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ERATES

**A Computer Program for Calculating Time-of-Use,
Block, and Demand Charges for Electricity Usage (Version 1.2)**

User's Guide and Reference Manual

Stephen R. Petersen
Office of Applied Economics

Building and Fire Research Laboratory
Gaithersburg, Maryland 20899

Sponsored by:
The Federal Energy Management Program
U.S. Department of Energy
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NIST

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ABSTRACT

ERATES (Electricity Rates) is a computer program for calculating monthly and annual electricity costs for a facility, building, or system under a variety of electricity rate schedules. Both kWh usage and kW demand charges can be included in these costs. Most typically these calculations will be used to support engineering-economic studies which assess the cost-effectiveness of energy conservation measures or measures to shift electricity use from on-peak to off-peak time periods. With ERATES a user can create time-of-use kWh price schedules, block-rate kWh price schedules, and demand-rate schedules and save these schedules to a disk file. The user can then compute monthly and annual electricity costs with ERATES, given hourly or monthly kWh usage and kW demand data for a facility, building, or system. ERATES is a menu-driven, interactive program, designed to be run on an IBM-PC or compatible microcomputer under DOS version 3.0 or higher. ERATES block-rate kWh price schedules and demand-rate schedules can be imported by the NIST BLCC computer program for use in computing the life-cycle cost of buildings and building systems. ERATES is not intended for use by utilities in setting up or administering electric rate schedules.

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PREFACE

The NIST ERATES computer program has been developed to support economic analyses of energy conservation and renewable resource projects which reduce electricity use or shift its use from on-peak to off-peak time periods. The calculation of annual electricity costs in an economic analysis of such projects is typically based on simple multiplication of average kWh costs by annual kWh usage, often without regard to summer or winter rate differentials, declining block rates, or demand charges. With ERATES, time-of-use kWh price schedules, block-rate kWh price schedules, and demand-rate schedules can be included in the economic analysis.

ERATES has been designed both as a stand-alone program and as a means of setting up block-rate kWh price schedules and demand-rate schedules for use with the NIST Building Life-Cycle Cost (BLCC) program, version 4.0 or later. BLCC is a comprehensive life-cycle cost computer program developed by NIST in support of the Federal Energy Management Program. ERATES and BLCC can be used for both public and private sector applications.

For representatives of Federal government agencies and contractors to the Federal government, these programs can be ordered from:

Energy Efficiency and Renewable Energy Clearing House
1-800-DOE-EREC

For others interested in obtaining the BLCC or ERATES computer programs, please contact one of the following organizations:

FlowSoft
5 Oak Forest Court
Saint Charles, MO 63303
(314) 441-1022

Energy Information Services
PO Box 381
St. Johnsbury, VT 05819-0381
(802) 748-5148

At the time of publication, these programs can be downloaded from the FEMP home page on the World-Wide Web at address <http://www.eren.doe.gov/femp/> under Technical Assistance.

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1. INTRODUCTION

1.1 Overview

ERATES (Electricity Rates) is a computer program for calculating the monthly and annual electricity costs of a facility, building, or system under a wide range of electricity rate schedules. Both kWh usage and maximum kW demand during on-peak periods can be included in these costs. Most typically these calculations will be used to support engineering-economic studies which assess the cost-effectiveness of energy conservation measures or measures to shift electricity use from on-peak to off-peak time periods. ERATES is intended to provide more accurate estimates of annual electricity costs (or savings) for specific design and operating conditions than can be calculated using average unit rates (e.g., \$0.07/kWh) and annual kWh usage data.

With ERATES you can create time-of-use (TOU) kWh price schedules, block-rate kWh price schedules, and demand-rate (kW price) schedules for a specific geographic location and customer class. ERATES can use these rate schedules to compute annual electricity costs, given hourly or monthly kWh usage and kW demand data for a specific end use. You can create experimental rate schedules to estimate their impact on electricity costs under varying usage and demand patterns. You can also evaluate different electricity usage patterns (e.g., shifting kWh usage from on-peak to off-peak time periods) to determine the impact on annual electricity costs when time-of-use rates are in effect. Block-rate kWh price schedules and demand-rate schedules created with ERATES can also be imported by the NIST Building Life-Cycle Cost (BLCC) program, version 4.0 or later.¹ BLCC is an economic evaluation tool for use in computing the cost-effectiveness of alternative building designs and systems, especially with regard to energy usage.

Electricity rate schedules, especially kW demand schedules, can be quite complex. ERATES provides a means of simulating these schedules in computing monthly and annual electricity costs for a specific activity, given appropriate energy usage and demand data. ERATES cannot incorporate all of the potential complexities of electricity price schedules, and is not intended for use by utilities in setting up or administering such schedules.

Before you can use ERATES to compute the monthly and annual electricity costs for a facility, building, or system, you must have a minimum of a kWh rate schedule and a file of kWh usage data (either monthly or hourly)² for an entire year. To include kW demand charges in the calculations, you must also have a demand-rate file and monthly maximum kW demand data. When an hourly kWh usage file is used in the cost calculations, the monthly maximum kW demand is assumed to be the same as the maximum hourly kWh consumption during designated on-peak hours for that month.

If the kWh cost or kW demand charge calculations involve block-rate calculations, you can include base levels of kWh consumption and maximum kW demand in order to determine the appropriate block rates to use in the calculation of monthly kWh and kW costs. However, the costs of the base kWh consumption and maximum kW demand are not reported in the actual cost summary.

¹ BLCC version 4.4 (scheduled release October 1996) will be able to import TOU rate schedule files from ERATES for use with annual kWh usage data grouped by TOU price code.

² For TOU cost calculations, annual kWh usage amounts, grouped by TOU price code, can be used instead of monthly kWh amounts, but no monthly subtotals will be reported.

ERATES was written for a PC-DOS computing environment. It does not generate graphics nor does it support a mouse for user input. Output reports can be displayed to the screen, sent to a printer, or saved to a text file for later incorporation into a larger report.

1.2 How To Use This Guide

Read section 2 before installing ERATES to your hard disk. Section 3 shows how to start the ERATES program, explains the features of the main ERATES menu, and discusses program set up. Succeeding sections (4 through 8) explain the five main functions of the program: setting up (1) time-of-use kWh price schedules, (2) block-rate kWh price schedules, and (3) demand-rate (kW price) schedules; (4) creating an electricity usage file for a specific application; and (5) computing the monthly and annual electricity costs for a specific application. Appendix A provides two alternative file formats for hourly kWh usage files.

1.3 ERATES Files and File Name Extensions

A number of different file types are generated by, or used with, ERATES. A complete list of these file types, with file name extension, is shown in table 1-1. The file name extensions are automatically assigned by the ERATES program, with the exception of the .KWX extension used with hourly kWh consumption files (which must be created outside the ERATES environment). Do not include the extension when ERATES requests you to enter a file name.

Table 1-1. File name extensions used by ERATES

File name Extension	File type
.BLK	Block-rate kWh price schedules
.DMD	Demand-rate (kW price) schedules
.EXE	Executable program (ERATES only)
.FIL	Used only for SETUPER.FIL (set up file)
.HLP	Used only for ERATES.HLP (help file)
.KWA	Annual TOU kWh/monthly kW usage files for TOU calculations
.KWM	Standard monthly kWh/kW usage files for block-rate cost calculations
.KWT	Monthly TOU kWh/kW usage files for TOU calculations
.KWX	Hourly kWh usage files for block-rate and TOU calculations
.TOU	Time-of-use kWh price schedules
.TXT	Electricity cost calculation report file (optional)

2. INSTALLING ERATES

ERATES can be run from a hard disk or directly from the ERATES diskette³. To install ERATES on a hard disk, use the following steps:

(1) For use with BLCC:

Using DOS:

- (a) Move to the BLCC subdirectory. For example, if BLCC is in subdirectory C:\BLCC, type **CD \BLCC** at the C: prompt.
- (b) Insert the ERATES disk into a floppy drive (e.g., A) and copy all of the files from the ERATES disk to the BLCC subdirectory (e.g., **COPY A:*.***).
- (c) Type **ERATES** at the ready prompt to start ERATES.

Using Windows:

- (a) Use the Windows file manager to move to the BLCC directory.
- (b) Insert the ERATES disk into a floppy drive (e.g., A) and copy all of the files from the ERATES disk to the BLCC directory using the copy command under File Manager (File, Copy).
- (c) Use the Windows Program Manager to add the ERATES program to the BLCC program group. You may want to make a PIF file using the Windows PIF editor.
- (d) Click on the BLCC program group, then click on the ERATES program icon to run ERATES.

(2) For use without BLCC:

Using DOS:

- (a) Make a subdirectory called "ERATES" on the disk drive of your choice (e.g., C:). To make a subdirectory called "ERATES", type **MD \ERATES** at the DOS ready prompt.
- (b) Type **CD \ERATES** to make this the current directory.
- (c) Insert the ERATES disk into a floppy drive (e.g., A) and copy all of the files from the ERATES disk to the ERATES subdirectory (e.g., **COPY A:*.***).
- (d) Type **ERATES** at the ready prompt to start ERATES.

Using Windows:

- (a) Use the Windows file manager to create an ERATES directory (File, New Directory).
- (b) Insert the ERATES disk into a floppy drive (e.g., A) and copy all of the files from the ERATES disk to the ERATES directory using the copy command under File Manager, File.
- (c) Use the Windows Program Manager to create a new program group called ERATES. Then use the Program Manager to add the ERATES program to the ERATES program group. You may want to make a PIF file using the Windows PIF editor.
- (d) Click on the ERATES program group, then click on the ERATES program icon to run ERATES.

³ ERATES may be distributed on the same diskette as the NIST EMISS program and NIST DISCOUNT program. It is recommended that all of these programs and supporting files be installed to the same directory as the NIST BLCC program.

To run ERATES directly from the ERATES diskette, use the following steps:

- (a) Make a back-up copy of the ERATES diskette.
- (b) Insert your new copy of the ERATES diskette into a floppy drive (e.g., A).
- (c) Make the floppy drive the current drive (e.g., type A:).
- (d) Type **ERATES** at the ready prompt to begin.

Use the "Set Up" function from the main menu to specify the drive and directory to which your ERATES data files will be saved (see section 3.1). If you run ERATES from the diskette rather than from a hard disk, space for file storage is limited and you might want to save your input and output files to a second diskette in another drive. If you are using ERATES to generate files of rate schedules for use with the BLCC program, save those files to the directory in which the BLCC4.EXE program resides.

The executable program ERATES.EXE, the set up file SETUPER.FIL, and the help file ERATES.HLP, are the only three files you will need to run ERATES. However, you will be creating additional files of rate schedules and electricity usage with ERATES. You will also be able to save your electricity cost calculations to a disk file in order to import them into a larger report. These report files have the file name extension .TXT.

There are eight demonstration files on the diskette for use in learning how to use ERATES. These files correspond to the files used in the examples in this user's guide. These files are:

DEMO3.BLK	DEMO3.KWM
DEMO3.TOU	DEMO3.KWT
DEMO3.DMD	DEMO3.KWX
DEMO3.KWA	DEMO2.KWX

3. RUNNING ERATES

ERATES is a menu driven program which allows you to enter relevant data related to electricity rate schedules and electricity usage patterns and then to calculate monthly and annual electricity costs based on those data. To run ERATES, move to the subdirectory in which ERATES resides, and then type **ERATES** at the DOS prompt, or run ERATES from the Windows run command. When you are making menu choices, you generally highlight your menu choice with the up and down cursor arrows and then press <Enter>. (ERATES does not currently support a mouse for choosing menu alternatives.) Alternatively, just press the character corresponding to the highlighted character in each menu choice, shown underlined in this guide. (This reduces the number of key strokes needed to navigate through the program.) You can generally press <Esc> to return to the previous menu.

ERATES displays a number of data entry forms to the screen, depending on the type of data to be entered. In general, press <PgDn> when the data entry form is completed; press <PgUp> or <Esc> to return to the previous screen. In this user's guide, data entry fields are designated by **bold** lettering when they contain data or underlined when they are void.

3.1 The ERATES Main Menu

After the initial ERATES screen is displayed, press any key to move to the main ERATES menu, as shown in figure 3-1. Press the highlighted character to make your menu choice.

```

Create Rate Schedule file
Create Electricity Usage file
Calculate Annual Electricity Cost
Help
Setup
eXit
```

Figure 3-1. ERATES main menu.

The first menu choice, **Create Rate Schedule file**, is used to create or edit files of electricity rate schedules for the specific location and customer type to be used in the electricity cost calculations. When you select this first choice, a second menu appears which allows you to select the type of rate schedule that you wish to create or edit, as show in figure 3-2.

```

TOU kWh price schedule
Block-Rate kWh price schedule
Demand-Rate schedule
```

Figure 3-2. Selection of rate schedule type.

The following definitions may be useful in determining which of the three rate types are most appropriate for your analysis of electricity costs.

Time-of-use kWh price schedules specify kWh prices by hour of the day, day of the week, and month of the year. They are generally used to promote a shift of electricity usage from on-peak time periods to off-peak time periods. To use time-of-use rates for computing annual electricity costs for a specific facility, you must have a file of hourly kWh usage data for an entire year or a file of total monthly or annual kWh usage summed by TOU price code.

Block-rate kWh price schedules specify kWh prices for different levels of monthly kWh usage. You can assign different schedules to different months of the year. Annual electricity costs based on a block-rate schedule can be calculated by ERATES using either hourly or monthly kWh consumption data for an entire year.

Demand-rate kW price schedules specify the price per kW of maximum power demand by a facility, usually determined on a monthly basis. In some cases the maximum power demand is measured only during designated "on-peak" hours; in other cases the measured peak may occur at any point during the 24-hour day. You can specify demand charges in block form (i.e., rates that vary with the level of maximum demand) and assign different price schedules to different months of the year. You can also specify on-peak and off-peak time periods. Demand charges can be calculated by ERATES using either hourly kWh usage or monthly maximum kW demand data for an entire year. (When hourly kWh data are used, the maximum kWh consumption for any hour designated as "on-peak" during the month is assumed to be the maximum kW demand for that month.)

The second main-menu choice, **Create Electricity Usage file**, is used to create or edit a file of kWh usage and kW demand data for a specific facility, building, or project activity. These files serve as the basis for calculating monthly and annual electricity costs using the block-rate kWh price schedules or TOU kWh price schedules and demand-rate kW price schedules created with ERATES. When you elect this choice, a second menu appears which allows you to specify the type of electricity usage file you wish to create or edit, as shown in figure 3-3.

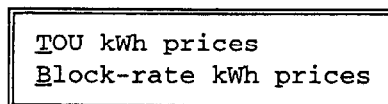


Figure 3-3. Selection of the type of electricity usage file to be created or edited.

For the calculation of kWh costs using block-rate kWh price schedules, only one type of file can be created and edited directly from ERATES: a "standard" monthly kWh/kW usage file. For the calculation of electricity costs using TOU kWh price schedules, two different types of electricity usage files can be created and edited: an annual TOU kWh file and a monthly TOU kWh file. (An hourly kWh usage file cannot be generated directly by ERATES. See Appendix A for information on this file type.) All three of these files can include monthly kW demand data. Figure 3-4 shows the menu choice that appears if you indicate that you want to create or edit a TOU file.

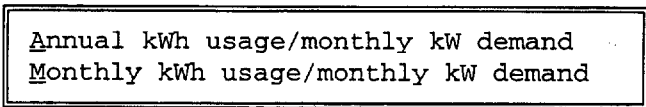


Figure 3-4. Selection of the type of TOU kWh usage file to be created or edited.

The annual TOU kWh usage file format allows you to specify kWh consumption data on an annual basis, grouped by TOU price code. That is, the total number of kWh for the year falling under each TOU price code is reported. A monthly TOU kWh file is only needed if you want to calculate monthly kWh cost subtotals in addition to the total annual kWh cost; the total annual cost (i.e., sum of monthly costs) will be identical to the monthly detail option if equivalent data are entered. Monthly kW demand amounts for the same project are needed with either file type if demand costs are to be included in the cost analysis. Section 7 provides details on how to create and edit these electricity usage files.

Select **Calculate Annual Electricity Cost** from the main menu to perform the calculation of monthly and annual electricity costs, once you have established the electricity usage file and the appropriate rate schedules. ERATES cost calculations are discussed in section 8.

Select **Help** from the main menu to display a description of the ERATES program on the screen. Press <PgDn> and <PgUp> to scroll through this description. Help messages for individual screens are not available at this time. File ERATES.HLP provides the description for display.

Select **Set Up** from the main menu to specify whether you are using a color or black and white monitor (or a monitor that emulates color but is actually monochrome) and the directory to which you want to save your working files. Set Up is discussed in section 3.2.

Select **Exit** from the main menu to terminate the ERATES program.

3.2 Program Set Up

The first time you run ERATES, select the "Set Up" option first. The Set Up screen is shown in figure 3-5. The "Set Up" option allows you to specify the subdirectory where files of rate schedules created by ERATES, as well as kWh usage files, will be saved to and retrieved from.⁴ The subdirectory must be an existing subdirectory on the same disk drive or on another disk drive that can be used for reading and writing data files by your computer. If you leave the subdirectory name blank, ERATES will use the directory from which you started the program to save and retrieve files. If you specify the name of a subdirectory that does not exist, ERATES will not let you save the set up information.

⁴ If you are creating rate schedule files for use with BLCC 4.0, save these files to the directory in which BLCC4.EXE is located (usually BLCC4), not to the subdirectory where BLCC data files for individual projects are saved.

```
Monitor (C=Color/M=Monochrome/E=B&W Emulation): C  
Directory to save files: \BLCC4
```

Figure 3-5. ERATES Set Up screen.

Set Up also permits you to enter an alternative specification for the monitor that you are using. Some monitors (especially some older monitors which do not display colors well) can be made more readable by selecting the E option for black and white emulation. (If you select black and white emulation, the key letter in each menu choice which appears as red on a color monitor will be displayed as bold text.)

Press <PgDn> to save any changes you make to the Set Up screen, <Esc> to return to the main menu without saving changes. If you save the changes, they are written to file SETUPER.FIL, which should always be in the same subdirectory as the ERATES program.

3.3 Navigating through ERATES

Menu selections and data entry forms displayed on the screen by ERATES were designed to make the electricity rate analysis as easy as possible. Some general instructions for navigating through ERATES are provided here.

(1) For menus where two or more choices are displayed to the screen, use the cursor arrows (↑↓) to highlight your choice, then press <Enter>. Alternatively (and with less key strokes) just press the character (case insensitive) that is displayed in red to mark your choice; do not press <Enter>. Press <Esc> if you want to return to the previous screen.

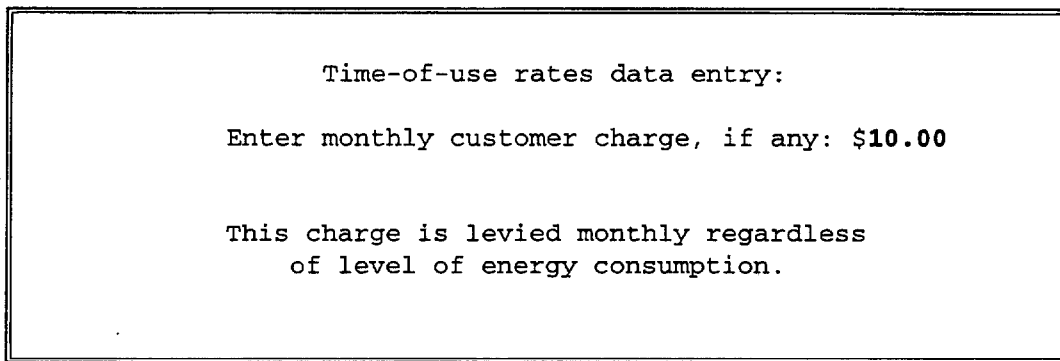
(2) For data fields, enter the appropriate number or word, then press <Enter>. Use <Cntl><End> to delete all characters to the right of the cursor. Use <End> to move to the end of the field; <Home> to move to the beginning of the field. Press <Tab> to move to the next field, <Shift><Tab> to move to the previous field. Use the up and down cursor arrows (↑↓) to move to a field above or below the current field. Press <PgDn> to move to the next page; <PgUp> or <Esc> to move to the previous screen.

In this user's guide, the character designating a menu choice, shown in red on the screen, is underlined. Data fields with data entries are shown in bold; data fields without data entries are underlined.

4. CREATING AND EDITING TIME-OF-USE KWH PRICE SCHEDULES

Use a time-of-use rate schedule to assign kWh prices to different hours of the day, days of the week, and months of the year. TOU rates usually reflect the utility's marginal kWh production and distribution costs at different levels of demand during those periods. ERATES allows you to assign up to 12 different kWh price codes (designated by letters A-L) to represent different kWh prices used at different times during the billing year. You then assign a price code to each hour of each day for each day of the week in a "weekly TOU schedule." You can fill out as many as six weekly schedules and assign them to different months of the year. You can also include a fixed monthly customer charge (independent of the level of kWh usage) in the TOU file.

To create a new file of TOU kWh price schedules, first select "Create Rate Schedule File" from the main menu; then select "TOU kWh price schedule" from the second menu; finally select "Create New File" from the third menu. Figure 4-1 shows the first data entry screen, which allows you to specify the monthly customer charge. The monthly customer charge will be included in the monthly total electricity cost every month of the year, regardless of the level of kWh consumption in each month. After entering the monthly customer charge, press <Enter> to continue.



```
Time-of-use rates data entry:

Enter monthly customer charge, if any: $10.00

This charge is levied monthly regardless
of level of energy consumption.
```

Figure 4-1. Customer charge data entry screen.

The next data entry screen, shown in figure 4-2, is used for assigning kWh prices to price codes (letters A-L). You must assign a kWh price to a price code before you can use that code in the weekly TOU schedule. However, even after you have assigned valid price codes to specific operating hours in the weekly TOU schedule you can return to this data entry form and change the prices that the codes represent. The set of price codes you assign here is used for all of the weekly TOU schedules in the same TOU file; that is, you do not set up a different set of codes for each schedule. You must assign prices to at least two price codes initially; up to 12 prices can be assigned. Figure 4-2 shows the kWh prices assigned to codes A (\$0.03), B (\$0.06), and C (\$0.15).

Press <PgDn> when data entry is completed. Note that you can always return to a previous screen by pressing <Esc> and that you can return to this screen from the TOU edit menu shown later.

Price kWh
Code Price

A	\$0.0300
B	\$0.0600
C	\$0.1500
D	\$_____
E	\$_____
F	\$_____
G	\$_____
H	\$_____
I	\$_____
J	\$_____
K	\$_____
L	\$_____

Figure 4-2. TOU price codes for use in specifying kWh prices.

Once the kWh price codes have been assigned, you are ready to assign these codes to specific hours of the day for each day of the week. Before a new weekly TOU schedule is displayed to the screen for data entry, you will be asked to identify the predominant (default) price code to be used with this schedule. Enter one valid price code (A-L), i.e., a code with a price already assigned to it. When the screen is displayed for the first time, the entire TOU schedule for the week will be filled out with the default TOU code.

Figure 4-3 shows the screen display for a weekly TOU schedule, with the data entry area confined to the box in the lower left corner, labeled with the seven days of the week down the side and 24 hours of the day across the top. When the TOU schedule is first displayed, this box area is filled out with the default price code that you designated in the prior step. You must change the codes for those hours in which the appropriate TOU code differs from the default code. Only valid price codes (displayed at the right side of the screen) can be entered. Use the cursor to highlight a specific day and hour for which you want to enter a different price code; then press the corresponding character key to enter the new code for that time. Figure 4-3 shows that the hours 7 a.m. through 8 p.m. (14 hours total), Monday through Friday, will be charged at \$0.06/kWh (code B). All other hours will be charged at \$0.03/kWh (code A). In figure 4-3, the months to which this weekly schedule is assigned (1, 2, 3, 4, 10, 11, and 12) are displayed at the top of the screen. This schedule assignment information is not displayed when you first create a weekly TOU rate schedule. It must be entered on a separate screen after two or more weekly schedules have been created. The method for entering these monthly assignments is discussed later.

After completing the first TOU schedule, press <PgDn> to move to the next screen. The schedule will be checked at this point to make sure that no invalid price codes (codes without prices) have been assigned. If only one TOU schedule is needed, this schedule will automatically be assigned to all 12 months of the year and you will move to the TOU edit menu. If you wish to enter additional TOU rate schedules for assignment to other months of the year, you can elect this option after exiting the first TOU schedule. Any time that you elect to create an additional TOU rate schedule (up to six can be specified) you will be asked to identify the default TOU code for that schedule before it is displayed.

WEEKLY TOU SCHEDULE #1
Months assigned: 1 2 3 4 10 11 12
(To change months, press <Esc>, M)

Assign valid price code (see box at right)
to each hour of each day of the week below.
Press <PgDn> when completed.

Hour of Day (1-24)
1 2
123456789012345678901234

Day of Week:

MONDAY	AAAAAABBBBBBBBBBBBBBAAAA
TUESDAY	AAAAAABBBBBBBBBBBBBBAAAA
WEDNESDAY	AAAAAABBBBBBBBBBBBBBAAAA
THURSDAY	AAAAAABBBBBBBBBBBBBBAAAA
FRIDAY	AAAAAABBBBBBBBBBBBBBAAAA
SATURDAY	AAAAAAAAAAAAAAAAAAAAAAAA
SUNDAY	AAAAAAAAAAAAAAAAAAAAAAAA

A = \$0.03000
B = \$0.06000
C = \$0.15000

Valid price codes
and assigned prices:

To change codes,
press <Esc>, P

Figure 4-3. Format for TOU weekly price schedule.

Figure 4-4 shows a second weekly TOU schedule (schedule #2) that was created and assigned to months 5, 6, 7, 8, and 9. In this second schedule three TOU codes are used, A, B, and C. When this schedule is first created it is filled out with the default TOU code that you assign. You must make changes as necessary to reflect the weekly rate schedule being represented. Press <PgDn> when you have completed this schedule.

WEEKLY TOU SCHEDULE #2
Months assigned: 5 6 7 8 9
(To change months, press <Esc>, M)

Assign valid price code (see box at right)
to each hour of each day of the week below.
Press <PgDn> when completed.

Hour of Day (1-24)
1 2
123456789012345678901234

Day of Week:

MONDAY	AAAAAABBBBBCCCCCBBBBBB
TUESDAY	AAAAAABBBBBCCCCCBBBBBB
WEDNESDAY	AAAAAABBBBBCCCCCBBBBBB
THURSDAY	AAAAAABBBBBCCCCCBBBBBB
FRIDAY	AAAAAABBBBBCCCCCBBBBBB
SATURDAY	AAAAAABBBBBBBBBBBBBBBBBB
SUNDAY	AAAAAABBBBBBBBBBBBBBBBBB

A = \$0.03000
B = \$0.06000
C = \$0.15000

Valid price codes
and assigned prices:

To change codes,
press <Esc>, P

Figure 4-4. Inclusion of second TOU weekly price schedule.

Note that the same list of valid TOU price codes is used for all weekly TOU schedules, regardless of the months that they are assigned to. This code list is displayed on the right side of the TOU schedule screen but it cannot be edited here. You must return to the price code data entry form, shown in figure 4-2, to modify the price codes. When you are first creating a weekly TOU schedule you can return to the form for editing price codes by pressing <Esc>. Later, when editing TOU schedules, pressing <Esc> will return you to the TOU menu; from the TOU menu press "P" to go to the price code form.

After you complete the initial entry of two or more TOU rate schedules, you must assign these schedules to the 12 months of the year. Figure 4-5 shows the data entry form displayed for this purpose. A valid rate schedule must be assigned to each month of the year. Figure 4-5 shows that TOU schedule #1 is assigned to the months of January through April and October through December and that schedule #2 is assigned to the remaining months. Press <PgDn> when the form is completed.

Month	Sched #
Jan	1
Feb	1
Mar	1
Apr	1
May	2
Jun	2
Jul	2
Aug	2
Sep	2
Oct	1
Nov	1
Dec	1

Figure 4-5. Assignment of TOU schedule number to months.

The TOU schedules shown in figures 4-3 and 4-4 are contained in the DEMO3.TOU file distributed with the ERATES program. This file will be used in section 8 in examples for computing TOU electricity costs with ERATES. You can load and read this file in the ERATES edit mode for TOU rate files. When finished viewing this screen, do not resave the file under the same file name as you exit unless you are sure that you have not changed any data.

After completing the initial steps for creating a new TOU kWh price file, a menu for editing the current TOU file is displayed, as shown in figure 4-6. The menu options allow you to edit, add, or delete weekly TOU schedules; change or add additional price codes; reassign the schedules to different months of the year; change the monthly customer charge; and save the file. Use the cursor to highlight the option desired and press <Enter>, or press the underlined character (shown in red on the screen).⁵

Display/edit weekly TOU schedule #_ is shown for as many weekly TOU-rate schedules as are contained in the current TOU file. Use this option to view or edit any existing TOU schedule in this file.

⁵ No provision for entering base kWh usage is provided with the TOU rate schedule as in the case of block rate kWh schedule because base kWh usage does not affect the total kWh cost for any given hour under TOU rates.

Add new weekly TOU schedule brings up a new weekly TOU schedule on the screen, after asking you to specify the default price code with which to fill out the form. Schedule numbers for additional schedules (1-6) are assigned sequentially.

Delete existing weekly TOU schedule asks you which schedule number to delete and clears all entries in that schedule. You will be asked to reassign valid weekly TOU schedules to the months that had been assigned to the deleted schedule, if any. If you delete a TOU schedule from the current file, the schedule numbers will not automatically change to reflect this deletion. You must use the **Renumber weekly TOU schedules** option to perform this task. If you do not renumber the schedules, the number of the deleted schedule will be shown on the TOU menu with the option **Respecify weekly TOU schedule #_**. This allows you to enter a new schedule in place of the old one without changing the schedule numbers.

```
Display/edit weekly TOU schedule #1
Display/edit weekly TOU schedule #2
Add new weekly TOU schedule
Delete existing TOU weekly schedule
Renumber weekly TOU schedules
Assign Prices to TOU codes
Assign Weekly TOU schedules to months
Change Monthly customer charge
Save TOU schedule
Quit TOU rates, exit to main menu
```

Figure 4-6. Menu for editing a file of TOU kWh price schedules.

Renumber weekly TOU schedules is used to renumber the remaining weekly schedules after one has been deleted; this option renumbers the remaining schedules consecutively and adjusts the assignment of weekly TOU schedules to the months of the year accordingly. If no schedule has been deleted, this menu option has no affect on the file.

Assign weekly TOU schedules to months allows you to assign weekly TOU schedules to different months of the year. All 12 months of the year must have an assigned schedule before you can save the file. Once the schedules have been assigned to the appropriate months, the assignments are displayed at the top of each weekly TOU schedule. The data entry form for assigning schedules to months is shown in figure 4-4.

Save TOU schedule allows you to save the new or modified time-of-use file to the disk. A DOS-compatible (8-character maximum) file name will be requested. A file name extension of .TOU will automatically be appended to the file name. If the file name specified already exists in the disk directory, a warning will be displayed to the screen. You can overwrite the old file or save the new/modified file under a new file name. If you attempt to return to the main ERATES menu without saving the current file, you will be asked to save the file first.

Quit TOU rates returns control to the main ERATES menu.

5. CREATING AND EDITING BLOCK-RATE KWH PRICE SCHEDULES

The most common type of rate schedule used by electric utilities for kWh charges is the block-rate schedule. A block-rate kWh price schedule generally levies a different price per kWh at different levels of monthly kWh usage. For example, the first 100 kWh may be charged at \$0.10/kWh, the next 400 at \$0.07/kWh, the next 1000 kWh at \$0.06/kWh, and any usage beyond that level (i.e., above 1500 kWh) at \$0.05/kWh. This is typically referred to as a "declining" block-rate schedule. The block-rate schedule may vary by month. For example, in the summer months when incremental generating and distribution costs are typically higher, monthly kWh usage above some level (say 500 kWh) may be charged at a higher rate. Utilities may also have different rate schedules for different classes of users. For example, some utilities have different rate schedules for residential customers who use electricity for space and water heating and those who do not.

To create a new file of block-rate kWh price schedules for a particular facility, select "Create Rate Schedule file" from the main menu; then select "Block-Rate kWh price schedule" from the second menu; then select "Create New File" from the third menu. A blank block-rate schedule form will appear on the screen as Schedule #1, with all 12 months of the year pre-assigned to the first schedule. Figure 5-1 shows the general data entry form for entering a block-rate kWh price schedule. You can include up to six different block-rate schedules in a single file, with each schedule assigned to different months of the year. This schedule shows that it is currently assigned to months 1-5 and 10-12. However, the monthly assignment data does not show on the form when it is first created. Monthly assignments are added after the individual schedules are created.

```
BLOCK-RATE KWH PRICE SCHEDULE #1
Months assigned:  1 2 3 4 5 10 11 12
(To change months, press <Esc>, M)

Enter monthly customer charge ($/month).
For each block in schedule, enter number of kWh and $/kWh.
(Leave unneeded kWh blocks with 0 kWh and 0 $/kWh)
```

Monthly customer charge:	\$10	/month
Block 1: first	100	kWh @ \$0.10000/kWh
Block 2: next	400	kWh @ \$0.07000/kWh
Block 3: next	1000	kWh @ \$0.06000/kWh
Block 4: next	0	kWh @ \$0.00000/kWh
Block 5: next	0	kWh @ \$0.00000/kWh
All additional kWh:		@ \$0.05000/kWh

Figure 5-1. Format for block-rate kWh price schedule.

In the block-rate schedule screen (figure 5-1), there are three types of data fields:

The monthly customer charge. This is a fixed monthly charge levied each month that this schedule is used, regardless of the number of kWh consumed in that month.
(range: 0 to 9999)

The number of kWh in each usage block. Each usage block will have its own price per kWh. Up to five blocks can be specified, but are not required. Block 1 in figure 5-1 shows that the first 100 kWh of monthly electricity usage are charged for at the rate of \$0.10 per kWh. (range: 0 to 9999)

The price per kWh for each block of kWh usage specified and for all kWh consumed above the last block specified. A kWh price is required for each block that has been assigned a number of kWh, and for all kWh usage above the blocks assigned. Figure 5-1 shows that the price per kWh for all kWh usage above 1500 kWh per month (100 + 400 + 1000) is \$0.05 per kWh. (range: 0.01 to 9.99, assuming that the number of kWh in the block is specified, otherwise 0.)

Note: The *minimum amount* of data you need to complete the block-rate data entry form is simply the *price per kWh for all additional kWh*. If no kWh blocks are specified, all of the kWh usage in the month will be charged at this rate.

Once you have completed the new block schedule, press <PgDn>. In the file creation mode, you will be asked if you want to create another block-rate kWh price schedule. Answer "Y" or "N". If you choose "Y", a second blank block-rate schedule will be displayed, titled "Schedule #2", with no months assigned. Figure 5-2 shows an example of a second block-rate schedule. In this example, all electricity usage after the first 100 kWh used in a month is charged at the same rate of \$0.07/kWh.

```
BLOCK-RATE KWH PRICE SCHEDULE #2
Months assigned:  6 7 8 9
(To change months, press <Esc>, W)

Enter monthly customer charge ($/month).
For each block in schedule, enter number of kWh and $/kWh.
(Leave unneeded kWh blocks with 0 kWh and 0 $/kWh)

Monthly customer charge:   $10      /month
Block 1: first 100 kWh @ $0.10000/kWh
Block 2: next 0 kWh @ $0.00000/kWh
Block 3: next 0 kWh @ $0.00000/kWh
Block 4: next 0 kWh @ $0.00000/kWh
Block 5: next 0 kWh @ $0.00000/kWh
All additional kWh:      @ $0.07000/kWh
```

Figure 5-2. Inclusion of second block-rate kWh price schedule.

After completing this schedule, press <PgDn>. The monthly schedule assignment screen will then appear as shown in figure 5-3, with all months currently assigned to Schedule #1. Enter a "2" to assign Schedule #2 to the appropriate months. Press <PgDn> when complete.

Month	Sched #
Jan	1
Feb	1
Mar	1
Apr	1
May	1
Jun	2
Jul	2
Aug	2
Sep	2
Oct	1
Nov	1
Dec	1

Figure 5-3. Assignment of block-rate kWh price schedules to months.

The data shown in figures 5-1 and 5-2 are contained in file DEMO3.BLK which is distributed with the ERATES disk. This data file will be used in section 8 as an example of computing annual electricity costs using a block-rate schedule for kWh prices.

After completing the initial steps for creating a new file of block-rate kWh price schedules, a menu for editing this file is displayed, as shown in figure 5-4. These options allow you to edit, add, or delete block-rate schedules; reassign the schedules to different months of the year; specify base kWh usage; and save the file. Use the cursor to highlight the option desired and press <Enter>, or press the underlined character (shown in red on the screen).

Display/edit block-rate schedule # <u>1</u>
Display/edit block-rate schedule # <u>2</u>
<u>A</u> dd new block-rate schedule
<u>D</u> elete existing block-rate schedule
<u>R</u> enumber block-rate schedules
Assign block-rate schedules to <u>M</u> onths
Specify <u>B</u> ase kWh usage (if any) by month
<u>S</u> ave block-rate schedule
<u>Q</u> uit block-rates, return to main menu

Figure 5-4. Menu for editing a file of block-rate kWh price schedules.

Display/edit block-rate schedule #_ is shown for as many block-rate schedules as are currently contained in this file. Use this option to view or edit any existing block-rate schedule.

Add new block-rate schedule allows you to add another block-rate schedule (up to six total). Schedule numbers for additional schedules (2-6) are assigned automatically.

Delete existing block-rate schedule asks you which schedule number to delete and clears all entries in that schedule. You will be asked to reassign valid block-rate schedules to the months that had been assigned to the deleted schedule, if any. If you delete a block-rate schedule from the current file, the schedule numbers will not automatically change to reflect this deletion. You must use the **Renumber block-rate schedules** option to perform this task. If you do not renumber the schedules, the number of the deleted schedule will be shown on the block-rate menu with the option **Respecify block-rate schedule #_**. This allows you to enter a new schedule in place of the old one without changing the schedule numbers.

Renumber block-rate schedules is used to renumber the remaining schedules after one has been deleted; this option renumbers the remaining schedules consecutively and adjusts the assignment of the schedules to the months of the year accordingly. If no schedule has been deleted, this menu option has no effect on the file.

Assign block-rate schedules to months allows you to assign schedules to different months of the year. All 12 months of the year must have an assigned schedule before you can save the file. Once the schedules have been assigned to the appropriate months, the assignments are displayed at the top of each block-rate schedule. The data entry form for assigning schedules to months is shown in figure 5-3.

Specify base kWh usage allows you to create a monthly kWh usage level that will be added to the kWh consumption data used in computing monthly and annual kWh costs, possibly shifting kWh consumption into higher usage blocks. The screen display for this data entry form is shown in figure 5-5. This option may be useful if you are interested in calculating the monthly and annual cost of space heating and cooling, using energy usage calculations for those two systems only. Monthly kWh usage for lighting, cooking, water heating, and other purposes can then be included as base kWh usage in this form. These base kWh usage data will be used to adjust the monthly kWh usage for space heating and cooling to the proper blocks, but will not be included in the monthly and annual energy cost that is reported.

Save block-rate schedule allows you to save the new or modified block-rate file to the disk. A DOS-compatible (8-character maximum) file name will be requested. A file name extension of .BLK will automatically be appended to the file name. If the file name specified already exists in the disk directory, a warning will be displayed to the screen. You can overwrite the old file or save the new/modified file under a new file name. If you attempt to return to the main ERATES menu without saving the current file, you will be asked to save the file first.

Quit block rates returns control to the main ERATES menu.

Month Base kWh

Jan	0
Feb	0
Mar	0
Apr	0
May	0
Jun	0
Jul	0
Aug	0
Sep	0
Oct	0
Nov	0
Dec	0

Figure 5-5. Base monthly kWh usage.

6. CREATING AND EDITING DEMAND-RATE SCHEDULES FOR MAXIMUM KW USAGE

Demand rates are charges applied to maximum kW power demands that occur during designated on-peak time periods (usually during the current monthly billing period or a previous monthly billing period). Maximum kW demand is usually measured by a demand meter, often over a 15-minute interval. Demand charges can have time-of-use characteristics; that is, there can be on-peak periods when the kW demand is metered and off-peak periods when kW demand is not metered. In ERATES you can specify two different on-peak periods on the same day; however, the demand rate is the same in both periods. No demand charges can be assigned to the off-peak periods. You can also specify whether to include weekends as "on-peak" or "off-peak" time periods when calculating annual demand costs. However, ERATES can only differentiate between on-peak and off-peak periods when calculating demand charges from a file of *hourly* kWh usage data. (ERATES uses maximum hourly kWh usage during on-peak periods as a proxy for maximum kW demand.) **If you use an electricity usage file with monthly kW demand data (see section 7), ERATES assumes that the kW demand data in this file occurred during on-peak periods when performing demand charge calculations.**

Demand rates are generally imposed on large electricity consumers (e.g., industrial and commercial facilities), but some utilities impose demand rates on residential customers as well. Demand-rate computations can be quite complex. For example, a "ratchet" provision imposed by the utility can base the kW demand charge for any given month on the maximum kW demand metered over a specified number of months previous to the billing date, not just the maximum kW demand for the current month. In ERATES version 1.2 (and later) you can specify the number of months (1-12) in the utility's ratchet provision, if any. Demand rates may also have a block-rate structure, so that the first block of demand may have a higher (or lower) rate than subsequent blocks. In ERATES, you can assign the size of each block (i.e., the number of kW in that block) as well as the corresponding price per kW of maximum demand.

When creating a new file of demand-rate schedules the following question is asked before the first demand-rate schedule is displayed to the screen:

Compute demand charges using Monthly maximum kW, Annual maximum kW,
or demand Ratchet in months (M/A/R)? _

If the maximum kW demand during the current month is the basis for calculating the kW demand charge for that month, enter "M". If the maximum kW demand for the entire year is to be used as the basis for calculating all 12 monthly demand charges, enter "A". If the monthly maximum (M) is selected, the monthly maximum kW demand for each month of the year is multiplied by the corresponding monthly kW demand charge. If the annual maximum demand is selected as the basis for calculating demand charges, the kW demand rate for each month is multiplied by the maximum kW demand for the year, even in months before the maximum occurs. (This assumes that the monthly kW demands of the last months in the previous year are identical to the monthly kW demands in the remaining months of the current year.)

If you wish to use a ratchet provision, enter "R". If you enter "R", the following data entry field will appear:

Enter number of months in demand ratchet (1-12): __

Enter the number of prior months (including the current month) over which the maximum kW demand is to be identified. Note that using a ratchet number of 1 is the same as specifying "M" for monthly analysis; using a ratchet number of 12 is the same as specifying "A" for annual analysis. (The M and A options are included to maintain compatibility with previous versions of ERATES.) When a ratchet provision is used, the maximum monthly kW demands that would extend into the previous year are assumed to be the same as those for the corresponding months in the current year. (For example, if a six month ratchet provision is specified for kW demand charges, the demand charge for January is based on the maximum kW demand for the time period from August to December and the month of January.)

When computing monthly demand charges with a ratchet provision, ERATES will not include the maximum kW demand for those months for which the demand rate schedule assigns a zero cost to maximum kW demand. For example, if a six-month ratchet is assigned, the maximum kW demand for the billing month (say June) is 100 kW, and the maximum kW in January is 125 kW, February 120 kW, March 115, April 110, May 105, then the maximum kW demand for the six month ratchet period ending in June is 125 kW, based on the January's maximum demand. However, if no kW demand charge is scheduled for the months of January and February (but charges are scheduled for March - June) then the maximum kW demand charge for the six month ratchet period will be based on the March demand, 115 kW. Setting up monthly kW demand schedules and assigning those schedules to each month of the year is discussed in the following paragraphs.

Figure 6-1 shows the format for entering a demand-rate schedule in ERATES. You can include up to six different demand-rate schedules in a single file, with each schedule assigned to different months of the year. To create a new file of demand-rate schedules for a particular location and customer class, select "Create Rate Schedule file" from the main ERATES menu; then select "Demand Rates File" from the second menu; then select "Create New File" from the third menu. A blank data form will appear on the screen as Schedule #1, with all 12 months of the year pre-assigned to the first schedule. The example shown in figure 6-1 shows that Schedule #1 is assigned to months 1-4 and 10-12. A second schedule, shown in figure 6-2, is assigned to months 5-9. The data in these examples are contained in file DEMO3.DMD which is distributed with the ERATES program. If you view the contents of this file in the ERATES rate file edit mode, do not resave the file unless you are sure that you did not change any of the data entries. This file is used in the computational examples in section 8 of this report.

DEMAND-RATE SCHEDULE #1
Months assigned: 1 2 3 4 10 11 12

Enter on-peak demand hours (1-24):

First Period	Second Period
Start 6 Stop 9	Start 14 Stop 22

For each demand block, enter number of kW and \$/kW.
(Leave unneeded demand blocks with 0 kW and 0 \$/kW)

Block 1: first 100	kW @ \$ 10.00/kW
Block 2: next 100	kW @ \$ 12.00/kW
Block 3: next 0	kW @ \$ 0.00/kW
Block 4: next 0	kW @ \$ 0.00/kW
Block 5: next 0	kW @ \$ 0.00/kW
All additional kW:	@ \$ 15.00/kW

Figure 6-1. Format for demand-rate schedule.

DEMAND-RATE SCHEDULE #2
Months assigned: 5 6 7 8 9
(To change months, press <Esc>, M)

Enter on-peak demand hours (1-24):

First Period	Second Period
Start 6 Stop 20	Start 0 Stop 0

For each demand block, enter number of kW and \$/kW.
(Leave unneeded demand blocks with 0 kW and 0 \$/kW)

Block 1: first 100	kW @ \$ 15.00/kW
Block 2: next 100	kW @ \$ 20.00/kW
Block 3: next 0	kW @ \$ 0.00/kW
Block 4: next 0	kW @ \$ 0.00/kW
Block 5: next 0	kW @ \$ 0.00/kW
All additional kW:	@ \$ 25.00/kW

Figure 6-2. Inclusion of a second demand rate schedule.

In the demand-rate schedule screen shown in figures 6-1 and 6-2 there are three types of data fields:

The on-peak hour designators. These are the starting and stopping hours for one or two on-peak demand periods when the schedule is in use. If the entire day is on peak, use 1 and 24 to designate the first period and leave the second period blank. (range: 0 to 9999)

The number of kW in each demand block. Each non-zero block will have its own price per kW. Up to five blocks can be specified, but not all blocks are required. Figure 6-1 shows that the price per kW of maximum demand is \$10.00 for the first 100 kW, \$20.00 for the second 100 kW, and \$25.00 for all kW demand above 200 kW in the month that this schedule is used. (range: 0 to 9999)

The price per kW for each block of kW demand specified and for all kW demand above the last block specified. A kW price is required for each block that has been assigned a non-zero amount. (range: 0.01 to 99.99, assuming that the block kW are specified, otherwise 0.)

Note: The *minimum amount* of data you need to complete this screen is simply the *first period start and stop hours*. If no kW demand charge is levied in some months, then the demand schedule that is assigned to those months should have a zero demand charge for all blocks, but the first period start and stop hours must still be identified. (Use 1 and 24.)

You will be asked to specify whether weekends are on-peak or off-peak periods when calculating annual electricity costs, but only if you use an hourly kWh file. (See section 8.)

Once you have completed the new demand-rate schedule, press <PgDn>. In the file creation mode, you will be asked if you want to create another demand-rate schedule. Answer "Y" or "N". If you choose "Y", a second blank demand-rate schedule will be displayed, titled "Schedule #2", with no months assigned. After completing this schedule, press <PgDn>. The monthly schedule assignment screen will then appear as shown in figure 6-3, with all months currently assigned to Schedule #1. Enter a "2" to assign Schedule #2 to the appropriate months. Press <PgDn> when complete. If you decline to enter a second schedule, all months are automatically assigned to the first schedule.

Month Schedule #

Jan	1
Feb	1
Mar	1
Apr	1
May	1
Jun	2
Jul	2
Aug	2
Sep	2
Oct	1
Nov	1
Dec	1

Figure 6-3. Assignment of demand-rate schedules to months.

After completing the initial steps for creating a new file of demand-rate schedules, a menu for editing this file is displayed, as shown in figure 6-4. These menu options allow you to edit, add, or delete demand-rate schedules in the file; reassign the schedules to different months of the year; specify base kW usage; and save the file. Use the cursor to highlight the option desired and press <Enter>, or press the underlined character (shown in red on the screen).

```
Display/edit demand-rate schedule #1
Display/edit demand-rate schedule #2
Add new demand-rate schedule
Delete existing demand-rate schedule
Renumber demand-rate schedules
Assign demand-rate schedules to Months
Specify Base kWh usage (if any) by month
Choose monthly/annual/ratchet demand
Save schedule changes
Quit demand rates, return to main menu
```

Figure 6-4. Menu for editing a file of demand-rate schedules.

Display/edit demand-rate schedule #_ is shown for as many demand-rate schedules as are currently contained in this file. Use this option to view or edit any existing demand-rate schedule.

Add new demand-rate schedule allows you to add another demand-rate schedule (up to six total). Schedule numbers for additional schedules (1-6) are assigned sequentially.

Delete existing demand-rate schedule asks you which schedule number to delete and clears all entries in that schedule. You will be asked to reassign valid demand-rate schedules to the months that had been assigned to the deleted schedule, if any. If you delete a demand-rate schedule from the current file, the schedule numbers will not automatically change to reflect this deletion. You must use the **Renumber demand-rate schedules** option to perform this task. If you do not renumber the schedules, the number of the deleted schedule will be shown on the demand-rate file option menu with the option **Respecify demand-rate schedule #_**. This allows you to enter a new schedule in place of the old one without changing the schedule numbers.

Renumber demand-rate schedules is used to renumber the remaining schedules after one has been deleted; this option renumbers the remaining schedules consecutively and adjusts the assignment of demand-rate schedules to the months of the year accordingly. If no schedule has been deleted, this menu option has no affect on the file.

Assign demand-rate schedules to months allows you to assign schedules to different months of the year. All 12 months of the year must have an assigned schedule before you can save the file. Once the schedules have been assigned to the appropriate months, the assignments are displayed at the top of each demand-rate schedule. The data entry form for assigning schedules to months is shown in figure 6-3.

Specify base kW demand allows you to set up a base monthly kW demand level that will be added to the kW demand being evaluated when computing monthly and annual kW costs, possibly shifting kW demand into higher demand blocks in the demand rate schedule. The screen display for this data entry

form is shown in figure 6-5. This option may be useful if you are interested in calculating the monthly and annual demand charge related to a specific system, based on demand data for that system only in the kWh/kW usage file (as described in section 7) but incorporating the effect of other systems in the same facility in terms of their impact on total kW demand when calculating kW demand charges. For example, monthly kW demand for lighting, cooking, water heating, and other purposes in the same facility can be included as base kW demand in this form. These base kW demand data will be used to adjust the monthly kW demand for the system of interest to the proper block(s), but the *cost of the base demand will NOT be included* in the monthly and annual demand charge that is reported in the ERATES analysis.

Month	kW demand
Jan	0
Feb	0
Mar	0
Apr	0
May	0
Jun	0
Jul	0
Aug	0
Sep	0
Oct	0
Nov	0
Dec	0

Figure 6-5. Base monthly kW demand.

When ERATES calculates monthly demand charges for a given system, given monthly kW demand data for that system in the kWh/kW usage file and base monthly kW demand in the demand rate schedule file, it first calculates the monthly demand charges for the base kW demand data alone; then it calculates the monthly demand charges for the combined base kW demand and system kW demand. ERATES then calculates the demand charges for a given system as the positive difference between those two calculations. (Negative differences, if any, are treated as zero.) When a ratchet provision is used, this may result in unanticipated results; this calculation requires careful analysis to reproduce by hand, especially if some months in the ratchet period have a zero demand charge assigned.

Choose monthly/annual/ratchet demand allows you to re-specify whether the monthly demand charge calculations are to be based on the annual maximum kW demand, monthly maximum kW demand, or the maximum kW demand over a specified number of prior months (ratchet). If you select to use the ratchet method, you will be requested to enter the number of months in the ratchet period.

Save schedule changes allows you to save the new or modified demand-rate schedule to the disk. A DOS-compatible (8-character maximum) file name will be requested. A file name extension of .DMD will automatically be appended to the file name. If the file name specified already exists in the disk directory, a warning will be displayed to the screen. You can overwrite the old file or save the new/modified file under a new file name. If you attempt to return to the main ERATES menu without saving the current file, you will be warned to save the file first.

Quit demand rates returns control to the main ERATES menu.

7. CREATING AND EDITING ELECTRICITY USAGE FILES

Three types of electricity usage files for a specific system, building, or facility can be created and edited with ERATES:

- (1) an **annual TOU kWh usage file** for use with TOU kWh price schedules (extension = .KWA);
- (2) a **monthly TOU kWh usage file**, also for use with TOU kWh price schedules (extension = .KWT); and
- (3) a **"standard" monthly kWh usage file** for use with block-rate kWh price schedules (extension = .KWM).

Both the first and second kWh file types are used only for time-of-use analyses. The monthly TOU kWh usage file is only needed if you require monthly kWh cost detail in the TOU analysis; it requires that the kWh usage for each TOU price code be identified for all 12 months, while the annual TOU kWh usage file requires only total annual kWh usage for each TOU price code.

All three of these file types can also contain the monthly maximum kW demand data that correspond to the monthly kWh usage; the maximum kW demand data are only needed if you want to calculate kW demand costs as well as kWh usage costs. The monthly kW demand data needed for all three of these electricity usage file types are identical. If you include kW demand data, these must correspond to the on-peak periods (if any) designated in the demand rate file to be used. (See section 6 for information regarding the designation of on-peak hours. ERATES only uses the on-peak hour specifications in the demand rate file when analyzing hourly kWh usage files, discussed below.)

A fourth type of electricity usage file, a file of hourly kWh usage for every hour of the year (extension = .KWX), can also be used with ERATES to calculate monthly and annual electricity costs using any of the ERATES rate schedule files. An hourly kWh usage file, requiring 8,760 hours of kWh usage data, must be created and edited outside of ERATES using a computer program or text editor. Most building load simulation programs with hourly time steps can generate hourly kWh usage data for a specific weather year and operating scenario and save them to a text file. You must reformat this text file to ERATES specifications using the information provided in Appendix A before ERATES can read this file. The hourly kWh usage file does not contain kW demand data; monthly maximum kW demands are derived from the hourly kWh usage data.

Important Note: The mapping of TOU rate codes by hour of the day, day of week, and month of year contained in a TOU rate schedule file, as well as the timing of peak demand hours contained in the demand schedule files, are only used with hourly kWh usage files when calculating TOU electricity costs. When you use monthly or annual TOU kWh usage to calculate kWh costs, the TOU mapping is ignored; only the price codes from the TOU rate schedule are used.

To create or edit any one of the first three file types using ERATES, select "Create electricity usage file" from the main menu (see figure 3-1). The next menu requires you to choose between a TOU kWh usage file (either monthly or annual) or a standard monthly kWh usage file for use with block-rate kWh prices.

Create/edit kWh usage/kW demand file for use with:

TOU kWh prices Block-rate kWh prices

Figure 7-1. Menu selection for creating or editing kWh usage files.

If you want to create or edit a kWh usage file for use with TOU prices, a third menu will appear, which requires you to choose between annual and monthly TOU kWh format:

Specify data entry format for TOU kWh usage & kW demand data:

Annual kWh usage/monthly kW demand Monthly kWh usage/monthly kW demand

Figure 7-2. Choose between annual and monthly TOU kWh format.

Finally, you must elect to create a new file or edit an existing file. If you elect to edit an existing file, a display of all of the matching files in the current directory (as specified with the set up utility from the main menu) is provided, from which you can select the file to be edited (highlight with the cursor, then press <Enter>).

Create new file Edit existing file

Figure 7-3. Choose between creating a new file or editing an existing file.

The following subsections describe the data entry forms and data requirements for each of these three kWh usage files.

7.1 Annual TOU Electricity Usage Files

Figure 7-4 shows the data entry form that appears on the screen when you elect to create or edit an annual TOU kWh file. This form shows 12 TOU price codes, labeled A to L. These codes correspond to the price codes in the TOU kWh price schedule that you intend to use with this file. Thus you should only enter kWh usage data for TOU codes that have prices assigned to them in the TOU kWh price schedule. (When you use ERATES to calculate annual electricity costs for an annual TOU kWh usage file and a TOU price schedule, you will get an error message if kWh usage has been assigned to any TOU code that does not have an assigned price.)

Calculating the appropriate kWh for each TOU code can be a complex task. You must know the time periods to which each TOU price code applies as you calculate the kWh usage for a given facility and allocate the kWh usage accordingly. If you are using an hourly load simulation model, it is usually easier to create an hourly kWh usage file and let ERATES allocate the hours using the hourly TOU map in a TOU kWh price schedule. If you do not have an hourly load simulation program, you may calculate kWh usage during each period having an assigned price code. For example, figure 7-4 shows the annual kWh usage, by TOU price code, for a variable-output lighting group which uses 6 kW when fully illuminated: 4,336 kWh during the hours when price code A applies, 18,298 kWh when price code B applies, and 2,726 kWh when price code C applies. Figure 7-4 also shows the corresponding peak kW demand (4 kW from June-September, 6 kW in the other months) for this lighting system. (The data in this example are contained in file DEMO3.KWA, which is distributed with the current version of the ERATES program.)

TOU Code	Annual kWh Usage	Month	Peak kW demand
A	4336	Jan	6
B	18298	Feb	6
C	2726	Mar	6
D	0	Apr	6
E	0	May	6
F	0	Jun	4
G	0	Jul	4
H	0	Aug	4
I	0	Sep	4
J	0	Oct	6
K	0	Nov	6
L	0	Dec	6

File documentation (optional):
demo tou annual kwh _____

Figure 7-4. Data entry form for annual TOU kWh usage and monthly kW demand.

7.2 Monthly TOU Electricity Usage Files

Figure 7-5 shows the data entry form in which monthly kWh usage data are entered. This form is also used to enter corresponding monthly maximum kW demand data. Monthly kWh usage should only be entered for TOU price codes which have assigned kWh prices in the corresponding TOU kWh price schedule. Only TOU price codes A-H are displayed on the screen initially. If more price codes are needed, the form will scroll to the right until the highest code (L) is displayed. (When you use ERATES to calculate electricity costs, you will get an error message if kWh usage has been assigned to any TOU price code that does not have a price assigned in the TOU kWh price schedule.)

Month	Peak kW demand	Number of kWh in each valid TOU price code category, by month							
		A	B	C	D	E	F	G	H
Jan	6	600	1794	0	0	0	0	0	0
Feb	6	576	1560	0	0	0	0	0	0
Mar	6	644	1716	0	0	0	0	0	0
Apr	6	636	1638	0	0	0	0	0	0
May	6	0	1474	920	0	0	0	0	0
Jun	4	0	1224	441	0	0	0	0	0
Jul	4	0	1260	462	0	0	0	0	0
Aug	4	0	1244	483	0	0	0	0	0
Sep	4	0	1240	420	0	0	0	0	0
Oct	6	600	1794	0	0	0	0	0	0
Nov	6	592	1716	0	0	0	0	0	0
Dec	6	688	1638	0	0	0	0	0	0

Figure 7-5. Data entry form for monthly TOU kWh usage and kW demand.

The monthly kWh data shown in the data entry form in figure 7-5 are equivalent to the annual kWh data shown in the form in figure 7-4. The monthly detail is only necessary if monthly subtotals are desired when calculating electricity costs. (The monthly maximum kW demand data are the same in both files.) For these two examples, the computed annual electricity cost will be identical. This monthly TOU kWh file is saved as DEMO3.KWT on the ERATES disk. You can examine the contents of this file by selecting "Create electricity usage file" from the main ERATES menu; selecting TOU kWh files from the second menu; selecting monthly TOU kWh files from the third menu; then selecting "edit file" from the last menu. If you open this file in the edit mode, do not resave it under the same file name unless you are sure that you have not changed any data. An example of annual electricity cost calculations using this file is included in section 8.

7.3 Standard Monthly kWh/kW Usage Files

A file of monthly kWh usage data (and corresponding peak kW demand, if needed) for a specific end use and operating scenario can be created (or edited) for use in calculating monthly and annual electricity costs. These files are referred to as "standard" monthly kWh/kW usage files in ERATES (to differentiate them from TOU kWh usage files) and always have the file name extension .KWM. This extension is automatically appended to the file name when the file is created in the ERATES environment. These files can only be used to support block-rate kWh price and demand charge (kW) calculations. They cannot be used with TOU kWh price schedules because the latter require kWh consumption data subdivided by TOU price code in order to compute kWh costs.

To create a standard monthly kWh/kW usage file, select "Create Electricity Usage file" from the ERATES main menu; select "Block-rate kWh price schedule" from the second menu; then select "Create New File" from the third menu. Figure 7-6 shows the data entry form which appears on the screen, allowing you to enter both the kWh and maximum kW amounts for each month. If you are only interested in calculating kWh costs you can leave the monthly maximum kW demand at zero. After entering each amount, press <Enter>. You can also use the up and down arrow keys and the <Tab> key to move from field to field. There are three lines at the bottom of the data entry form which allow you to enter documentation data related to this file. This documentation might include the name and location of the facility and additional identification related to the energy usage scenario represented by this schedule.

Month	Monthly kWh Usage	Peak kW demand
Jan	2394	6
Feb	2136	6
Mar	2360	6
Apr	2274	6
May	2394	6
Jun	1665	4
Jul	1722	4
Aug	1727	4
Sep	1660	4
Oct	2394	6
Nov	2308	6
Dec	2326	6

File documentation (optional):
demo 3 test month kwh/kw usage

Figure 7-6. Data entry form for standard monthly kWh/kW usage file.

Press <PgDn> when the data entry form for the monthly kWh/kW data is completed. A DOS-compatible (8-character maximum) file name will be requested for saving the file. A file name extension of .KWM will automatically be appended to the file name. If the file name specified already exists in the disk directory, a warning will be displayed to the screen. You can overwrite the old file or save the new/modified file under a new file name. Press <Esc> if you do not wish to save the file.

To view or edit a standard monthly kWh/kW usage file, select "Create Electricity Usage file" from the main ERATES menu; select "Block Rates" from the second menu; then select "Edit Existing File" from the third menu. A list of all of the available files with the extension .KWM will be shown. Highlight the file to be edited with the cursor and press <Enter>. The data in the file will be displayed as shown in figure 7-6. Press <PgDn> to re-save the file (after editing) or <Esc> to return to the main menu.

Remember that base kWh usage and base kW demand for the facility can be included in the files of block-rate kWh price schedules and demand-rate schedules, respectively. Therefore the standard monthly kWh/kW usage file should include only the kWh usage and kW demand for which you want to calculate monthly and annual costs. The base usage and demand amounts are used to adjust the total kWh usage/kW demand in each month so that costs will be computed from the correct price blocks. But the costs reported in the cost calculations are for the kWh/kW amounts included in the standard monthly kWh/kW usage file only.

8. CALCULATING ANNUAL ELECTRICITY COSTS

Calculation of electricity usage costs is based on electricity usage data for a specified facility and appropriate rate schedules (a kWh price schedule and (optionally) a kW demand rate schedule), all of which can be created with ERATES. In addition to TOU kWh usage files and standard monthly kWh usage files (all of which can contain monthly maximum kW demand data as well), electricity cost calculations can also be based on hourly kWh usage files (8,760 hours of operation, 8,784 hours during leap years). These hourly kWh files must be created outside of the ERATES environment. See Appendix A for information on the format requirements of hourly kWh files.

If kW demand charges are included in the cost computations, monthly and annual kW demand charges are calculated identically for all four types of electricity usage files, with one exception: When hourly kWh files are used, the maximum kW demand is assumed to be identical to the monthly maximum kWh usage, but only for those hours designated as "on-peak" in the kW demand schedule and only for weekdays if so designated when running the analysis. Once the monthly maximum kW demands have been derived from the hourly kWh file, the method for computing kW demand charges is identical to the method used for monthly kW demand data specified directly by the user. When calculating a monthly kW demand charge with annual maximum kW or a ratcheted maximum kW, the current monthly kW rate is applied to that kW demand, regardless of the month in which it actually occurred.

Demand charge calculations cannot be made alone in ERATES; they must be combined with an analysis of kWh usage costs. If monthly base kW demand amounts are included in the demand-rate file, the monthly base kW demand will be added to the monthly maximum kW demand of the system being evaluated to determine the appropriate kW charges. However, the cost of the base kW demand will not be reported. The monthly and annual kW charges reported include only costs over and above the cost of the base kW demand, calculated using the same rate schedule. Note that the monthly base kW demand is assumed to occur at the same time as the monthly maximum demand for the system being evaluated. This may not always be a valid assumption and may require additional analysis if the base demand and the system demand are not directly additive.

Note: If the computation of demand charges is based on the annual maximum kW demand or on kW demand in prior months due to the use of a ratchet provision, rather than the maximum kW demand in the billing month, it is possible that there will be no demand charge for that month attributed to the system being evaluated when monthly base kW demand amounts are included in the analysis. When the maximum kW demand imposed by a system occurs in a different month than the maximum base kW demand of the facility in which it is located, the system may not increase the overall maximum kW demand of the facility during the relevant months and therefore would not incur an additional demand charge for the billing month.

To calculate electricity costs, first select "Calculate Annual Electricity Cost" from the main ERATES menu. (See figure 3-1.) You will be asked if the calculations are to include demand charges. Answer "Y" for Yes, "N" for No. If you respond positively, you will be asked to select the demand-rate file to be used in the calculations from the list of all available demand-rate files displayed on the screen (i.e., files with file name extension .DMD). Highlight the desired file and press <Enter>.

Next, you must indicate whether you want to base the kWh cost calculations on TOU kWh prices or block-rate kWh prices, as shown in figure 8-1. Highlight your choice and press <Enter> or press the

underlined character (shown in red on the screen). Depending on your choice, you will have different options with regard to the electricity usage files to be used in the cost analysis.

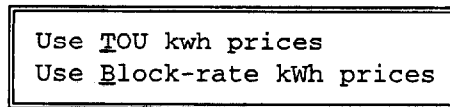


Figure 8-1. Selecting the type of price schedule to use in calculating kWh costs.

8.1 Cost Calculations Based on Time-of-Use kWh Prices

You can compute monthly and annual electricity costs using a file of TOU kWh price schedules (extension = .TOU) together with one of three different kWh usage files: an hourly kWh file (extension = .KWX), a monthly TOU kWh file (extension = .KWT), or an annual TOU kWh file (extension = .KWA). If you want to include demand charges in these calculations, you must also have a demand rate schedule (extension = .DMD), and if you are using a monthly or annual TOU kWh usage file it must include monthly maximum kW demand data. The kWh usage data in an hourly kWh file serve as the basis for both kWh usage and kW demand; the maximum kW demand will be determined by the maximum hourly kWh usage during the designated on-peak hours only.

Select the type of kWh usage file on which the cost calculations will be based. This selection menu is shown in figure 8-2. Highlight your choice and press <Enter> or press the underlined character (shown in red on the screen).

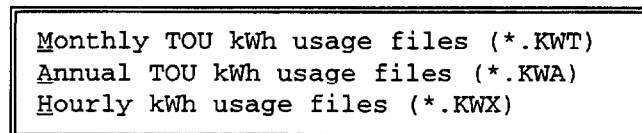


Figure 8-2. Selection of electricity usage file type for TOU cost calculations.

Next a list of available electricity usage files of the type selected will be displayed to the screen. Highlight the desired file and press <Enter>. Then a list of available files with TOU kWh price schedules will be displayed to the screen; highlight the desired file and press <Enter>. (Except for the demonstration files included with ERATES, these are files that you have prepared yourself.)

8.1.1 Hourly kWh usage files

If you are using hourly kWh usage files as the basis of your TOU cost calculations you must designate the day of the week to be assigned to January 1 (the first day of the kWh consumption data in the file). Figure 8-3 shows that this selection can be any day of the week or "non-day specific." Highlight the desired choice with the cursor and press <Enter>. If a day of the week is specified, this information will be used to select the appropriate time-of-use price and to determine whether the maximum kW demand occurs on a weekday or weekend. If "non-day specific" is selected, kWh cost calculations for any given hour of the day will be based on the average weekly kWh price at that hour (i.e., the daily prices at that

hour averaged over the seven days of the week), and maximum kW demand will be based on the maximum hourly kW demand during on-peak periods, regardless of the day of the week on which it falls. Declaration of a specific day of the week may be important when conducting an analysis of energy usage schedules representing "before" and "after" scenarios in which energy usage is shifted from on-peak periods to off-peak periods.

<u>N</u> on-day specific
<u>S</u> unday
<u>M</u> onday
<u>T</u> uesday
<u>W</u> ednesday
<u>T</u> hursday
<u>F</u> riday
<u>S</u> aturday

Figure 8-3. Declaration of day of week for January 1.

If a specific day of the week is assigned to January 1, and you have elected to include demand costs in the analysis, an additional question will be asked:

Include weekend as on-peak time period for demand charges (Y/N)?

Answer "Y" if on-peak hours occur on every day of the week. In this case, the search for the maximum hourly kWh usage (the proxy for maximum kW demand) in each month will be made on every day of the month. Answer "N" if you do not want to include weekends when searching for the maximum hourly kWh consumption. (Note that ERATES does not consider holidays in the calculations.)

Finally, you must indicate whether the cost report is to be sent to the screen, printer, or a disk file of your choosing. If you choose to send the report to a disk file, you must supply a valid DOS file name. The file will be saved to the directory that you designated the last time you used the "Set Up" option in the main menu.

Figure 8-4 shows the ERATES calculation of monthly and annual kWh costs and demand charges using hourly kWh data from file DEMO3.KWX with TOU kWh prices from file DEMO3.TOU and demand rates from file DEMO3.DMD. The TOU kWh price schedules shown in figures 4-3 and 4-4 were used in the calculation of these kWh costs. The demand-rate schedules shown in figures 6-1 and 6-2 were used to calculate the monthly demand charges, based on monthly maximum kW demand.

Note that the *average* monthly kWh cost and *marginal* maximum kW demand price are reported in ERATES cost reports when using TOU kWh prices (see figure 8-4). A marginal kWh cost cannot be calculated on a monthly (or annual) basis when using TOU kWh prices because this cost changes from hour to hour. However, kW demand costs are calculated on a monthly maximum basis using block rates. Therefore the marginal cost of maximum kW demand is meaningful, in that it represents the price of the last unit of kW demand each month and thus the potential value of a kW of demand that can be scaled back by demand-side management techniques during on-peak demand periods.

Electricity costs using hourly kWh consumption from file DEMO3.KWX
 TOU rates from file DEMO3.TOU; Demand rates from file DEMO3.DMD

Month	----- kWh Usage and Cost -----			---- kW Demand and Cost ----			Total Cost
	kWh Use	Total	Average	Peak kW	Total	Marginal	
1	2,394	\$135.64	\$0.0567	6.0	\$60.00	\$10.00	\$195.64
2	2,136	\$120.88	\$0.0566	6.0	\$60.00	\$10.00	\$180.88
3	2,360	\$132.28	\$0.0561	6.0	\$60.00	\$10.00	\$192.28
4	2,274	\$127.36	\$0.0560	6.0	\$60.00	\$10.00	\$187.36
5	2,394	\$236.44	\$0.0988	6.0	\$90.00	\$15.00	\$326.44
6	1,665	\$149.59	\$0.0898	6.0	\$90.00	\$15.00	\$239.59
7	1,722	\$154.90	\$0.0900	6.0	\$90.00	\$15.00	\$244.90
8	1,727	\$157.09	\$0.0910	6.0	\$90.00	\$15.00	\$247.09
9	1,660	\$147.40	\$0.0888	6.0	\$90.00	\$15.00	\$237.40
10	2,394	\$135.64	\$0.0567	6.0	\$60.00	\$10.00	\$195.64
11	2,308	\$130.72	\$0.0566	6.0	\$60.00	\$10.00	\$190.72
12	2,326	\$128.92	\$0.0554	6.0	\$60.00	\$10.00	\$188.92
Total	25,360	\$1,756.86	\$0.0693	n/a	\$870.00	n/a	\$2,626.86

Annual maximum kW demand used. On-peak hours occur on weekdays only.
 Jan 1 = Sunday. Customer charge included in kWh cost.

Figure 8-4. Electricity cost calculations based on TOU kWh prices with a file of hourly kWh usage data.

8.1.2 Monthly and annual electricity usage files

Once you have elected to use either monthly or annual TOU kWh usage files, the only remaining step is to indicate whether the cost report is to be sent to the screen, printer, or a disk file. If you choose to send the report to a disk file, you must supply a valid DOS file name. The file will be saved to the directory that you designated the last time you used the "Set Up" option.

Figure 8-5 shows the ERATES calculation of monthly and annual kWh costs and demand charges, based on monthly TOU kWh usage and maximum kW demand data from file DEMO3.KWT, TOU kWh prices from file DEMO3.TOU, and demand rates (kW prices) from file DEMO3.DMD. The TOU kWh price schedules shown in figures 4-3 and 4-4 were used in the calculation of kWh costs. The demand-rate schedules shown in figures 6-1 and 6-2 were used to calculate the monthly demand charges, using monthly maximum kW demand. The monthly kWh usage and corresponding kWh costs are the same for this example as in the hourly example shown in figure 8-4. This is because the hourly kWh data in file DEMO3.KWX (the file used in the hourly example) were summed to monthly subtotals, by TOU price code, and saved as file DEMO3.KWT. (This operation was performed manually; ERATES does not have such a conversion capability.) The monthly and annual kW demand charges are identical to the hourly TOU example shown in figure 8-4 because the monthly maximum kW demands used in file DEMO3.KWT were derived from hourly file DEMO3.KWX.

Electricity costs using kWh/kW consumption data from file DEMO3.KWT
 TOU rates from file DEMO3.TOU; Demand rates from file DEMO3.DMD

Month	kWh Use	Total	Average	Peak kW	Total	Marginal	Total Cost
1	2,394	\$135.64	\$0.0567	6.0	\$60.00	\$10.00	\$195.64
2	2,136	\$120.88	\$0.0566	6.0	\$60.00	\$10.00	\$180.88
3	2,360	\$132.28	\$0.0561	6.0	\$60.00	\$10.00	\$192.28
4	2,274	\$127.36	\$0.0560	6.0	\$60.00	\$10.00	\$187.36
5	2,394	\$236.44	\$0.0988	6.0	\$90.00	\$15.00	\$326.44
6	1,665	\$149.59	\$0.0898	6.0	\$90.00	\$15.00	\$239.59
7	1,722	\$154.90	\$0.0900	6.0	\$90.00	\$15.00	\$244.90
8	1,727	\$157.09	\$0.0910	6.0	\$90.00	\$15.00	\$247.09
9	1,660	\$147.40	\$0.0888	6.0	\$90.00	\$15.00	\$237.40
10	2,394	\$135.64	\$0.0567	6.0	\$60.00	\$10.00	\$195.64
11	2,308	\$130.72	\$0.0566	6.0	\$60.00	\$10.00	\$190.72
12	2,326	\$128.92	\$0.0554	6.0	\$60.00	\$10.00	\$188.92
Total	25,360	\$1,756.86	\$0.0693	n/a	\$870.00	n/a	\$2,626.86

Annual maximum kW demand used.
 Customer charge included in kWh cost.

Figure 8-5. Electricity cost calculations based on TOU kWh prices with a file of monthly kWh usage/kW demand data.

Figure 8-6 shows the ERATES calculation of annual kWh costs and monthly demand charges, based on annual TOU kWh usage data and monthly kW demand data from file DEMO3.KWA, TOU kWh prices from file DEMO3.TOU, and demand rates from file DEMO3.DMD. The TOU kWh price schedules shown in figures 4-3 and 4-4 were used in the calculation of kWh costs. The demand-rate schedules shown in figures 6-1 and 6-2 were used to calculate the monthly demand charges, using monthly maximum kW demand. The annual kWh cost in figure 8-6 is identical to the annual kWh cost based on monthly TOU kWh usage (figure 8-5) because the annual kWh usage (by TOU price code) is the sum of the monthly kWh usage in that example. Note that the monthly kW demand costs are the same in both examples since the kW demand data in both files are identical.

8.2 Cost Calculations Based on Block-Rate kWh Prices

You can compute monthly and annual electricity costs using a file of block-rate kWh price schedules together with one of two different electricity usage files: a standard monthly kWh file or an hourly kWh file. If you want to include demand charges in these calculations, you must also have a demand rate file, and if you are using a standard kWh usage file it must include monthly maximum kW demand data. The hourly kWh usage in an hourly kWh file serves as the basis for both kWh usage and kW demand. If you use an hourly kWh file the maximum kW demand will be determined by the maximum hourly kWh usage during the designated on-peak hours only.

Electricity costs using kWh/kW consumption data from file DEMO3.KWA
 TOU rates from file DEMO3.TOU; Demand rates from file DEMO3.DMD

Month	----- kWh Usage and Cost -----			---- kW Demand and Cost ----			Total Cost
	kWh Use	Total	Average	Peak kW	Total	Marginal	
1				6.0	\$60.00	\$10.00	
2				6.0	\$60.00	\$10.00	
3				6.0	\$60.00	\$10.00	
4				6.0	\$60.00	\$10.00	
5				6.0	\$90.00	\$15.00	
6	(monthly data not available)			6.0	\$90.00	\$15.00	
7				6.0	\$90.00	\$15.00	
8				6.0	\$90.00	\$15.00	
9				6.0	\$90.00	\$15.00	
10				6.0	\$60.00	\$10.00	
11				6.0	\$60.00	\$10.00	
12				6.0	\$60.00	\$10.00	
Total	25,360	\$1,756.86	\$0.0693	n/a	\$870.00	n/a	\$2,626.86

Annual maximum kW demand used.
 Customer charge included in kWh cost.

Figure 8-6. Electricity cost calculations based on TOU kWh prices with a file of annual kWh usage/monthly kW demand data.

After you elect to calculate electricity costs from the main menu, you must select the type of kWh usage file on which the cost calculations will be based. This selection menu is shown in figure 8-7. Highlight your choice and press <Enter> or press the underlined character (shown in red on the screen). Whether you choose a monthly file (extension .KWM) or an hourly file (extension .KWX), a list of available files of the type designated will be displayed to the screen; select the file by highlighting its name and pressing <Enter>. Then a list of available files with block-rate kWh schedules will be displayed to the screen (extension .BLK); again select the appropriate file for use in the cost analysis.

<u>S</u> tandard monthly kWh/kW usage files (*.KWM) <u>H</u> ourly kWh usage files (*.KWX)

Figure 8-7. Selection of electricity usage file type for block-rate kWh cost calculations.

If you choose to use an hourly kWh usage file, and you have indicated that you want to calculate demand costs, you must designate the day of the week to be assigned to January 1. Figure 8-1 shows that this selection can be any day of the week or "non-day specific". Highlight the desired choice with the cursor and press <Enter>. If the day of the week is specified, this information will be used to determine whether the maximum kW demand occurs on a weekday or weekend. If "non-day specific" is selected, the maximum kW demand during on-peak hours will be found each month, regardless of whether it occurs on a weekday or weekend. Declaration of a specific day of the week may be important when conducting an analysis of energy usage files representing "before" and "after" scenarios in which maximum demand is shifted from on-peak periods to off-peak periods.

If a specific day of the week is assigned to January 1, then an additional question will be asked:

Include weekend as on-peak time period for demand charges (Y/N)?

Answer "Y" if on-peak hours occur on every day of the week. In this case, the search for the maximum hourly kWh usage (the proxy for maximum kW demand) in each month will be made over every day of the month. Answer "N" if you do not want to include weekends when searching for the maximum hourly kWh consumption. Note that ERATES does not consider holidays as weekends.

Finally, you must indicate whether the cost report is to be sent to the screen, printer, or a disk file. If you choose to send the report to a disk file, you must supply a valid DOS file name. The file will be saved to the directory that you designated the last time you used the "Set Up" option.

Figure 8-8 shows the ERATES calculation of monthly and annual kWh costs and demand charges using monthly kWh and kW demand data from file DEMO3.KWM, block-rate kWh prices from file DEMO3.BLK, and demand rates (kW prices) from file DEMO3.DMD. The monthly kWh usage and maximum kW demand data in DEMO3.KWM is the same as shown in figures 8-4 and 8-5 for DEMO3.KWT and DEMO3.KWA, respectively. Figures 5-1 and 5-2 show the block-rate schedules included in DEMO3.BLK. The demand-rate schedules shown in figures 6-1 and 6-2 (file DEMO3.DMD) were used in the calculation of monthly and annual demand charges, using monthly maximum kW demand rather than the annual maximum. While the kWh usage is the same in figures 8-4 and 8-5, the monthly kWh costs are different because a different rate schedule is used.

Exactly the same cost calculations would result if the cost analysis shown in figure 8-8 had been performed with hourly kWh file DEMO3.KWX, DEMO3.BLK, and DEMO3.DMD. This is because the monthly kWh usage and kW demand data in DEMO3.KWM were derived from the hourly data in DEMO3.KWX.

Figure 8-8 shows *marginal* unit costs for kWh usage and kW demand for each month. These marginal costs represent the price of the last kWh used and of the maximum kW of demand for that month. Marginal cost calculations are important in the analysis of conservation and demand-side management (DSM) investments because they represent the price of the units actually saved each month. Note there is no annual marginal price since these charges are levied on a monthly basis.

Electricity costs using monthly kWh/kW consumption data from file DEMO3.KWM
 Block rates from file DEMO3.BLK; Demand rates from file DEMO3.DMD

Month	----- kWh Usage and Cost -----			----- kW Demand and Cost -----			Total Cost
	kWh Use	Total	Marginal	Peak kW	Total	Marginal	
1	2,394	\$152.70	\$0.0500	6.0	\$60.00	\$10.00	\$212.70
2	2,136	\$139.80	\$0.0500	6.0	\$60.00	\$10.00	\$199.80
3	2,360	\$151.00	\$0.0500	6.0	\$60.00	\$10.00	\$211.00
4	2,274	\$146.70	\$0.0500	6.0	\$60.00	\$10.00	\$206.70
5	2,394	\$152.70	\$0.0500	6.0	\$90.00	\$15.00	\$242.70
6	1,665	\$129.55	\$0.0700	4.0	\$60.00	\$15.00	\$189.55
7	1,722	\$133.54	\$0.0700	4.0	\$60.00	\$15.00	\$193.54
8	1,727	\$133.89	\$0.0700	4.0	\$60.00	\$15.00	\$193.89
9	1,660	\$129.20	\$0.0700	4.0	\$60.00	\$15.00	\$189.20
10	2,394	\$152.70	\$0.0500	6.0	\$60.00	\$10.00	\$212.70
11	2,308	\$148.40	\$0.0500	6.0	\$60.00	\$10.00	\$208.40
12	2,326	\$149.30	\$0.0500	6.0	\$60.00	\$10.00	\$209.30
Total	25,360	\$1,719.48	n/a	n/a	\$750.00	n/a	\$2,469.48

Monthly maximum kW demand used.
 Customer charge included in kWh cost.

Figure 8-8. Electricity cost calculations based on block-rate kWh price schedules.

If monthly base kWh usage is included in the block-rate file for kWh prices, the base usage will be added to the kWh usage in the standard monthly kWh/kW file to determine the appropriate kWh price blocks. Only the cost of the kWh usage in the standard monthly kWh/kW file will be reported, not the cost of the base usage. The kWh cost reported is the cost over and above the cost of the base kWh usage. Similarly, if monthly base kW demand amounts are included in the demand-rate file, the monthly base kW demand will be added to the maximum kW demand of the system being evaluated (either directly from a monthly kWh/kW file or derived from an hourly kWh file) to determine the correct block charges. The cost of the base kW demand will not be reported. See the introduction to section 8 to learn more about the use of base kW demand in a demand rate file.

APPENDIX A. FORMAT FOR HOURLY KWH USAGE FILES

Two different formats are available for creating hourly kWh usage files that are readable by ERATES. Each format can include or exclude a leap year day (February 29). ERATES can distinguish formats by the number (integer) on line 4. Format 1 requires this number to represent the number of days in the year (365 or 366 for leap year). See file DEMO3.KWX for an example. Format 2 requires this number to represent the number of hours in the year (8760 or 8784 for leap year). See file DEMO2.KWX for an example. No other number on this line is acceptable. These files can be created by a text editor or by a computer program which contains these formatting requirements. They cannot be created or edited by ERATES.

Format 1: one line of hourly kWh consumption data for each day of the year:

description

```

line 1: "identification 1"           First three lines must be in quotes (" "); leave
line 2: "identification 2"           line blank if no identification is necessary.
line 3: "identification 3"
line 4: 365                          number of days in year (use 366 for leap year).
line 5: month(1), day(1), kwh(1), kwh(2), ...kwh(24)
line 6: month(1), day(2), kwh(1), kwh(2), ...kwh(24)

line 35: month(1), day(31), kwh(1), kwh(2), ...kwh(24)
line 36: month(2), day(1), kwh(1), kwh(2), ...kwh(24)

line 63: month(2), day(28), kwh(1), kwh(2), ...kwh(24)

line 339: month(12), day(1), kwh(1), kwh(2), ...kwh(24)
line 369: month(12), day(31), kwh(1), kwh(2), ...kwh(24)

where month(1) = 1, 2, ..., 12
      day(1) = 1, 2, 3, ..., 28/29/30/31 (as appropriate in month(m))
      kwh(i) = kWh consumption in hour h, h = 1, 2, ..., 24

```

Example:

```

"test building, case 1"
"location: Bethesda, MD"
"year: 1993"
365
1 1 3.0 3.0 3.0 3.0 3.0 3.0 10.0 10.0 10.0 10.0 10.0 10.0 8.0 8.0 8.0 8.0 8.0 5.0 5.0 5.0
5.0 5.0 5.0 5.0
1 2 3.0 3.0 3.0 3.0 3.0 3.0 10.0 10.0 10.0 10.0 10.0 10.0 8.0 8.0 8.0 8.0 8.0 5.0 5.0 5.0
5.0 5.0 5.0 5.0
1 3 3.0 3.0 3.0 3.0 3.0 3.0 10.0 10.0 10.0 10.0 10.0 10.0 8.0 8.0 8.0 8.0 8.0 5.0 5.0 5.0
5.0 5.0 5.0 5.0
. . . . .
1 31 3.0 3.0 3.0 3.0 3.0 3.0 10.0 10.0 10.0 10.0 10.0 10.0 8.0 8.0 8.0 8.0 8.0 5.0 5.0 5.0
5.0 5.0 5.0 5.0
2 1 3.0 3.0 3.0 3.0 3.0 3.0 10.0 10.0 10.0 10.0 10.0 10.0 8.0 8.0 8.0 8.0 8.0 5.0 5.0 5.0
5.0 5.0 5.0 5.0
. . . . .
2 28 3.0 3.0 3.0 3.0 3.0 3.0 10.0 10.0 10.0 10.0 10.0 10.0 8.0 8.0 8.0 8.0 8.0 5.0 5.0 5.0
5.0 5.0 5.0 5.0
. . . . .
12 1 3.0 3.0 3.0 3.0 3.0 3.0 10.0 10.0 10.0 10.0 10.0 10.0 8.0 8.0 8.0 8.0 8.0 5.0 5.0 5.0
5.0 5.0 5.0 5.0

```

.
12 31 3.0 3.0 3.0 3.0 3.0 3.0 10.0 10.0 10.0 10.0 10.0 10.0 8.0 8.0 8.0 8.0 8.0 5.0 5.0 5.0
5.0 5.0 5.0 5.0

Note: If February 29 is to be included, change "365" to "366" and add the corresponding line of kWh consumption immediately after February 28. If month order and day order do not follow the standard calendar convention, the file cannot be read. Spaces or commas can serve as delimiters between numbers (but do not use a comma at the end of a line of data).

Format 2: Hour number and kWh usage entered in pairs, one pair per line:

	<u>description</u>
line 1: "identification 1"	First three lines must be in quotes (" "); leave line blank if no identification is necessary.
line 2: "identification 2"	
line 3: "identification 3"	
line 4: 8760	8760 = number of hours in year (use 8784 for leap year)
line 5: 1 kWh(1)	hour number, kwh usage for this hour.
line 6: 2 kWh(2)	
line 7: 3 kWh(3)	
.	
.	
.	
line 8764: 8760 kWh(8760)	

If hours are not numbered sequentially or any hours are missing, ERATES cannot read the file. Spaces or commas can serve as delimiters between numbers, but do not place a comma at the end of a line of data.

Example:

```
"test building, case 1"
"location: Bethesda, MD"
"year: 1993"
8760
  1  3.0
  2  3.0
  3  3.0
  .  .
  .  .
8759 5.0
8760 5.0
```


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