8 Energy Conservation Opportunity (ECO) Input

8 ENERGY CONSERVATION OPPORTUNITY (ECO) INPUT

8.1 Introduction

Once a building has been operated for some time, the owners or operators may decide that it is worthwhile to consider retrofitting its structure, operating profile, or HVAC system to reduce energy consumption. Such measures are called Energy Conservation Opportunities (ECOs). ASEAM3.0 can model the effects of ECOs, both individually and in combination, on the building's overall energy consumption.

The determination of which ECOs to consider initially needs to be decided upon by you and the building owners and operators. Chapter 4 discusses some factors to be considered when selecting ECOs. Generally, you will model a number of ECOs individually and select from these a subset of cost-effective ECOs. Then you can model various combinations of ECOs to evaluate the economic feasibility of the entire package of ECOs.

There are many hand-calculation methods for determining the energy savings due from a particular ECO. These have the advantage of being quick and simple to perform. Hand-calculation methods, however, cannot account for the interactive effects of more than one ECO. For example, if you want to determine the combined energy savings resulting from increasing wall insulation, weatherstripping doors and windows, and reducing the thermostat setpoint, you would perform three separate calculations and then add the savings together. The result would not be accurate, however, because if the thermostat setpoint is reduced, the savings due to increased wall insulation are reduced because of the smaller indoor-outdoor temperature difference.

ECOs can be modifications of loads, systems, or plant parameters. The initial ECOs to be considered will probably be determined by a building energy audit or inspection of the building's energy bills. Lists of ECOs can be found in numerous publications. A recent publication (April 1990) entitled "Architects and Engineers Guide to Energy Conservation in Existing Buildings" demonstrates the use of ASEAM2.1 to model several ECOs. It is not the purpose of this ASEAM3.0 User's Manual to discuss possible ECOs and their applicability. Rather, once a list of potential ECOs has been determined, this section instructs the user how to model them with ASEAM3.0 to determine their projected energy savings. The above reference is recommended.

ASEAM3.0 models ECOs by repeating simulation runs of a base-case building whose parameters are changed by varying ECO variables. You could perform this simulation by creating numerous input files, each basically the same but with a few values changed for the ECOs. To save disk space and user input time, ASEAM3.0 has an ECO input routine. First you define the base-case file completely. Next, the base-case file is referenced, and you define any number of ECOs, each of which modifies one or more input parameters. The changes are stored in files (much smaller than the complete input files) and are referenced from the "Specify Analyses" segment of the program.

Every ECO file name will have the form: AAAA###L.TEC

1. AAAA is a user-specified prefix.
2. ### is a number that identifies the type of ECO.
3. L is a letter that identifies the number of the type ### (above) ECO (A is the first ECO of type ###, B the second, etc.).

4. TEC is the suffix that identifies the type of ECO:
   LEC_Loads ECO
   SEC_Systems ECO
   PEC_Plant ECO

You will need to use this file-naming convention in the Specify Analyses segment, when you are asked to identify which ECO files are to be used in the simulation.

8.1.1 Conventional ECO Modeling

When using any computer program to calculate the energy savings resulting from an ECO, the "normal" method of performing the analysis has several steps:

1. Define the base case input files and perform calculations with these files.

2. Change input variables in the base case input files to reflect the ECO and perform the calculations with these new sets of input files.

3. Manually determine the resultant energy savings by subtracting the ECO energy usage from the base case annual energy usage.

4. Perform Life-Cycle cost calculations if desired.

5. Repeat steps 2 through 4 for each ECO.

In the method described above, each ECO requires a separate input data file. If you desire to investigate all possible combinations of five individual loads ECOs, this would require 32 separate loads input files. Each individual loads input file would model either one ECO or any combination of up to five individual ECOs. ASEAM3.0 can model ECOs in this manner. Since each ECO or ECO combination is modeled in a separate input file, ASEAM3.0 refers to these type files as "batch" ECO files.

There are many limitations to this method:

■ As described above, many complete input files are required.

■ The calculation of the resultant energy savings must be performed manually by subtracting the ECO energy usage from the base case energy usage.

■ Life-Cycle cost analysis is not integrated.

ASEAM3.0, on the other hand, requires less input time, automatically compares the ECO with the base case energy consumption, and integrates the BLCC calculations.

8.1.2 ASEAM3.0 ECO Modeling

Simple ECOs

Many simple ECOs only require a minimal change to the base case input files (e.g. changing the wall U-factor for insulation, minimum outside air percent for systems, etc.). The ASEAM3.0 ECO Input Program was specifically designed for these simple ECOs. In the ECO Input Program, you first specify what input screen contain the input data that is to be changed for an ECO. For example, to model an ECO for adding wall insulation, you would want to change the U-Factor value in the "wall" screen of the base case loads input file. If you wanted to investigate both R-19 and R-27, you would specify two wall ECOs.

After you specify the number of ECOs for each ECO type (or input screen), ASEAM3.0 will first ask some general information about the ECO (ECO description, file name for storage). Then, ECO input screens appear for each ECO selected. These ECO input screens appear vary similar to the normal loads, systems, and plant input screens. Some of the normal input questions do not appear in the ECO screen (e.g. wall orientation, area, etc.). The base case information is shown on the input screen, and you may change any input value (or combination of input values) in the ECO input screen. You can only change the information in the base case file - you cannot add window sections, for example, since the area and window orientation would not be known. After you edit the values in the base case files, the new values are automatically stored in a small ECO file for each ECO type - not a complete new loads input file.

Note that ASEAM3.0 does not refer to ECOs by "names" - but rather by "types". That is, "Install Economizer Controls" or "Reduce Outside Air Intake" are never explicitly defined as ECOs by name. To model these ECOs, you must access the "Outside Air Controls" input screen for systems ECOs. To investigate different possible combinations of outside air controls (e.g. enthalpy versus dry bulb economizer, with different minimum percent outside air intake), you would indicate multiple "Outside Air Control" ECO types. For example, four "Outside Air Control" ECOs would be requested to simulate the following:

ECO #1	Install Enthalpy Economizer (same minimum %)
ECO #2	Install Dry Bulb Economizer with (75 deg switchover) (same minimum percent outside air)
ECO #3	Install Enthalpy Economizer (reduced minimum %)
ECO #4	Install Dry Bulb Economizer with (75 deg switchover) (reduced minimum percent outside air)

Complex ECOs

Many ECOs cannot be modeled as simple changes to a particular input screen. Examples would include changing the system or plant type, replacing window areas with walls, or adding daylighting. To model these more complex ECOs, you must use the normal loads, systems, and plant input programs to reflect the required changes in all input screens. Complete new loads, systems, and plant files (with different file names) must be saved. These

ECOs are referred to as "batch" ECOs.

Complex ECOs cannot be modeled with the ECO input program since many different screens must be accessed for an ECO.

Before attempting to model an ECO, you must first decide whether the ECO input program can be used, or whether you must edit existing base case files with the normal loads, systems, and plant input programs ("batch" ECOs). The ECO input program should be used whenever possible. However, you can always use the "batch" ECO method.

The ECO input program can be used only if all the input changes required for an ECO are available on the ECO input screens. Therefore, you must first review the ECO input screens in sections 8.3 (Loads ECOs), 8.4 (Systems ECOs), and 8.5 (Plant ECOs). If all the inputs requiring changes can be found in these sections, you should use the ECO input program. If you cannot completely model an ECO by changing values in these ECO input screens, you must use "batch" ECO files.

Reset Schedule ECOs

Some specific ECOs cannot be modeled directly by ASEAM3.0. However, if the change in the zone load or plant load can be calculated, ASEAM3.0 can account for these load changes as a Reset Schedule ECO. Examples would include adding moveable insulation to windows at night or using heat recovery to reduce the boiler load. ASEAM3.0 includes two ECO input screens (Loads Reset Schedule #240 and Systems Reset Schedule #410) that allow you to change the loads on the systems and plant. You must first determine the change in BTUH load as a function of outside air temperature (i.e. a slope and intercept must be determined).

Example: Moveable Window Insulation at Night

Assume the following base case conditions:

window area = 500 square feet
U-Factor (same for occupied and unoccupied cycles) = .57
Unoccupied cycle thermostat setpoint = 60 deg F.
Design winter outside air temperature = 10 deg F.

Assume the following ECO conditions:

U-Factor during the unoccupied cycle only = .10
(all other values are the same as the base case)

Heat loss through windows at night = U * Area * (Toa - Tspace)

At design winter (10 deg F)

Present heat loss = (.57)(500)(10-60) = -14,250 BTUH
ECO heat loss = (.10)(500)(10-60) = -2,500 BTUH

At 60 deg F outside temperature, the heat losses in both cases would be zero since the temperature difference is zero.

Therefore, the change in load (ECO load minus base case load) for this ECO would be:

11,750 BTUH at 10 deg F (positive value)
0 BTUH at 60 deg F

The slope and intercept representing these two points is:
Slope = -235 BTUH/deg F (negative number)
Intercept = 14,100 BTUH (positive number)

The above two values (slope and intercept) would be entered for the slope adjustment and constant change respectfully in the Loads Reset Schedule ECO input screen (see section 8.3.15). Note that these values only "adjust" the loads up or down. Be sure to use positive adjustments for additional cooling loads (or reduced heating loads). DO NOT USE THE WRONG SIGNS FOR THESE VALUES.

The Reset Schedule ECOs allow you to use up to four different slope and intercept (constant) adjustment schedules per zone or system. Additionally, each schedule number can apply to different months and occupied or unoccupied cycle. Assuming the above two values were entered as schedule #1, they could be used only during the unoccupied cycle during the months of September through April, for example. Each zone or system has separate Reset Schedule ECO screens (the window area, for example, could be different between zones one and two).

Example - Heat Recovery

Assume a heat recovery device was installed as an ECO, and it reduced the boiler load during the months of October through April by 10,000 BTUH. In this case, the boiler load reduction is not dependent on the outside air temperature, and the slope adjustment would be entered as zero. The constant change input value would be entered as -10,000 (BTUH). Note that negative numbers represent load reductions and positive numbers indicate additional loads. You must use the System Reset Schedule (see section 8.4.12) for this ECO since it reduces the plant load. The Loads Reset Schedule ECO only adjusts the systems load.

8.1.3 ASEAM3.0 ECO Calculations

After you have created ECO files from the ECO input program or "batch" ECO files from the loads, systems, or plant input programs, you are ready to perform the energy calculations for these ECOs. If Life-Cycle cost analysis is desired, you should also create BLCC input files to be used for each ECO or combination.

During the "Specify Analysis" segment (see Chapter 11) you define which files are to be used in the calculations. There are two calculation modes for ECOs: Single ECO Run Mode, and Multiple ECO Run Mode. In both modes, you begin by defining the base case input files to be used. Then separate input screens appear for the two modes:

Single ECO Run Mode - in this mode, you may enter only one new file name for the ECO calculations. This may be a file created by the ECO input program (e.g. wall ECO), or it may be a completely different "batch" loads, systems or plant input file. Up to 40 different ECO calculations can be performed in this mode.

Multiple ECO Run Mode - in this mode you may enter several different ECOs files to be considered together for the calculations. That is, the combined effects of wall insulation, storm windows, economizer controls, increased chiller COP, etc. can be specified. If only one ECO is specified in this mode, the effect would be similar to the Single ECO Run Mode. Up to twenty different sets in ECO input files (combination runs) can be specified in this mode.

During the calculations, three "preprocessor" programs (for loads, systems, and plant) determine which input data is to be used for the calculations. Each preprocessor program first determines which loads, systems, or plant input file should be used and read into memory. This could be either the base case input files or batch ECO files. Next, if an ECO input file was specified (created in the ECO input program), the program reads the specified files and "substitutes" the new values for the base case values. Next, the Reset Schedule ECOs, if specified, are read in to adjust the loads on the systems or plant. Finally, the preprocessor passes the input values and loads to the correct calculation program. (Note: these preprocessor programs also make similar "substitutions" in the parametric run mode).

From the above discussion, you may note that only one complete input file (loads, systems, or plant) is ready into memory at the beginning. Therefore, only one batch type loads, system or plant ECO file can be used for any ECO calculation. (If the second batch file of the same type was read into memory, it would completely overwrite the first file). In the multiple ECO run mode, you could specify different ECO files for each calculation segment (loads, systems, and plant). Secondly, only one ECO of a particular type (e.g. wall, outside air control, etc.) can be used in any ECO calculation. If a second wall ECO input file was read in, for example, the changed data from the first wall ECO would be lost. Therefore, if you want to model combinations of ECOs of the same type, you must specify multiple ECOs in the ECO input program. For example, if you wanted to consider both reducing the shading coefficient and weatherstripping the windows individually and in combination, you must specify three window type ECOs in the ECO input program. The first two ECOs would reflect the ECOs individually and the third would reflect the combination.

8.2 Entering ECO Data

The ECO input program is divided into loads, systems, and plant segments like the standard input routines. Before accessing the ECO input, first make sure that the data subdirectory for the base case files are correct. From the ASEAM3.0 Main Menu, choose "Input Data" and then "ECO" from the pull-down menu:

ASEAM3 MAIN MENU

| Input Data   Print Reports   Specify Analyses   Run Calcs   Exit DOS |

```
│ Loads   │
│ Systems │
│ Plant   │
│ ECO     │
│ Quick   │
│ Weather │
│ Drives  │
│ Exit    │
└─────────┘
```

The ASEAM3 ECO Input Menu will appear on the screen:

ASEAM3 ECO INPUT

```
┌──────────────────────────────────────────────────────────┐
│ Select ECOs (New Data)     Edit Existing ECOs     Exit │
└──────────────────────────────────────────────────────────┘
```

The ECOs that you will model will fall into the loads, systems, or plant category. You will enter these one category at a time. To enter new ECOs, choose the "Select ECOs" option. Use "Edit Existing ECOs" to change ECO data entered previously.

8.3 Loads ECOs

To begin with the loads ECOs, choose "Loads" from the pull-down menu. A directory of existing loads input files in the data subdirectory will be shown. Indicate the input file that is to be used as the base case file. If there are no loads input data files on the data subdirectory, an error message will be issued.

The next screen asks you to specify the number of ECOs for each type. To do this, you must know how a given ECO will change the base-case building parameters. For example, adding wall insulation will change the wall U-factor and is therefore a wall ECO. Adding weatherstripping will change the leakage coefficient for doors and windows and is therefore both a window and a door ECO. Before using the ECO input routine, you should have a list of ECOs and the new input values for each ECO. From this list, enter the number of ECOs for each type on this screen.

```
LOADS ECO SELECTION
--------------------------------------------------------------------------
Enter the number of analyses for each type

100 - Wall                          _
110 - Roof                          _
120 - Window                        _
130 - Door                          _
140 - Infiltration                  _
150 - Miscellaneous Conduction      _
160 - Lighting                      _
170 - Miscellaneous Electric        _
180 - Miscellaneous Sensible        _
190 - Daylighting                   _
200 - Diversity Factors             _
210 - Occupancy Schedules           _
220 - Thermostat Setpoints          _
230 - Building Schedules            _

240 - Special - User Entered        _
      Loads Reset Schedule on Systems
```

For every ECO there is a screen of general data, which looks like this:

```
General ECO Data                              Input File:SAMPLE
ECO Type - Type               ECO No: ###   Case No: #
--------------------------------------------------------------------------
Enter the description of the ECO below
Line 1   ________________________________________________
Line 2   ________________________________________________
Line 3   ________________________________________________
Line 4   ________________________________________________
Line 5   ________________________________________________

Four Character Filename Prefix                  ____
```

The ECO type, number, and case number will be listed at the top of the screen. Enter a description of the ECO (this description does not appear on any report - it is for your reference only) and a four character file name prefix. The complete file name, as explained in Section 8.1, will be the four-character prefix, the ECO number, and a letter designating the case of this ECO type. Keep note of these file names, because you will choose the ECOs by these names when you Specify Analysis.

The following screens pertain to the type of ECO. They look very much like the input screens for the same components (e.g., walls or windows). The difference is that only values which may be changed by ECOs are shown on the screen. For example, neither changing the wall area nor orientation are considered as ECOs, so the area and orientation data are omitted from the Wall ECO screens.

Any of the components that were originally input by zone will have one ECO screen for each zone. Thus, it is possible to model, for example, only the ECO of installing wall insulation in the north walls. The ECO input screens will initially display the base case data for all components. To enter the changes due to an ECO, edit the data just as you would normally. Once you have completed all the screens for the ECO (which may be just one screen, as in the case of operating hours, or one screen per zone, as in the case of a wall ECO), a file will automatically be written that contains the data for this ECO.

The ECO Input routine will go through all the ECOs that you identified on the first screen. All ECOs of one type will be completed before moving to the next type.

All types of ECOs are shown below. The screens contain data from a sample base case file. Note that an ECO screen will never appear without data unless the original base case file had no data. This may occur occasionally (for example, a core zone will not have any data entered for windows), but in general ECO screens will be shown with existing, base case data.

8.3.1 Wall ECOs #100 (1 screen per zone)

```
│ASEAM3 ECO INPUT: ZONE  1 - South Exposure              Input File:SAMPLE │
│WALL ECOS                   ECO No: 100   Case No: 1   ECO File:SAMP100A│
│--------------------------------------------------------------------------│
│WALLS                             Wall 1    Wall 2    Wall 3    Wall 4    │
│Name (Optional)                  ________  ________  ________  ________   │
│                                                                          │
│U-Factor (BTUH/ft²-°)             _____     _____     _____     _____     │
│Wall Construction Group             _         _         _         _       │
│Color Correction                   ___       ___       ___       ___      │
│                                                                          │
│        Wall Construction Groups - see page F26.9 ('A' through 'G')       │
│        Color Correction Codes     1=Dark   .83=Medium   .65=Light        │
```

8.3.2 Roof ECOs #110 (1 screen per zone)

```
│ASEAM3 ECO INPUT: ZONE  1 - South Exposure              Input File:SAMPLE │
│ROOF ECOS                   ECO No: 110   Case No: 1   ECO File:SAMP110A│
│--------------------------------------------------------------------------│
│ROOFS                             Roof 1    Roof 2                        │
│Name (Optional)                  ________  ________                       │
│                                                                          │
│U-Factor (BTUH/ft²-°)             _____     _____                         │
│Roof Construction Code             __        __                           │
│Color Correction                   ___       ___                          │
│                                                                          │
│     Roof Construction Codes - see ASHRAE F26.8 T5 - numbers 1 thru 13    │
│     Color Correction Codes   1 = Dark Colored or in an industrial area   │
│                              .5 = permanently light colored or in rural area│
```

8.3.3 Window ECOs #120 (1 screen per zone)

```
│ASEAM3 ECO INPUT: ZONE  1 - South Exposure              Input File:SAMPLE │
│WINDOW ECOS                 ECO No: 120   Case No: 1   ECO File:SAMP120A│
│--------------------------------------------------------------------------│
│WINDOWS                        Window 1   Window 2   Window 3   Window 4  │
│Name (optional)                ________   ________   ________   ________  │
│                                                                          │
│Shading coefficient              ___        ___        ___        ___     │
│U-Factor (BTUH/ft²-°)            ____       ____       ____       ____    │
```

```
│Leakage coefficient             __      __      __      __      │
└──────────────────────────────────────────────────────────────────┘
```

8.3.4 Door ECOs #130 (1 screen per zone)

```
┌──────────────────────────────────────────────────────────────────┐
│ASEAM3 ECO INPUT: ZONE  1 - South Exposure            Input File:SAMPLE │
│DOOR ECOS                     ECO No: 130   Case No: 1   ECO File:SAMP130A│
│-------------------------------------------------------------------------│
│DOORS                                   Door 1        Door 2             │
│                                                                         │
│Name (optional)                       __________    __________           │
│                                                                         │
│U-Factor (BTUH/ft²-°)                    _____         _____             │
│Leakage coefficient                      ___           ___               │
└──────────────────────────────────────────────────────────────────┘
```

8.3.5 Infiltration ECOs #140 (1 screen per zone)

```
┌──────────────────────────────────────────────────────────────────┐
│ASEAM3 ECO INPUT: ZONE  1 - South Exposure              Input File:SAMPLE │
│INFILTRATION ECOS              ECO No: 140   Case No: 1   ECO File:SAMP140A│
│-------------------------------------------------------------------------│
│INFILTRATION                                                             │
│                                                                         │
│Occupied air change rate                    ____  Air changes per hour │
│                                                                         │
│Unoccupied air change rate                  ____  Air changes per hour │
│                                                                         │
│          These entries exclude infiltration by crack length method     │
└──────────────────────────────────────────────────────────────────┘
```

8.3.6 Miscellaneous Conduction ECOs #150 (1 screen per zone)

```
┌──────────────────────────────────────────────────────────────────┐
│ASEAM3 ECO INPUT: ZONE  1 - South Exposure              Input File:SAMPLE │
│MISCELLANEOUS CONDUCTION          ECO No: 150   Case No: 1   ECO File:SAMP150A│
│-------------------------------------------------------------------------│
│MISCELLANEOUS CONDUCTION                          Type 1        Type 2       │
│                                                                         │
│Name (Optional)                              _____________ _____________│
│                                                                         │
│U-Factor (BTUH/ft²-°)                             _____       _____      │
│Reference temperature at design summer (°F)       _____       _____      │
│Reference temperature at design winter (°F)       _____       _____      │
└──────────────────────────────────────────────────────────────────┘
```

8.3.7 Lighting ECOs #160 (1 screen per zone)

```
|ASEAM3 ECO INPUT: ZONE  1 - South Exposure              Input File:SAMPLE |
|LIGHTING ECOS                  ECO No: 160   Case No: 1   ECO File:SAMP160A|
|--------------------------------------------------------------------------|
|                        Ltg Func 1 Ltg Func 2 Ltg Func 3 Ltg Func 4 |
|Function name (optional)        __________ __________ __________ __________ |
|                                                                          |
|Installed watts/ft²              _____      _____      _____      _____     |
| (times) Percent of zone area      ___        ___        ___        ___     |
|  (or) Total installed watts     ________   ________   ________   ________  |
|                                                                          |
|Percent light heat to space (%)    ___        ___        ___        ___     |
|'A' classification                 ___        ___        ___        ___     |
|'B' classification                  _          _          _          _      |
|                                                                          |
|          A classification - .45, .55, .65, .75  (See ASHRAE F26.19 T15)      |
|          B classification -  A, B, C, D         (See ASHRAE F26.19 T16)      |
```

8.3.8 Electrical Equipment ECOs #170 (1 screen per zone)

```
|ASEAM3 ECO INPUT: ZONE  1 - South Exposure              Input File:SAMPLE |
|EQUIPMENT ECOS                  ECO No: 170   Case No: 1   ECO File:SAMP170A|
|--------------------------------------------------------------------------|
|ELECTRICAL EQUIPMENT                          Type 1        Type 2        |
|                                                                          |
|Electric equipment name (optional)          ______________ ______________ |
|                                                                          |
|Installed watts/ft²                          _____          _____         |
|  (times) Percent of zone area                ___            ___          |
|  (or) Total installed watts                 ________       ________      |
|                                                                          |
|Hooded (Y/N)                                  _              _            |
|                                                                          |
|              All watts are converted to space heat gains                  |
```

8.3.9 Miscellaneous Sensible Loads ECOs #180 (1 screen per zone)

```
|ASEAM3 ECO INPUT: ZONE  1 - South Exposure              Input File:SAMPLE |
|MISCELLANEOUS SENSIBLE LOADS      ECO No: 180   Case No: 1   ECO File:SAMP180A|
|--------------------------------------------------------------------------|
|MISCELLANEOUS SENSIBLE LOADS                  Type 1        Type 2        |
|                                                                          |
|Load source name (optional)                 ______________ ______________ |
|                                                                          |
|Installed BTUH/ft²                           _____          _____         |
|  (times) Percent of zone area                ___            ___          |
|  (or) Total installed BTUH                  _____          _____         |
|                                                                          |
|Hooded (Y/N)                                  _              _            |
|                                                                          |
|Enter Heat Gains as (+) and Heat Losses as (-)                            |
```

8.3.10 Daylighting ECOs #190 (2 screens per zone)

```
│ASEAM3 ECO INPUT: ZONE  1 - South Exposure              Input File:SAMPLE │
│DAYLIGHTING ECOS                ECO No: 190   Case No: 1   ECO File:SAMP190A│
│--------------------------------------------------------------------------│
│                           Ltg Func 1 Ltg Func 2 Ltg Func 3 Ltg Func 4 │
│Function name (Optional)         __________ __________ __________ __________│
│                                                                          │
│Glass visible transmittance (%)    ___      ___      ___      ___      │
│Wall reflectance (%)             ___      ___      ___      ___      │
│Design footcandles for space       ___      ___      ___      ___      │
│Control type ('D'im or 'S'tep)     _        _        _        _       │
```

```
│ASEAM3 ECO INPUT: ZONE  1 - South Exposure              Input File:SAMPLE │
│DAYLIGHTING ECOS (CONTROLS)       ECO No: 190   Case No: 1   ECO File:SAMP190A│
│--------------------------------------------------------------------------│
│                           Ltg Func 1 Ltg Func 2 Ltg Func 3 Ltg Func 4 │
│Function name (optional)         __________ __________ __________ __________ │
│                                                                          │
│For Dimming Control Only                                                  │
│  Minimum FC maintained by lights ___      ___      ___      ___       │
│  % of total power at min FC (%)  ___      ___      ___      ___       │
│                                                                          │
│For Stepped Control Only                                                  │
│  Number of Steps (max=4)          _        _        _        _        │
│     Step 1 artificial FC        ___      ___      ___      ___        │
│     Step 1 lighting watts       ___      ___      ___      ___        │
│     Step 2 artificial FC        ___      ___      ___      ___        │
│     Step 2 lighting watts       ___      ___      ___      ___        │
│     Step 3 artificial FC        ___      ___      ___      ___        │
│     Step 3 lighting watts       ___      ___      ___      ___        │
│     Step 4 artificial FC        ___      ___      ___      ___        │
│     Step 4 lighting watts       ___      ___      ___      ___        │
```

8.3.11 Operating Use Profiles ECOs #200 (1 screen per zone)

```
│ASEAM3 ECO INPUT: ZONE  1 - South Exposure              Input File:SAMPLE │
│OPERATING USE PROFILES (DIVERSIT  ECO No: 200   Case No: 1   ECO File:SAMP200A│
│--------------------------------------------------------------------------│
│                               OCCUPIED  UNOCCUPIED MONTHLY DIV FC│
│                                 PERIOD     PERIOD    TABLE # (1-4)│
│People:                                                                   │
│   Average % of full occupancy        ____      ____      ____        │
│                                                                          │
│Lights:                                                                   │
│   Average % of installed capacity    ____      ____      ____        │
│   Average % of installed capacity    ____      ____      ____        │
│   Average % of installed capacity    ____      ____      ____        │
│   Average % of installed capacity    ____      ____      ____        │
│                                                                          │
│Electric Equipment:                                                       │
│   Average % of installed capacity    ____      ____      ____        │
│   Average % of installed capacity    ____      ____      ____        │
│                                                                          │
│Miscellaneous Sensible Loads:                                             │
│   Average % of installed capacity    ____      ____      ____        │
│   Average % of installed capacity    ____      ____      ____        │
```

8.3.12 Occupancy Schedule ECOs #210 (1 screen only)

```
|ASEAM3 ECO INPUT                                Input File:SAMPLE |
|OCCUPANCY SCHEDULES ECOS         ECO No: 210   Case No: 1   ECO File:SAMP210A|
|---------------------------------------------------------------------------|
|   Enter the typical OCCUPIED schedule - Use military time (5:30 pm = 1730) |
|                                                                           |
|          Values should be in 'hundreds' of hours  - 8 am = 800             |
|                                                                           |
|              If UNOCCUPIED for entire day - use   0  to  0                 |
|              If OCCUPIED for entire day   - use   0  to  2400              |
|                                                                           |
|                         Day of Week                                       |
|                                                                           |
|                    Weekdays .... from   ____  to   ____                   |
|                    Saturdays ... from   ____  to   ____                   |
|                    Sundays ..... from   ____  to   ____                   |
```

8.3.13 Thermostat ECOs #220 (1 screen per zone)

```
|ASEAM3 ECO INPUT: ZONE  1 - South Exposure              Input File:SAMPLE |
|THERMOSTAT ECOS                  ECO No: 220   Case No: 1   ECO File:SAMP220A|
|---------------------------------------------------------------------------|
|                                                                           |
|Zone label                 ____________________________________            |
|                                                                           |
|Thermostat Set Point Temperatures                                          |
|  Summer occupied temperature                          ____  °F            |
|  Winter occupied temperature                          ____  °F            |
|  Winter unoccupied temperature                        ____  °F            |
```

8.3.14 Operating Schedule ECOs #230 (1 screen only)

```
|PROJECT DATA SCREEN 2                                                      |
|OPERATING SCHEDULE ECOS          ECO No: 230   Case No: 1   ECO File:SAMP230A|
|---------------------------------------------------------------------------|
|                                                                           |
|Operating Schedules:                                                       |
|  Typical weekday occupancy starting hour                  __              |
|  Typical weekday operating hours per day                  __              |
|     (Use only 8, 10, 12, 14, 16)                                          |
|                                                                           |
|Summer thermostat schedule beginning month number          __              |
|Summer thermostat schedule ending month number             __              |
```

8.3.15 Special Loads Reset Schedule ECOs #240 (1 screen per zone)

This screen, unlike all the others, does not correspond to any screen in the standard input set. It is used for ECOs that cannot be modeled directly by ASEAM3.0. Any ECO that ASEAM3.0 cannot handle can nonetheless be simulated providing that you can estimate how it will change the building load profile. You must estimate how the ECO will affect the building load, and this data can be input to the program, thereby changing the load that is passed on to the system calculations. See Section 8.1.2 for an example.

Be careful when redefining the load curve. The changes made in the slope and the intercept will adjust the ASEAM3.0 load calculations.

```
ASEAM3 ECO INPUT: ZONE  1 - South Exposure              Input File:SAMPLE
LOADS RESET SCHEDULE              ECO No: 240   Case No: 1   ECO File:SAMP240A
--------------------------------------------------------------------------------
Enter Loads Reset Schedule in BTUH
Schedule #1    Slope Adjustment  ________ Constant Change  ________
Schedule #2    Slope Adjustment  ________ Constant Change  ________
Schedule #3    Slope Adjustment  ________ Constant Change  ________
Schedule #4    Slope Adjustment  ________ Constant Change  ________

Applicable Months - Enter Schedule # (or 'blank')
        Occupied Schedule #        Unoccupied Schedule #
January                _                    _
February               _                    _
March                  _                    _
April                  _                    _
May                    _                    _
June                   _                    _
July                   _                    _
August                 _                    _
September              _                    _
October                _                    _
November               _                    _
December               _                    _
```

8.4 Systems ECOs

Systems ECOs are input in the same way as loads ECOs. Enter the systems ECO input by choosing "Systems" from the ECO Menu. Next, indicate which existing systems input file is to be used for the base-case file. If there are no systems input files on the data subdirectory, an error message will be issued. Remember that the loads, systems, and plant base-case data files must all be on the same data subdirectory.

The first screen will ask you how many ECOs of each type you will model.

```
SYSTEMS ECO SELECTION
--------------------------------------------------------------------------
        Enter the number of analyses for each type

              300 - Heating                    _
              310 - Cooling                    _
              320 - Preheat                    _
              330 - Humidification             _
              340 - Baseboard                  _
              350 - Fan                        _
              360 - Outside Air Control        _
              370 - Furnace                    _
              380 - Heat Pump Cooling          _
              390 - Heat Pump Heating          _
              400 - Direct Expansion           _

              410 - Special - User Entered     _
                  Plant Loads Reset Schedule
```

The different types of ECOs are shown below. The screens show data from a sample base-case file. If the data fields are blank, this indicates that no data were entered for this item in the base-case file.

8.4.1 Heating ECOs #300 (1 screen per system)

```
ASEAM3 ECO INPUT: SYSTEM  1 - 1                        Input File:SAMPLE
HEATING                    ECO No: 300   Case No: 1   ECO File:SAMP300A
--------------------------------------------------------------------------
Heating Availability
  Outside temperature above which heating is off          ___ °F
  Heating available beginning month #                     __
  Heating available ending month #                        __

Heating Discharge Conditions
  Design heating coil discharge temperature               ___ °F

(Dual Duct System Only)
  Discriminator Control (Y/N)                             _
  Outside temperature at maximum hot deck temperature     ___ °F
  Maximum hot deck temperature                            ___ °F
  Outside temperature at minimum hot deck temperature     ___ °F
  Minimum hot deck temperature                            ___ °F
```

8.4.2 Cooling ECOs #310 (1 screen per system)

```
│ASEAM3 ECO INPUT: SYSTEM  1 - 1                    Input File:SAMPLE │
│COOLING                    ECO No: 310   Case No: 1   ECO File:SAMP310A│
│-------------------------------------------------------------------------│
│Cooling Availability                                                     │
│  Outside temperature below which cooling is off          ___ °F         │
│  Cooling available beginning month #                     __             │
│  Cooling available ending month #                        __             │
│                                                                         │
│Cooling Discharge Conditions                                             │
│  Design cooling coil discharge temperature               __  °F         │
│  Discriminator control (Y/N)                             _              │
│  Maximum cooling coil discharge temperature              __  °F         │
```

8.4.3 Preheat ECOs # 320 (1 screen per system)

```
│ASEAM3 ECO INPUT: SYSTEM  1 - 1                    Input File:SAMPLE │
│PREHEAT                    ECO No: 320   Case No: 1   ECO File:SAMP320A│
│-------------------------------------------------------------------------│
│Preheat Availability                                                     │
│  Outside temperature above which preheat is off          ___ °F         │
│  Preheat available beginning month #                     __             │
│  Preheat available ending month #                        __             │
│                                                                         │
│Preheat Discharge Conditions                                             │
│  Design preheat coil discharge temperature               ___ °F         │
```

8.4.4 Humidification ECOs # 330 (1 screen per system)

```
│ASEAM3 ECO INPUT: SYSTEM  1 - 1                    Input File:SAMPLE │
│HUMIDIFICATION             ECO No: 330   Case No: 1   ECO File:SAMP330A│
│-------------------------------------------------------------------------│
│Humidification Availability                                              │
│  Outside temperature above which humidification is off   ___ °F         │
│  Humidification available beginning month #              __             │
│  Humidification available ending month #                 __             │
│  Humidification available during unoccupied cycle (Y/N)  _              │
│                                                                         │
│Humidification Discharge Conditions                                      │
│  Minimum relative humidity maintained (% RH)             __  % RH       │
```

8.4.5 Baseboard ECOs #340 (1 screen per system)

```
│ASEAM3 ECO INPUT: SYSTEM  1 - 1                    Input File:SAMPLE │
│BASEBOARD                  ECO No: 340   Case No: 1   ECO File:SAMP340A│
│-------------------------------------------------------------------------│
│Baseboard Availability                                                   │
│  Outside temperature above which baseboard is off        ___ °F         │
│  Baseboard available beginning month #                   __             │
│  Baseboard available ending month #                      __             │
│                                                                         │
│Baseboard Control and Capacity                                           │
│  Baseboard control type                                  _              │
│    (1 = thermostatic   2 = reset by outside temperature)                │
```

```
|                                                      |
|Percent of design heating load satisfied at design winter    ___ %   |
|Percent of design heating load satisfied at balance temp     ___ %   |
```

8.4.6 Fan ECOs #350 (1 screen per system)

```
|ASEAM3 ECO INPUT: SYSTEM  1 - 1                   Input File:SAMPLE |
|FAN                       ECO No: 350   Case No: 1   ECO File:SAMP350A|
|---------------------------------------------------------------------------|
|Supply Fans                                                  |
|  Total supply fan power required (blank=default)         ___  KW       |
|   (or) Supply fan power per 1000 CFM                    ____ KW/1000 CFM|
|  Supply fan temperature rise (blank=default)            ____  °F       |
|                                                         |
|Return Fans                                                  |
|  Total return fan power required (blank=default)         ___  KW       |
|   (or) Return fan power per 1000 CFM                    ____ KW/1000 CFM|
|  Return fan temperature rise (blank=default)            ____  °F       |
|                                                         |
|  (VAV) Minimum percent of design air volume when heating    ___  %      |
|  (VAV) Air volume control method                        _         |
|   (1=Variable Speed   2=Discharge Dampers   3=Inlet Vanes)          |
|                                                         |
|Fan Control Methods  (See Codes Below)                               |
|  Occupied cycle fan control method                       _          |
|  Unoccupied cycle fan control method                     _          |
|---------------------------------------------------------------------------|
|                       Fan Control Methods                            |
|              1=On Continuously     2=Cycles with load                |
```

8.4.7 Outside Air Control #360 ECOs (1 screen per system)

```
|ASEAM3 ECO INPUT: SYSTEM  1 - 1                   Input File:SAMPLE |
|OUTSIDE AIR CONTROLS            ECO No: 360   Case No: 1   ECO File:SAMP360A|
|---------------------------------------------------------------------------|
|Occupied Cycle Only                                          |
|  Outside air damper control method (see codes below)      _          |
|  Minimum percent outside air intake                    ___ %        |
|  Dry bulb switchover temperature                       ___ °F       |
|                                                         |
|Unoccupied Cycle Only                                        |
|  Outside air damper control method (see codes below)      _          |
|  Minimum percent outside air intake                    ___ %        |
|  Dry bulb switchover temperature                       ___ °F       |
|                                                         |
|                   Outside Air Damper Control Methods                 |
|   1=No Outside Air     2=Fixed Dampers      3=Dry Bulb      4=Enthalpy   |
|                                          (Economizer)    (Economizer)  |
```

8.4.8 Furnace ECOs #370 (1 screen per system)

```
|ASEAM3 ECO INPUT: SYSTEM  1 - 1                   Input File:SAMPLE |
|FURNACE                     ECO No: 370   Case No: 1   ECO File:SAMP370A|
|---------------------------------------------------------------------------|
|Furnace Heat Output                                          |
|  Furnace capacity (blank=autosize)                    ______ KBTUH     |
```

```
│  (if autosized) Percent of design load satisfied        ___ %      │
│                                                                    │
│Furnace Efficiency                                                  │
│  Furnace efficiency at design load                      ___ %      │
│                                                                    │
│Furnace Losses                                                      │
│  Losses as percent of design load (at design load)      ___ %      │
│  Losses as percent of design load (at no load)          ___ %      │
│  Pilot gas annual consumption                           ___ therms │
└────────────────────────────────────────────────────────────────────┘
```

8.4.9 Heat Pump Cooling ECOs #380 (1 screen per system)

```
┌──────────────────────────────────────────────────────────────────────────┐
│ASEAM3 ECO INPUT: SYSTEM  1 - 1                      Input File:SAMPLE   │
│HEAT PUMP COOLING            ECO No: 380   Case No: 1   ECO File:SAMP380A│
│--------------------------------------------------------------------------│
│Cooling Performance                                                       │
│  Design coefficient of performance                           ___         │
│                                                                          │
│Water Source Heat Pump Only                                               │
│  Outside temperature at minimum fluid loop temperature       ___ °F      │
│     Minimum fluid loop temperature                           ___ °F      │
│  Outside temperature at maximum fluid loop temperature       ___ °F      │
│     Maximum fluid loop temperature                           ___ °F      │
└──────────────────────────────────────────────────────────────────────────┘
```

8.4.10 Heat Pump Heating ECOs #390 (1 screen per system)

```
┌──────────────────────────────────────────────────────────────────────────┐
│ASEAM3 ECO INPUT: SYSTEM  1 - 1                      Input File:SAMPLE   │
│HEAT PUMP HEATING            ECO No: 390   Case No: 1   ECO File:SAMP390A│
│--------------------------------------------------------------------------│
│Outside temperature below which backup heating is on          ___ °F      │
│                                                                          │
│Heating Performance                                                       │
│  Design heating coefficient of performance                   ____        │
└──────────────────────────────────────────────────────────────────────────┘
```

8.4.11 Direct Expansion ECOs #400 (1 screen per system)

```
┌──────────────────────────────────────────────────────────────────────────┐
│ASEAM3 ECO INPUT: SYSTEM  1 - 3                      Input File:SAMP     │
│DX COOLING                   ECO No: 400   Case No: 1   ECO File:SAMP400A│
│--------------------------------------------------------------------------│
│Cooling Performance                                                       │
│  Design coefficient of performance                           ____        │
│  Minimum unloading ratio (% of capacity)                     ___ %       │
│  Minimum hot gas bypass ratio (% of capacity)                ___ %       │
│                                                                          │
│DX Condenser                                                              │
│  Condenser fan KW (blank=default)                            ___ KW      │
│  Outside temperature below which condenser fan is off        ___ °F      │
└──────────────────────────────────────────────────────────────────────────┘
```

8.4.12 Special System Reset Schedule ECOs #410 (1 screen per system)

This screen is like the Loads Reset Schedule ECO screen, discussed above. Its purpose is to adjust the slope and intercept of the systems load curve, which is passed on to the plant calculations when the ECO cannot be modeled directly by ASEAM3.0. See section 8.12 for an example.

```
ASEAM3 ECO INPUT: SYSTEM  1 - 1                    Input File:SAMPLE
SYSTEM RESET SCHEDULE            ECO No: 410   Case No: 1   ECO File:SAMP410A
--------------------------------------------------------------------------------
Type of Plant Load to Adjust                                          NA
  1=Centrifugal   2=Absorption      3=DB Chiller    4=Reciprocating
  5=Dist Cooling  6=Cooling Tower   7=DB Heat Recv  8=Elec Res HTG
  9=Boiler       10=Dist Heating

Enter Plant Loads Reset Schedule in BTUH
Schedule #1    Slope Adjustment  ________ Constant Change  ________
Schedule #2    Slope Adjustment  ________ Constant Change  ________
Schedule #3    Slope Adjustment  ________ Constant Change  ________
Schedule #4    Slope Adjustment  ________ Constant Change  ________

Applicable Months - Enter Schedule # (or 'blank')
Month      Occup   Unocc        Month      Occup   Unocc
January      _       _          July         _       _
February     _       _          August       _       _
March        _       _          September    _       _
April        _       _          October      _       _
May          _       _          November     _       _
June         _       _          December     _       _
```

8.5 Plant ECOs

Plant ECOs are input just like Loads ECOs. To access the Plant ECO Input routine, select "Plant" from the ECO Input Menu. Next, indicate the Plant Input file that is to be used as the base case file.

The following screen will ask how many of each of the different types of plant ECOs you would like to model.

```
PLANT ECO SELECTION
----------------------------------------------------------------------------
        Enter the number of analyses for each type

     500 - Energy Costs & Conversions              _
     510 - Miscellaneous Energy Consumption        _
     520 - Centrifugal Chiller                     _
     530 - Absorption Chiller                      _
     540 - Double Bundle Chiller                   _
     550 - Reciprocating Chiller                   _
     560 - Cooling Tower                           _
     570 - Domestic Hot Water                      _
     580 - Boiler                                  _
```

The different types of ECOs are shown below. These screens show initial data values from a sample base-case file. Note that some of the screens have no data values entered; these components were not initially modeled.

8.5.1 Energy Costs/Conversions ECOs #500

```
ASEAM3 ECO INPUT: PLANT - Energy Costs              Input File:SAMPLE
ENERGY COSTS/CONVERSIONS     ECO No: 500   Case No: 1   ECO File:SAMP500A
----------------------------------------------------------------------------
Fuel Type       Energy      Unit Cost
                Units       $ / Unit
----------------------------------------------------------------------------
Electricity     KWH         _____
Natural Gas     Therms      _____
#2 Oil          Gallons     _____
#4 Oil          Gallons     _____
#6 Oil          Gallons     _____
Dist Heating    MBTU        _____
Dist Cooling    MBTU        _____
```

8.5.2 Miscellaneous Energy Consumption ECOs #510

```
│ASEAM3 ECO INPUT: PLANT - Misc Energy Consumption          Input File:SAMPLE │
│MISCELLANEOUS ENERGY CONSUMPTION  ECO No: 510   Case No: 1   ECO File:SAMP510A│
│---------------------------------------------------------------------------│
│                                                                           │
│Label for Miscellaneous            Fuel Units        Annual Consumption    │
│Energy Consumption               (See Codes Below)      in Energy Units     │
│---------------------------------------------------------------------------│
│ ____________________               _               ______                 │
│ ____________________               _               ______                 │
│ ____________________               _               ______                 │
│ ____________________               _               ______                 │
│ ____________________               _               ______                 │
│                                                                           │
│---------------------------------------------------------------------------│
│                Fuel Code       Fuel Type      Energy Units                │
│                ---------       ---------      ------------                │
│                    1          Natural Gas       therms                    │
│                    2          Oil              gallons                    │
│                    3          Electricity      KWH                        │
│                    4          Dist Heating      MBTU                      │
│                    5          Dist Cooling      MBTU                      │
```

8.5.3 Centrifugal Chiller ECOs #520

```
│ASEAM3 ECO INPUT: PLANT - Centrifugal                    Input File:SAMPLE │
│CENTRIFUGAL CHILLER             ECO No: 520   Case No: 1   ECO File:SAMP520A│
│---------------------------------------------------------------------------│
│                                                 Type 1    Type 2          │
│Cooling Performance                                                        │
│  Design coefficient of performance                ____      ____          │
│  Minimum unloading ratio (% of capacity)           __        __      %    │
│  Minimum part load ratio (% of capacity)           __        __      %    │
│  Load management/operating method                   _         _           │
│     (1 = always on   2 = as needed)                                       │
│                                                                           │
│Chilled Water Parameters                                                   │
│  Chilled water temperature at design load          ___       ___      °F  │
│  Chilled water temperature at minimum load         ____      ____     °F  │
│  Chilled water flow (blank=autosized)             ____      ____     gpm  │
│  Chilled water pump kw (blank=autosized)           ____      ____     KW  │
```

8.5.4 Absorption Chiller ECOs #530

```
│ASEAM3 ECO INPUT: PLANT - Absorption                     Input File:SAMPLE │
│ABSORPTION CHILLER              ECO No: 530   Case No: 1   ECO File:SAMP530A│
│---------------------------------------------------------------------------│
│                                                 Type 1    Type 2          │
│                                                                           │
│Cooling Performance                                                        │
│  Design coefficient of performance                ____      ____          │
│  Minimum unloading ratio (% of capacity)           __        __      %    │
│                                                                           │
│  Load management/operating method                   _         _           │
│     (1 = always on   2 = as needed)                                       │
│                                                                           │
│Chilled Water Parameters                                                   │
```

```
│ Chilled water temperature at design load        ___    ___   °F │
│ Chilled water temperature at minimum load       ____   ____  °F │
│ Chilled water flow (blank=autosized)            ____   ____  gpm│
│ Chilled water pump kw (blank=autosized)         ____   ____  KW │
└─────────────────────────────────────────────────────────────────┘
```

8.5.5 Double Bundle Chiller ECOs #540

```
┌─────────────────────────────────────────────────────────────────┐
│ASEAM3 ECO INPUT: PLANT - DB Chiller            Input File:SAMPLE │
│DOUBLE BUNDLE CHILLER       ECO No: 540   Case No: 1   ECO File:SAMP540A│
│-----------------------------------------------------------------│
│                                            Type 1   Type 2      │
│Cooling Performance                                              │
│ Design coefficient of performance            ____    ____       │
│ Minimum unloading ratio (% of cap - clg mode)  __     __    %   │
│ Minimum unloading ratio (% of cap - htg mode)  __     __    %   │
│ Minimum part load ratio (% of capacity)      __      __    %    │
│ Load management/operating method              _       _         │
│   (1 = always on   2 = as needed)                               │
│Chilled Water Parameters                                         │
│ Chilled water temperature at design load     ____    ____  °F   │
│ Chilled water temperature at minimum load    ____    ____  °F   │
│ Chilled water flow (blank=autosized)         ____    ____  gpm  │
│ Chilled water pump kw (blank=autosized)      ___     ___   KW   │
│                                                                 │
│Heat Recovery Parameters                                         │
│ Design heat recovery temperature             ___     ___   °F   │
└─────────────────────────────────────────────────────────────────┘
```

8.5.6 Reciprocating Chiller ECOs #550

```
┌─────────────────────────────────────────────────────────────────┐
│ASEAM3 ECO INPUT: PLANT - Reciprocating         Input File:SAMPLE │
│RECIPROCATING CHILLER       ECO No: 550   Case No: 1   ECO File:SAMP550A│
│-----------------------------------------------------------------│
│                                            Type 1   Type 2      │
│Cooling Performance                                              │
│ Design coefficient of performance            ____    ____       │
│ Minimum unloading ratio (% of capacity)      __      __    %    │
│ Minimum part load ratio (% of capacity)      __      __    %    │
│ Load management/operating method              _       _         │
│   (1 = always on   2 = as needed)                               │
│                                                                 │
│Chilled Water Parameters                                         │
│ Chilled water temperature at design load     ____    ____  °F   │
│ Chilled water temperature at minimum load    ____    ____  °F   │
│ Chilled water flow (blank=autosized)         ____    ____  gpm  │
│ Chilled water pump KW (blank=autosized)      ___     ___   KW   │
└─────────────────────────────────────────────────────────────────┘
```

8.5.7 Cooling Tower ECOs #560

```
┌─────────────────────────────────────────────────────────────────┐
│ASEAM3 ECO INPUT: PLANT - Cooling Tower         Input File:SAMPLE │
│COOLING TOWER               ECO No: 560   Case No: 1   ECO File:SAMP560A│
│-----------------------------------------------------------------│
│Tower Performance                                                │
│ Fan KW per cell (blank=autosized)                 ___   KW      │
│ Number of fan speeds (1 or 2)                      _            │
│ Approach temperature                              __    °F      │
│                                                                 │
```

```
|Condenser Water Parameters                                  |
|  Condenser water temperature at design load        ___  °F  |
|  Condenser water temperature at minimum load       ___  °F  |
|  Condenser water flow rate (blank=autosized)       ___  gpm |
|  Condenser water pump KW (blank=autosized)         ___  KW  |
```

8.5.8 Domestic Hot Water ECOs #570

```
|ASEAM3 ECO INPUT: PLANT - Domestic Hot Water          Input File:SAMPLE  |
|DOMESTIC HOT WATER           ECO No: 570   Case No: 1  ECO File:SAMP570A|
|--------------------------------------------------------------------------|
|Annual pilot consumption (if gas)                     ___   therms  |
|                                                                    |
|  Average hourly DHW usage - occupied cycle           ____  gal/hou|
|  Average hourly DHW usage - unoccupied cycle         ____  gal/hou|
|                                                                    |
|DHW Temperatures                                                   |
|  Domestic hot water supply temperature               ___   °F     |
|  DHW inlet temperature - design summer               __    °F     |
|  DHW inlet temperature - design winter               __    °F     |
|Circulating Pumps                                                  |
|  Circulating pump KW - occupied cycle                ___   KW     |
|  Circulating pump KW - unoccupied cycle              ___   KW     |
|DHW Efficiency and Losses                                          |
|  Design DHW heating efficiency                       ___   %      |
|  DHW losses - occupied cycle                         ______ BTUH  |
|  DHW losses - unoccupied cycle                       ______ BTUH  |
```

8.5.9 Boiler ECOs #580

```
|ASEAM3 ECO INPUT: PLANT - Boiler                      Input File:SAMPLE  |
|BOILER                       ECO No: 580   Case No: 1  ECO File:SAMP580A|
|--------------------------------------------------------------------------|
|Annual pilot consumption (if gas)                ____   ____  therms|
|                                                                    |
|  Load management/operation                       _      _          |
|    (1 = always on    2 = as needed)                                |
|                                                                    |
|Boiler Performance                                                 |
|  Boiler efficiency method (1=user entered   2=calc)  _   _         |
|  Design boiler efficiency                        ____   ____  %    |
|  (if calc) Combustion air temperature            ___    ___   °F   |
|  (if calc) Stack temperature                     ___    ___   °F   |
|  (if calc) Air-Fuel ratio                        ____   ____  Lb/Lb|
|  Minimum part load operating ratio (% of capacity)  __   __   %    |
|  Boiler pump KW (blank=autosized)                ___    ___   KW   |
|  Boiler losses - percent of capacity             __     __    %    |
|  Boiler losses - percent of load                 __     __    %    |
```

8.6 ECO Input Hints

When you enter a four-character file-name prefix for the ECO files, it is helpful to use a name that will define the ECO. Although the second four characters also define the type of ECO, you have to look up these numbers to determine which ECOs they refer to.
If you input the ECO data in more than one sitting, be sure to use different file-name prefixes for the ECOs. Whenever the ECO Input program is accessed, the first file saved is assumed to be A and the second file B, and so on. For example, if you enter three wall ECOs in the first sitting, with the file-name prefix "WALL," the program will create three ECO files: "WALL100A.LEC", "WALL100B.LEC", and "WALL100C.LEC". If you subsequently reenter the ECO Input program to create a fourth wall ECO and use the name "WALL" again, the new ECO file will be called "WALL100A.LEC" and will overwrite the first ECO file.

This concludes the presentation of the ECO Input program. Create ECO Input files for all ECOs that you will model. The files will be on the data subdirectory.

You are now ready to perform the calculations. Enter the Specify Analysis program and enter the base-case files and ECO modifications to be analyzed. Refer to Chapter 11 for instructions on the Specify Analysis procedure.