No. of Observations 54 339.649 340.431 0.23%
Degrees of Freedom 49 308.134 309.817 0.55%
319.248 319.467 0.07%
X Coefficient(s) 2601.85333 5186.82055 618.221332 748.345037 287.335 288.853 0.53%
Std Err of Coef. 28.3218108 28.3218108 3.59416929 3.08328822 357.346 356.814 -0.15%
325.835 326.200 0.11%
312.011 310.519 -0.48%
Regression Output: Peak Cooling Load Zone 1 279.500 279.905 0.14%
Constant 24055.1227 292.423 289.555 -0.98%
Std Err of Y Est 152.355915 259.032 258.941 -0.04%
R Squared 0.99651912
No. of Observations 54
Degrees of Freedom 49

X Coefficient(s) 25505.8388 32430.9666 4708.45118 2527.73975
Std Err of Coef. 507.85305 507.85305 64.4489101 55.2880371

## Lookup Tables

A second way to help you analyze parametric results is by using the '@lookup' function on your spreadsheet. The enclosed spreadsheet 'SAMPLE.WK1' contains not only the results of the parametric analysis, but also an area where you can select run numbers and get a comparison quickly. This area, shown on the next page, can be found in cells A61 through AO81.

This spreadsheet also contains macros that display comparisons of base case versus ECO case data:

The figure to the left was generated using the Alt-P macro in the spreadsheet "SAMPLE.WK1". The data for this graph can be found in the percent savings columns.

The monthly electric consumption comparison between the base case and ECO case can be graphed with the Alt-E macro.

INSTRUCTIONS

Enter the base case and ECO case run numbers, then use macros below

| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Run Num | UNO-Inf A C Rate | Roof U-Fact | Window U-Fact | Window Shad Coef | Window Leak Coef | Light Watts/ft2 | Min % OA OCC | Boiler therms | Rec Chil KWH | Lights KWH | Tot Gas therms | Tot Elec KWH | Tot $ $ | Site MBTU | Source MBTU |
| Base Case | 1 | 1 | 0.1 | 1.1 | 1 | 6 | 2.5 | 20 | 10,634 | 18,395 | 26,883 | 10,944 | 102,501 | 10,597 | 1,444 | 2,283 |
| ECO Case | 32 | 0.5 | 0.05 | 0.57 | 0.7 | 2 | 2 | 10 | 5,614 | 12,805 | 21,506 | 5,925 | 72,606 | 6,593 | 840 | 1,435 |
| Savings | | | | | | | | | 5,020 | 5,590 | 5,377 | 5,020 | 29,895 | 4,005 | 604 | 849 |
| Percent Change | | | | | | | | | 47.20 | 30.39 | 20.00 | 45.87 | 29.17 | 37.79 | 41.82 | 37.17 |

| Use the following macros to graph your results | | Alt-P | Alt-E | Alt-G | Alt-S |
|---|---|---|---|---|---|
| Alt-P | Percent Savings | /gnupcsaved~ | /gnuelect~ | /gnugas~ | /gnusaved~ |
| Alt-G | Monthly Gas Comparison | {esc}{esc} | {esc}{esc} | {esc}{esc} | {esc}{esc} |
| Alt-E | Monthly Electric Comparison | | | | |
| Alt-S | Monthly Energy Saved | | | | |