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ERATES: A Computer Program for Calculating Time-of-Use, Block, and Demand Charges for Electricity Usage (Version 1.0)

User's Guide and Reference Manual

Stephen R. Petersen

U.S. DEPARTMENT OF COMMERCE
Technology Administration
National Institute of Standards
and Technology
Office of Applied Economics
Computing and Applied Mathematics Laboratory
Gaithersburg, MD 20899

Sponsored by
Federal Energy Management Program
U.S. Department of Energy
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July 1993



U.S. DEPARTMENT OF COMMERCE
Ronald H. Brown, Secretary

**NATIONAL INSTITUTE OF STANDARDS
AND TECHNOLOGY**
Arati Prabhakar, Director

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 electric utility rate schedules. Both kWh usage and maximum 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 set up time-of-use-rate schedules, block-rate 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, with or without a hard disk. ERATES block-rate and demand-rate schedules can be imported by the NIST BLCC 4.0 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.

Note: ERATES is a public domain program, not subject to copyright. It may be freely copied and distributed. However, it is requested that attribution be given to the National Institute of Standards and Technology.

The author has made a concerted effort to produce a computer program that works as intended and is free from error. However, NIST makes no guarantee that ERATES is free of errors and assumes no responsibility or liability for the accuracy of this program or for the results which may come from its use.

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-rate schedules, block-rate 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 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:

Advanced Sciences, Inc.
2000 North 15th Street
Suite 407
Arlington, VA 22201
(703) 243-4900

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

PC Software Interest Group
1030D East Duane Avenue
Sunnyvale, CA 94086
(408) 730-9291

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

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1. INTRODUCTION

1.1 Overview

ERATES (Electricity Rates) is a computer program for calculating the monthly and annual electricity costs for a facility, building, or system under a wide range of electric utility 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 set up time-of-use- (TOU-) rate schedules, block-rate schedules, and demand-rate 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 set up experimental rate schedules to estimate their impact on electricity costs under varying usage and demand patterns. Block-rate 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. 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.

Utility 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 utility rate schedules, and is not intended for use by utilities in setting up or administering such schedules.

Before you can compute the monthly and annual electricity costs for a facility, building, or system with ERATES, you must have a minimum of a kWh rate file (either TOU or block) and a file of kWh usage data (either monthly or hourly) 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, unless you use hourly kWh consumption data. (When hourly kWh data are used, the monthly maximum kW is assumed to be the same as the maximum hourly kWh consumption during designated on-peak hours.)

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

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 explain the five main functions of the program: setting up (1) time-of-use-rate schedules, (2) block-rate schedules, and (3) demand-rate schedules; (4) creating a monthly kWh/kW usage file for a specific application; and (5) computing the monthly and annual electricity costs for a specific application. Appendix A provides the file format for both the monthly kWh/kW and 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 you enter a file name for saving a file.

Table 1-1 Filename extensions used by ERATES

<u>File name</u> <u>Extension</u>	<u>File type</u>
.BLK	Block-rate files (kWh)
.DMD	Demand-rate files (kW)
.EXE	Executable program (ERATES only)
.KWM	Monthly kWh/kW usage files (for calculating monthly and annual electricity costs)
.KWX	Hourly kWh usage files (for calculating monthly and annual electricity costs)
.TOU	Time-of-use-rate files (kWh)

2. INSTALLING ERATES

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

- (1) 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.
- (2) Type **CD \ERATES** to make this the current directory.
- (3) 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:*.***).
- (4) Type **ERATES** at the ready prompt to start ERATES.

Note: If you are going to use ERATES with BLCC 4.0, you can install and run ERATES in the BLCC4 subdirectory.

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

- (1) Make a back-up copy of the ERATES diskette. If you are going to run ERATES in a high-density (1.2 MB) disk drive, copy ERATES to a high-density diskette formatted on that drive.

IMPORTANT: ERATES writes temporary and permanent files to the disk. If you use the original double-density (360K) diskette in a high-density drive, you may destroy the original disk during the write process.

- (2) Insert your new copy of the ERATES diskette into a floppy drive (e.g., A).
- (3) Make the floppy drive the current drive (e.g., type **A:**).
- (4) 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 should therefore save your own 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 4.0 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 monthly kWh/kW usage with ERATES.

There are several 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 are files:

DEMO1.BLK	DEMO.KWM
DEMO1.TOU	DEMO1.KWX
DEMO1.DMD	DEMO2.KWX

3. RUNNING ERATES

ERATES is a menu driven program which allows you to enter relevant data related to rate schedules and electricity usage patterns and which can be used to calculate monthly and annual electricity costs. To run ERATES, type ERATES at the DOS ready prompt. When you are making menu choices, you generally highlight the menu choice with the cursor and press <Enter>. Alternatively, just press the character corresponding to the highlighted character in each menu choice. From menu displays you can generally press <Esc> to return to the previous screen. ERATES displays a number of different 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.

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.

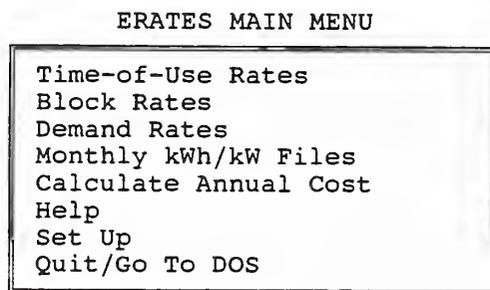


Figure 3-1. ERATES main menu.

The first three menu choices are used to create or edit electricity rate files for the specific location and customer type to be used in the electricity cost calculations. Time-of-use-rate files, block-rate files, and demand-rate files are discussed in detail in sections 4, 5, and 6, respectively. 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-rate 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 within ERATES, you must have hourly kWh usage data for an entire year in an ERATES-compatible data file. (See section 8.2.)

Block-rate 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 schedules specify the price per kW of maximum power demand by the customer and are usually levied 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 on-peak 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.)

Select **Monthly kWh/kW Files** to set up a monthly kWh usage and kW demand schedule for a year. This file serves as the basis for calculating monthly and annual electricity costs using block-rate and demand-rate files (but not with TOU files, which require hourly data). Section 7 provides details on how to set up the monthly kWh/kW file.

Select **Calculate Annual Cost** to perform the calculation of monthly and annual electricity costs, once you have established the monthly or hourly kWh usage schedule and the appropriate rate schedules. ERATES calculations are discussed in section 8.

Select **Help** 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.

Use **Set Up** 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.

Use **Quit** to terminate the ERATES program and return to DOS.

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 3-2. 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.¹ 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 specify the name of a subdirectory that does not exist, you will not be able to save the set up information.

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

Figure 3-2. ERATES Set Up screen.

Set Up also permits you to enter an alternative specification for the monitor that you are using. Some monitors (especially monitors which do not display colors well) can be made more readable by selecting the E option for color emulation.

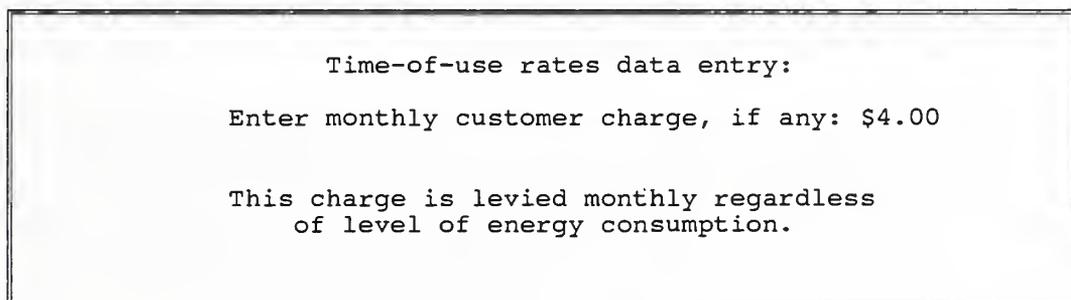
Press <PgDn> to save any changes you make to the Set Up screen, <Esc> to return to the main menu without saving changes. If you save the changes, they are written to file SETUPER.FIL, which should always be in the same subdirectory as the ERATES program.

¹ 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.

4. CREATING AND EDITING TIME-OF-USE-RATE SCHEDULES FOR KWH PRICES

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 set up to 12 price codes to designate hourly kWh prices. You then assign these price codes to each hour of each day 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 TOU-rate file, select "Time-of-use Rates" from the main ERATES menu; then select "Create New File" from the secondary 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: $4.00

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 kWh prices to these codes before you can assign the codes to specific hours of the day and week in the weekly TOU schedule. However, even after you have assigned price codes 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. You must assign prices to at least two price codes; up to 12 prices can be assigned. Figure 4-2 shows five different prices assigned to codes A through E.

Press <PgDn> when data entry is completed. Note that you can always return to a previous screen by pressing <Esc>.

Price Code	kWh Price
A	\$0.0400
B	\$0.0600
C	\$0.0800
D	\$0.1000
E	\$0.2000
F	\$
G	\$
H	\$
I	\$
J	\$
K	\$
L	\$

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

Before a new weekly TOU schedule is displayed to the screen, you will be asked to identify the predominant 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 this code.

Figure 4-3 shows the screen display for a weekly TOU schedule, with the data entry form confined to the box in the lower left corner, labeled with days of the week and hours of the day. When the TOU schedule is first displayed, it is filled out with the price code that you designated as predominant. You must change the code in each hour that has a different kWh price by entering one of the valid price codes displayed at the right side of the display. Use the cursor to mark 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 7 p.m. (13 hours total), Monday through Friday, will be charged at \$0.10/kWh (code D). All other hours will be charged at \$0.04/kWh (code A).

WEEKLY SCHEDULE #1

Assign valid price code (see box at right) to each hour of each day of the week below.

Hour of Day (1-24)
1
2
123456789012345678901234

Day of Week:	<pre> MONDAY AAAAAADDDDDDDDDDDDDA TUESDAY AAAAAADDDDDDDDDDDDDA WEDNESDAY AAAAAADDDDDDDDDDDDDA THURSDAY AAAAAADDDDDDDDDDDDDA FRIDAY AAAAAADDDDDDDDDDDDDA SATURDAY AAAAAAAAAAAAAAAAAA SUNDAY AAAAAAAAAAAAAAAAAA </pre>	Valid price codes and assigned prices <div style="border: 1px solid black; padding: 5px; margin: 5px 0;"> A (\$0.0400) B (\$0.0600) C (\$0.0800) D (\$0.1000) E (\$0.2000) </div> To change codes, press <Esc>
--------------	---	---

Figure 4-3. TOU weekly price schedule.

Note that while the price codes are shown in a box on the right side of the screen, you cannot modify them on this screen. You must return to the price code data entry form shown in figure 4-2 to modify the price codes. Press <Esc> to return the form for entering price codes. (Later, in the edit mode, pressing <Esc> will return you to the TOU menu; from the TOU menu press "P" to go to the price code screen.)

Once you have completed the first weekly TOU schedule, press <PgDn>. In the file create mode, you will be asked if you want to create another weekly rate schedule. Answer "Y" or "N". If you choose "Y", you will be asked to specify the predominant price code to be used with the second weekly rate schedule. As with the first schedule, you must enter a valid price code (A-L). The second weekly rate schedule will then be displayed, filled out with the code specified. You must fill in valid price codes for hours which have different kWh prices than designated by the predominant code. After completing the second schedule, press <PgDn>.

When creating a TOU file, Weekly Schedule #1 is initially assigned to all 12 months. However, if a second weekly TOU schedule is filled out, the screen shown in figure 4-4 will be displayed to allow you to assign different schedules to different months of the year. Figure 4-4 shows that a second TOU schedule (not shown here) has been assigned to the months June through September. If you create more weekly TOU schedules you must designate the months that they are to be used on this same screen.

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

After completing the initial steps for creating a new TOU file, a menu for editing the current TOU-rate file is displayed, as shown in figure 4-5. These 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 highlighted character on the screen.

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

Figure 4-5. TOU-rate file editing menu.

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.

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.

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 twelve 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) filename will be requested. A filename extension of "TOU" will automatically be appended to the filename. If the filename 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 filename. 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 TOU rates returns control to the main ERATES menu.

5. CREATING AND EDITING BLOCK-RATE SCHEDULES FOR KWH PRICES

The most common type of rate schedule used by electric utilities for kWh charges is the block-rate schedule. This schedule generally charges different rates for 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, and any usage beyond that level (i.e., above 500 kWh) at \$0.05/kWh. This is typically referred to as a "declining" block-rate schedule. The block-rate schedule may vary by time of year. 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 rate that is higher than charged for the lower usage levels. 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.

Figure 5-1 shows the data entry form for entering a block-rate schedule in ERATES. You can include up to six different block-rate schedules in a single file, with each schedule assigned to different months of the year. To create a new file of block-rate schedules for a particular location and customer class, select "Block Rates" from the main menu; then select "Create New File" from the secondary 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.

BLOCK-RATE SCHEDULE #1

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

Monthly customer charge:	\$10.00 /month
Block 1: first 100	kWh @ \$0.1000/kWh
Block 2: next 500	kWh @ \$0.0700/kWh
Block 3: next 1000	kWh @ \$0.0600/kWh
Block 4: next 0	kWh @ \$0.0000/kWh
Block 5: next 0	kWh @ \$0.0000/kWh
All additional kWh	@ \$0.0500/kWh

Figure 5-1. Format for block-rate 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 not all blocks are 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. Figure 5-1 shows that the price per kWh for all kWh usage above 1600 kWh per month (100 + 500 + 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 file. Answer "Y" or "N". If you choose "Y", a second blank block-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 5-2, 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 5-2. Assignments of block-rate schedule number to months.

After completing the initial steps for creating a new block-rate file, a menu for editing this file is displayed, as shown in figure 5-3. 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 highlighted character on the screen.

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

Figure 5-3. Block-rate file editing menu.

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 (1-6) are assigned sequentially.

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 affect on the file.

Assign block-rate schedules to months allows you to assign schedules to different months of the year. All twelve 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 5-2.

Specify base kWh usage allows you to set up 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 5-4. 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) filename will be requested. A filename extension of "BLK" will automatically be appended to the filename. If the filename 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 filename. 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 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 5-4. Base monthly kWh usage.

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

Demand rates are charges applied to maximum kW power demand during designated on-peak time periods (usually during the current month or a previous month). 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 a monthly kWh/kW file in the demand charge calculations, ERATES assumes that the kW demand data in this file occurred during on-peak periods.

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. A "ratchet" provision may use the maximum demand in a previous month, if it is higher than the current month's peak, as the basis of calculating the current demand charge. 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 demand-rate file, the following question is asked before the first demand schedule is displayed to the screen:

Compute demand charges using Monthly maximum or
Annual maximum kW demand (M/A)?

If the annual maximum kW demand is to be used as the basis for calculating monthly demand charges (instead of the monthly maximum), enter "A"; otherwise enter "M" to use the monthly maximum. "M" is the default value for this factor. 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. If the monthly maximum is selected, then the monthly maximum kW demand for each month of the year is multiplied by the corresponding monthly kW demand charge. (See the discuss of ratchet rates at the end of this section for additional ways to compute kW demand charges.)

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 "Demand Rates" from the main menu; then select "Create New File" from the secondary 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.

DEMAND-RATE SCHEDULE #1

Enter on-peak demand hours (1-24)

First Period	Second Period
Start <u>6</u> Stop <u>9</u>	Start <u> </u> Stop <u> </u>

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 @ \$	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 6-1. Format for demand-rate schedule.

In the demand-rate schedule screen (figure 6-1), 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 be 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 file. 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 6-2, 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 6-2. Assignment of demand-rate schedule to months.

After completing the initial steps for creating a new demand-rate file, a menu for editing this file is displayed, as shown in figure 6-3. These options allow you to edit, add, or delete demand-rate schedules; 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 highlighted character 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 maximum kW
Save schedule changes
Quit demand rates, return to main menu
```

Figure 6-3. Demand-rate file editing menu.

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 deletes the schedule that you designate from the current file. Don't forget to reassign valid demand-rate schedules to months that had been assigned to the deleted schedule.

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 twelve 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 6-2.

Specify base kW demand allows you to set up a base monthly kW demand level that will be added to the kW demand used being directly evaluated when computing monthly and annual kW costs, possibly shifting kW demand into higher demand blocks. The screen display for this data entry form is shown in figure 6-4. This option may be useful if you are interested in calculating the monthly and annual demand charge related to a specific function, using demand data for that function only but incorporating the effect of other systems in the same facility in terms of their effect on total demand. For example, monthly kW demand for lighting, cooking, water heating, and other purposes can then 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 function 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.

Choose monthly/annual maximum kW allows you to re-specify whether the monthly demand charge calculations are to be based on the annual maximum or monthly maximum kW demand.

Save schedule changes allows you to save the new or modified demand-rate schedule to the disk. A DOS-compatible (8-character maximum) filename will be requested. A filename extension of "DMD" will automatically be appended to the filename. If the filename 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 filename. 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.

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 6-4. Base monthly kW demand.

If a ratchet rate is used by the utility to calculate monthly demand charges, essentially using the maximum demand in one month in the calculation of demand charges for a subsequent month (usually with a lower maximum demand), there are two suggested ways of incorporating this into an ERATES analysis.

(1) Select the option to use an annual maximum demand rather than a monthly maximum demand in the demand charge calculations. The maximum kW demand for the year becomes the ratchet base for the entire year. By using different demand schedules for different months, different demand charges (\$/kW) can be applied to the maximum annual demand in each month if desired.

(2) Select the option to use monthly maximum kW demand in the demand charge calculations. Then enter the ratchet amount rather than the actual maximum kW demand in each month to which the demand charge will be levied. For example, if the ratchet base of 100 kW is established in July and the demand charge is based on 90 percent of this amount for all subsequent months, then enter 100 for July and 90 for all subsequent months (unless the actual maximum demand was higher), including the months of January through June. (This method will not work with hourly kWh usage data, since the monthly maximum kW demand is the same as the maximum hourly kWh usage in that month.)

7. CREATING AND EDITING MONTHLY KWH/KW USAGE FILES

A schedule of monthly kWh usage and corresponding peak kW demand for a specific use and operating scenario can be created and edited for use in calculating monthly and annual electricity costs. Monthly kWh/kW files always have the filename extension "KWM". This filename is automatically appended to the filename when the file is created in the ERATES environment. These files can only be used to support block-rate (kWh) and demand charge (kW) calculations. They cannot be used with time-of-use schedules since the latter require hourly kWh consumption data to compute monthly and annual electricity costs. The structure of the monthly kWh/kW file is provided in Appendix A if you wish to create such a file outside the ERATES environment (for example, as the output of an energy analysis program).

To create a new kWh/kW file in the ERATES environment, select "Monthly kWh/kW Files" from the main ERATES menu; then select "Create New File" from the secondary menu. Figure 7-1 shows the data entry form, which allows 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 maximum kW amounts at zero. After entering each amount, press <Enter>. 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 may include the name and location of the facility and additional identification related to the energy usage scenario represented by this schedule.

Monthly kWh/kW Schedule

Month	kWh Usage	Peak kW demand
Jan	10000	10
Feb	10000	10
Mar	10000	10
Apr	10000	10
May	10000	10
Jun	10000	20
Jul	10000	20
Aug	10000	20
Sep	10000	10
Oct	10000	10
Nov	10000	10
Dec	10000	10

File documentation (optional):
TEST BUILDING, CASE 1
TEST BUILDING, CASE 1
TEST BUILDING, CASE 1

Figure 7-1. Data entry form for monthly kWh/kW usage.

Press <PgDn> when the data entry form for monthly kWh/kW is complete. A DOS-compatible (8-character maximum) filename will be requested for saving the file. A file name extension of "KWM" will automatically be appended to the filename. 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 filename. Press <Esc> if you do not wish to save the file.

To view or edit a monthly kWh/kW file, select "Monthly kWh/kW Files" from the main ERATES menu; then select "Edit Existing File" from the secondary menu. A list of all of the 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 7.1. 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 block-rate and demand-rate files, respectively. Therefore the monthly kWh/kW file should include only the kWh usage and kW demand for which you want to calculate monthly and annual costs. The base usage 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 monthly kWh/kW file only.

8. CALCULATING ANNUAL ELECTRICITY COSTS

Calculations of annual electricity costs can be based on electricity usage patterns contained in a monthly kWh/kW file or an hourly kWh file. The monthly kWh/kW file can be created in the ERATES environment as discussed in section 7. The file of hourly kWh consumption data must be generated outside the ERATES environment, using a text editor or an energy analysis program modified to generate such a file. The acceptable formats for the hourly kWh file are outlined in Appendix A. The file must contain hourly kWh data for every hour of the year (8760 hours, 8784 hours in leap year). Maximum kW demand is not included in this file; instead ERATES assumes that the maximum kW demand in each month is the same as the maximum hourly kWh usage during the on-peak periods designated in the demand-rate file.²

8.1 Calculations Based on Block-Rate and Demand-Rate Files

After creating a block-rate schedule and a kWh usage schedule (either a monthly kWh/kW file or an hourly kWh file) and saving these schedules to the disk, you can use ERATES to calculate monthly and annual electricity costs. If you want to include demand charges, you must have also created a demand-rate schedule and included kW demand data in the monthly kWh/kW usage schedule. Demand calculations cannot be made alone in ERATES; they must be combined with an analysis of kWh usage using block or time-of-use schedules in calculating monthly and annual electricity costs.

To generate an annual cost report using block rates, select "Calculate Annual Cost" from the main ERATES menu. 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> .

Then you will be asked to specify whether you will be using a monthly kWh/kW file or an hourly kWh file in the analysis. 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> .

If you choose to use a monthly kWh/kW file, ERATES assumes that you will be using a block-rate file for the kWh prices, and will ask you to select the appropriate block-rate file from the list of available files displayed to the screen (i.e., files with filename extension "BLK").

If you choose to use an hourly kWh file, and you have already chosen to calculate demand costs, you must designate the day of the week to be assigned to January 1 (i.e., the first day of kWh consumption data in the file). Figure 8-1 shows that this selection can be any day of the week or

² If you want to use specific monthly maximum kW amounts for calculating demand charges and hourly kWh usage for calculating TOU charges, run the analysis first for TOU rates alone. Make a file of monthly kWh/kW usage amounts, leaving the kWh amounts at zero and filling in only the desired monthly maximum kW demand amounts. Then use ERATES to calculate monthly and annual electricity costs using any block rate file (since the kWh usage is 0, there will be no charge) and the desired demand rate file. Add the results of the analyses together to get the desired result.

"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 schedules representing "before" and "after" scenarios in which maximum demand is shifted from on-peak periods to off-peak periods.

Select day of week for January 1:

Non-day specific
Sunday
Monday
Tuesday
Wednesday
THursday
Friday
SATurday

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

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 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 as weekends.

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.

Figure 8-2 shows the ERATES calculation of monthly and annual kWh costs and demand charges using monthly kWh and kW demand data from file DEMO.KWM, with block rates from file DEMO1.BLK and demand rates from file DEMO1.DMD. The monthly kWh consumption is the same in all 12 months of the year in this example. The block-rate schedule shown in figure 4-6 was used in the calculation of monthly and annual electricity costs. The demand-rate schedule shown in figure 6-1 was used in the calculation of monthly and annual demand charges, using monthly maximum kW demand rather than the annual maximum. Base kWh usage or kW demand (if any) specified in the block-rate or demand-rate schedules are not included in the total costs shown in the ERATES report. However, they may be used to shift the kWh usage to a higher block or in the determination of an annual maximum kW demand.

Electricity costs using kWh consumption from file DEMO.KWM
Block rates from file DEMO.BLK; Demand rates from file DEMO1.DMD

Month	kWh Usage and Cost			kW Demand and Cost			Total Cost
	kWh Use	Total	Marginal	Peak kW	Total	Marginal	
1	10,000	\$535	\$0.050	10.0	\$100	\$10.00	\$635
2	10,000	\$535	\$0.050	10.0	\$100	\$10.00	\$635
3	10,000	\$535	\$0.050	10.0	\$100	\$10.00	\$635
4	10,000	\$535	\$0.050	10.0	\$100	\$10.00	\$635
5	10,000	\$535	\$0.050	10.0	\$150	\$15.00	\$685
6	10,000	\$713	\$0.070	20.0	\$300	\$15.00	\$1,013
7	10,000	\$713	\$0.070	20.0	\$300	\$15.00	\$1,013
8	10,000	\$713	\$0.070	20.0	\$300	\$15.00	\$1,013
9	10,000	\$713	\$0.070	10.0	\$150	\$15.00	\$863
10	10,000	\$535	\$0.050	10.0	\$100	\$10.00	\$635
11	10,000	\$535	\$0.050	10.0	\$100	\$10.00	\$635
12	10,000	\$535	\$0.050	10.0	\$100	\$10.00	\$635
Total	120,000	\$7,132	n/a	n/a	\$1,900	n/a	\$9,032

Monthly maximum kW demand used.

Figure 8-2 Monthly and annual calculations of kWh and kW demand costs using block rates and demand rates.

If monthly base kWh usage is included in the block-rate file for kWh prices, the base usage will be included with the kWh usage in the monthly kWh/kW file to determine the correct block rates. However, only the cost of the kWh usage in the monthly kWh/kW file will be reported, not the cost of the base usage. The cost reported is a "marginal" cost; that is, the cost over and above the cost of the base kWh usage.

If monthly base kW demand amounts are included in the demand-rate file, the monthly base kW demand will be added to the maximum on-peak 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. However, the cost of the base kW demand will not be reported. The monthly and kW charges reported are "marginal" costs; that is, the cost over and above the cost of the base kW demand. 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.

If the computation of demand charges is based on the annual maximum kW demand rather than the monthly maximum, it is possible that there will be no demand charge attributed to the system being evaluated if monthly base kW demand amounts are included in the analysis. This will occur if the maximum kW demand for this system occurs in a different month than the maximum base kW demand and this system does not increase the annual maximum kW demand.

8.2 Calculations Based on Time-of-Use Files

You can also compute monthly and annual electricity costs using a time-of-use- (TOU-) rate schedule. You must have hourly kWh consumption for an entire year to serve as the basis of the TOU computations.³ If you want to include demand charges in the calculations, and the demand-rate schedule designates on-peak hours other than 1 to 24, the maximum kW demand will be determined by the maximum hourly kWh usage during the designated on-peak hours only.

To generate an annual cost report using time-of-use rates, select "Calculate Annual Cost" from the main ERATES menu. 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>. Then a list of available hourly kWh consumption files (extension "KWX") will be displayed to the screen. Highlight the desired file and press <Enter>. You must choose the hourly file format for time-of-use calculations. The entire file, 8760 hours of kWh consumption data (8784 hours during leap year), must be read from the disk before continuing; this may take several seconds.

A list of all available TOU-rate files will be displayed to the disk; highlight the desired file and press <Enter>.

Next you must designate the day of the week to be assigned to January 1 (the first day of kWh consumption data). 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 a day of the week is specified, this information will be used in selecting the appropriate time-of-use price and in determining whether the maximum kW demand occurs on a weekday or weekend. If "non-day specific" is selected, kWh cost calculations for any hour of the day will be based on the average kWh price for that hour (averaged over the seven days of the week in the current month), and maximum kW demand will be based on the maximum hourly kWh 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.

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 as weekends.

³ If you have only part-year data and want to make monthly calculations, fill in the remaining hours in the hourly kWh file with zeros.

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.

Figure 8-3 shows the ERATES calculation of monthly and annual kWh costs and demand charges using hourly kWh data from file DEMO1.KWX with TOU rates from file DEMO1.TOU and demand rates from file DEMO1.DMD. The TOU-rate schedule shown in figure 4-3 was used in the calculation of kWh costs. The demand-rate schedule shown in figure 6-1 was used to calculate the monthly demand charges, which were based on monthly maximum kW demand.

If monthly base kW demand amounts are included in the demand-rate file, the monthly base kW demand will be added to the maximum on-peak kW demand of the system being evaluated (as derived from the hourly kWh file) to determine the correct block charges. However, the cost of the base kW demand will not be reported. The monthly and annual kW charges reported are "marginal" costs; that is, costs over and above the costs of the base kW demand. 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.

If the computation of demand charges is based on the annual maximum kW demand rather than the monthly maximum, it is possible that there will be no demand charge attributed to the system being evaluated if monthly base kW demand amounts are included in the analysis. This will occur if the maximum kW demand for this system occurs in a different month than the maximum base kW demand and this system does not increase the annual maximum kW demand.

Electricity costs using kWh consumption from file DEMO1.KWX
 TOU rates from file DEMO1.TOU; Demand rates from file DEMO1.DMD

Month	kWh Usage and Cost			kW Demand and Cost			Total Cost
	kWh Use	Total	Average	Peak kW	Total	Marginal	
1	4,743	\$352	\$0.074	10.0	\$100	\$10.00	\$452
2	4,284	\$313	\$0.073	10.0	\$100	\$10.00	\$413
3	4,743	\$345	\$0.073	10.0	\$100	\$10.00	\$445
4	4,590	\$332	\$0.072	10.0	\$100	\$10.00	\$432
5	4,743	\$352	\$0.074	10.0	\$150	\$15.00	\$502
6	4,590	\$332	\$0.072	10.0	\$150	\$15.00	\$482
7	4,743	\$345	\$0.073	10.0	\$150	\$15.00	\$495
8	4,743	\$352	\$0.074	10.0	\$150	\$15.00	\$502
9	4,590	\$326	\$0.071	10.0	\$150	\$15.00	\$476
10	4,743	\$352	\$0.074	10.0	\$100	\$10.00	\$452
11	4,590	\$339	\$0.074	10.0	\$100	\$10.00	\$439
12	4,743	\$338	\$0.071	10.0	\$100	\$10.00	\$438
Total	55,845	\$4,076	\$0.073	n/a	\$1,450	n/a	\$5,526

Monthly maximum kW demand used. On-peak hours occur on all days of week.
 Jan 1 = Sunday

Figure 8-3. Monthly and annual calculations of kWh and kW demand costs using TOU rates and demand rates.

APPENDIX A. FORMAT FOR KWH USAGE/KW DEMAND FILES

Two basic types of electricity usage schedules can be used with ERATES to calculate monthly and annual electricity costs: a monthly kWh/kW schedule and an hourly kWh schedule. These schedules must be readable from an ASCII (DOS text) file. The data layout, or format, of each of these schedule types is shown in this appendix. Commas between amounts in lines 5 through 16 are optional.

(1) Monthly kWh/kW file format

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: 12	Number of months (must be 12).
line 5: kwh(1), kw(1)	kwh(i) = monthly kWh usage in month i, i = 1,2,...,12
line 6: kwh(2), kw(2)	kw(i) = maximum kW demand in month i, i = 1,2,...,12
:	
:	
:	
line 16:kwh(12), kw(12)	

example:

```
"test building, case 1"  
"location: Bethesda, MD"  
"year: 1993"  
12  
10000, 10  
10000, 10  
10000, 10  
10000, 10  
10000, 10  
10000, 20  
10000, 20  
10000, 20  
10000, 10  
10000, 10  
10000, 10  
10000, 10  
10000, 10
```


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

description

line 1: "identification 1"

line 2: "identification 2"

line 3: "identification 3"

line 4: 8760

line 5: 1 kWh(1)

line 6: 2 kWh(2)

line 7: 3 kWh(3)

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line 8764: 8760 kWh(8760)

First three lines must be in quotes (" "); leave line blank if no identification is necessary.

8760 = number of hours in year (use 8784 for leap year)
hour number, kWh usage for this hour.

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

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· ·

8759 5.0

8760 5.0

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