Building Energy Analysis Program Interfaces

The following is one personal and biased view of energy program interfaces - particularly eQUEST. Since eQUEST is based on the DOE2 program and since both programs are free, eQUEST would be my first choice. However, I would like to use Detailed Edit only combined with the option to create the building model, floor plans and spaces graphically by tracing AutoCAD drawings. The user should be able to name each space before creating it. This is possible in eQUEST when creating all the other components in systems and plants. eQUEST should allow independent building modeling by the program user without interference by the wizards.

The best energy program to use on a project is the one that the program user has mastered and can therefore apply it correctly to the project. Programs can be used incorrectly if the user does not have an in-depth knowledge of the subject and no reference experience (just knowing theory is not enough) in the AE design, construction and operation processes. One energy program is not going to produce better or more superior results compared to another assuming that both programs have been tested and approved by the industry.

Every energy consuming MEP system is not usually included in the model. This affects the demand costs. Weather varies every year and schedules are approximate, and so energy programs only give an estimate of energy use. The programs are therefore used for comparing alternatives to make decisions. After the program determines the most energy efficient systems, you have to consider the reliability of selected systems & plants, maintenance and parts availability issues at the project location and life-cycle costs. The engineer already has an idea of what systems & plants to use for a project based on experience, and computer energy analysis programs are being used for all projects today to show energy code compliance (LEED is not mandatory) when submitting construction documents.

Building energy use is monitored by Building Management Systems (BMS) and can be viewed by remote computers using internet websites. Unless sub-meters and data-loggers are specified at critical points of energy consuming systems, the computer energy analysis cannot be checked with the information provided by BMS. For Measurement & Verification (M&V), the only operating information that you usually have is the bottom-line energy use and cost as represented by the monthly utility bills. This bill includes all energy usages including those not considered in the energy analysis. This was a problem during M&V for the CCGT building.

eQUEST is supposed to be a graphics, forms & spreadsheet input interface to the DOE2.2 energy program. The ability to create floor plans, zones, and full building model by tracing AutoCAD drawings is one of its best features. In my opinion, eQUEST is superior to other energy program interfaces in terms of the “Office & Graphics” type tools that are available for developing and editing the model. How these “interface office” tools are used to organize and structure the building input data based on the AE design process makes a difference also. The “ergonomics” of the program interface relative to the design process is important.

eQUEST is an energy program in itself because it makes building envelope and engineering component assumptions and design decisions given the type of building. So it is not just an interface to DOE2.2 and it should be approved and certified independently of DOE2.2.

TRACE has global & project libraries (so does DOE2 but they are not easy to edit and expand) and master, override, and default organization structure to set up project design standards and then make exceptions. The project design criteria and other project information can be transferred from one project to another and edited. The DOE2 ".inp" and ".bdl" files can be read like an English language description of the project. You can also build up libraries of DOE2 BDL templates for space, system & plant design criteria and utility rates, etc. and use them again with several projects. I have turned out projects quickly this way. Both the TRACE and DOE2.1E programs are organized into 4 phases – Loads, Systems, Plants & Utility Costs. This is useful with large projects since the input can be checked at the end of each phase before moving to the next phase. This structure was due to computer power limitations in past.

DOE2.2 has combined the Loads, Systems & Plants modules within one time loop to imitate the actual building operation process with real-time simulation. DOE2.2 seems to have eliminated some of the features of DOE2.1E that allowed the user to structure (with saved templates) the project design criteria for use with other projects. This includes:
"UN"=SPACE-CONDITIONS to set design criteria for space types.
"UN"=ZONE-CONTROL, ZONE-FANS, & ZONE-AIR to set design criteria for zone types.
"UN"=SYSTEM-CONTROL, SYSTEM-FANS, & SYSTEM-AIR to set design criteria for system types.

The "SET-DEFAULT FOR xxxx" is still there for space, windows, exterior & interior walls, doors, zones and systems. However eQUEST does not provide a forms or spreadsheet input system at the beginning of the program to set the project design criteria. You cannot see the overall picture when this has to be set at each input cell in the forms and spreadsheets. Neither the TRACE nor DOE2 energy programs print out a summary sheet of the design criteria set for the project. A design & performance check list in terms sf/ton, cfm/sf, etc. for spaces, zones (group of spaces under one control system), each system, each plant-equipment, combined systems & plants and also a summary building check list would be helpful.

Except for report SV-A, the DOE2 systems reports are not useful for checking the systems input data. Conditions before and after each system component can be checked with hourly reports but this information for design conditions in a DOE2 report would be useful to check systems input and equipment schedules of construction documents. In the case of distributed chilled and hot water to coils in Air Handling Units (AHUs) on each floor with a central Outdoor Air Unit (OAU) serving all the AHUs, DOE2 produces a SV-A report for each of the identical AHUs. You could end up with over 50 such identical reports.

One of eQUEST's limitations is that you cannot enter the space names shown on architectural drawings. The space names created by eQUEST are unrecognizable except maybe for the 5 zones per floor case. Trying to find them on the drawings and rename them in detailed edit is not worth the time and trouble. When each new space is created graphically, it should be

possible to enter a user-name for the space before entering the coordinates. When creating all other building components in DD such as systems, you can enter your own component name.

eQUEST assumes most of the non project specific (dimensions are project specific) input data and these component attributes are recreated in duplicate several times. 1000 zones do not require 1000 infiltration schedules. A project typically uses 2 to 5 wall, glass and other component types and not one for each shell, floor and zone. You cannot select reports from the wizards and so you end up with several thousand pages of the input description.

It is unrealistic to check all this input created by eQUEST for errors. Fixing everything to match the exact project data has to be done in detailed edit. The actual project components have to be created first and then the eQUEST components have to be replaced and deleted one at a time. "Global" changes using a word processor can be done in the ".inp" file which is not eQUEST. Detailed edit means you lose access to the graphical method of creating the building model from AutoCAD drawings which is one of the main benefits of this program.

Another limitation of eQUEST is that it tries to do everything (almost all the architectural & engineering decisions and it assumes most of the non project specific data) for the user once the building type is entered. Specifying "Unknown" does not help. It is a nuisance to try and get rid of all the eQUEST assumptions and decisions and replace them with what you want to do and to try and match the exact project model and design criteria.

If there are more than two typical floors, the program assumes there is a ground floor, a top floor, and one or more middle floors. This happens for each shell that you create and that are placed one on top of the other in a high-rise building. Usually there is no ground or top floor in a high-rise building. The "ground" floor is on top of a conditioned basement floor and above the "top" floor is a mechanical floor that is heated and ventilated. The roof is covered with equipment such as cooling towers. Homes in the US Mid-West have basements and attics.

The Schematic Design (SD) might be useful in comparing baseline & proposed envelope performance. But building the actual project envelope components in layers and getting the composite properties have to be done in Detailed Edit (DE). So SD cannot check the envelope properties with ASHRAE Std90. SD is not suitable for comparing systems and plants. If it is "schematic", why assume the percentage areas for a variety of space types given the building type. To evaluate an office building in SD there would be office spaces (exterior & interior with one design criteria) and a core space (with one design criteria) for elevators, stairs, toilets, tel/elec closets, shafts, storage & MEP. ComCHECK has standards for whole building types.

So eQUEST needs the Design Development (DD) Wizard only. Changing Space names (Zone names have to be changed separately) generated by eQUEST, and selecting reports can only be done in Detailed Edit (DE). It should be possible to go back from DE to DD to revise the building model? During the design process of a large project, the building and floor plans are revised constantly throughout the duration of the project. In my opinion eQUEST needs just one input system that is structured as Loads (Shell Floor, Zone, Space and Space surfaces that can also be

defined graphically), Systems, Plants and Economics. There should be one menu for this and another for the libraries to provide direct access to each input category section like TRACE.

eQUEST has made energy engineering experts of people who are not qualified in this science. Anyone (including Al Gore) can do a complete analysis if they know that a building is made up of floors, rooms, walls, etc., with areas & dimensions. They just have to know stuff like that there is a difference between "Office" and "Hotel" buildings. It is a quick analysis tool for architects who understand buildings, but they require additional training and experience (not necessary today because of eQUEST) to do a full analysis for energy code compliance when issuing construction documents.

Energy analysis used to be the job of mechanical engineers because after the energy analysis study they have to justify the analysis results by following through with developing the construction documents, checking shop drawings, measurement & verification, and taking responsibility for things going wrong during operation. Mechanical & electrical systems and equipment in the building consume energy. The architectural components are passive but important, and even here engineers are better trained to understand the overall energy efficiency of building geometry and materials and they are responsible for analyzing the envelope and using the information in HVAC design. This is why ASHRAE is responsible for setting the standards for building envelope and materials also.

There are several more "ergonomics" type issues with the eQUEST interface but here are some problems with how eQUEST handles just schedules. You only need one infiltration schedule for exterior zones, **none for interior** and one for the core (elevators, stairs, shafts, storage, toilets, M-E closets and spaces). 1000 schedules for 1000 zones will not produce greater accuracy when all schedules are approximate. The schedules have to be the same in Baseline and Proposed and so they are neutral and cancel out in estimating energy savings.

DOE2.2 will accept the DOE2.1E schedules but "TYPE = FRACTION" , etc has to be added. eQUEST accepts this entry in its ".inp" file but reformats it so that it is broken up and relocated in several sections of the file. This inconvenience is especially irritating when utility rate schedules are separated from the utility rates. eQUEST schedules (and your design criteria, etc.) cannot be copied from one project to another and edited for the project. It could be done by copying the DOE2.2 inp file except that eQUEST has broken up the schedule and everything else and scattered them all over the .inp file.

EXAMPLE: Use Two Infiltration Schedules for Pressurized High-Rise Building

```
SCH-INFLTR-EXTER = SCHEDULE  $ 0.06 cfm/sf wall+window-A. Convert to ACH $
      THRU FEB 28  (ALL) (1,24)=(1.0)      THRU APR 30  (ALL) (1,24)=(0.7)
      THRU OCT 31  (ALL) (1,24)=(0.3)      THRU NOV 30  (ALL) (1,24)=(0.7)
      THRU DEC 31  (ALL) (1,24)=(1.0)   ..

SCH-INF-DOOR/CORE = SCHEDULE  $ High-Rise core infltr due to stack effect $
    THRU FEB 28
        (WD) (1,7)=(0.5) (8,9)=(0.9) (10,11)=(0.7) (12,13)=(0.9)
                         (14,16)=(0.7) (17,18)=(0.9) (19,24)=(0.2)
```

```
        (WEH) (1,24)=(0.5)
    THRU MAR 31
        (WD) (1,7)=(0.4) (8,9)=(0.7) (10,11)=(0.6) (12,13)=(0.7)
                         (14,16)=(0.6) (17,18)=(0.7) (19,24)=(0.4)
         (WEH) (1,24)=(0.3)
    THRU SEP 30
        (WD) (1,7)=(0.2) (8,9)=(0.5) (10,11)=(0.4) (12,13)=(0.5)
                         (14,16)=(0.4) (17,18)=(0.5) (19,24)=(0.2)
        (WEH) (1,24)=(0.52
    THRU NOV 30
        (WD) (1,7)=(0.4) (8,9)=(0.7) (10,11)=(0.6) (12,13)=(0.7)
                          (14,16)=(0.6) (17,18)=(0.7) (19,24)=(0.4)
        (WEH) (1,24)=(0.3)
    THRU DEC 31
        (WD) (1,7)=(0.5) (8,9)=(0.9) (10,11)=(0.7) (12,13)=(0.9)
                          (14,16)=(0.7) (17,18)=(0.9) (19,24)=(0.2)
        (WEH) (1,24)=(0.5)
..
```

EXAMPLE: Compact and easy-to-check space schedule in DOE2.1E

```
SCH-OFC-OCCP = SCHEDULE
    THRU DEC 31
         $ AM/PM    1    2    3    4    5    6    7    8    9    10   11   12  $
   (WD)  (1 24) = (0.00 0.00 0.00 0.00 0.00 0.00 0.10 0.20 0.95 0.95 0.95 0.95
                  0.50 0.95 0.95 0.95 0.95 0.30 0.10 0.10 0.10 0.10 0.05 0.05)
   (SAT) (1 24) = (0.00 0.00 0.00 0.00 0.00 0.00 0.10 0.10 0.30 0.30 0.30 0.30
                  0.10 0.10 0.10 0.10 0.10 0.05 0.05 0.00 0.00 0.00 0.00 0.00)
   (SUN) (1 24) = (0.00 0.00 0.00 0.00 0.00 0.00 0.05 0.05 0.05 0.05 0.05 0.05
                  0.05 0.05 0.05 0.05 0.05 0.05 0.00 0.00 0.00 0.00 0.00 0.00)
   (HOL) (1 24) = (0.00 0.00 0.00 0.00 0.00 0.00 0.05 0.05 0.05 0.05 0.05 0.05
                  0.05 0.05 0.05 0.05 0.05 0.05 0.00 0.00 0.00 0.00 0.00 0.00)
..

SCH-OFC-LGTG = SCHEDULE
    THRU DEC 31
         $ AM/PM    1    2    3    4    5    6    7    8    9    10   11   12  $
   (WD)  (1 24) = (0.05 0.05 0.05 0.05 0.05 0.10 0.35 0.50 0.90 0.90 0.90 0.90
                  0.90 0.90 0.90 0.90 0.90 0.90 0.90 0.50 0.35 0.35 0.10 0.05)
   (SAT) (1 24) = (0.05 0.05 0.05 0.05 0.05 0.05 0.10 0.10 0.50 0.50 0.50 0.50
                  0.50 0.50 0.50 0.50 0.10 0.10 0.05 0.05 0.05 0.05 0.05 0.05)
   (SUN) (1,24) = (0.05)
   (HOL) (1,24) = (0.05)   ..

SCH-OFC-EQPT = SCHEDULE
    THRU DEC 31
         $ AM/PM    1    2    3    4    5    6    7    8    9    10   11   12  $
   (WD)  (1 24) = (0.00 0.00 0.00 0.00 0.00 0.10 0.20 0.50 0.95 0.95 0.95 0.95
                  0.95 0.95 0.95 0.95 0.95 0.95 0.95 0.50 0.20 0.20 0.05 0.00)
   (SAT) (1 24) = (0.00 0.00 0.00 0.00 0.00 0.00 0.10 0.10 0.30 0.30 0.30 0.30
                  0.30 0.30 0.30 0.30 0.10 0.05 0.05 0.00 0.00 0.00 0.00 0.00)
   (SUN) (1,24) = (0.0)
   (HOL) (1,24) = (0.0)   ..
```

EXAMPLE: Hourly Report Schedule next to System Report Variables

```
SCH-HOURLY-SYSTM = SCHEDULE            $ Hourly Report for Jan 27 and Aug 30 $
   THRU JAN 26 (ALL) (1,24) = (0)     THRU JAN 27 (ALL) (1,24) = (1)
   THRU AUG 29 (ALL) (1,24) = (0)     THRU AUG 30 (ALL) (1,24) = (1)
   THRU DEC 31 (ALL) (1,24) = (0)  ..

AHU-SYSTEM = REPORT-BLOCK
  VARIABLE-TYPE = AHU-FLR-4                          $ User-Name of System $
  VARIABLE-LIST = (17,36,37,38,48,70,71)             $ CFM, HRe, HRl, D-HR $
..                                                           $ LH, TH, SH $
```

```
SYSTM-HOUR-REP = HOURLY-REPORT
    REPORT-SCHEDULE = SCH-HOURLY-SYSTM     REPORT-BLOCK = (AHU-SYSTEM)
 ..
```

EXAMPLE: Compact and easy-to-check utility schedules next to the utility rates

```
ENERGY-RESOURCE
   RESOURCE = ELECTRICITY      UNIT-NAME = KWH
   DEM-UNIT-NAME = KW          SOURCE-SITE-EFF = 0.333
   ENERGY/UNIT = 3412.969   ..

ENERGY-RESOURCE
   RESOURCE = NATURAL-GAS      UNIT-NAME = THERM
   DEM-UNIT-NAME = THERMS/HR   SOURCE-SITE-EFF = .95
   ENERGY/UNIT = 100000      ..

ENERGY-RESOURCE
   RESOURCE = STEAM            UNIT-NAME = MBTU
   DEM-UNIT-NAME = MBTU/HR     SOURCE-SITE-EFF = .6
   ENERGY/UNIT = 1000000    ..

ENERGY-RESOURCE
   RESOURCE = DISTRICT-CHW    UNIT-NAME = TON-HR
   DEM-UNIT-NAME = TONS       SOURCE-SITE-EFF = .90
   ENERGY/UNIT = 12000     ..

$----- ELECTRICITY ------------------------------------------------------------$
$ Consolidated Edison 2003 NYC, Class 9 Rate II (general, large, time-of-day) $
$-------------------------------------------------------------------------------$

ELECTRIC-RATE = UTILITY-RATE                          $ UTILITY-RATE Command $

    RESOURCE = ELECTRICITY
    MIN-MON-CHGS = ( 0 )

    ENERGY-CHG-SCH = SCH-ELEC-ENERGY
    BLOCK-CHARGES= ( SP-DEM-PEAK, SP-DEM-OFFPK, SM-DEM-PEAK, SM-DEM-OFFPK,
                     FL-DEM-PEAK, FL-DEM-OFFPK, WN-DEM-PEAK, WN-DEM-OFFPK )
                                                        $ Up to 10 Block Charges $
..                                                  $ End of UTILITY-RATE Command $

$-------------------Schedule Flags-----------------------------------------$

SCH-ENER-FLAG = SCHEDULE         $ Time-Of-Use (TOU) Electric Energy Schedule $
                                           $ Peak: 8 AM to 10 PM , Jan - Dec $
THRU DEC 31   (WD)    (1,8) = (1)          $ Off-Peak $
                      (9,22) = (2)         $ Peak $
                     (23,24) = (1)         $ Off-Peak $
              (WEH)  (1,24) = (1)          $ Off-Peak $
..

$---------------------Energy Charges (May-03 to Apr-04 ----------------------$

SCH-ELEC-ENERGY = SCHEDULE

THRU JAN 31 (WD)    (1,8)=(0.0709) (9,22)=(0.0974) (23,24)=(0.0709)    $ 2004 $
            (WEH)  (1,24)=(0.0709)


THRU FEB 28 (WD)    (1,8)=(0.0711) (9,22)=(0.0977) (23,24)=(0.0711)    $ 2004 $
            (WEH)  (1,24)=(0.0711)


THRU MAR 31 (WD)    (1,8)=(0.0635) (9,22)=(0.0893) (23,24)=(0.0635)    $ 2004 $
            (WEH)  (1,24)=(0.0635)

THRU APR 30 (WD)    (1,8)=(0.0660) (9,22)=(0.0918) (23,24)=(0.0660)    $ 2004 $
            (WEH)  (1,24)=(0.0660)
```

```
THRU MAY 31 (WD)    (1,8)=(0.0603) (9,22)=(0.0878) (23,24)=(0.0603)    $ 2004 $
            (WEH)  (1,24)=(0.0603)

THRU JUN 30 (WD)    (1,8)=(0.0589) (9,22)=(0.0968) (23,24)=(0.0589)    $ 2004 $
            (WEH)  (1,24)=(0.0589)

THRU JUL 31 (WD)    (1,8)=(0.0773) (9,22)=(0.1146) (23,24)=(0.0773)    $ 2004 $
            (WEH)  (1,24)=(0.0773)

THRU AUG 31 (WD)    (1,8)=(0.0709) (9,22)=(0.1162) (23,24)=(0.0709)    $ 2004 $
            (WEH)  (1,24)=(0.0709)

THRU SEP 30 (WD)    (1,8)=(0.0678) (9,22)=(0.0916) (23,24)=(0.0678)    $ 2004 $
            (WEH)  (1,24)=(0.0678)

THRU OCT 31 (WD)    (1,8)=(0.0634) (9,22)=(0.0845) (23,24)=(0.0634)    $ 2004 $
            (WEH)  (1,24)=(0.0634)

THRU NOV 30 (WD)    (1,8)=(0.0635) (9,22)=(0.0838) (23,24)=(0.0635)    $ 2003 $
            (WEH)  (1,24)=(0.0635)

THRU DEC 31 (WD)    (1,8)=(0.0647) (9,22)=(0.0871) (23,24)=(0.0647)    $ 2003 $
            (WEH)  (1,24)=(0.0647)

..

$------------------------------Demand Flags---------------------------------$

$ Time-Of-Use (TOU) Electric Demand Schedule.   Peak: 8-22 , Jan - Dec $

SCH-DEMAND-FLAG = SCHEDULE


THRU FEB 28   (WD)    (1,8) = (1.3)              $ Winter Off-Peak Flag = 1.3 $

                     (9,22) = (1.1)                  $ Winter Peak Flag = 1.1 $
                    (23,24) = (1.3)              $ Winter Off-Peak Flag = 1.3 $
              (WEH)  (1,24) = (1.3)      $ Weekends, Sat, Sun, Hol Flag = 1.3 $

THRU MAY 31   (WD)    (1,8) = (2.3)              $ Spring Off-Peak Flag = 2.3 $
                     (9,22) = (2.1)                  $ Spring Peak Flag = 2.1 $
                    (23,24) = (2.3)              $ Spring Off-Peak Flag = 2.3 $
              (WEH)  (1,24) = (2.3)      $ Weekends, Sat, Sun, Hol Flag = 2.3 $

THRU AUG 31   (WD)    (1,8) = (3.3)              $ Summer Off-Peak Flag = 3.3 $
                     (9,22) = (3.1)                  $ Summer Peak Flag = 3.1 $
                    (23,24) = (3.3)              $ Summer Off-Peak Flag = 3.3 $
              (WEH)  (1,24) = (3.3)      $ Weekends, Sat, Sun, Hol Flag = 3.3 $


THRU NOV 30   (WD)    (1,8) = (4.3)                $ Fall Off-Peak Flag = 4.3 $
                     (9,22) = (4.1)                    $ Fall Peak Flag = 4.1 $
                    (23,24) = (4.3)                $ Fall Off-Peak Flag = 4.3 $
              (WEH)  (1,24) = (4.3)      $ Weekends, Sat, Sun, Hol Flag = 4.3 $

THRU DEC 31   (WD)    (1,8) = (1.3)              $ Winter Off-Peak Flag = 1.3 $

                     (9,22) = (1.1)                  $ Winter Peak Flag = 1.1 $
                    (23,24) = (1.3)              $ Winter Off-Peak Flag = 1.3 $
              (WEH)  (1,24) = (1.3)      $ Weekends, Sat, Sun, Hol Flag = 1.3 $

..

$----------------------------Demand Charges---------------------------------$

WN-DEM-PEAK = BLOCK-CHARGE                          $ Winter Demand. Peak Hrs $
       BLOCK-SCH = SCH-DEMAND-FLAG
       SCH-FLAG = 1.1
                                          $ TOU-SEASON-LINKS = (SP-DEM-PEAK) $
       BLOCK1-TYPE = DEMAND
       BLOCK1-DATA = (1, 14.29)                                $ KW, Dollars $
```

```
..

WN-DEM-OFFPK = BLOCK-CHARGE                    $ Winter Demand. Off-Peak Hrs $
        BLOCK-SCH = SCH-DEMAND-FLAG
        SCH-FLAG = 1.3
                                          $ TOU-SEASON-LINKS = (SP-DEM-OFFPK) $
        BLOCK1-TYPE = DEMAND
        BLOCK1-DATA = (1,3.17)                                  $ KW, Dollars $

..

SP-DEM-PEAK = BLOCK-CHARGE                       $ Spring Demand. Peak Hrs $
        BLOCK-SCH = SCH-DEMAND-FLAG
        SCH-FLAG = 2.1
                                           $ TOU-SEASON-LINKS = (SM-DEM-PEAK) $
        BLOCK1-TYPE = DEMAND
        BLOCK1-DATA = (1,15.75)                                 $ KW, Dollars $
..

SP-DEM-OFFPK = BLOCK-CHARGE                    $ Spring Demand. Off-Peak Hrs $
        BLOCK-SCH = SCH-DEMAND-FLAG
        SCH-FLAG = 2.3
                                          $ TOU-SEASON-LINKS = (SM-DEM-OFFPK) $
        BLOCK1-TYPE = DEMAND
        BLOCK1-DATA = (1, 3.17)                                $ KW, Dollars $
..

SM-DEM-PEAK = BLOCK-CHARGE                       $ Summer Demand. Peak Hrs $
        BLOCK-SCH = SCH-DEMAND-FLAG
        SCH-FLAG = 3.1
                                           $ TOU-SEASON-LINKS = (FL-DEM-PEAK) $
        BLOCK1-TYPE = DEMAND
        BLOCK1-DATA = (1, 16.33)                                $ KW, Dollars $
..

SM-DEM-OFFPK = BLOCK-CHARGE                    $ Summer Demand. Off-Peak Hrs $
        BLOCK-SCH = SCH-DEMAND-FLAG
        SCH-FLAG = 3.3
                                          $ TOU-SEASON-LINKS = (FL-DEM-OFFPK) $
        BLOCK1-TYPE = DEMAND
        BLOCK1-DATA = (1, 9.79)                                 $ KW, Dollars $
..

FL-DEM-PEAK = BLOCK-CHARGE                         $ Fall Demand. Peak Hrs $
        BLOCK-SCH = SCH-DEMAND-FLAG
        SCH-FLAG = 4.1
                                           $ TOU-SEASON-LINKS = (WN-DEM-PEAK) $
        BLOCK1-TYPE = DEMAND
        BLOCK1-DATA = (1, 16.30)                                $ KW, Dollars $
..

FL-DEM-OFFPK = BLOCK-CHARGE                    $ Fall Demand. Off-Peak Hrs $
        BLOCK-SCH = SCH-DEMAND-FLAG
        SCH-FLAG = 4.3
                                          $ TOU-SEASON-LINKS = (WN-DEM-OFFPK) $
        BLOCK1-TYPE = DEMAND
        BLOCK1-DATA = (1, 5.38)                                 $ KW, Dollars $
..

$-------------------------------------------------------------------------$
$ Steam  $
$-------------------------------------------------------------------------$
$ Consolidated Edison 2003, Service Class 1, General, Supply press. > 125 psig $

STEAM-RATE = UTILITY-RATE
   RESOURCE = STEAM
   MIN-MON-CHGS = (1608)
   BILLING-DAYS = (31,28,31,30,31,30,31,31,30,31,30,31)          $ Days/Month $
   BLOCK-CHARGES = (STEAM-WINTER, STEAM-SUMMER)
                                        $ ENERGY-CHG-SCH = SCH-GAS-ENERGY $
..
```

```
SCH-STEAM-ENERGY = SCHEDULE
     THRU APR 30   (ALL) (1,24) = (1)              $ SCH-FLAG = 1  for Winter $
     THRU OCT 31   (ALL) (1,24) = (2)              $ SCH-FLAG = 2  for Summer $
     THRU DEC 31   (ALL) (1,24) = (1)              $ SCH-FLAG = 1  for Winter $
..

STEAM-WINTER = BLOCK-CHARGE
     BLOCK-SCH = SCH-STEAM-ENERGY
     SCH-FLAG = 1
     BLOCK1-TYPE = ENERGY
     BLOCK1-DATA = ( 250,6.770 1500,15.041 5000,14.082 25000,13.590 1,12.869 )
..

STEAM-SUMMER = BLOCK-CHARGE
     BLOCK-SCH = SCH-STEAM-ENERGY
     SCH-FLAG = 2
     BLOCK1-TYPE = ENERGY
     BLOCK1-DATA = ( 250,6.770 1000,9.047 1,12.869 )
..
$-------------------------------------------------------------------------$
$ NATURAL GAS  $
$-------------------------------------------------------------------------$
$ Consolidated Edison NYC 2003. Service Classif. No. 2. General Firm Sales  $

NATURAL-GAS-RATE = UTILITY-RATE
    RESOURCE = NATURAL-GAS
    BILLING-DAYS = (31,28,31,30,31,30,31,31,30,31,30,31)          $ Days/Month $
    BLOCK-CHARGES = (GAS-ENERGY , GAS-DEMAND)
    $ PCT-TAX-DATA = (5000,9 99999999,5) <=5000 dollrs @ 9%, >5000 dollrs @ 5% $
    METERS = (M1)
..

GAS-ENERGY = BLOCK-CHARGE
    BLOCK1-TYPE = ENERGY
    BLOCK1-DATA = ( 3,3.7, 100,0.4434, 3000,0.2855, 1,0.1920 )
..

GAS-DEMAND = BLOCK-CHARGE
    BLOCK1-TYPE = DEMAND
    BLOCK1-DATA = ( 1 , 0 )

..

$-----------------------------District Chilled Water (Cooling)--------------$
$ Consolidated Edison NYC.  Service Classification No. 2, Annual Power Service $

$ CITY-CHW-RATE = UTILITY-RATE $
    $ RESOURCE = CHILLED-WATER $
    $ ENERGY-CHG = 0.3                                  30 cents per TON-HOUR $
    $ MIN-MON-CHGS = (0) $
    $ PCT-TAX-DATA = (5000,0 99999999,0) $
$ .. $
```