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Software for an Energy Consumption Monitoring System

Massachusetts
Energy
Office

Conservation Extension Service

SOFTWARE
FOR
ENERGY CONSUMPTION MONITORING

December 1, 1978

by
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Massachusetts Energy Office

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User's Manual

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USER'S MANUAL

By

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FOREWORD

Consumption Monitoring is an important first step in the energy conservation program of any large organization. This system will help to identify where the greatest potential for savings lies. It can then be used to measure the success of conservation measures.

With proper management support it can be used to monitor the performance of building engineers. Often there is great potential for energy savings through low or no-cost measures but there is no incentive to do so.

The software and the accompanying document were developed by the Massachusetts Energy Office and funded by the New England Regional Commission. Since it is the result of tax supported funds, it is not proprietary.

This manual uses a cookbook approach to show a person with no computer experience how to use the software we have developed.

In addition to this manual, it is recommended that any prospective designer of an energy consumption monitoring system refer to the following document: "AN ENERGY CONSUMPTION MONITORING SYSTEM FOR LARGE-SCALE ORGANIZATIONS: Designed For and Implemented In The State-owned Facilities of the Commonwealth of Massachusetts." This document is available from the Massachusetts Energy Office or from Gary A. Bare, the author.

1.1 CONSUMPTION MONITORING TERMINOLOGY

The following terms are used throughout this manual and the reader should be familiar with them.

- Fiscal Year:** A fiscal year goes from July 1 to June 30. Therefore, July 1978 is part of fiscal year 1979. It is very important that the user keep from confusing fiscal year and calendar year.
- Degree Day:** A measure of the amount of heating that needs to be done. This can help determine how much change in energy use is caused by weather conditions. Unfortunately, it is sometimes difficult to determine what part of energy consumption is for heating and what part is for other uses. Some people refer to another measure called "cooling degree days". We do not monitor these since air conditioning is usually electric and we cannot determine what part of electric use is for air conditioning.
- BTU:** In the output reports the different fueltypes are aggregated by total BTUs (British Thermal Units). This is the amount of energy contained in the fuel. For electricity and steam this can be measured by the amount of energy required to create a given unit or by the amount that can be obtained from a given unit. For electricity there is a threefold difference. We use the first method since it shows the energy use by society. Our conversion factors are:

Electricity	10,500	BTUs/KWH
Natural Gas	105,000	BTUs/CCF
Propane	91,500	BTUs/Gallon
Coal	26,000,000	BTUs/Ton
Oil No. 2	139,600	BTUs/Gallon
Oil No. 4	145,100	BTUs/Gallon
Oil No. 5	148,800	BTUs/Gallon
Oil No. 6	152,400	BTUs/Gallon
Steam	1,265,000	BTUs/thousand pounds

1.2 Computer Basics

Once you have logged into the computer, there are basically three (3) different levels of the computer that you will have to deal with. Within each level there are certain functional areas of the Consumption Monitoring software that will have to be used at that level. In an effort to make this clear, Figure 1 shows the three levels and the Consumption Monitoring functions that can be executed in each level.

FIGURE 1

This manual will address each of the above functional areas. In addition, a few pointers for avoiding problems will be included. The software anticipates some of the problems that may arise, however, it is possible that you may occasionally have difficulties. If so refer to Section 7 of this manual. If this is not sufficient, refer to the Systems' Maintenance Manual for a more detailed explanation of the specific area that is causing difficulties. With a little care, all should go well -- GOOD LUCK.

2. Logging On/Off the Computer

Obviously, before you can use the Consumption Monitoring software you must first "get on" the computer. To do that use the following procedure. A sample is shown in Figure 2-A.

1. Make sure the terminal (and coupler if independent) are plugged in and turned on.
2. Make sure that the correct typeset or typeball is selected.
3. Dial the telephone number that connects you with the computer.
4. When you hear a high pitched whistle, place the receiver in the acoustic coupler.
5. Press the RETURN key several times.
6. When asked to "enter 1", do so several times, pressing RETURN each time.
7. The computer will eventually respond with:
VM370 ONLINE
8. You can now log in. Type:
L *account*
where *account* is your account identifier.
Your account identifier is:
9. The computer will then ask you to enter your password. Do so.
Your password is
10. The computer will then type some information and you will then be in the CP environment. This is where you set up the "virtual machine" that you will be using. The only thing you will need to define is the storage space needed. Type:
DEF STOR 1M
11. Now you are ready to enter the CMS environment. Anytime you may accidentally find yourself in CP you can execute this command to enter CMS. Type:
IPL CMS
If you wish to perform any of the operations in the CMS environment you should do so now. If you wish to continue and go into APL. Type:
VSAPL
The last thing the computer will respond with is:
CLEAR WS
After this you must put the APL typeset on the terminal or hit a switch so that the new character set is used.


```
enter l
us@un y
l
l
l
l
DMKL OG020E USERID MISSING OR I NVAL ID
l mass2
ENTER PASSWORD:
*****
LOGMSG - 10:06:03 EST TUESDAY 11/21/78
*TS*RJETIMESHARING WILL BE UNATTENDED FROM 0001 NOV 23 TO 0600 NOV 24.
LOGON AT 10:22:26 EST TUESDAY 11/21/78
CALLDATA/370 R3.0 PLC 13
def stor 1m
DMSACC 723I Y (19F) R/O
DMSACC 723I G (531) R/O
R;
CONNECT= 00:00:38 VIRT CPU= 000:00.04 TOT CPU= 000:00.30
CARDS= 000000 PUNCH= 000000 LINES= 000000 DISK/TAPE= 00000040
SESSIONCONNECT = 00.00.39 ESTIMATED CONNECT CHARGE = $0000.11
SESSION ISRU = 0000.00 ESTIMATED ISRU CHARGE = $0000.16
STORAGE = 01024K
DMKDSP450W CP ENTERED; DISABLED WAIT PSW '00020000 00000000'
CP
ipl cms
CALLDATA/370 R3.0 PLC 13
vsapl
DMSACC 723I Y (19F) R/O
DMSACC 723I G (531) R/O
R;

v s a p l

clear ws
```

FIGURE 2-A

Logging Off

1. To exit from the VSAPL workspace type:
)OFF HOLD
 This puts you back in the CMS environment. Change the typeset
 or typeball back. If you were not in APL skip this entire step.
2. Once you are in the CMS environment type:
 log
 to log off the system.
3. When the terminal's response is finished hang up the phone and
 turn off the terminal and computer.

The above two procedures should get you on and off the computer system with no trouble. If you do have serious problems you can always hang up the phone and try again. This is not recommended however.

3. DATA PREPARATION

This section assumes you have the required data available in machine readable form or ready to be keypunched. The software is set up to handle consumption data on a monthly basis (i.e., one consumption record is for one entity for one fuel type for one month).

The next three sections discuss the required file formats, ways of entering the data and the procedures for editing (or correcting) existing files.

3.1 File Formats

There are only two basic file formats that are required for putting the necessary information in CMS files. These are the Consumption File and the Master File.

Consumption Files - There should be one 80 character record for one facility for each month for each fueltype used. For example, one facility that uses 4 different fuels would have 48 records per year. If the facility uses a given fuel type at any time during the year, records should be entered for all twelve months (enter zero's) otherwise it will show up as missing data.

The format and some sample records are shown below:

Columns

1 - 10	Facility (or building) identification number. This can be up to 10 numeric characters left justified in the field.
21 - 24	Degree days right justified (Optional)
27	Fueltype. Must be one of these characters: E N P C 2 4 5 6 S. *
49 - 52	Year and month the record is for in the form: YYMM (i.e., 7807 for July 1978)
61 - 70	Quantities for that fueltype in the appropriate units right justified. Electricity - KWH, Natural Gas - CCF, Propane oil #2, 4, 5, 6 in gallons, Coal - tons, and steam - in 1000 lbs.
71 - 80	Total cost for the given quantity in dollars and cents with no decimal, right justified. If you wish, dollars only can be entered in columns 71 - 78 right justified.

* E = Electricity, N = Natural Gas, P = Propane, C = Coal, S = Steam, and the numbers denote oil types.

-8-
Consumption File

10101	237	E	780701780731	435600	2803451
10101	237	S	780701780731	134	130065
10102	11	E	780701780731	1070400	6186726
10102	11	S	780701780731	5138	2814953
10103	237	E	780701780731	919000	5176284
10103	237	N	780701780731	0	000
10103	237	S	780701780731	0	000
10104	11	E	780701780731	766700	4274695
10104	11	S	780701780731	7529	5673419
10105	11	E	780701780731	186200	1083835
10105	11	S	780701780731	1555	809159

Master File - There should only be one CMS master file. This file contains a unique identification number and a name for each entity that is part of the system. In addition a value is needed for square footage. The value for square footage should be the value for the earliest date included in the system. You will be given the opportunity to make changes in the latter section. If you do not know the square footage, enter a one (1).

The format and some sample records are shown below.

Columns

1 - 10	Identification Number. This can be up to 10 numeric characters left justified in the field
21 - 60	Name of the Entity (facility or building)
61 - 70	Gross Square footage. The value should be right justified.

MASTER FILE

10101	ST AT E HOUSE	500000
10102	MC CORMACK BUILDING	750000
10103	SALT ONSTALL BUILDING	750000
10104	HURL EY BUILDING	325000
10105	L I N D E M A N N C E N T E R	257000
40101	B E L C H E R T O W N S T A T E S C H O O L	509000
40102	N O R T H A M P T O N S T A T E H O S P I T A L	517182
40103	Q L A V I N R E G I O N A L C E N T E R	108325
40104	G A R D N E R S T A T E H O S P I T A L	1
40105	W O R C E S T E R S T A T E H O S P I T A L	794559
40106	M O N S O N S T A T E H O S P I T A L	973236
40107	S O L O M O N M E N T A L H E A L T H C E N T E R (L O W E L L)	67456

3.2 Setting up the CMS Files

There are three ways which you may get the data into the CMS files:
1. from cards, 2. from magnetic tape, or by 3. entering it into a CMS file from a terminal. The first and third will likely to be the most common ways and will be addressed herein.

3.2.1 Keypunching the Data onto Cards and Loading It Into CMS Files

In most cases the consumption data is collected on some type of form. This data can most easily be converted to a machine readable format by keypunching the data onto punch cards. Since both CMS files are set up with 80 character records, it turns out that one card is one record in the CMS file. The data should be punched on the cards with the exact same format as the CMS files described in section 3.1. Using cards also gives you a hard copy backup of all your data.

Once you have the cards in hand you need to go through the following steps to get the information into the CMS file.

1. Put a card on the front of the deck with the following information
ID *account*
Where the word *account* is you should enter the name of your account.
ID must start in column 1 with one space after the D
2. Send the cards to customer service indicating that you want them read into your virtual reader and then you want the cards returned to you.
3. After the cards have been read in (you will get a message when you are logging in indicating a file in the RDR) you should go through the procedures described in Section 2.0 in order to get into the CMS environment.
4. Execute the following command to read the file from the virtual reader to a CMS file.
READ *f_n* *f_t*
where
f_n = any filename up to 7 characters in length
f_t = any filetype up to 7 characters in length
Make sure you do not duplicate any filename or filetype combination. The following methodology is offered for appropriate filenames and filetypes.

Name the master file MASTER FILE. For the Consumption files pick a filename such as JULY OR FY76 or QTR1 to indicate what period of time the data in in that file covers. For the filetype use the date that the file was last updated such as CF0731 for a consumption file updated or entered on July 31. Some samples:
READ FY76 CF0731
READ QTR1 CF1021
5. The data is now stored in a CMS file under the filename and filetype you chose. If you want a list of the names of all your consumption files type the CMS command:
L * CF* (L

3.2.2 Using The Terminal To Enter Data Into CMS File

This is recommended only when you have a small number of records to enter since it is time consuming and somewhat costly. Use the following steps to enter the data into a CMS file.

1. Log in and proceed to the CMS environment using the steps in section 2
2. Pick an appropriate filename and filetype using the suggestions in section 3.2.1 and then type:
EDIT f_n f_t
where f_n and f_t are the filename and filetype
3. You are now in the CMS Editor. Type:
input
4. You can input the data line by line using the formats explained in section 3.1. Be very careful to put the data in the correct columns. Do not worry about any errors you make, you can fix them later.
5. After you have entered the last record, hit the RETURN key twice. The computer should respond by typing EDIT:.
6. Type FILE to store this new file as a CMS file. This puts you back into the CMS environment.
7. Use the CMS Editor described in Section 6.1 to type out the contents of the file and then correct the errors
8. Records that have been entered directly should be keypunched and processed as in Section 3.2.1 These can then serve as a backup.

4.0 THE DATA BASE SYSTEM

This chapter will allow you to define and initialize the size of the consumption monitoring data base. To do this you must have a CMS Master File as discussed in 3.1. You will also be shown how to load the consumption files into the data base and make changes to some of the variables. The maintenance manual should be consulted for making changes to other parameters.

4.1 Setting Up The System

All of the functions needed for Consumption Monitoring are stored in an APL workspace called CMPRGMS. The data base will be set up in an APL workspace under a name you choose. This workspace contains your main consumption monitoring system. You should only go through the setup phase when you want to redefine the entire data base system. The following steps allow you to do so. There is a sample session in Figure 4-A.

1. Follow the procedure in section 2 and proceed to the APL environment.
2. Pick a workspace I.D. (up to 8 characters) that you want the data base stored under. Then execute the following command:
)WSID *id*
 where *id* is the I.D. you picked. This will not be referred to as the data base workspace (D.B. workspace).
3. Copy in the functions used by the Consumption Monitoring Programs.
 Type:
)COPY CMPRGMS
4. Now you need to build the matrices that will store the data. Type:
 BUILDARRAYS
 You will then be asked two questions. Enter the years that you will be loading the data for. In addition, you may want to include the following year so that you won't have to redefine the data base to make room for it later. You will then be asked the name of the master file. After entering this you may get a syntax error. This is caused by bad data in your CMS Master file. You should exit from this function and correct the file using the CMS Editor. Then redo this procedure starting with step 1.
5. Now you can erase the unneeded initialization functions by typing:
)ERASE BUILDARRAYS CONSTANTS LITERALS FACIL ENTERFACID
6. Now save the workspace by typing:
)SAVE


```
)WST D SAMPLE
WAS CLEAR WS
)COPY CMRR GMS
SAVED 15:00:54 11/20/78
BUILDARRAYS
THIS PROGRAM SHOULD BE USED ONLY WHEN SETTING UP A NEW SYSTEM.
IF THAT IS WHAT YOU WANT TO DO TYPE YES OTHERWISE TYPE NO.
YES
ENTER THE FISCAL YEARS YOU WANT IN CHRONOLOGICAL ORDER
FOR EXAMPLE 73 78 79 80
□:
73 76 78 79
ENTER THE ID OF THE MASTER FILE
ENTER THE *FILENAME FILETYPE* AT THIS TIME.
MASTER FILE
LOAD COMPLETE
PROGRAM COMPLETE
)ERASE BUILDARRAYS CONSTANTS II TERALS FACIL ENTER FACID
)SAVE
16:26:57 11/20/78 SAMPLE
```

7. You can now use the procedure in section 1 to log off or you can proceed to step 3 of the procedure for loading the data into the data base. This procedure is described in the next section.

4.2 Loading Data Into the System

The functions below permanently store data in the system you set up in section 4.1. These functions tend to be costly for large files so they should not be run more than once for the same data.

4.2.1.1 Adding Consumption Data to the Data Base

Once the consumption data has been loaded into CMS it must be converted to a more usable form. This is done by putting it into APL matrices. Using this system new data can easily be added and the data is in a format where it can be easily accessed. In this phase the data is checked for certain obvious errors and these records are printed out.

In order to convert the data into APL and validate it, follow the steps below. Figure 4-B is a sample run of this program.

1. Follow the procedure in section 1 and proceed into the APL environment
2. Then load in the workspace containing your data matrices and the input functions. To do this type:
)*LOAD id*
 where *id* is the I.D. that was picked in section 4.1.
3. Make sure you have corrected the errors from the previous run. If you haven't but are planning to you can rename the ERROR DATA file. To do this type:
 CMS'RENAME ERROR DATA A ERROR *ft* A'
 where the *ft* should be a unique identifier for the renamed file. The new filename will then be ERROR *ft*
4. Then type:
 ADDATA
5. The computer will then remind you to do something about your last error file. Since you have already done this type "OK". (In some computer software packages typing the first letter of an answer is sufficient. It is not adequate in this system however. This will give those of you who are beginners an advantage over experienced computer users.)
6. You will then be asked the filename and filetype. Enter the name you determined in section 3.2.1. If you are loading an error file enter that name.

)LOAD SAMPLE
 SAVED 16:26:57 11/20/78
 ADDATA

THIS READS THE CMS CONSUMPTION FILE INTO THE DATA BASE.
 RECORDS FOUND IN ERROR ARE PUT INTO A CMS FILE CALLED ERROR DATA.
 IF YOU READ ANOTHER FILE BEFORE CORRECTING AND RELOADING 'ERROR DATA', ERROR DATA
 MUST BE RENAMED OR IT WILL BE ERASED. TYPE 'EXIT' TO GET OUT OF THIS FUNCTION.
 TYPE 'OK' TO CONTINUE.

OK
 ENTER THE *FILENAME FILETYPE* AT THIS TIME.
 FY79 CM

TURN CARRIAGE TO TOP OF NEW PAGE. THEN PRESS THE RETURN KEY.

THE FOLLOWING CARDS WERE FOUND IN ERROR

RECNO	I.D.	DEGD	FUEL
196	50603	1	N
426	50611	1	N
429	50611	1	N

THE ABOVE RECORDS ARE IN A CMS FILE CALLED
 'ERROR DATA'. YOU SHOULD MAKE CORRECTIONS
 AND RELOAD THE FILE.

16:34:58 11/20/78 SAMPLE

START	END	QUANTITY	COST
780701780731		217	29 277
770701770731		3	344
770801770831		3	344

FIGURE 4-B

7. You will be asked to move the carriage to the top of the next page and then press return. If you are loading a large file you may have to wait a couple of minutes so don't worry.

The terminal will then print out a list of errors. Then the workspace will automatically be saved. There will be a short pause for this. Then the terminal will print out the time, date, and the name of the workspace.

4.2.1.2 Correcting Errors and Reloading the Data

The ADDATA function described in the last section creates a list of errors which must be corrected and then loaded into the data base.

Records can be rejected for any of five reasons. These are:

- a. Non-existent facility I.D.
- b. Non-existent fuel type.
- c. Incorrect month.
- d. Fiscal year which is not monitored. The software converts the calendar year on the input data into the fiscal year (July - July). For instance, if you are monitoring 1976 but not 1977, 7607 will be an error since it is part of fiscal year 1977.
- e. Incorrect cost/quantity ratio. The software divides the cost by the quantity and checks to see if this ratio fits within a certain range. There are several reasons why this ratio would be incorrect. For natural gas and steam, there is often a problem with units. Natural gas should be reported in CCF (hundred cubic feet) but it is sometimes reported in cubic feet or thousand cubic feet. Steam should be reported in thousand pounds. Errors can also be caused by keypunching which is discussed below. A third possible problem is caused by small quantities for which the ratios are sometimes out of line. A fourth possibility is that the minimum or maximum accepted values are wrong. If you want to correct these values, see the systems manual.

If your problem is caused by either small quantities or incorrect ratios, you can bypass this check. This procedure will be described shortly. Make sure, however, you have corrected your other errors.

1. When you have found out what your errors are, determine their source. Perhaps they are keypunch errors and these can be corrected by looking back at the original form.
2. When you are ready, correct the ERROR DATA file as described in section 6.1 on the CMS Editor.

ADDDATA

THE S READS THE CMS CONSUMPTION FILE INTO THE DATA BASE.
 RECORDS FOUND IN ERROR ARE PUT INTO A CMS FILE CALLED ERROR DATA.
 IF YOU READ ANOTHER FILE BEFORE CORRECTING AND RELOADING 'ERROR DATA' ERROR DATA
 MUST BE RENAMED OR IT WILL BE ERASED. TYPE 'EXT' TO GET OUT OF THE S FUNCTION.
 TYPE 'OK' TO CONTINUE.
 OK

ENTER THE *FILENAME FILETYPE* AT THIS TIME.
 ERROR DATA

IF YOU WANT THE UNIT COST PART OF THE VALIDATION ROUTINE
 BYPASSED TYPE 'BYPASS', OTHERWISE TYPE 'OK'
 BYPASS

TURN CARRIAGE TO TOP OF NEW PAGE. THEN PRESS THE RETURN KEY.

THE FOLLOWING CARDS WERE FOUND IN ERROR
 RECNO I.D. DEGD FUEL

START END QUANTITY COST

THE ABOVE RECORDS ARE IN A CMS FILE CALLED
 'ERROR DATA'. YOU SHOULD MAKE CORRECTIONS
 AND RELOAD THE FILE.
 12:22:14 11/21/78 SAMPLE

3. Now go through the procedure described in section 4.2.1.1. You will be asked if you want to bypass the ratio test. You should type "OK" unless you are sure all the cost and quantity figures are correct. After running this once you may get another list of errors. If you are sure all of the ratio errors are caused by small quantities or incorrect acceptable ratios, run the ADDATA function again. The filename, filetype is once again ERROR DATA. This time when you are asked if you wish to skip part of the validation routine type:

BYPASS

In no case will you be able to load data which has any of the first four problems which are listed above.

4.2.2 Adding New Square Footage Information

When you initialize a system you should have the square footage for the starting dates of the system in the master file. However, facilities often change their square footage so it is necessary to update this value. For purposes of comparison we like to know the square footage for each month so we can determine how much differences in energy use was caused by changes in the size of the facility.

When you make changes they are applicable for all dates in the future. We assume a facility will stay the same size unless we are given contrary information. Therefore, if you have several changes for a given facility, enter the earliest first.

To update the square footage information, follow the procedure below. A sample run showing the exact questions is exhibited in Figure 4-D.

1. Follow the procedure in Section 2 and proceed into the APL environment.
2. Load the workspace containing your data matrices and input functions. To do this type:
)LOAD *id*
 where *id* is the I.D. that was picked in section 4.1.
3. Then type:
 NEWSQFT
 You will be warned about making the changes in chronological order and then you will be asked a series of questions. When you are asked the beginning date of the change, answer with the last two digits of the year, followed by the two digits for the month. This might be confusing at first but it was done to be consistent throughout the system. At this point don't worry about the fiscal year, the program will take care of that.

NEWSQFT

THIS PROGRAM CHANGES THE SQUARE FOOTAGE FOR A FACILITY FOR THE MONTH AND YEAR CHOSEN AND ALL SUBSEQUENT MONTHS. THEREFORE IF YOU ARE ENTERING SEVERAL CHANGES FOR A FACILITY ENTER THE EARLIEST FIRST. IF YOU WISH TO EXIT FROM THIS FUNCTION TYPE 'EXIT' OTHERWISE TYPE 'OK'

OK

ENTER THE I.D. NUMBER OF THE FACILITY WHICH IS TO BE CHANGED
□:

50504

YOU WILL BE CHANGING THE SQUARE FOOTAGE FOR:

50504 UNIV. OF MASS./AMHERST (ACADEMIC)

IF THIS IS INCORRECT TYPE 'AGAIN' OTHERWISE TYPE 'OK'

OK

ENTER THE BEGINNING CALENDAR DATE FOR THE CHANGE IN THE FORM YYMM (FOR EXAMPLE 7809)

7711

THE LISTED VALUE FOR THAT MONTH WAS

5778876

ENTER THE NEW SQUARE FOOTAGE

□:

5833000

IF YOU WISH TO MAKE ADDITIONAL CHANGES TYPE YES OTHERWISE TYPE NO

16:45:17 11/20/78 SAMPLE

4. After you have made one change you will be given the option of making additional changes. When you are finished, there will be a slight pause as the workspace is automatically saved. Then the time, date, and the workspace I.D. is printed out.

4.2.3 Adding New Weather Station Degree Day Information

Before running the monthly reports you should see that the station degree day information is up to date. To do this use the ADDEGD function. In order to do this use the following steps. Figure 4-E is a sample run of this program.

1. Follow the procedure in Section 2 and proceed into the APL environment.
2. Load the workspace containing your data matrices and input functions. To do this type:
`)LOAD id`
 where *id* is the I.D. that was picked in section 4.1.
3. Type:
`ADDEGD`
 You will be asked what month you wish to make a change for. Enter the calendar year and month. Then you will be given a list of the stations. Enter the number of the station.
4. The current value will be listed. It should be "1" indicating no information has been entered. Now type in the correct value.
5. You will be asked if you have other information to enter. When you say NO the workspace will be saved.

If at any point you want to know what station degree day information is in the system, type:

`SDEGD`

You will get a printout something like the one below.

SDEGD

3	4	51	405	673	385	1033	971	666	450	258	24
16	41	171	622	897	1152	1200	1120	738	555	338	37
0	12	164	350	547	1065	1320	898	850	443	272	13
2	47	223	413	586	1161	1412	972	920	511	310	60
0	4	85	304	498	948	1127	1057	885	480	209	17
16	32	189	481	711	1202	1359	1255	1054	674	288	69
11	1	1	1	1	1	1	1	1	1	1	1
33	1	1	1	1	1	1	1	1	1	1	1

The columns are the months starting with July. The rows are the stations and the various groupings represent years.

ADDEGD

THIS PROGRAM ALLOWS YOU TO ENTER DEGREE DAY INFORMATION FOR
A GIVEN MONTH, YEAR, AND WEATHER STATION.

WHAT CALENDER YEAR AND MONTH IN THE FORM YYMM DO YOU WISH
TO ENTER DATA FOR (EXAMPLE 7809)

7808

YOU HAVE THE FOLLOWING WEATHER STATIONS IN YOUR SYSTEM.

1 BOSTON

2 WORCESTER

ENTER THE NUMBER OF THE STATION YOU WISH TO ADD THE INFORMATION FOR
□:

1

THE LISTED VALUE WAS

1

A '1' INDICATES THE INFORMATION NEEDS TO BE REPORTED.

WHAT IS THE NEW VALUE?

□:

11

DO YOU WISH TO ENTER OTHER STATION DEGREE INFORMATION. ANSWER
YES OR NO.

YES

WHAT CALENDER YEAR AND MONTH IN THE FORM YYMM DO YOU WISH
TO ENTER DATA FOR (EXAMPLE 7809)

7808

YOU HAVE THE FOLLOWING WEATHER STATIONS IN YOUR SYSTEM.

1 BOSTON

2 WORCESTER

ENTER THE NUMBER OF THE STATION YOU WISH TO ADD THE INFORMATION FOR
□:

2

THE LISTED VALUE WAS

1

A '1' INDICATES THE INFORMATION NEEDS TO BE REPORTED.

WHAT IS THE NEW VALUE?

□:

8

DO YOU WISH TO ENTER OTHER STATION DEGREE INFORMATION. ANSWER
YES OR NO.

NO

16:49:19 11/20/78 SAMPLE

4.2.4 Deleting a Consumption Record

At some point you may have entered a card for a fueltype that is never used by a facility. This will show up on the reports and give the impression that the fuel is sometimes used. To correct this problem you can delete the record using the function DELETERECORD described below. Figure 4-F is a sample run of this program.

1. Follow the procedure in Section 2 and proceed into the APL environment.
2. Load your workspace by typing:
)LOAD *id*
3. Type:
 DELETERECORD
4. When queried give the facility I.D., fiscal year, month, and fueltype. If this record was not in the system you will be told so. Otherwise the facility, month, year, fueltype, quantity, and cost will be displayed.
5. You will be asked if you want to delete more records. If you answer "YES" you will be back in step 3 otherwise the workspace will be saved.

4.2.5 Adding A New Facility To The System

As time goes on you may wish to expand your system to monitor more facilities. This can be done using the ADFAC function. Figure 4-G is a sample run of this program. The procedure is described below:

1. Follow the procedure in Section 2 and proceed into the APL environment.
2. Load your workspace by typing:
)LOAD *id*
3. Type:
 ADFAC
4. When queried enter the I.D. number of the new facility. It must be numeric and can be as long as ten digits.
5. When queried enter the name of the facility. This can be up to 40 characters long.
6. Next you will be asked its original square footage. Enter the square footage from the time you have the earliest consumption information for the facility. If it has changed you can run NEWSQFT after finishing this function.
7. The new facility will now be added into the system and the workspace will be automatically saved.

DELETER ECOR D
FOR WHAT FAC I L I T Y DO YOU WANT THE R ECOR D DELETED?
□:
50611
YOU W I L L BE DELETT NG A R ECOR D FOR
50611 N O R T H S H O R E C O M M U N I T Y C O L L E G E
WHAT FUELTYPE I S TO BE E L I M I N A T E D ? (E X A M P L E N)
E
FOR WHAT F I S C A L Y E A R Y Y DO YOU WANT THE R ECOR D DELETED?
□:
79
FOR WHAT MONTH(S) DO YOU WANT THE R ECOR D DELETED?
□:
7
T H I S R E C O R D H A S N O T B E E N E N T E R E D I N T O T H E S Y S T E M .
DO YOU W I S H TO DELETE MORE R ECOR D S ?
ANSWER 'YES' OR 'NO' .
YES
FOR WHAT FAC I L I T Y DO YOU WANT THE R ECOR D DELETED?
□:
50504
YOU W I L L BE DELETT NG A R ECOR D FOR
50504 U N I V . O F M A S S . / A M H E R S T (A C A D E M I C)
WHAT FUELTYPE I S TO BE E L I M I N A T E D ? (E X A M P L E N)
E
FOR WHAT F I S C A L Y E A R Y Y DO YOU WANT THE R ECOR D DELETED?
□:
79
FOR WHAT MONTH(S) DO YOU WANT THE R ECOR D DELETED?
□:
7
YOU W I L L H A V E T H E O P T I O N O F D E L E T T N G
FAC I L I T Y 50504
JULY O F F I S C A L Y E A R 79
E L E C T R I C I T Y
T H E Q U A N T I T Y L I S T E D I S
6064459
T H E C O S T L I S T E D I S
175147
DO YOU WANT TO DELETE THESE R ECOR D S ?
ANSWER 'YES' OF 'NO' .
YES
DO YOU W I S H TO DELETE MORE R ECOR D S ?
ANSWER 'YES' OR 'NO' .
NO
16:53:02 11/20/78 SAMPLE

```
)LOAD SAMPLE
SAVED 16:53:3 11/20/78
ADFAC
WHAT IS THE I .D . NUMBER OF THE FACI LI TY YOU WISH TO ADD?
□:
    123456789
WHAT IS THE NAME OF THIS FACI LI TY?
MASSACHUSETTS ENERGY OFFICE
WHAT WAS ITS ORIGINAL SQUARE FOOTAGE?
□:
    54321
10:41:34 11/21/78 SAMPLE
```


5.0 OUTPUT FUNCTIONS

The Massachusetts Consumption Monitoring allows the user to access the data base in various ways. These are described in this section.

5.1 Checking for Completeness of Data

Periodically, you may want to see whether all your data is in the data base. Whenever data is added to the input phase a "1" is placed in a separate matrix to indicate the existence of data. The COMPLETENESS routine adds up these numbers for a given fuel type to see if all the data has been entered. A sample is shown below:

78

10101	12	0	0	0	0	0	0	0	12
10102	12	0	0	0	0	0	0	0	12
10103	12	0	0	0	0	0	0	0	12
10104	12	0	0	0	0	0	0	0	12
10105	12	0	0	0	0	0	0	0	12
40101	12	1	12	0	12	0	0	12	0
40102	12	12	11	7	12	0	0	12	0
40103	12	0	0	0	10	0	0	0	0
40104	0	0	0	0	0	0	0	0	0
40105	12	12	0	0	11	0	0	11	0

The numbers represent the number of months of data that are there for each fueltype and for that year for each facility. Remember that if a facility normally uses a fuel but has zero use in a given month, a card should still be entered for it.

To get this report follow these steps. A sample is shown in Figure 5-B.

1. Follow the procedure in section 2 and proceed to the APL environment.
2. Load you workspace by typing:
)LOAD *id*
3. Now type:
 COMPLETENESS
4. You will be asked what year you want the information for; answer this question.
5. If you want completeness reports for other years go back to step 3.

COMPLETENESS

WHAT YEAR DO YOU WANT THE COMPLETENESS REPORT FOR?

YOUR CHOICES ARE:

73 76 78 79

ENTER THE 2 DIGIT YEAR NOW.

□:

78

10101	12	0	0	0	0	0	0	0	12
10102	12	0	0	0	0	0	0	0	12
10103	12	0	0	0	0	0	0	0	12
10104	12	0	0	0	0	0	0	0	12
10105	12	0	0	0	0	0	0	0	12
40101	12	1	12	0	12	0	0	12	0
40102	12	12	11	7	12	0	0	12	0
40103	12	0	0	0	10	0	0	0	0
40104	0	0	0	0	0	0	0	0	0
40105	12	12	0	0	11	0	0	11	0
40106	12	0	12	0	12	0	0	12	0
40107	12	12	0	0	0	0	0	0	0

FIGURE 5-B

5.2 Facility Reports

The Massachusetts Consumption Monitoring System allows the user to display the data for a facility for a given year. Appendix A is an example of this report. If you are printing a small number of reports you can do so on the terminal using the DISPLAY function. If you have a large number of reports they should be done on the high speed printer using the PRINTDATA function.

In order to print out these reports follow the steps below. Figure 5-C shows examples of the procedure to follow to print these reports.

1. Follow the first two steps of section 5.1 to get ready for output.
2. To send reports to the high speed printer, type:
PRINTDATA
To display reports on the terminal type:
DISPLAY
3. Enter the facility I.D.'s you want in response to the query from the computer. You may type FACILITIES if you want all facilities printed out. You also have the option to enter any name that contains a series of I.D. numbers that has been set up beforehand.
4. Enter the fiscal year you want. If you want reports for more than one fiscal year, go back to step 2 after step 5.
5. If you are using the DISPLAY function you should turn the carriage control to the top of the page when asked. Then press return and the report will start printing. Make sure the paper remains straight if you are printing several reports.

If you are using the PRINTDATA functions, after a few minutes, the computer will indicate that the reports are being printed. You should make arrangements to pick up the reports.

PRINTDATA

ENTER THE ID NUMBER OF THE FACILITIES YOU WISH TO DISPLAY
IF YOU WANT ALL FACILITIES TYPE 'FACILITIES.'

□:

10101

ENTER THE FISCAL YEAR YY YOU WISH TO BE PRINTED.

□:

78

PR T FILE 5153 TO VNET COPY 01 NOHOLD

PROGRAM COMPLETE

12:25:03**NOTE FROM VNET : SENT FILE 5153 ON LINK VNETWS TO VS
STON AS JOB V 325056

DISPLAY

ENTER THE ID NUMBER OF THE FACILITIES YOU WISH TO DISPLAY

□:

50504 10101

ENTER THE FISCAL YEAR YY YOU WISH TO DISPLAY

□:

78

TURN PAPER TO TOP OF PAGE, THEN PRESS RETURN.

5.3 The Monthly Report

The system allows the user to print two page MONTHLY reports. An example is shown in Appendix B . Before running this report, make sure that you loaded all the data into the system (section 4.2.1). Check the COMPLETENESS function (5.1.1) and see what data you are missing.

When you are ready, perform the following steps. Figure 5-D shows a sample run.

1. Follow the first two steps of Section 5.1 to get ready for output.
2. Type:
MONTHLY
3. When you are asked for the year, enter the Fiscal year you want a report for.
4. Enter the month of the fiscal year when asked.
5. Enter the facility I.D.'s you want in response to the query from the computer. You may type FACILITIES if you want reports for all facilities. You also have the option to enter any name that contains a series of I.D. numbers that has been set up beforehand.
6. You will be asked if you want station degree day information displayed. You should answer "YES" if you have performed the ADDEGD function (section 4.2.3) for the current month.
7. You will be asked if you want to display any back years. If you have any available you should type YES.
8. You should then wait a couple of minutes and then you will get a message on the terminal that the reports have been sent to the printer. You should arrange to pick up the reports.

5.4 Querying the Data Base

Often one wishes to obtain information that cannot be accessed directly by any of the programs. User's who are somewhat familiar with

MONTHLY

WHAT 2 DIGIT FISCAL YEAR DO YOU WANT THE REPORT FOR

□:

73

WHAT MONTH OF THE FISCAL YEAR DO YOU WANT THE REPORT FOR
FOR EXAMPLE 1 FOR JULY 12 FOR JUNE

□:

2

IF YOU WANT THE REPORTS FOR ALL FACILITIES TYPE 'FACILITIES'
OTHERWISE TYPE THE FACILITY ID NUMBERS YOU WANT.

□:

10101 10103

DO YOU WANT TO DISPLAY DEGREE DAY INFORMATION FOR WEATHER
STATIONS? ANSWER YES OR NO

YES

YOU HAVE THE OPTION TO DISPLAY INFORMATION FOR ZERO,
ONE, OR TWO PREVIOUS FISCAL YEARS. YOU HAVE THE FOLLOWING
FISCAL YEARS AVAILABLE.

73 76 78 79

I SUGGEST YOU DISPLAY THE PAST YEAR AND A BASE YEAR

DO YOU WANT TO DISPLAY ANY BACK YEARS?

ANSWER 'YES' OR 'NO'

YES

PLEASE ENTER THE YEARS YOU WANT IN THE ORDER YOU WANT THEM.

□:

78 73

PROGRAM COMPLETE

APL can access this information directly from the data base.

The primary data is stored in 4 dimensional matrices called COST and QUAN. Their dimensions are years, facility, fueltype, and month. Other information is in SQFT and DEGD. These have dimensions of years, facilities, and months. To access information you must obtain the index for each dimension. This can be done using the `⍒` operator which is above the "I" on the keyboard. Figure 5-E shows a sample run where we accessed information directly from the data base. Here are the steps to take to access data:

1. Follow the procedure in Section 2 and proceed to the APL environment.
2. Put the data into the active memory by typing:
 `)COPY id`
 where *id* is the workspace I.D. you determined in section 3.1.
 By using the copy command the data can not be accidentally altered.
3. Find the indexes of the information you want to access. This is most clearly seen in the tables.
4. Type in the name of the matrix and the indexes you want. The terminal will respond with the value.

You can access multiple entries in the same command. If you leave a dimension empty all values will be assumed. Remember not to leave out any semicolons. The command:

`+/[n]array[indexex]`

allows you to add up all the entries in the *n* dimension of the array and indexes you have specified.

Do not use the `+/` command on the fueltype dimension of the quantity matrix since the different fuels are in different units.

If you want to add up or display some of the entries in a given dimension but not all, you can put multiple values in a given dimension. You can either enter several values or use the `⍒` command with a single argument. Examples of this are shown in Figure 5-E.

We first copy the workspace rather than loading it

)COPY SAMPLE

SAVED 10:41:34 11/21/78

We determine the indexes for the year and facility
we are interested in

YEAR S 176

2

FACILITIES 150504

62

✓ We determine the indexes for fueltype, natural gas, and the month, May.
The fueltype must be in quotes since it is a literal

FUELTYPES 'N'

2

MONTHS 5

11

We now find the cost and quantity for those parameters

COST [2;62;2;11]

1756

QUAN [2;62;2;11]

7382

By leaving out the cost term we could have a listing of the cost
for each month

COST [2;62;2;]

3 35 773 1847 2253 1968 1736 1333 2006 2146 2228 1756 13 047

Using the +/ command we could get total cost for the year

+/COST [2;62;2;]

38034

Leaving out the fueltype we get total usage of all fueltypes
for May

+/COST [2;62;;11]

327553

We could also get the total costs for all facilities, fueltypes, and
months for each year

+/+/+/COST [;;;]

13139706 33982940 39980522 4770614

This is the total cost for the month of May for all facilities by fueltypes

+/ [1]COST [2;;;11]

1152718 134985 7353 136774 44277 16323 5636 788259 80751

6. EDITING

The user has the ability to change CMS files or APL programs. The procedure is similar but not identical. Section 6.1 describes in detail how to edit a CMS file. Section 6.2 describes the slightly different procedure for editing in APL.

6.1 The CMS Editor

1. Get into the CMS environment. If you are not already there follow the procedures in section 2.
2. Now type:
 EDIT *f*_n *f*_t
 where *f*_n *f*_t are the filename and filetype of the file you want to edit.
3. Now if you wish to list out the entire file type:
 TYPE *
4. Now get to the line you want. To do this make use of these two commands:
 N*n*
 U*n*
 where *n* is the number of lines you wish to go forward or up. You may use these commands as much as you want until you get to the line you want to correct.
5. Make the correction. To do this use the command:
 C/*wrong entry/right entry*
 The computer will replace the incorrect line with the corrected version. If the series of characters you want to change appear more than once, the left most series will be corrected. Therefore before making a change, make sure that you are correcting what you think you are correcting. Spaces are treated as characters so make sure the number of characters and spaces between the two slashes is equal to the number between the second slash and the carriage return. The corrected line will now be printed out.

 To add new lines type:
 INPUT
 You will now be able to add as many lines as you like. When you are done with your inputs, press the RETURN key twice.

 To delete a record go to the line it is on and type:
 DELETE
6. After you have made a change you can go back to step 4 and

make additional changes.

7. When you are done type:

FILE

and the new form of the file will replace the old run.

If you have made mistakes and don't want the new version saved type:

QUIT

8. You will now be back in CMS and you can go on from there.

6.2 The APL Editor

This is similar to the CMS Editor but the following differences should be noted.

Step 1 You should enter the APL environment

Step 2 To get into the editor type:

E'*name*'

where *name* is the name of the function you wish to edit.

7.1 Correcting Errors in APL

If you make a mistake while typing in an entry, it can be corrected. To do so backspace to the error and quickly press the break or attention key. You may then continue typing from the point of the error.

Sometimes when you are executing a function an error will occur. The line of code where the error occurred will be listed along with the reason for the error. Generally the cause of the error is improper inputs. After identifying your error you must get out of the suspended state. To do this type a right facing arrow.

If you were in the ADDATA function, you must close the file. To do this type:

CLOSE

You may now try and run the function again. If you are still having trouble consult the Systems Manual. If you get a READ ERROR you should reenter the line. If you want to interrupt the computer while it is doing something such as printing quickly, hit the attention or break key. If the computer every displays "CP" while you are doing something type:

BEGIN

and you will be returned to where you left off.

7.2 Correcting Errors in CMS

If you are typing something and you discover you have made an error, type:

¢

on the line you made the error. They press the RETURN key and the whole line will be ignored.

ENERGY CONSUMPTION REPORT

TAUNTON STATE HOSPITAL

I.D. NUMBER 40123

FISCAL YEAR 1976

	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTALS
ELEC(KWH)	195101	213155	190475	214172	229425	238302	264454	218051	238831	207033	221949	212517	2648591
NATG(CCF)	1303	1155	1265	1345	1541	1282	1611	2112	859	1038	875	834	15281
OIL NO2(GAL)	31	170	924	4259	8666	12344	15298	9654	8618	5350	1491	639	67564
OIL NO6(GAL)	22436	22334	32725	60581	85753	142563	171653	131121	125602	78464	51946	31409	956647
WATER(SOURCE)	5798	5975	7417	12406	17051	26226	31531	24034	23154	15177	10742	7390	186970
SQUARE FOOTAGE	949355	949355	949355	949355	949355	949355	949355	949355	949355	949355	949355	949355	
MBTU / SQFT	6	6	8	13	18	28	33	25	24	16	11	8	137
TOTAL COST	14155	14712	17555	28458	38619	58330	69805	53224	51523	34564	23925	16553	421423

MONTHLY ENERGY CONSUMPTION REPORT

JUNE 1978

40123 TAUNTON STATE HOSPITAL

THIS REPORT GIVES INFORMATION ON ENERGY CONSUMPTION AT YOUR FACILITY. IT IS BASED ON THE 'ENERGY CONSUMPTION REPORTING FORMS' YOU HAVE SUBMITTED.

BELOW IS DATA FOR THIS JUNE AND FOR JUNE OF PREVIOUS YEARS.

MONTHLY USAGE		FY78	FY76	FY73
-----		----	----	----
ELECTRICITY	KILOWATT HOURS	174344	212517	232600
	DOLLARS	7447	7012	7908
NATURAL GAS	100 CUBIC FEET	932	834	3404
	DOLLARS	397	420	765
OIL NO. 2	GALLONS	655	699	1066
	DOLLARS	333	245	373
OIL NO. 6	GALLONS	27938	31409	31054
	DOLLARS	9005	8876	9937

TOTALS	MMBTU (SOURCE)	6431	7390	7886
	DOLLARS	17182	16553	18983
SQUARE FOOTAGE		949355	949355	949355
DEGREE DAYS FOR THIS MONTH:				

FOR YOUR FACILITY		19	***	***
WEATHER STATIONS	NORMS			
-----	-----			
BOSTON	36	17	13	24
WORCESTER	78	69	60	37

40123

PAGE 2

THE INFORMATION BELOW IS THE CUMULATIVE TOTAL FOR JULY THROUGH JUNE

YEAR-TO-DATE -----	FY78 -----	FY76 -----	FY73 -----
ELECTRICITY THOUSAND KWH:	2443	2649	2810
DOLLARS:	104682	90564	95545
OTHER FUELS MILLION BTUS:	163954	156829	193055
DOLLARS:	353395	330859	411009
DEGREE DAYS:	4515		
ELECTRICITY KWH/SQFT:	2.57	2.79	2.96
OTHER FUELS 1000 BTU/SQFT:	173	165	203
TOTAL 1000 BTU/SQFT:	202	197	237
TOTAL COST/SQFT	.48	.44	.53

THE FIGURES BELOW REFER TO CHANGES BETWEEN THE TWO YEARS LISTED.

PERCENT CHANGE -----	FY78/76 -----	FY78/73 -----
ELECTRICITY BTU/SQFT:	-7.75	-13.05
OTHER FUELS BTU/SQFT:	4.54	-15.07
TOTAL BTU/SQFT:	2.56	-14.79
DOLLARS/SQFT:	8.70	-9.57
COST/MILLION BTUS:	5.98	6.12

SYSTEMS MAINTENANCE MANUAL

By

Daniel Kahn

Massachusetts Energy Office

1. INTRODUCTION

This manual is intended for use by programmers who wish to make changes to the software for Massachusetts Consumption Monitoring programs. It should be used in conjunction with the User's Manual which describes how the software is used.

This software was written in VSAPL on an IBM 370 VM/CMS supported machine. Modifications might be required if a different machine is used. With some modifications it should be possible to run these programs on a mini-computer with APL capabilities.

This code was written to be as general purpose as possible, and to allow for easy access of data. However, changes may be necessary depending on the user's requirements. To simplify interpretation, a limited set of APL operators are used. The listings at the end of this manual are current as of December 1, 1978 .

2. CALLING SEQUENCES

Calling sequences show the order in which functions are executed. The functions on the far left are the main functions, which then call the subfunctions in the order listed. Some of these call other functions.

These listings serve as a guide to other sections of this manual.

DISPLAY

- DTITLE
- DFILL
- DTOTALS

PRINTDATA

- PRINTBOS
- DTITLE
- DFILL
- DTOTALS
- PRINTPAGE
- PRINTCLOSE

MONTHLY

- QUESTIONS
- HEADER
- KEEP
- PRINTNEWTON.
- FIRST
- TOTALS
- PDEGD
- PRINTPAGE
- SECOND
- PRINTPAGE
- PRINTCLOSE

CHANGES

3. BRIEF DESCRIPTION OF FUNCTIONS

3.1 Setup Functions

BUILDARRAYS:	Establishes data matrices
CONSTANTS:	Defines values for global variables used in inputs and output workspaces
MINMAX:	Defines minimum and maximum acceptable values for the cost/quantity ratio in the input phase
FACIL:	Takes the facility I.D.'s, names, and square footage from the master file and puts it into global variables
ENTERFACID:	Reads the CMS master file
OPEN:	Opens shared variables with a CMS file

3.2 Input Functions For Entering Consumption Data

ADDATA: Takes a data record from the CMS consumption file and puts it into the APL matrices. Prints out invalid records and also stores them in a CMS file. It then saves the workspace.

READCARD: Takes a CMS card image and breaks it down into its various data elements.

VALIDATE: Checks each record to see if it is valid. If it is not, it is put into ERRORMATRIX.

FINDDEGD: If no degree day information is available put in "1".

3.3 Other Input Functions

NEWSQFT: Allows the terminal user to enter new square footage information.

ADDEGD: Allows the terminal user to enter station degree day information.

ADFAC: Allows the user to enter new facilities to be monitored.

3.4 Output Functions - Facility Summary Reports

DISPLAY:	Prints the Facility Consumption Reports on the terminal
PRINTDATA:	Prints the reports on the high speed printer
DTITLE:	Sets up the titles for the report
DFILL:	Puts the data by fueltype into the report
DTOTALS:	Puts the totals into the report
PRINTBOS:	Opens a shared variable to the printer for output to CallData in Boston
PRINTPAGE:	Prints a page on the high speed printer line by line
PRINTCLOSE:	Closes the shared variable with the printer

OUTPUT FUNCTIONS - Monthly Reports

MONTHLY:	Calls all the functions necessary to print out monthly reports
QUESTIONS:	Asks the user all necessary questions and processes the answers
HEADER:	Establishes the headings for the first page of the report
KEEP:	Establishes the headings for the second page of the report
FIRST:	Puts the consumption and cost for each fueltype into the first page of the montly report
TOTALS:	Puts the totals into the first page of the report
PDEGD:	Puts in the degree day and square footage information at the bottom of the first page of the report
SECOND:	Fills in all the information in the upper part of the second page of the report
CHANGES:	Fills in the bottom part of the second page of the report
PRINTNEWTON:	Opens a shared variable with the printer for high speed output in Newton, Mass. Also requests the use of special paper
PRINTPAGE and PRINTCLOSE:	Same as in the facility summary report

OTHER OUTPUT FUNCTIONS

COMPLETENESS: Prints out the number of months for which data has been reported for each fuel type

COSTSUM: Prints out the total amount of money spent by each facility for each fueltype in the year given

QUANSUM: Prints out the total quantity of fuel consumed by each facility for each fueltype in the year given

4. DICTIONARY OF GLOBAL VARIABLES

The following is a list of the global variables used in the system. Local variables which are created and used within a single program are not included. The letter in parentheses; N or L, indicates whether the array is numeric or literal. The number is the rank of the array.

AMON (L2):	Contains the three letter abbreviations for the months of the fiscal year
AMONTHS (L2)	The months of the calendar year written out with a maximum of nine letters
COMP (N4)	A matrix consisting of zeros and ones. A one indicates that data for a given year, facility, fueltype, and month has been reported. This can be used to see if a facility has failed to report a fuel they normally use in a given month
COST (N4)	Contains the amount of money spent by year, facility, fueltype, and month
DEGD (N3)	Contains heating degree days reported by facilities for each month. A "1" indicates no information was reported
DFUELS (L2)	12 character abbreviations for the fueltypes and units. This is used in the DTITLE function
DMON (L2)	3 letter abbreviation for the months in fiscal year order. Contains three spaces before and two spaces after each entry
ERRORMATRIX (L2)	This is the error list from the last time the ADDATA function was run. It is the APL version of what was written to ERROR DATA in CMS
FACILITIES (N1)	A list of the facility I.D.'s that are being monitored
FUELTYPES (L1)	A vector consisting of the one letter abbreviation for each fueltype.
MAXIMUM (N2)	The highest allowable ratio of cost to quantity for each fueltype. It is indexed by year and fueltype
MINIMUM (N2)	The lowest allowable ratio of cost to quantity for each fueltype. It is indexed by year and fueltype.
MONTHS (N1)	The number of the months in the order they occur within the fiscal years
NAMES (L2)	The names of the facilities being monitored.
NDEGD (N2)	Contains 30 year degree day norms for the weather stations.

NFAC (N0):	The number of facilities that are being monitored at a given time.
NFLS (N0)	The number of fueltypes being monitored
NSTATIONS (N0)	The number of weather stations being monitored
NYRS (N0)	The number of years being monitored
QUAN (N4)	Contains the quantity of fuel consumed indexed by year, facility, fueltype, and month. It is measured in units for each fueltype.
SDEGD (N3)	Degree days for each weather station for each month and year
SOURCE (N1)	The conversion of units of a fuel to BTUs at the source
SQFT (N3)	The square footage for each facility by year and month
STATIONS (L2)	The names of the weather stations that will be printed out in the monthly report.
TYPE (L2)	Names of fueltypes for monthly reports
UNITS (L2)	Units of fuels for monthly reports
YEARS (N1)	The years that are being monitored

5. DETAILED PROGRAM DESCRIPTIONS

5.1 Setup Programs

This phase initializes the data matrices, constants, and literals used throughout the programs. The system has been designed so that hopefully all the adjustments for different organizations can be performed in this stage. These programs, with the exception of MINMAX, should only be used when setting up a new system.

BUILDARRAYS: Calls the other programs in this phase. Then the main data arrays are initialized.

CONSTANTS: Establishes various global constants. The years to be monitored are entered interactively.

MINMAX: Establishes the acceptable range for the ratio of cost/quantity for each fueltype. In the input phase if the ratio for a given fueltype and year is smaller than the MINIMUM or greater than the MAXIMUM the record is put aside. The range should not be too small or too large. If it is too small, too many records will be rejected to deal with them effectively. If the range is too large incorrect data may be put into the system.

The years that the MINIMUM and MAXIMUMS are for should be the same as those inputted in BUILDARRAYS. If they are not, then default values are put in for all years. These default values are not dependent on the year so if there were changes in fuel prices the ranges will be too large.

Before setting up a system you should see that the years and values in the MINMAX program are correct. If after setting up the system you would like to change the values you can edit MINMAX and then execute the function.

FACIL: Calls ENTERFACID which creates the IDSQFT matrix containing the facility I.D.s, names, and original square footage. FACIL finds the number of facilities. Then it breaks down the original matrix and creates the arrays: FACILITIES, NAMES, and SQFT.

ENTERFACID: Opens the master file. Then it reads the file and creates the array IDSQFT. Then the file is closed.

LITERALS: Defines various literals that are used throughout the system. The names and units for the fueltypes are put in two forms. If you ever want to change the fueltypes being monitored this function will have to be altered.

5.2 Input Programs - Consumption Data

These programs enter information into the data base. Great care should be taken in modifying these programs in an existing system so that data is not accidentally altered. It is suggested that any changes be thoroughly tested in a temporary workspace.

- ADDDATA: Adds consumption data from a CMS file into the APL data base. If the filename starts with ERROR the user is given the option of bypassing the cost/quantity validation checks. The program reads one card image and processes it. Then it is checked by the VALIDATE routine. If it is rejected we go on to the next record. Otherwise the COST, QUAN, and DEGD information is entered. A "1" is put into the COMP matrix. Then the ERRORMATRIX is printed out. The ERRORMATRIX is written into a CMS file called ERROR DATA. Then the workspace is saved.
- READCARD: Takes the information off the card image and puts it in a form that can be used later in the program. The indexes are determined and the input information is put into numeric form.
- VALIDATE: First checks to see if any of the indexes are wrong. In an index was not found in the READCARD function a value of the number of elements in the array plus one is returned. Therefore, we check to see if the index is greater than the number of elements. If so the record is considered an error.
- If in the ADDDATA function the user indicated he did not want the cost/quantity validation performed SKIP has a value of one, so at this point the record is passed. Otherwise a check is made to see if the quantity was zero. There is sometimes a charge even with zero quantity so these records are passed. Then a check is made to see that the ratio is less than the maximum and greater than the minimum. If this is not the case the record drops through as an error.
- In case of error the record number from the CMS file is catenated onto the card record. Then this is catenated onto the ERRORMATRIX. The matrix starts with dimensions of 0 90. Every time a new record is added, the first dimension increases by one. Then FLAG is set to "1" so that this record will not be added to the data base.
- FINDDEGD: If no degree day information was reported a "1" is put into the DEGD matrix. If this information was already in the system, it is left there.

The weather stations to be monitored are put into STATIONS and the number into NSTATIONS. The norms for the stations are put into NDEGD. Then the degree day information for the various years which were available when the system was set up are put into SDEGD. When you wish to add new degree day information, you should use the ADDEGD function. Remember that if this function is ever run after the system is set up, the new degree day information will be eliminated.

5.3 Other Input Programs

NEWSQFT: Accepts input from the terminal on what square footage change is to be entered. If the month entered is not in the system, the first available month is put in its place. The program takes the existing information on a facility and unravels it from two dimensions into a vector. The new information is put into the vector and the vector is reloaded into the SQFT matrix. When the operator is finished the workspace is saved.

DELETERECORD: The program asks which record is to be deleted. Then this information is given back to the operator. The currently listed cost and quantity information is also displayed. The operator is asked whether or not he wishes to delete the record. If he does, zero is put in for all the data including completeness (Comp). When the operator is finished the workspace is saved.

ADDEGD: This function accepts input from the terminal on which weather station the operator wishes to change. Then the currently listed value is displayed and the operator is allowed to enter the new data. When all changes have been made the workspace is saved.

ADFAC: Allows the operator to enter new facilities to be monitored. An extra 3-space is created for COST, QUAN, and COMP. This is catenated onto the matrix. The same is done for DEGD, SQFT. and names. Then the workspace is saved.

5.4 The Facility Reports

DISPLAY: This function prints out the one page yearly facility summary reports on the terminal. The program receives input from the terminal. Then the literal matrix, PAGE is defined. This is then assigned, by the various subprograms, all the output for each page. This is then displayed.

PRINTDATA: Performs the same functions as DISPLAY. In addition it calls PRINTBOS, PRINTPAGE, and PRINTCLOSE so the reports are sent to the high speed printer.

DTITLE: Calls for the date and time. Then the month, day and year are put at the top of the output matrix. Then the various headers are put into the matrix.

DFILL: This program first checks to see if the fueltype was reported by the facility in the relevant year. If it was reported the name and units are put into the output matrix. Then each month is checked. If for a given month the fuel was reported, the quantity, which might be zero is put into the matrix. Otherwise stars are put in the spot. After all the months are checked the total is put in at the end of the line.

DTOTAL: This program puts in the totals at the bottom of the report. First total BTU's are found. The array T gives the BTU conversion factor in a form that is conformable with the quantity array. After BTUs for each month are found, the total is calculated. Then the square footage and BTU's/square foot are calculated. Finally cost information is put into the matrix.

5.5 Monthly Reports

It is likely that new users may wish to make changes to the format of this report. To aid in debugging the program, DISMONTHLY can be run. This is the same as MONTHLY except that rather than sending the reports to the printer, they are written on the terminal.

MONTHLY: This is the core program that produces the monthly report. It first calls, QUESTIONS, which asks the user what he wants in the reports. Then the headers are put in for the two pages. These are not changed between reports. Then the print file is opened. If a facility is not found a message is displayed on the terminal.

The data that will be used for a given facility is pulled out so that the large arrays won't have to be searched as often. We then see if there is any data for a facility in a given year. If there was no data we don't do any comparisons with that year. If there is no data for any years no facility report is printed. ASOURCE is an array that contains the BTU conversion factors. It is made to be conformable with a quantity array used later in the program. Then the programs are called to set up the two pages and print them. Then we go through the loop again. When all the reports have been printed the printfile is closed.

QUESTIONS: This program first asks the calendar year and month the report is for. This is then converted to fiscal year. Then the user is asked which facilities he wants the report for. If only one is requested it must be converted from a scalar to an array. If the user doesn't want any station degree day information printed out a flag is set so that that page is skipped. Then the user is asked what back years he wants displayed. These are catenated with the current year.

HEADER: This function first asks the date and time. The day, month, and year are put on the top of the page. Then all the headings for the first page are put into the output matrix after each facility is printed.

KEEP: This sets up the header for the second page. The left side of the page does not change from one report to another so it is not erased.

FIRST: Puts in headers that vary from report to report. Then the program determines which fueltypes have been used by this facility. If a fuel is used its name and units

are put in the matrix. Then the usage for each year for the month in question is put into the matrix. If the data was not reported for a year, stars are printed in its place.

TOTALS: Puts in the totals for the first page. The total quantity in MMBTUs is calculated. Then total cost for the months in question is added up. These numbers are put into the output matrix.

PDEGD: The square footage information is processed. Then the facility degree days are reported. A "1" indicates no information was reported so we replace it by stars.

Then the weather station information is printed out. If the user indicated in QUESTIONS that he wanted this information skipped it is not printed out,

SECOND: The headers are put in that vary from report to report. INDEX is defined as the columns in which information is to be placed. The various quantities that are needed for the top part of the second page are calculated. Note that YS is a vector so the results can be multi-valued. The various values are put into the output matrix as the various columns. If for any year, degree day information was not reported, stars are put in that place.

CHANGES: This is called by SECOND so it can take advantage of local variables. If there are no comparisons the first line exits from the program. Then the heading with the first two years to be compared is put in. If two comparisons are to be made the title for the second comparison is put in.

Then the percent changes between the first and second year are calculated and put in the matrix. The variable WHERE tells where on the page to put the numbers calculated.

If there is three year's data the first and third year's data is then compared.

FOOTNOTE: This routine checks to see if electricity was reported for every month. If it is not a note is printed out at the bottom of the report.

5.6 The Print Programs

These programs were written specifically for use by the CALldata computer. They allow the yearly summary reports to be printed on their remote terminal in Boston. The monthly reports are printed on 8½ x 11 paper at their main computer in Newton, MA.

New users will probably want to change these programs to make them relevant for their computer system.

PRINTBOS:	Opens the shared variable for the printer in Boston and gives the output report a tag.
	The CP and CMS commands allow a line in APL to be processed as if it were a line in CP or CMS
PRINTNEWTON:	Opens a shared variable to the printer in Newton. This program also gives a tag and requests 8½ x 11 plain paper
PRINTPAGE:	Sends a page to the printer
PRINTCLOSE:	Closes the print file

5.7 Basic Functions

The following functions are canned programs that go along with our Consumption Program.

- CMS: Allows a user in the APL environment to execute a statement as if it were in CMS.
- CP: Allows a user in the APL environment to execute a statement as if it were in CP.
- E,E: Allows the user to edit APL functions using standard edit functions. These are described in the User's Manual.

6. Software Listings

```

VBUT LDARRAYS [] ]V
V BUT LDARRAYS;ANS
[1 ]  THIS PROGRAM INITIALIZES THE ARRAYS USED THROUGHOUT THE SYSTEM.
[2 ]  'THIS PROGRAM SHOULD BE USED ONLY WHEN SETTING UP A NEW SYSTEM.'
[3 ]  'IF THAT IS WHAT YOU WANT TO DO TYPE YES OTHERWISE TYPE NO.'
[4 ]  ANS←[]
[5 ]  →(ANS[1]≠'Y')/0
[6 ]  CONSTANTS
[7 ]  MINMAX
[8 ]  FACT L
[9 ]  LITERALS
[10 ] COST←(NYRS,NFAC,NFLS,12)ρ0
[11 ] QUAN←(NYRS,NFAC,NFLS,12)ρ0
[12 ] COMP←(NYRS,NFAC,NFLS,12)ρ0
[13 ] DEGD←(NYRS,NFAC,12)ρ0
[14 ] 'PROGRAM COMPLETE'
V

```

```

VCONSTANTS [] ]V
V CONSTANTS
[1 ]  INITIALIZES GLOBAL VARIABLES TO BE USED THROUGHOUT THE SYSTEM.
[2 ]  FUELTYPES←'ENPC2456S'
[3 ]  MONTHS← 7 8 9 10 11 12 1 2 3 4 5 6
[4 ]  'ENTER THE FISCAL YEARS YOU WANT IN CHRONOLOGICAL ORDER '
[5 ]  'FOR EXAMPLE 73 78 79 80'
[6 ]  YEARS←[]
[7 ]  NFLS←ρFUELTYPES
[8 ]  NYRS←ρYEARS
[9 ]  SOURCE←9ρ 10500 105000 91500 26000000 139600 145100 148800
152400 1265000
V

```



```

VMI NMAX [ ] V
V MI NMAX
[1] A OF THE YEARS ARE NOT IN CORRESPONDANCE WE GO TO THE DEFAULT.
[2] →(NYRS≠4)/L1
[3] →(∼(Λ/YEAR S=(73 76 78 79)))/L1
[4] MI NI MI UM+(NYRS,NFLS)ρ0
[5] MAXI MI UM+(NYRS,NFLS)ρ0
[6] MI NI MI UM [1;]← 0.005 0.05 0.09 18 0.1 0.06 0.06 0.06 0.5
[7] MI NI MI UM [2;]← 0.02 0.1 0.25 40 0.25 0.25 0.15 0.15 3
[8] MI NI MI UM [3;]← 0.02 0.1 0.25 40 0.25 0.25 0.15 0.15 3
[9] MI NI MI UM [4;]← 0.02 0.1 0.25 40 0.25 0.25 0.15 0.15 3
[10] MAXI MI UM [1;]← 0.04 0.5 0.27 35 0.25 0.25 0.25 0.35 8
[11] MAXI MI UM [2;]← 0.075 0.8 0.7 70 0.7 0.55 0.5 0.5 10
[12] MAXI MI UM [3;]← 0.09 0.9 0.9 70 0.8 0.55 0.5 0.5 12
[13] MAXI MI UM [4;]← 0.09 0.9 0.9 70 0.8 0.55 0.5 0.5 12
[14] →0
[15] L1:MI NI MI UM+(NYRS,9)ρ 0.009 0.12 0.13 18 0.1 0.06 0.06 0.06 2
[16] MAXI MI UM+(NYRS,9)ρ 0.09 0.9 0.9 70 0.8 0.55 0.5 0.5 12
V

```

```

VFACIL [ ] V
V FAC L;A;REC;IDSQFT;CODES
[1] ENTER FACID
[2] A THIS PROGRAM COPIES SQFT,FACT LITY NAMES, AND FACT LITY ID'S FROM
[3] IDSQFT INTO ARRAYS CONSISTENT WITH THE NEW CMS SYSTEM
[4] NFAC←CODES [3]-1
[5] FAC LIT IES←NFACρ0
[6] SQFT←(NYRS,NFAC,12)ρ0
[7] A←1
[8] L1:FAC LIT IES [A]←IDSQFT [A;110]
[9] SQFT [;A;]←IDSQFT [A;6+110]
[10] A←A+1
[11] →(A≤NFAC)/L1
[12] NAMES←(NFAC,40)ρIDSQFT [;20+140]
[13] 'LOAD COMPLETE'
V

```

```

VENTER FACID [ ] V
V ENTER FACID;I;N;Z;CTL
[1] 'ENTER THE ID OF THE MASTER FILE'
[2] OPEN
[3] I←CTL
[4] A THIS READS THE MAIN FILE CONTAINING FACT LITY IDS, NAMES AND
[5] ORIGINAL SQUARE FOOTAGE INTO AN APL CHARACTER MATRIX.
[6] N←1
[7] IDSQFT←((CODES [3]-1),80)ρ' '
[8] L1:IDSQFT [N;]←REC
[9] N←N+1
[10] →(CTL [2]<CODES [3])/L1
[11] N←[ ]SVR 2 3 ρ'RECCTL'
V

```

V L I T E R A L S [] V

V L I T E R A L S

```
[1] A DFUELS IS USED IN DFT LL .
[2] DFUELS← 9 12 ρ' '
[3] DFUELS [1 2 3 ; ]← 3 12 ρ' ELEC(KWH) NATG(CCF) PROP(GAL) '
[4] DFUELS [4 5 6 ; ]← 3 12 ρ' COAL(TONS) OIL NO2(GAL) OIL NO4(GAL) '
[5] DFUELS [7 8 9 ; ]← 3 12 ρ' OIL NO5(GAL) OIL NO6(GAL) STEAM(KLBS) '
[6] AMON← 12 3 ρ' JUL AUG SEP OCT NOV DEC JAN FEB MAR APR MAY JUN '
[7] A DMON IS USED IN DTT TLE .
[8] DMON← (12 3 ρ' ' ) , AMON , (12 2 ρ' ' )
[9] A TYPE IS USED IN FIR ST .
[10] TYPE← 9 11 ρ' '
[11] TYPE [1 ; ]← 'ELECTRICITY'
[12] TYPE [2 ; ]← 'NATURAL GAS'
[13] TYPE [3 ; ]← 'PROPANE'
[14] TYPE [4 ; ]← 'COAL'
[15] TYPE [5 ; ]← 'OIL NO . 2'
[16] TYPE [6 ; ]← 'OIL NO . 4'
[17] TYPE [7 ; ]← 'OIL NO . 5'
[18] TYPE [8 ; ]← 'OIL NO . 6'
[19] TYPE [9 ; ]← 'STEAM'
[20] A UNITS IS USED IN FIR ST .
[21] UNITS← 9 14 ρ' '
[22] UNITS [1 ; ]← 'KILOWATT HOURS'
[23] UNITS [2 ; ]← '100 CUBIC FEET'
[24] UNITS [3 5 6 7 8 ; ]← 5 14 ρ' GALLONS
[25] UNITS [4 ; ]← 'TONS'
[26] UNITS [9 ; ]← 'KILO POUNDS'
[27] A STATIONS , NSTATIONS , NDEGD , AND SDEGD ARE USED IN PDEGD .
[28] STATIONS← 2 10 ρ' '
[29] STATIONS [1 ; ]← 'BOSTON'
[30] STATIONS [2 ; ]← 'WORCESTER'
[31] NSTATIONS← 2
[32] NDEGD← (NSTATIONS , 12) ρ 1
[33] SDEGD← (NRS , NSTATIONS , 12) ρ 1
[34] NDEGD [1 ; ]← 0 9 60 316 603 983 1088 972 846 513 208 36
[35] NDEGD [2 ; ]← 6 34 147 450 774 1172 1271 1123 938 612 304 78
[36] SDEGD [1 ; 1 ; ]← 3 4 51 405 673 985 1033 371 666 450 258 24
[37] SDEGD [2 ; 1 ; ]← 0 12 164 350 547 1065 1320 898 850 443 272 13
[38] SDEGD [3 ; 1 ; ]← 0 4 85 304 498 948 1127 1057 885 480 209 17
[39] SDEGD [4 ; 1 ; ]← 11 1 1 1 1 1 1 1 1 1 1 1
[40] SDEGD [1 ; 2 ; ]← 16 41 171 622 897 1152 1200 1120 738 555 338 37
[41] SDEGD [2 ; 2 ; ]← 2 47 223 413 586 1161 1412 972 920 511 310 60
[42] SDEGD [3 ; 2 ; ]← 16 32 189 481 711 1202 1359 1255 1054 674 288 69
[43] SDEGD [4 ; 2 ; ]← 33 1 1 1 1 1 1 1 1 1 1 1
[44] A AMONTHS IS USED IN DTT TLE AND HEADER .
[45] AMONTHS← 12 9 ρ' '
[46] AMONTHS [1 ; ]← 'JANUARY'
[47] AMONTHS [2 ; ]← 'FEBRUARY'
[48] AMONTHS [3 ; ]← 'MARCH'
[49] AMONTHS [4 ; ]← 'APRIL'
[50] AMONTHS [5 ; ]← 'MAY'
[51] AMONTHS [6 ; ]← 'JUNE'
[52] AMONTHS [7 ; ]← 'JULY'
[53] AMONTHS [8 ; ]← 'AUGUST'
[54] AMONTHS [9 ; ]← 'SEPTEMBER'
[55] AMONTHS [10 ; ]← 'OCTOBER'
[56] AMONTHS [11 ; ]← 'NOVEMBER'
[57] AMONTHS [12 ; ]← 'DECEMBER'
```

V

```

VADDDATA [ ] V
V ADDATA;I ;J;K;L;CARD;CYEAR;CFAC;CFL;CMTH;ERROR MATRIX;FLAG;I ;J;K
;L;CDEGD;CCOST;CQUAN;Z ;Z ;SKIP;REC;CODES;SPACE
[1 ] 'THIS READS THE CMS CONSUMPTION FILE INTO THE DATA BASE.'
[2 ] 'RECORDS FOUND IN ERROR ARE PUT INTO A CMS FILE CALLED ERROR DAT
A .'
[3 ] 'IF YOU READ ANOTHER FILE BEFORE CORRECTING AND RELOADING ''ERROR
R DATA'' ,ERROR DATA'
[4 ] 'MUST BE RENAMED OR IT WILL BE ERASED. TYPE ''EXIT'' TO GET OUT
OF THIS FUNCTION .'
[5 ] 'TYPE ''OK'' TO CONTINUE .'
[6 ] ANS←[ ]
[7 ] →(ANS[1 ]≠'O')/0
[8 ] ATHIS PROGRAM READS A CMS CONSUMPTION DATA FILE INTO THE 4 DIMENS
IONAL MATRICES
[9 ] OPEN
[10 ] SKIP←0
[11 ] →(~/Z[15]='ERROR')/S1
[12 ] 'IF YOU WANT THE UNIT COST PART OF THE VALIDATION ROUTINE'
[13 ] 'BYPASSED TYPE ''BYPASS'' ,OTHERWISE TYPE ''OK'' '
[14 ] ANS←[ ]
[15 ] →(ANS[1 ]≠'B')/S1
[16 ] SKIP←1
[17 ] S1: 'TURN CARRIAGE TO TOP OF NEW PAGE. THEN PRESS THE RETURN KEY .'
[18 ] [ ]
19 ] A THE FIRST RECORD IS CONTROL
[20 ] CARD←CTL
[21 ] AINITIALIZE ERROR MATRIX
[22 ] ERROR MATRIX← 0 90 00
[23 ] ATHE MAIN LOOP TAKES ONE RECORD AND PROCESSES IT
[24 ] L1: CARD←REC
[25 ] READCARD
[26 ] AIF THE CARD IS FOUND TO BE IN ERROR WE PUT IT IN THE ERROR MATRIX
AND
[27 ] ASKIP THE MAIN MATRICES .
[28 ] FLAG←VALIDATE
[29 ] →FLAG/L3
[30 ] FINDDEGD
[31 ] ALOAD NEW DATA INTO MATRICES .
[32 ] COST [ ;J;K;L ]←CCOST
[33 ] QUAN [ ;J;K;L ]←CQUAN
[34 ] COMP [ ;J;K;L ]←1
[35 ] DEGD [ ;J;L ]←CDEGD
[36 ] A CHECK TO SEE IF WE ARE AT END OF FILE .
[37 ] L3: →(CTL[2 ]<CODES[3 ])/L1
[38 ] APRINT OUT BAD ENTRIES .
[39 ] 'THE FOLLOWING CARDS WERE FOUND IN ERROR '
[40 ] ' RECNO I.D. DEGD FUEL START
END QUANTITY COST'
[41

```



```

      VADDDATA [ ]41 ]V
[41]  ERRORMATRIX
[42]  ACLOSE FILE.
[43]  L4:ANS←[ ]SVR 2 3 p'RECCTL'
[44]  CMS 'ERASE ERROR DATA'
[45]  REC←'ERROR DATA (370 FT X'
[46]  CTL←'ERROR DATA (CTL'
[47]  I←110 [ ]SVO 2 3 p'RECCTL'
[48]  I←CTL
[49]  I←pERRORMATRIX
[50]  CTL← 0 0 J [1]
[51]  REC←ERRORMATRIX[;10+180]
[52]  'THE ABOVE RECORDS ARE IN A CMS FILE CALLED'
[53]  ''ERROR DATA''. YOU SHOULD MAKE CORRECTIONS'
[54]  'AND RELOAD THE FILE.'
[55]  I←[ ]SVR 2 3 p'RECCTL'
[56]  REC←'CMS (APL BEG'
[57]  REC←101 [ ]SVO 'REC'
[58]  REC←')SAVE'
[59]  REC←[ ]SVR 'REC'

```

```

      READCARD [ ] ]V
      V READCARD
[1]  ACHECKS TO SEE IF ANY ESSENTIAL COLUMNS ARE BLANK.
[2]  L1:→(V/CARD[27 49 50 51 52 70 78]=' ')/MISSING
[3]  CFAC←CARD[11]
[4]  J←FACILITIES\CFAC
[5]  CFL←CARD[27]
[6]  K←FUELTYPES\CFL
[7]  CMTH←CARD[51 52]
[8]  L←MONTHS\CMTH
[9]  ACONVERTS CALENDER YEAR TO FISCAL YEAR
[10]  CYEAR←CARD[49 50]
[11]  →(CMTH<7)/L2
[12]  CYEAR←CYEAR+1
[13]  L2:I←YEARS\CYEAR
[14]  A FIND COST AND QUANTITY.
[15]  CCOST←CARD[70+18]
[16]  CQUAN←CARD[60+110]
[17]  SPACE←0
[18]  →0
[19]  A IF THERE IS A ZERO IN THE CENTS COLUMN AND NOT IN DOLLARS THIS
      IS CORRECTED.
[20]  MISSING:→((CARD[78]=' ' )^(CARD[80]='0'))/S1
[21]  SPACE←1
[22]  →0
[23]  S1: CARD[78]←'0'
[24]  →L1
      V

```

```

      VVALID DATE [ ] V
      V FLAG←VALID DATE;? ATTO;LOW;HIGH;LINE
[1 ] A IF THERE WAS DATA MISSING IN THE READCARD PHASE THE CARD IS IN
      ER? OR .
[2 ] →SPACE/ER? OR
[3 ] A CHECK TO SEE ALL CARD INPUTS ARE WITHIN THE ARRAY PARAMETERS .
[4 ] →(I>NYRS)/ER? OR
[5 ] →(J>NFAC)/ER? OR
[6 ] →(K>NFLS)/ER? OR
[7 ] →(L>12)/ER? OR
[8 ] A IF NONE OF A FUEL IS USED IT IS O.K. SO WE PASS IT ON TO
[9 ] →SKIP/PASSED
[10 ] A THE MAIN MATRICES .
[11 ] →(CQUAN=0)/PASSED
[12 ] ? ATTO←CCOST÷CQUAN
[13 ] LOW←MINIMUM [ ;K ]
[14 ] HIGH←MAXIMUM [ ;K ]
[15 ] A WE CHECK TO SEE IF THE COST/QUANTITY RATIO FOR A GIVEN
[16 ] AFUEL AND YEAR ARE REALISTIC .
[17 ] →((? ATTO>LOW)^(? ATTO<HIGH))/PASSED
[18 ] ER? OR:LINE← 190 ρ(50 CTL[2]),' ',CARD
[19 ] A IF THE ? ATTO IS NOT REALISTIC WE STORE IT IN THE ER? OR MATRIX
[20 ] A AND PUT THE FLAG TO '1' SO IT WILL NOT BE STORED IN MAIN MATRIX
      ES .
[21 ] ER? OR MATRIX←ER? OR MATRIX,[1 ] LINE
[22 ] FLAG←1
[23 ] →0
[24 ] PASSED:FLAG←0
      V

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      VFTNDDEGD [ ] V
      V FTNDDEGD
[1 ] A IF THE NUMBER OF DEGREE DAYS WAS BLANK WE SUBSTITUTE A 1
[2 ] A SO WE KNOW THE STATISTIC WAS NOT REPORTED .
[3 ] →(CARD[24]=' ')/L1
[4 ] CDEGD←CARD[20+14 ]
[5 ] →0
[6 ] L1:→(DEGD [ ;J;L ]≠0)/L2
[7 ] CDEGD←1
[8 ] →0
[9 ] L2:CDEGD←DEGD [ ;J;L ]
      V

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VNEWSQFT[ ]V
V NEWSQFT;ANS;FAC;TIME;MM;MT;YY;YR;A;B;C;D;G;REC
[1] 'THIS PROGRAM CHANGES THE SQUARE FOOTAGE FOR A FACILITY FOR THE'
[2] 'MONTH AND YEAR CHOSEN AND ALL SUBSEQUENT MONTHS. THEREFORE IF Y
OU'
[3] 'ARE ENTERING SEVERAL CHANGES FOR A FACILITY ENTER THE EARLIEST
FIRST.'
[4] L5: 'IF YOU WISH TO EXIT FROM THIS FUNCTION TYPE 'EXIT' OTHERWISE
[5] 'TYPE 'OK''
[6] ANS←[ ]
[7] →(ANS[1]='E')/SAVE
[8] L2: 'ENTER THE I.D. NUMBER OF THE FACILITY WHICH IS TO BE CHANGED'
[9] ANS←[ ]
[10] FAC←FACILITIES\ANS
[11] →(FAC>NFAC)/L6
[12] 'YOU WILL BE CHANGING THE SQUARE FOOTAGE FOR:'
[13] (VANS), ' NAMES[FAC;]
[14] 'IF THIS IS INCORRECT TYPE 'AGAIN' OTHERWISE TYPE 'OK''
[15] ANS←[ ]
[16] →(ANS[1]='A')/L5
[17] L4: 'ENTER THE BEGINNING CALENDER DATE FOR THE CHANGE IN THE FORM
[18] 'YYMM ( FOR EXAMPLE 7809 )'
[19] TIME←[ ]
[20] MM←TIME[3 4]
[21] MT←MONTHS\MM
[22] YY←TIME[1 2]
[23] →(MM<7)/L1
[24] YY←YY+1
[25] L1: YR←YEARS\YY
[26] →(YR>NYRS)/L3
[27] A←(MT-1)+12×YR-1
[28] D←(NYRS×12)-A
[29] B←(NYRS,12)ρSQFT[;FAC;]
[30] C←B
[31] 'THE LISTED VALUE FOR THAT MONTH WAS'
[32] C[A+1]
[33] 'ENTER THE NEW SQUARE FOOTAGE'
[34] ANS←[ ]
[35] C[(A+1D)]←ANS
[36] SQFT[;FAC;]←(NYRS,12)ρC
[37] 'IF YOU WISH TO MAKE ADDITIONAL CHANGES TYPE YES OTHERWISE TYPE
NO'
[38] ANS←[ ]
[39] →(ANS[1]='Y')/L2
[40] →SAVE
[41] L3: MT←1
[42] YY←YY+1
[43] →(YY>85)/L4
[44] →(YY<70)/L4
[45] →L1
[46] L6: 'THE ID NUMBER YOU ENTERED WAS NOT FOUND.'
[47] →L5
[48] SAVE: REC←'CMS (APL BEG'
[49] REC←101 SVO 'REC'
[50] REC←')SAVE'
[51] REC←SVO 'REC'
V

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VDELETERECORD []V
V DELETERECORD;ANS;FAC;FT;I;J;K;L;MT;REC
[1 ] L1: 'FOR WHAT FACILITY DO YOU WANT THE RECORD DELETED?'
[2 ] FAC←[]
[3 ] J←FACILITIES\FAC
[4 ] 'YOU WILL BE DELETING A RECORD FOR '
[5 ] (FAC), ' , NAMES[J; ]
[6 ] 'WHAT FUELTYPE IS TO BE ELIMINATED? (EXAMPLE N)'
[7 ] FT←[]
[8 ] K←FUELTYPES\FT
[9 ] 'FOR WHAT FISCAL YEAR YY DO YOU WANT THE RECORD DELETED?'
[10 ] YR←[]
[11 ] I←YEARS\YR
[12 ] 'FOR WHAT MONTH(S) DO YOU WANT THE RECORD DELETED?'
[13 ] MT←[]
[14 ] L←MONTHS\MT
[15 ] →(V/COMP [J;K;L]=0)/MISSING
[16 ] 'YOU WILL HAVE THE OPTION OF DELETING'
[17 ] 'FACILITY', ' , (FAC)
[18 ] ( ,AMONTHS[MT; ]), ' OF FISCAL YEAR ' ,YR
[19 ] TYPE[K; ]
[20 ] 'THE QUANTITY LISTED IS'
[21 ] QUAN [J;K;L]
[22 ] 'THE COST LISTED IS'
[23 ] COST [J;K;L]
[24 ] 'DO YOU WANT TO DELETE THESE RECORDS?'
[25 ] 'ANSWER 'YES' OF 'NO'.'
[26 ] ANS←[]
[27 ] →(ANS[1]≠'Y')/S1
[28 ] COST [J;K;L]←0
[29 ] QUAN [J;K;L]←0
[30 ] COMP [J;K;L]←0
[31 ] →S1
[32 ] MISSING: 'THIS RECORD HAS NOT BEEN ENTERED INTO THE SYSTEM.'
[33 ] S1: 'DO YOU WISH TO DELETE MORE RECORDS?'
[34 ] 'ANSWER 'YES' OR 'NO'.'
[35 ] ANS←[]
[36 ] →(ANS[1]='Y')/L1
[37 ] REC←'CMS (APL BEG'
[38 ] REC←101 SVO 'REC'
[39 ] REC←')SAVE'
[40 ] REC←[]SVR 'REC'
V

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VADDEGD [ ] V
V ADDEGD;ANS;MM;MT;REC;S;YR;YY
[1 ] 'THIS PROGRAM ALLOWS YOU TO ENTER DEGREE DAY INFORMATION FOR '
[2 ] 'A GIVEN MONTH, YEAR , AND WEATHER STATION .'
[3 ] L1: 'WHAT CALENDER YEAR AND MONTH IN THE FORM YYMM DO YOU WISH'
[4 ] 'TO ENTER DATA FOR (EXAMPLE 7809 )'
[5 ] ANS←[ ]
[6 ] MM←ANS[3 4 ]
[7 ] MT←MONTHS\MM
[8 ] YY←ANS[1 2 ]
[9 ] →(MM<7)/S1
[10 ] YY←YY+1
[11 ] S1:YR←YEAR S\YY
[12 ] 'YOU HAVE THE FOLLOWING WEATHER STATIONS IN YOUR SYSTEM.'
[13 ] (V(NSTATIONS,1)ρ\NSTATIONS),((NSTATIONS,5)ρ' '),STATIONS
[14 ] 'ENTER THE NUMBER OF THE STATION YOU WISH TO ADD THE INFORMATION
      FOR '
[15 ] S←[ ]
[16 ] 'THE LISTED VALUE WAS'
[17 ] SDEGD[YR;S;MT]
[18 ] 'A ''1'' INDICATES THE INFORMATION NEEDS TO BE REPORTED.'
[19 ] 'WHAT IS THE NEW VALUE?'
[20 ] SDEGD[YR;S;MT]←[ ]
[21 ] 'DO YOU WISH TO ENTER OTHER STATION DEGREE INFORMATION. ANSWER '
[22 ] 'YES OR NO .'
[23 ] ANS←[ ]
[24 ] →(ANS[1]='Y')/L1
[25 ] REC←'CMS (APL BEG'
[26 ] REC←101 [ ]SVO 'REC'
[27 ] REC←')SAVE'
[28 ] REC←[ ]SVR 'REC'
V

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VADFAC [] ]V
V ADFAC;A;B;C;D;E;FAC;NAME;REC;S
[1 ] 'WHAT IS THE I.D. NUMBER OF THE FACILITY YOU WISH TO ADD?'
[2 ] FAC←[]
[3 ] 'WHAT IS THE NAME OF THIS FACILITY?'
[4 ] A←[]
[5 ] NAME← 1 40 pA
[6 ] 'WHAT WAS ITS ORIGINAL SQUARE FOOTAGE?'
[7 ] S←[]
[8 ] NFAC←NFAC+1
[9 ] FACILITIES←FACILITIES ,FAC
[10 ] NAME← 1 40 p' '
[11 ] E←pA
[12 ] NAME[1;1E]←A
[13 ] NAMES←NAMES ,[1 ] NAME
[14 ] B←(NYRS ,NFLS ,12)p0
[15 ] QUAN←QUAN ,[2 ] B
[16 ] COST←COST ,[2 ] B
[17 ] C←(NYRS ,12)p0
[18 ] DEGD←DEGD ,[2 ] C
[19 ] D←(NYRS ,12)pS
[20 ] SQFT←SQFT ,[2 ] D
[21 ] REC←'CMS (APL BEG'
[22 ] REC←101 []SVO 'REC'
[23 ] REC←')SAVE'
[24 ] REC←[]SVR 'REC'
V

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V D SPLAY [ ] V
V D SPLAY; YR; PAGE; T; DQUAN; I; J; ROW; FC; NUM; X
[1] A THIS PROGRAM PRINTS ON THE TERMINAL A REPORT OF A YEARS
[2] A CONSUMPTION FOR A FACILITY OR FACILITIES.
[3] X←1
[4] 'ENTER THE ID NUMBER OF THE FACILITIES YOU WISH TO DISPLAY'
[5] FAC←
[6] NUM←ρFAC
[7] A IF ONE NUMBER IS ENTERED IT MUST BE MADE INTO AN ARRAY:
[8] →(NUM≠1)/S1
[9] FAC←1ρFAC
[10] S1: 'ENTER THE FISCAL YEAR YY YOU WISH TO DISPLAY'
[11] YR←
[12] 'TURN PAGE TO TOP OF PAGE, THEN PRESS RETURN.'
[13]
[14] I←YEARS\YR
[15] L1: J←FACILITIES\FAC[X]
[16] PAGE← 66 120 ρ' '
[17] ROW←17
[18] DTITLE
[19] T← 9 12 ρ0
[20] A THE PARTS OF THE QUAN ARRAY THAT ARE NEEDED ARE ISOLATED.
[21] DQUAN← 9 12 ρQUAN[I; J;;]
[22] DETLL
[23] DTOTALS
[24] PAGE
[25] X←X+1
[26] →(X≤NUM)/L1
[27] 'PROGRAM COMPLETE'
V

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VPRINTDATA [ ] V
V PRINTDATA;YR;PAGE;T;DQUAN;I;J;ROW;FAC;NUM;X
[1]  A THIS PROGRAM SENDS A REPORT ON A YEARS CONSUMPTION FOR A
[2]  A FACILITY OR FACILITIES TO THE HIGH SPEED PRINTER.
[3]  X←1
[4]  'ENTER THE ID NUMBER OF THE FACILITIES YOU WISH TO DISPLAY'
[5]  'IF YOU WANT ALL FACILITIES TYPE ''FACILITIES.'''
[6]  FAC←[ ]
[7]  NUM←ρFAC
[8]  A IF ONE FACILITY IS ENTERED IT MUST BE MADE INTO AN ARRAY.
[9]  →(NUM≠1)/S1
[10] FAC←1ρFAC
[11] S1:'ENTER THE FISCAL YEAR YY YOU WISH TO BE PRINTED.'
[12] YR←[ ]
[13] I←YEARS,YR
[14] PRINTBOS
[15] PRCTL← 66 1 ρ'1',65ρ' '
[16] L7:J←FACILITIES\FAC[X]
[17] →(J≤NFAC)/L1
[18] 'THE FOLLOWING FACILITY I.D. WAS NOT FOUND'
[19] FAC[X]
[20] →L2
[21] L1:PAGE← 66 120 ρ' '
[22] ROW←17
[23] DTITLE
[24] T← 9 12 ρ0
[25] DQUAN← 9 12 ρQUAN[I;J;;]
[26] DFTLL
[27] DTOTALS
[28] PAGE←PRCTL,PAGE
[29] PRINTPAGE PAGE
[30] L2:X←X+1
[31] →(X≤NUM)/L7
[32] PRINTCLOSE
[33] 'PROGRAM COMPLETE'
V

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VDTT TLE[]V

V DTT TLE;WHEN

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[1 ] A THIS PRINTS THE TTLES FOR THE YEARLY CONSUMPTION REPORTS.
[2 ] WHEN←[ ]TS
[3 ] PAGE ROW-15;95+125 ]←'PRINTED ' ,AMONTHS[WHEN[2]; ] ,(2 0 ▽WHEN[3 ] ) ,
    ' , ' ,(▽WHEN[1 ])
[4 ] PAGE ROW-13;40+125 ]←'ENERGY CONSUMPTION REPORT'
[5 ] PAGE ROW-11;40+140 ]←NAMES[J; ]
[6 ] PAGE ROW-9;40+122 ]←'T.D. NUMBER ' ,(10 0 ▽FAC[X ])
[7 ] PAGE ROW-7;40+116 ]←'FISCAL YEAR 19 ' ,▽YR
[8 ] PAGE ROW-3;14+1106 ]←( ,DMON) ,' TOTALS'
D ] PAGE ROW-2;14+1106 ]←(9 6p' --- ' ) ,' -----'
V
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VDFILL[]V

V DFI LL;K;L

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[1 ] K←L+1
[2 ] A WE FIRST CHECK TO SEE IF ANY OF A FUEL IS USED. IF
[3 ] A NONE IS USED WE CHECK NEXT FUEL.
[4 ] L5:→((+/COMP[ ] ;J;K; ])=0)/6
[5 ] A IF A FUEL IS USED WE PRINT ITS NAME AND UNITS.
[6 ] PAGE ROW;112 ]←DFUELS[K; ]
[7 ] A WE THEN CHECK THE INDIVIDUAL MONTHS.
[8 ] L1:→(COMP[ ] ;J;K;L ]=0)/L2
[9 ] PAGE ROW;6+(8×L)+18 ]← 8 0 ▽DUAN[K;L ]
[10 ] →L3
[11 ] A FILL IN STARS IF NONE OF A FUEL IS USED.
[12 ] L2:PAGE ROW;6+(8×L)+18 ]←' *****'
[13 ] L3:L+L+1
[14 ] →(L>12)/L4
[15 ] →L1
[16 ] A END AND PRINT THE TOTAL FOR EACH FUEL.
[17 ] L4:PAGE ROW;110+110 ]← 10 0 ▽(+/DQUAN[K; ])
[18 ] ROW←ROW+3
[19 ] L←1
[20 ] A FILL IN AN ARRAY THAT HAS THE BTU/UNIT FOR ALL MONTHS.
[21 ] T[K; ]←SOURCE[K ]
[22 ] L6:K←K+1
[23 ] →(K>NFLS)/0
[24 ] →L5
V
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VDTOTALS [ ] V
V DTOTALS; BTU; TBTU; DSQFT; TSQFT; DCOST; TCOST
[1] BTU←12p0
[2] A TOTAL BTUS FOR MONTH ARE FOUND BY MULTIPLYING EACH FUEL TYPE
[3] A BY BTUS/UNIT .
[4] TOTALS:BTU←(+/[1](T×DQUAN))÷1000000
[5] TBTU←+/BTU
[6] PAGE[ROW-2;10+1110]←110p'-'
[7] A WE PRINT OUT TWELVE MONTHS CONSUMPTION THEN THE TOTAL.
[8] PAGE[ROW;]←'MMBTU(SOURCE) ',(8 0 ▽BU),(10 0 ▽TBTU)
[9] ROW←ROW+3
[10] PAGE[ROW;1110]←'SQUARE FOOTAGE',(8 0 ▽SQFT[;J;])
[11] A DSQFT IS 1000 BTUS/SQFT/MONTH.
[12] DSQFT←BTU÷SQFT[;J;]÷1000
[13] ROW←ROW+3
[14] A TSQFT IS TOTAL MBTU/SQFT FOR THE ENTIRE YEAR.
[15] TSQFT←+/DSQFT
[16] PAGE[ROW;112]←'MBTU / SQFT '
[17] PAGE[ROW;14+1106]←(8 0 ▽DSQFT), 10 0 ▽TSQFT
[18] ROW←ROW+3
[19] A DCOST IS COST FOR EACH MONTH FOR ALL FUELS.
[20] DCOST←+/[1] COST[;J;;]
[21] A TCOST IS TOTAL COST FOR ALL THE FACILITIES FOR THE YEAR.
[22] TCOST←+/DCOST
[23] PAGE[ROW;]←'TOTAL COST ',(8 0 ▽DCOST),(10 0 ▽TCOST)
V

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V MONTHLY [ ] V
V MONTHLY; A; ASOURCE; CNT; FAC; FCOMP; FCOST; FLAG; FUAN; J; L; MT; NOTE; N
  UM; NUMF; PAGE; ROW; TNUM; TWO; TYRS; TYS; YRS; YS; Z
[1]  A THIS IS THE PROGRAM THAT PRINTS THE MONTHLY REPORTS
[2]  QUESTIONS
[3]  Z+1
[4]  PAGE← 66 85 p' '
[5]  TWO← 66 85 p' '
[6]  A THE HEADERS ARE PLACED ONCE NO MATTER HOW MANY FACILITIES
[7]  A THERE ARE.
[8]  HEADER
D ]  KEEP
[10] PRINTNEWTON
[11] A THE PAGE EXCLUSIVE OF THE HEADERS IS ERASED.
[12] L1: PAGE[11, 22+144; ]←' '
[13] J←FACILITIES FACZ ]
[14] →(J≤NFAC)/S1
[15] 'THE FOLLOWING FACILITY WAS NOT FOUND.'
[16] FACZ ]
[17] →L2
[18] A CHECK TO SEE IF THERE IS NO DATA FOR A GIVEN FACILITY IN A YEAR
.
[19] S1: FCOMP←(NRS, NFLS, 12)ρCOMP[; J; ; ]
[20] FQUAN←(NRS, NFLS, 12)ρQUAN[; J; ; ]
[21] FCOST←(NRS, NFLS, 12)ρCOST[; J; ; ]
[22] A←0÷+/FCOMP[TYS; 1; ]
[23] →(√/A≠0)/S2
[24] 'THERE WAS NO DATA FOR FACILITY ', (√FACZ ]), ' SO NO REPORT WAS
  PRINTED'
[25] →L2
[26] S2: YS←A/TYS
[27] YRS←A/TYRS
[28] A NUM IS THE NO. OF YEARS FOR WHICH WE WILL PRINT OUT DATA FOR A
  FACILITY.
[29] NUM←ρYS
[30] ASOURCE←(NUM, NFLS)ρSOURCE
[31] PAGE[11; 8+152 ]←(10 0 √FACZ ]), ' ', NAMES[J; ]
[32] FIRST
[33] TOTALS
[34] PDEGD
[35] PRINTPAGE PAGE
[36] TWO[10 11 13 14 16 17 19 22 24 26 27 34 35 37 39 41 42 43 ; 38+1
  42 ]←' '
[37] SECOND
[38] FOOTNOTE
[39] TWO[44+120; 13+146 ]←NOTE
[40] ROW←44+CNT
[41] PRINTPAGE TWO
[42] L2: Z←Z+1
[43] →(Z≤NUMF)/L1
[44] PRINTCLOSE
[45] 'PROGRAM COMPLETE'
V

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      VQUESTIONS [ ] V
      V QUESTIONS;Y;ANS;YR
[1 ] A THIS ROUTINE ASKS THE USER FOR ALL THE TERMINAL INPUT NEEDED
[2 ] A IN THE MONTHLY REPORT.
[3 ] L2: 'WHAT 2 DIGIT FISCAL YEAR DO YOU WANT THE REPORT FOR '
[4 ]   YR←[ ]
[5 ]   'WHAT MONTH OF THE FISCAL YEAR DO YOU WANT THE REPORT FOR '
[6 ]   'FOR EXAMPLE 1 FOR JULY 12 FOR JUNE'
[7 ]   L←[ ]
[8 ]   MT←MONTHS[L ]
[9 ]   Y←YEARS,Y
[10 ] →(Y>NYRS)/L2
[11 ] 'IF YOU WANT THE REPORTS FOR ALL FACILITIES TYPE 'FACILITIES'
[12 ] 'OTHERWISE TYPE THE FACILITY ID NUMBERS YOU WANT.'
[13 ] FAC←[ ]
[14 ] NUMF←pFAC
[15 ] →(NUMF≠1)/S1
[16 ] FAC←1pFAC
[17 ] S1:FLAG←1
[18 ] 'DO YOU WANT TO DISPLAY DEGREE DAY INFORMATION FOR WEATHER '
[19 ] 'STATIONS? ANSWER YES OR NO'
[20 ] ANS←[ ]
[21 ] →(ANS[1]='N')/S3
[22 ] FLAG←0
[23 ] S3: 'YOU HAVE THE OPTION TO DISPLAY INFORMATION FOR ZERO,'
[24 ] 'ONE, OR TWO PREVIOUS FISCAL YEARS. YOU HAVE THE FOLLOWING '
[25 ] 'FISCAL YEARS AVAILABLE.'
[26 ] YEARS
[27 ] 'I SUGGEST YOU DISPLAY THE PAST YEAR AND A BASE YEAR '
[28 ] 'DO YOU WANT TO DISPLAY ANY BACK YEARS?'
[29 ] 'ANSWER 'YES' OR 'NO''
[30 ] ANS←[ ]
[31 ] →('Y'=ANS[1])/S2
[32 ] →('N'≠ANS[1])/S3
[33 ] TYRS←1pYR
[34 ] TYS←1pY
[35 ] TNUM←1
[36 ] →0
[37 ] S2: 'PLEASE ENTER THE YEARS YOU WANT IN THE ORDER YOU WANT THEM.'
[38 ] TYRS←[ ]
[39 ] TYRS←YR,TYRS
[40 ] TYS←YEARS,TYRS
[41 ] TNUM←pTYS
[42 ] →(^(TYS≤NYRS))/0
[43 ] 'YOU ENTERED AN INVALID YEAR. TRY AGAIN.'
[44 ] →S1
      V

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VHEADER [ ]V
V HEADER ;WHEN;CY
[1]  * THIS ESTABLISHES THE HEADINGS USED IN THE FIRST PAGE.
[2]  WHEN←[ ]TS
[3]  PAGE[1;60+118]←AMONTHS[WHEN[2]; ],' ',(2 0 *WHEN[3]),', ',(4 0 *
    WHEN[1 ])
[4]  PAGE[6;25+133]←'MONTHLY ENERGY CONSUMPTION REPORT'
[5]  CY←TYS[1 ]
[6]  →(MT<7)/S1
[7]  CY←CY-1
[8]  S1:PAGE[8;36+114]←AMONTHS[MT; ],' 19',(2 0 *CY)
[9]  PAGE[14;13+159]←'THIS REPORT GIVES INFORMATION ON ENERGY CONSUMP
    TION AT YOUR '
[10] PAGE[15;8+166]←'FACTORY. IT IS BASED ON THE 'ENERGY CONSUMPTI
    ON REPORTING FORMS''
[11] PAGE[16;8+119]←'YOU HAVE SUBMITTED.'
[12] PAGE[18;8+153]←'BELOW IS DATA FOR THIS ',AMONTHS[MT; ],' AND FOR
    ',AMONTHS[MT; ],' OF'
[13] PAGE[19;8+115]←'PREVIOUS YEARS.'
V

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VKEEP [ ]V
V KEEP;X
[1]  TWO[3;72+16]←'PAGE 2'
[2]  TWO[10;8+112]←'YEAR -TO-DATE'
[3]  * PLACES TTLES ON THE SECOND PAGE THAT ARE NOT CHANGED.
[4]  TWO[7;8+172]←'THE INFORMATION BELOW IS THE CUMULATIVE TOTAL FOR
    JULY THROUGH ',AMONTHS[MT; ]
[5]  TWO[13;11+126]←'ELECTRICITY THOUSAND KWH:'
[6]  TWO[14;14+18]←'DOLLARS:'
[7]  TWO[16;11+126]←'OTHER FUELS MILLION BTUS:'
[8]  TWO[17;14+18]←'DOLLARS:'
[9]  TWO[19;11+112]←'DEGREE DAYS:'
[10] TWO[22;11+122]←'ELECTRICITY KWH/SQFT:'
[11] TWO[24;11+126]←'OTHER FUELS 1000 BTU/SQFT:'
[12] TWO[26;11+120]←'TOTAL 1000 BTU/SQFT:'
[13] TWO[27;11+116]←'TOTAL COST/SQFT '
[14] TWO[30;8+168]←' THE FIGURES BELOW REFER TO CHANGES BETWEEN TH
    E TWO YEARS LISTED.'
[15] TWO[31;8+163]←'A NEGATIVE NUMBER INDICATES AN IMPROVEMENT (DECRE
    ASE) IN CONSUMPTION.'
[16] TWO[34;8+114]←'PERCENT CHANGE'
[17] TWO[35;8+114]←14p'-'
[18] L1:TWO[37;11+121]←'ELECTRICITY BTU/SQFT:'
[19] TWO[39;11+121]←'OTHER FUELS BTU/SQFT:'
[20] TWO[41;11+121]←'TOTAL BTU/SQFT:'
[21] TWO[42;13+113]←'DOLLARS/SQFT:'
[22] TWO[43;13+118]←'COST/MILLION BTUS:'
V

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      V FIRST[ ] V
      V FIRST;X;WHERE;Z;SKIPS
[1]  A PUTS IN FUEL USE IN FIRST PAGE.
[2]  PAGE[22;8+113]←'MONTHLY USAGE'
[3]  PAGE[23;8+113]←13p'- '
[4]  PAGE[22;42+1NUM×12]←,((NUM,10)p'          FY'),((NUM,2)p(2 0 YRS)
      )
[5]  PAGE[23;42+1NUM×12]←,((NUM,12)p'          ----')
[6]  ROW←23
[7]  X←0
[8]  A DETERMINES WHICH FUEL TYPES WERE NOT USED.
[9]  SKIPS←0=+[1] FCOMP[YS;;L]
[10] L1:X←X+1
[11] →(X>3)/0
[12] →(1=SKIPS[X])/L1
[13] ROW←ROW+3
[14] WHERE←42
[15] Z←1
[16] PAGE[ROW;11+127]←TYPE[X;],' ',UNITS[X;]
[17] PAGE[ROW+1;24+17]←'DOLLARS'
[18] L2:→(Z>NUM)/L1
[19] →(0=FCOMP[YS[Z];X;L])/STARS
[20] PAGE[ROW;WHERE+112]←12 0 FQUAN[YS[Z];X;L]
[21] PAGE[ROW+1;WHERE+112]←12 0 FCOST[YS[Z];X;L]
[22] L3:WHERE←WHERE+12
[23] Z←Z+1
[24] →L2
[25] A PRINTS STARS IF DATA IS NOT AVAILABLE.
[26] STARS:PAGE[(ROW,ROW+1);WHERE+112]←2 12 p'          *** '
[27] →L3
      V

```

VTOTALS [] V

V TOTALS

[1] A PUTS TOTALS FOR FIRST PAGE INTO PAGE MATRIX.

[2] ROW←ROW+4

[3] PAGE ROW-2;11+165]←65p'-'

[4] PAGE ROW;11+126]←'TOTALS MMBTU(SOURCE)'

[5] TQUANS←(+ / FQUAN[YS;;L] × ASOURCE) ÷ 1000000

[6] PAGE ROW;42+1(12×NUM)]← 12 0 ▼TQUANS

[7] PAGE ROW+1;24+17]←'DOLLARS'

[8] TCOSTS←+ / FCOST[YS;;L]

[9] PAGE ROW+1;42+1(12×NUM)]← 12 0 ▼TCOSTS

V

VPDEGD [] V

V PDEGD;X;Z

[1] A PRINTS THE DEGREE DAY AND SQUARE FOOTAGE INFO ON THE FIRST PAGE

[2] ROW←ROW+3

[3] PAGE ROW;11+114]←'SQUARE FOOTAGE'

[4] PAGE ROW;42+1NUM×12]← 12 0 ▼SQFT[YS;J;L]

[5] ROW←ROW+3

[6] PAGE ROW;11+127]←'DEGREE DAYS FOR THIS MONTH:'

[7] PAGE ROW+1;11+127]←27p'-'

[8] ROW←ROW+3

[9] PAGE ROW;11+117]←'FOR YOUR FACTILITY'

[10] PAGE ROW;42+1NUM×12]← 12 0 ▼DEGD[YS;J;L]

[11] A IF DEGD FOR A MONTH IS ONE WE SUBSTITUTE STARS BECAUSE IT

[12] WAS NOT REPORTED.

[13] Z←1

[14] L2:→(DEGD[YS [];J;L] ≠ 1) / S1

[15] PAGE ROW;30+(Z×12)+112]←'

*** '

[16] S1:Z←Z+1

[17] →(Z ≤ NUM) / L2

[18] →FLAG / 0

[19] ROW←ROW+2

[20] PAGE ROW;11+130]←'WEATHER STATIONS

NORMS'

[21] PAGE ROW+1;11+116]←16p'-'

[22] PAGE ROW+1;36+15]←5p'-'

[23] ROW←ROW+3

[24] X←1

[25] L1:PAGE ROW;11+110]←STATONS[X;]

[26] PAGE ROW;23+112×NUM+1]←(12 0 ▼NDEGD[X;L]),(12 0 ▼SDEGD[YS;X;L])

[27] X←X+1

[28] ROW←ROW+1

[29] →(X ≤ NSTATIONS) / L1

V


```

▽SECOND[ ]▽
▽ SECOND;INDEX;EQUAN;ECOST;A;B;OQUAN;OCOST;ASQFT;ESQFT;OSQFT;TSQ
FT;TCSQFT;X
[1]  A PUTS THE PRIMARY DATA INTO THE SECOND PAGE .
[2]  TWO[3;8+110]← 10 0 ▽FACT LINES[J]
[3]  TWO[10;42+1NUM×12]←,((NUM,10)ρ'          FY'),((NUM,2)ρ(2 0 ▽YRS))
[4]  TWO[11;8+112]←12ρ'- '
[5]  TWO[11;42+1NUM×12]←,(NUM,12)ρ'          ----'
[6]  INDEX←42+1(NUM×12)
[7]  A ELECTRICAL CONSUMPTION .
[8]  EQUAN←+/FQUAN[YS;1;1L]
[9]  TWO[13;INDEX]← 12 0 ▽(EQUAN÷1000)
[10]  ECOST←+/FCOST[YS;1;1L]
[11]  TWO[14;INDEX]← 12 0 ▽ECOST
[12]  A←+/FQUAN[YS;1+18;1L]
[13]  B←A×ASOURCE[;1+1(NFLS-1)]
[14]  OQUAN←+/B
[15]  TWO[16;INDEX]← 12 0 ▽(OQUAN÷1000000)
[16]  OCOST←+/+/FCOST[YS;1+18;1L]
[17]  TWO[17;INDEX]← 12 0 ▽OCOST
[18]  TWO[19;INDEX]← 12 0 ▽(+/DEGD[YS;J;1L])
[19]  X←1
[20]  L1:→(L≠+/DEGD[YS[X];J;1L])/S1
[21]  TWO[19;30+(X×12)+112]←'          *** '
[22]  S1:X←X+1
[23]  →(X≤NUM)/L1
[24]  A AVERAGE SQUARE FOOTAGE FOR THE YEAR .
[25]  ASQFT←+/((SQFT[YS;J;1L])÷L)
[26]  A ELECTRICAL CONSUMPTION PER SQUARE FOOT .
[27]  ESQFT←EQUAN÷ASQFT
[28]  TWO[22;INDEX]← 12 2 ▽ESQFT
[29]  A OTHER CONSUMPTION PER SQ. FOOT .
[30]  OSQFT←OQUAN÷ASQFT
[31]  TWO[24;INDEX]← 12 0 ▽(OSQFT÷1000)
[32]  A TOTAL CONSUMPTION PER SQ. FOOT .
[33]  TSQFT←(ESQFT×SOURCE[1])+OSQFT
[34]  TWO[26;INDEX]← 12 0 ▽(TSQFT÷1000)
[35]  A TOTAL COST PER SQ. FOOT .
[36]  TCSQFT←(+//+ /COST[YS;J;;1L])÷ASQFT
[37]  TWO[27;INDEX]← 12 2 ▽TCSQFT
[38]  CHANGES
[39]  A SET PAGE AT 43 FOR PRINTPAGE STAGE .
[40]  ROW←43
▽

```



```

VCHANGES[ ]V
V CHANGES;WHERE;X;CE;CO;CT;CCSQFT;TBTU;TCOST;TCBTU;CCBTU
[1] A IF THERE ARE NO COMPARISON YEARS SKIP THE ROUTINE.
[2] →(NUM=1)/0
[3] TWO[34;55+17]←'FY',(YRS[1]),'/',(YRS[2])
[4] TWO[35;55+17]←7p'-
[5] A PUT IN ONE COMPARISON IF TWO YEARS, TWO IF 3 YEARS.
[6] →(NUM<3)/S1
[7] TWO[34;67+17]←'FY',(YRS[1]),'/',(YRS[3])
[8] TWO[35;67+17]←7p'-
[9] A GOES THROUGH LOOP ONCE OR TWICE.
[10] S1:X+2
[11] WHERE+55
[12] L1:→(ESQFT[X]=0)/S3
[13] A CE IS CHANGE IN ELECTRICAL CONSUMPTION.
[14] CE←(1+ESQFT[1]÷ESQFT[X])×100
[15] TWO[37;WHERE+17]←71▼CE
[16] A CO IS CHANGE IN OTHER CONSUMPTION.
[17] →(V/OSQFT=0)/S2
[18] CO←(1+OSQFT[1]÷OSQFT[X])×100
[19] TWO[39;WHERE+17]←71▼CO
[20] A CT IS TOTAL CHANGE IN CONSUMPTION.
[21] S2:CT←(1+TSQFT[1]÷TSQFT[X])×100
[22] TWO[41;WHERE+17]←71▼CT
[23] A CCSQFT IS CHANGE IN COST/SQFT.
[24] CCSQFT←(1+TCSQFT[1]÷TCSQFT[X])×100
[25] TWO[42;WHERE+17]←71▼CCSQFT
[26] TBTU←OQUAN+EQUAN×SOURCE[1]
[27] TCOST←ECOST+OCOST
[28] TCBTU←TCOST÷TBTU
[29] A CCBTU IS CHANGE IN COST OF FUELPER BTU.
[30] CCBTU←(1+TCBTU[1]÷TCBTU[X])×100
[31] TWO[43;WHERE+17]←71▼CCBTU
[32] S3:X←X+1
[33] WHERE←WHERE+12
[34] →(X>NUM)/0
[35] →L1
V

```

```

VFOOTNOTE[ ]V
V FOOTNOTE;A;M
[1] NOTE←2046p'
[2] CNT←A←M←0
[3] L1:A←A+1
[4] M←0
[5] →(A>NUM)/0
[6] Y←YS[A]
[7] L3:M←M+1
[8] →(M>L)/L1
[9] →(FCOMP[Y;1;M]=1)/L3
[10] CNT←CNT+1
[11] →(CNT<20)/S1
[12] NOTE[20;123]←'THE ERROR TABLE IS FULL'
[13] →0
[14] S1:NOTE[CNT;]←'NO DATA WAS REPORTED FOR 'AMON[M;],' OF FISCAL YE
AR',(20▼YRS[A])
[15] →L3
V

```

∇COMPLETENESS [□] ∇

∇ COMPLETENESS;ANS;A;B

[1] 'WHAT YEAR DO YOU WANT THE COMPLETENESS REPORT FOR?'

[2] 'YOUR CHOICES ARE:'

[3] YEARS

[4] 'ENTER THE 2 DIGIT YEAR NOW.'

[5] $ANS \leftarrow \square$

[6] A 4-YEAR SENS

[7] $B \leftarrow (NFAC, 1) \rho FACT LI T T ES$

[8] $B, (NFAC \ 3) \uparrow \uparrow / A \leftarrow COMP[A; ; ;]$

▽

▽QUANSUM[□]▽

▽ QUANSUM;ANS;A;B;C;D;Y

[1] 'WHAT YEAR DO YOU WANT THE YEARLY QUANTITY REPORT FOR?'

[2] 'YOUR CHOICES ARE: '

[3] YEARS

[4] 'ENTER THE 2 DIGIT YEAR NOW.'

[5] $ANS \leftarrow \square$

[6] $Y \leftarrow A \leftarrow YEAR$ S1ANS

[7] $B \leftarrow (NFAC, 1) \rho FAC$ LITES

[8]

[3] ' *FAC* *E* *N* *P* *C* 2 4
5 6 *S* '

[10] ' '

```
[11] B,((NFAC,NFLS)↑↑/A←QUAN[A;;;])
```

[12]

[13] ' '

[14] ' YEARLY CONSUMPTION OF EACH FUELTYPE'

[15] $\square \leftarrow C \leftarrow + / [1] + / [3] \text{ QUAN}[Y; ; ;]$

[16] ' '

[17] 'BTUS BY FUELTYPE'

[18] $\square \leftarrow D \leftarrow C \times SOURCE$

[19] ,

[20] 'TOTAL BTUS'

[21] $+ / D$

▽

```

∇COSTSUM[ ]∇
∇ COSTSUM;ANS;A;B
[1 ] 'WHAT YEAR DO YOU WANT THE YEARLY COST REPORT FOR?'
[2 ] 'YOUR CHOICES ARE:'
[3 ] YEARS
[4 ] 'ENTER THE 2 DIGIT YEAR NOW.'
[5 ] ANS←
[6 ] Y←A+YEARS;ANS
[7 ] B←(NFAC,1)ρFAC I I ES
[8 ] ' '
[9 ] '   FAC           E           N           P           C           2           4
    5           6           S   TOTAL'
[10 ] ' '
[11 ] B,((NFAC,NFLS)++/A+COST[A;;;]),(++/C+COST[A;;;])
[12 ] ' '
[13 ] ' '
[14 ] '           YEARLY COST BY FUELTYPE'
[15 ] +/[1 ]+/[3 ] COST[Y;;;]
[16 ] ' '
[17 ] ' '
[18 ] ' TOTAL COST'
[19 ] +/+//COST[Y;;;]
∇

```

▽PRINTBOS[]▽

▽PRINTBOS;A

- [1] A THIS ACCESSES THE PRINTER TO PRINT OUT A REPORT IN BOSTON.
 - [2] CP 'TAG DEV PR T VS BOSTON'
 - [3] CP 'SPOOL PR T TO VNET CONT'
 - [4] CMS 'FT GARY PRINTER (BLKSIZE 137 RECFM VA'
 - [5] TERM←' GARY (370'
 - [6] A←111 □SVO 'TERM'
 - [7] A←TERM
- ▽

▽PRINTNEWTON[]▽

▽PRINTNEWTON;A

- [1] CP 'TAG DEV PR T DELIVER TO CALDATA BOSTON ATTN: MASS ENERGY OFFICE (727-193 0)'
 - [2] CP 'SPOOL PR T TO SYSTEM CONT CLASS W '
 - [3] CMS 'M OP CLASS W FILES (8.5 BY 11 PLAIN PAPER) HAVE BEEN SPOOLED TO THE PRINTER '
 - [4] CMS 'FT GARY PRINTER (BLKSIZE 137 RECFM VA'
 - [5] TERM←'GARY (370'
 - [6] A←111 □SVO 'TERM'
 - [7] A←TERM
- ▽

▽PRINTPAGE[]▽

▽PRINTPAGE PAGE

- [1] A PRINTS A PAGE ON THE HIGH SPEED PRINTER .
 - [2] TERM←'1'
 - [3] CTR←ROW
 - [4] L1:TERM←,PAGE[1+CTR ;]
 - [5] →L1×10<ρCTR +1+CTR
- ▽

▽PRINTCLOSE[]▽

▽PRINTCLOSE;A

- [1] A THIS FUNCTION CLOSES THE PRINT FILE .
 - [2] A←□SVR 'TERM'
 - [3] CP 'SPOOL PR T NOCONT CLOSE'
- ▽


```

      VOPEN[ ]V
      V OPEN;Z
[1]  A OPENS THE SHARED VARIABLES 'REC' AND 'CTL' WITH A CMS FILE
[2]  A AND CREATES THE VARIABLE 'CODES' WITH THE OPENING CMS
[3]  A POINTER LOCATIONS.
[4]  'ENTER THE *FILENAME FILETYPE* AT THIS TIME.'
[5]  ZZ←[ ]
[6]  REC←ZZ ,'(370'
[7]  CTL←ZZ ,'(CTL'
[8]  →(4=+/Z←110 [ ]SVO 2 3 p 'RECCTL')/L2
[9]  'SHARED VARIABLE NOT ACCEPTED'
[10] →0
[11] L2:CODES←REC
      V

```

```

      VCP[ ]V
      V CP ARG;X;Y
[1]  X←'CP'
[2]  Y←100 [ ]SVO 'X'
[3]  X←ARG
[4]  ECODE←X
      V

```

```

      VCMS[ ]V
      V CMS ARG;X;Y
[1]  X←'CMS'
[2]  Y←100 [ ]SVO 'X'
[3]  X←ARG
[4]  ECODE←X
      V

```