APPLICATION OF INTERACTIVE PROGRAMMING AND WORD PROCESSING TO ENERGY CONSERVATION OPPORTUNITIES

BY

REBECCA JACKS JOHNSTON

Bachelor of Science

Oklahoma State University

Stillwater, Oklahoma

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ABSTRACT

Past research prepared a series of standardized forms for use by the Energy Analysis and Diagnosic Center. The purpose of these forms was to decrease the time spent by the Center in repetitive computations. One of the disadvantages of these forms was the typing time required. In addition, the forms savings in computation time were accompanied by increased time spent by staff members trying to interpret the standardized forms.

The purpose of this study is to develop a computer program which combines arithmetic calculations and word processing capabilities to produce energy conservation opportunities for industry use. The program should be interactive and should be designed to produce output acceptable to the Energy Analysis and Diagnostic Center, its main user. It should also be easy for a beginning staff member to use.

INTRODUCTION

The Energy Analysis and Diagnostic Center (EADC) has been helping Oklahoma industries confront their energy management problems since 1975. The Center, providing energy audits for small- to medium-sized Oklahoma industries, has an objective "to help Oklahoma industry improve profits and enhance competitive positions through judicious energy management."

Contained in these energy audits are energy conservation opportunities (ECO's) which, if implemented, will enable an industry to more efficiently utilize its energy. The ECO's use plant data and manufacturing costs to provide the industry with a good estimate for the actual implementation cost, Btu savings, dollar savings, and simple payback period for each suggestion.

Throughout the years that the Energy Analysis and Diagnostic Center has been functioning, a list of standardized ECO's has been developed. These suggestions are ones which consistently pay back in less than three years and are recommended to many different industries. While these suggestions are frequently used, the EADC staff is also interested in developing new ECO's and in learning new ways to improve energy utilization. These standard ECO's provide good suggestions

for industry in an efficient manner but could hinder new learning as they require extensive time to prepare. The staff must gather data, perform the calculations, organize data and results into a logical flow and format, type the ECO, and compile the report. Although the procedure is well known, every step must be performed each time the particular ECO is recommended as each industry has different data.

In an effort to decrease the time spent preparing these standard ECO's, standardized forms were developed. These forms provided a logical format complete with summary and transitions between sections. While these standardized forms decreased the amount of time spent preparing the ECO's, the tedious processes of calculation and typing still remained.

The purpose of this report is to take the standardized forms one step further by developing a computer program which will eliminate both calculation time and typing time. The program will provide a menu of standardized ECO's. It will prompt the user to input the required information for the chosen ECO, perform the calculations, and produce output in typed final form ready for compilation in the report.

This report is divided into three major sections: program usage, samples, and further research. The program usage section discusses how the program actually works, how the files are manipulated, and how data is transferred from initial input to hard copy output. Also included in the program usage section is the user's guide. It details how to use the program to produce output.

The samples section contains output for each of the ECO's using real data, and the further research section provides a summary and a discussion of possible future research topics.

SECTION 1

PROGRAM USAGE

PROGRAM USAGE

The EADC Energy Conservation Opportunities Program consists of three parts: a CLIST driver file, a partitioned Fortran CNTL file, and an empty script DATA file.

The driver file is named EADC.CLIST. The CLIST program provides an easy means of prompting the user for data input; it is also designed for easy acceptance of the input. The driver file calls the appropriate member of the Fortran CNTL file for each ECO. A listing of the CLIST driver file is provided in Appendix A.

A CLIST file is written using TSO commands and command procedure statements. These are similar to programming statements of a computer language such as Fortran. The command procedure statements used in the CLIST are explained in Appendix B.

When the driver file calls a partitioned Fortran CNTL member, that member is compiled into a load module and then executed. Each member of the partitioned data set prompts for its own required information.

The partitioned data sets are written in Fortran, and a listing of each member appears in Appendix C. Because neither script nor TSO command procedures provide statements for arithmetic operations, Fortran was used to perform arithmetic

calculations. The major Fortran commands used are explained in Appendix D.

The Fortran program takes data input, performs the required calculations, and then writes a script program into the empty file. This is accomplished by imbedding the script program within the Fortran program. For example, the Fortran statements

```
      WRITE  (8,100)
  100 FORMAT  (' .sk 0')
```

write .sk 0 to the empty script data file (file #8). The statement .sk 0 is a script command which produces text output when the file is scripted.

After the Fortran program has executed and produced a script program in the file named EADC.SCRIPT.DATA, the driver file calls for the program to be scripted. This is the final step in producing output. A listing of the script programs for each of the Fortran members is provided in Appendix E, and explanations of the major script commands used in the programs are given in Appendix F.

The following section contains the user's guide. It includes instructions for logging on to a terminal, executing the driver file, and inputing data for each of the energy conservation opportunities. In addition, it contains the tables and figures referenced by each ECO.

SECTION 2

USER'S GUIDE

A. Logging On

B. OG&E PEAKS

C. Reduce Compressed Air to Minimum Required

D. Move Air Compressor Intake to Coolest Location

E. Night Setback

F. Example Input

   1. OG&E PEAKS

   2. Reduce Compressed Air to Minimum Required

   3. Move Air Compressor Intake to Coolest Location

   4. Night Setback

USER'S GUIDE

The user's guide contains six major sections. In section one, the user is provided with the necessary information to log on to a terminal and access the EADC ECO program. Sections two through five list the required information for the various ECO selections. They also contain the necessary reference figures and graphs. Section six is an examples section and contains data input for each of the four ECO's.

In the user's guide, *GREAT SCRIPT* type is used to depict computer prompts, while PRESTIGE PICA type depicts user responses.

A. Logging On

The following procedure is designed to assist the user in executing the EADC ECO program.

Step 1: Gather all tables, figures, and required information necessary to execute the chosen ECO.

Step 2: Go to Math Sciences to the TSO terminals. These are located on the south side of the room at the south end of the basement corridor.

Step 3: Press the Return key and enter the following sequence.

IKJ54012A ENTER LOGON -

LOGON

IKJ56700A ENTER USERID -

U13155A

ENTER CURRENT PASSWORD FOR U13155A -

EADC

U13155A LOGON IN PROGRESS AT 17:59:58 ON AUGUST 18, 1983
AS OF AUGUST 15, 1983 ALL OUTPUT PRINTED LOCALLY WILL BE SORTED
VIA THE ROOM PARAMETE OF JES. FOR MORE INFORMATION CONSULT THE
AUGUST 1983 NEWSLETTER, PAGE 7.
DATA SET STARTUP.CLIST NOT IN CATALOG OR CATALOG CAN NOT BE ACCESSED
READY.

EXEC EADC.CLIST

Step 5: Computer gives the following messages.

Press Return when appropriate.

FILE FT05F001 NOT FREED, IS NOT ALLOCATED
FILE FT06F001 NOT FREED, IS NOT ALLOCATED
FILE FT08F001 NOT FREED, IS NOT ALLOCATED

THIS IS THE ENERGY ANALYSIS AND DIAGNOSTIC CENTER'S PROGRAM
TO CALCULATE STANDARD ENERGY CONSERVATION OPPORTUNITIES.
THE PROGRAM WILL PROMPT YOU FOR ALL THE NECESSARY INPUT.

PRESS RETURN TO CONTINUE

****

YOU MUST INPUT A BLANK SPACE
BEFORE EACH DATA ENTRY
AND INCLUDE A DECIMAL POINT
IN ALL NUMERICAL ANSWERS.

****

FOR EXAMPLE IF YOU WANT TO ENTER AN AIR PRESSURE OF 100 PSIG
YOU WOULD PRESS THE SPACE BAR AND THEN ENTER 100. WHEN YOU
ARE ASKED FOR A TYPE OF COMPRESSOR OR LAMP YOU SHOULD INPUT
THE NAME. THE QUESTIONS OF TYPE ARE REQUESTING ALPHABETIC
NOT NUMERIC ANSWERS.

IF FOR SOME REASON THERE IS A NUMERICAL INPUT WHICH DOES NOT REQUIRE A
DECIMAL POINT THE PROGRAM WILL TELL YOU NOT TO USE A DECIMAL.

PRESS RETURN TO CONTINUE

```
**************************************************************************

                        THE EADC ECO PROGRAM
                            DOES NOT
                         PROVIDE ANY FIGURES

          WHEN ASKED TO INPUT DATA FROM A FIGURE YOU MUST EITHER
          HAVE THE FIGURE TO REFER TO OR THE REQUIRED INFORMATION

          COPIES OF THE FIGURES ARE PROVIDED IN THE USER'S GUIDE

**************************************************************************

PRESS RETURN TO CONTINUE

          WHICH ECO WOULD YOU LIKE TO EXECUTE?

          1. OKLAHOMA GAS AND ELECTRIC PEAKS PROGRAM
          2. REDUCE COMPRESSED AIR PRESSURE TO THE MINIMUM REQUIRED
          3. MOVE AIR COMPRESSOR INTAKE TO COOLEST LOCATION
          4. NIGHT TIME SETBACK
          5. SWITCH TO ENERGY EFFICIENT FLUORESCENT BULBS
          6. SWITCHING TO MORE EFFICIENT LIGHT SOURCES (HG VAP TO HPS)
ENTER     1, 2, 3, 4, 5, OR 6:
1

WHICH ECO IN THE REPORT WILL THIS BE?

ENTER 1 FOR FIRST, 2 FOR SECOND, 3 FOR THIRD, ETC.

THIS NUMBER DOES NOT REQUIRE A DECIMAL POINT
1
```

After this question is answered, the computer will prompt for the required information for a given ECO. The required information is outlined in the following sections. Upon entering all of the required information, the computer will ask the following series. Enter each response exactly as it appears.

```
OSU5110 ENTER 5 DIGIT UCC PROJECT NUMBER:
13155

OSU5120 ENTER 4 CHARACTER UCC PROJECT NUMBER PASSWORD:
EADC

JOB B13155J(JOB01250) SUBMITTED
WOULD YOU LIKE TO EXECUTE ANOTHER ECO?
#SP165 JOB 1250 B13155J ENDED CN(00)
NO (OR YES)

THIS IS THE END OF THE EADC ECO PROGRAM.
YOU MAY PICK UP YOUR FINAL OUTPUT WITHIN 24 HOURS AT MATH SCIENCES.
THE OUTPUT WILL BE LOCATED IN THE NORTH END OF THE COMPUTER CENTER
(WHERE THE LINE PRINTERS ARE) IN THE 'E' BIN ON THE NORTH WALL
READY
```

When asked "would you like to execute another ECO?," a "no" response causes termination of the program. To end the terminal session, type logoff when the ready prompt appears.

B. OG&E PEAKS

Required Information:

- Number of air conditioning units
- Full load amperage/running load amperage for each A/C unit
- Voltage for each unit
- Phase correction factcr for each unit (1.0 for single phase, and 1,732 for 3 phase)
- Rate of credit per KVA in $/KVA-month (Figure 1)
- Number of months the credit is applicable

Example 1 at the end of the user's guide provides a sample of the data input for an OG&E PEAKS program run.

INFORMATION SHEET FOR RATE OF CREDIT

(1) Credit (if billed under either the R-1 or G-1 rate schedule):

$2.62 per KVA of connected air conditioning compressor capacity per month for three months but not to exceed thirty percent (30%) of the consumer's bill, excluding the customer charge, before application of the credit.

(2) Credit (if billed under PL-1 rate schedule):

$1.82 per KVA of connected air conditioning compressor capacity per month for three months but not to exceed thirty percent (30%) of the consumer's bill, excluding the customer charge, before application of the credit.

Figure 1

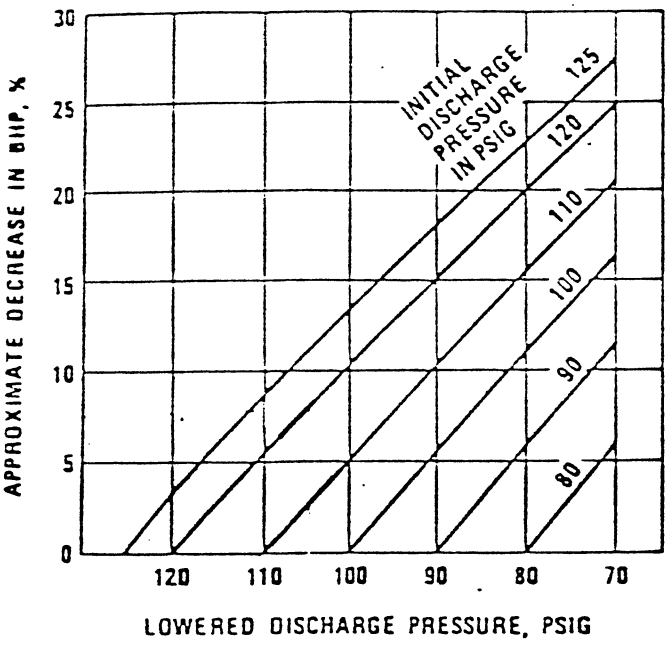
C. Reduce Compressed Air to the Minimum Required

Required Information:

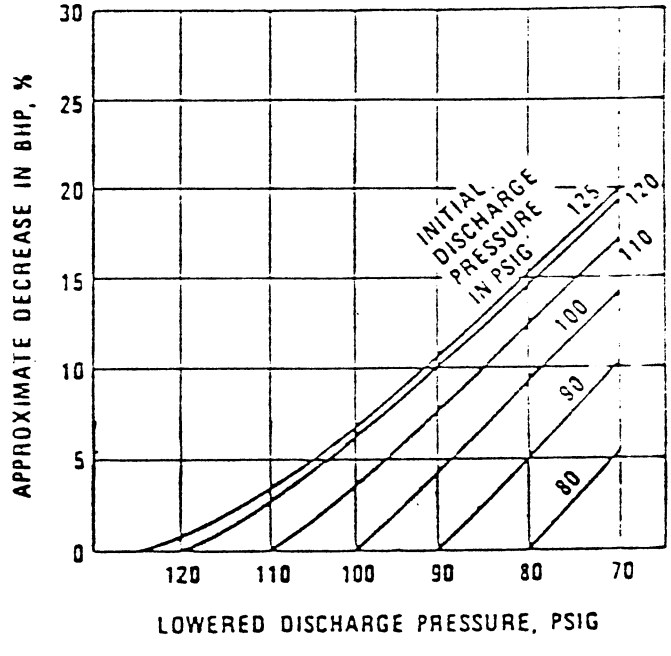
- Present air compressor discharge in PSIG
- Type of compressor
- Size of compressor in horsepower
- Operating hours per year
- Cost of electricity in $/KWH
- Recommend air discharge pressure
- The reduction in base horsepower from Figure 2
- Percent (%) load factor

Example 2 at the end of the user's guide provides a sample of the data input for the ECO, reducing compressed air to the minimum required.

Reduction in Base Horsepower



Part A – Single Stage Reciprocating and Rotary Screw Compressors



Part B – Two Stage Reciprocating and Centrifugal Compressors

Source: Energy Conservation Program Guide for Industry and Commerce, NBS Handbook 115 (US Dept. of Commerce/National Bureau of Standards).

Figure 2

D. Move Air Compressor Intake to Coolest Location

Required Information:

- Average Inside air temperature in degrees Fahrenheit
- Average outside air temperature in degrees Fahrenheit
- Compressor size in hp
- Operating hours per year
- Electricity cost in $/kwh
- Percent (%) load on compressor
- Duct work length in linear feet
- The volume of air corresponding to T1 from column two, Figure 3
- The volume of air corresponding to T2 from Figure 3
- Cost in $/linear feet for insulated flexible duct with vinyl coated spring steel (or aluminum)
- Labor cost in $/hr
- Number of workers required
- Number of hours workers should be employed on the job

Example 3 at end of the user's guide provides a trial input procedure for moving an air compressor intake to the coolest location.

Change in Horsepower Requirements
for Different Air Intake
Temperatures

Temperature of Air Intake, F	Intake Volume Required to Deliver 1000 cu. ft. of Free Air at 70 F	% HP Saving or Increase Relative to 70 F Intake
30	925	7.5 Saving
40	943	5.7 Saving
50	962	3.8 Saving
60	981	1.9 Saving
70	1000	0
80	1020	1.9 Increase
90	1040	3.8 Increase
100	1060	5.7 Increase
110	1080	7.6 Increase
120	1100	9.5 Increase

Source: Energy Conservation Program Guide for Industry and Commerce, NBS Handbook 115 (US Dept. of Commerce/National Bureau of Standards).

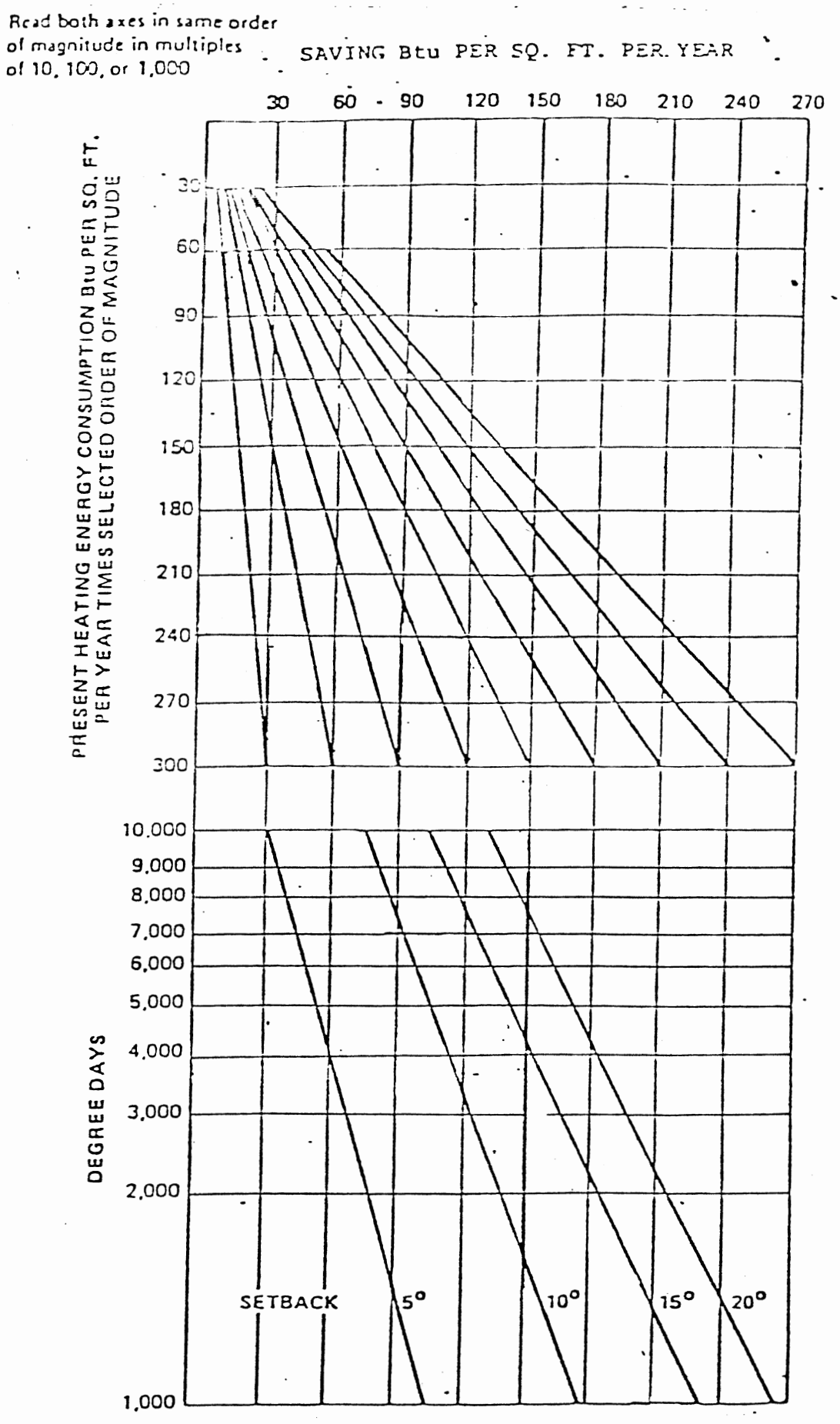
Figure 3

E. Night Setback

Required Information:

- Existing level of temperature for space heating
- Heating unit efficiency
- Heating degree days for the area
- Natural gas cost in $/mcf
- Total area for conditioned space in square feet
- Energy used for space heating in million Btu/yr
- Degrees setback in degrees fahrenheit
- Energy savings in btu/ft^2 year from Figure 4
- Number of channels on programmable 7-way sequencer
- Number of instruments (sequencers) required
- Instrument cost in dollars
- Total labor cost in $/hr-instrument
- Total labor hours per instrument

Example 4 at the end of the user's guide provides a sample input trail for Night Setback.



Source: Guidelines for Saving Energy in Existing Buildings, ECM-1, FEA, 1975

Figure 4.--Heating Energy Saved by Night Setback

F. Example Input

1. OG&E PEAKS

ENTER VALUES FOR THE FOLLOWING:
NUMBER OF A/C UNITS
THIS IS AN INTEGER - DO NOT USE A DECIMAL POINT !!!

11

THIS IS UNIT #1
TYPE OF A/C UNIT

YORK

FLA-RLA (FULL LOAD AMPERAGE/RUNNING LOAD AMPERAGE)

19.9

VOLTAGE

208.

PHASE CORRECTION FACTOR
1.0 FOR SINGLE PHASE, AND 1.732 FOR 3 PHASE

1.732

THIS IS UNIT #2
TYPE OF A/C UNIT

LENNOX

FLA/RLA (FULL LOAD AMPERAGE/RUNNING LOAD AMPERAGE)

21.3

VOLTAGE

208.

PHASE CORRECTION FACTOR
1.0 FOR SINGLE PHASE, AND 1.732 FOR 3 PHASE

1.732

THIS IS UNIT #4
TYPE OF A/C UNIT

LENNOX

FLA/RLA (FULL LOAD AMPERAGE/RUNNING LOAD AMPERAGE)

21.3

VOLTAGE

208.

PHASE CORRECTION FACTOR
1.0 FOR SINGLE PHASE, AND 1.732 FOR 3 PHASE

1.733

THIS IS UNIT #5
TYPE OF A/C UNIT

GE

FLA/RLA (FULL LOAD AMPERAGE/RUNNING LOAD AMPERAGE)

30.0

VOLTAGE

208.

PHASE CORRECTION FACTOR
1.0 FOR SINGLE PHASE, AND 1.732 FOR 3 PHASE

1.732

THIS IS UNIT #6
TYPE OF A/C UNIT

YORK

FLA/RLA (FULL LOAD AMPERAGE/RUNNING LOAD AMPERAGE)

32.0

VOLTAGE

208.

PHASE CORRECTION FACTOR
1.0 FOR SINGLE PHASE, AND 1.732 FOR 3 PHASE

1.732

THIS IS UNIT #7
TYPE OF A/C UNIT

YORK

FLA/RLA (FULL LOAD AMPERAGE/RUNNING LOAD AMPERAGE)

32.0

VOLTAGE

208.

PHASE CORRECTION FACTOR
1.0 FOR SINGLE PHASE, AND 1.732 FOR 3 PHASE

1.732

THIS IS UNIT #8
TYPE OF A/C UNIT

LENNOX

FLA/RLA (FULL LOAD AMPERAGE/RUNNING LOAD AMPERAGE)

21.4

VOLTAGE

208.

PHASE CORRECTION FACTOR
1.0 FOR SINGLE PHASE, AND 1.732 FOR 3 PHASE

1.732

THIS IS UNIT #9
TYPE OF A/C UNIT

FLA/RLA (FULL LOAD AMPERAGE/RUNNING LOAD AMPERAGE)

13.7

VOLTAGE

208.

PHASE CORRECTION FACTOR
1.0 FOR SINGLE PHASE, AND 1.732 FOR 3 PHASE

1.732

THIS IS UNIT #10
TYPE OF A/C UNIT

FLA/RLA (FULL LOAD AMPERAGE/RUNNING LOAD AMPERAGE)

15.0

VOLTAGE

208.

PHASE CORRECTION FACTOR
1.0 FOR SINGLE PHASE, AND 1.732 FOR 3 PHASE

1.732

THIS IS UNIT #11
TYPE OF A/C UNIT

FLA/RLA (FULL LOAD AMPERAGE/RUNNING LOAD AMPERAGE)

15.0

VOLTAGE

208.

PHASE CORRECTION FACTOR
1.0 FOR SINGLE PHASE, AND 1.732 FOR 3 PHASE

1.732

RATE OF CREDIT PER KVA IN $/KVA-MONTH

1.82

OF MONTHS THE CREDIT IS APPLICABLE

3.

2. Reduce Compressed Air to the Minimum Required

ENTER VALUES FOR THE FOLLOWING
PRESENT AIR COMPRESSOR DISCHARGE IN PSIG
160.

TYPE OF COMPRESSOR
Single Stage Reciprocating

SIXE OF COMPRESSOR IN HORSEPOWER
25.

OPERATING HOURS PER YEAR
8760.

COST OF ELECTRICITY IN $/KWH
.0288

FUEL ADJUSTMENT COST FACTOR CHARGE IN $/KWH
.00

RECOMMENDED AIR COMPRESSOR DISCHARGE PRESSURE
120.

INPUT THE REDUCTION IN BASE HORSEPOWER FROM FIGURE 2
20.

% LOAD FACTOR (I.E. 50.)
50.

3. Move Air Compressor Intake to Coolest Location

ENTER VALUES FOR THE FOLLOWING
AVERAGE INSIDE AIR TEMPERATURE (T1) IN DEGREES FAHRENHEIT

80.

AVERAGE OUTSIDE AIR TEMPERATURE (T2) IN DEGREES FAHRENHEIT

48.

COMPRESSOR SIZE IN HP

20.

OPERATING HOURS PER YEAR

1150.

ELECTRICITY COST IN $/KWH

.0523

% LOAD ON COMPRESSOR

75.

DUCT-WORK LENGTH IN LINEAR FEET

20.

FROM THE SECOND COLUMN IN FIGURE 3 INPUT THE VOLUME OF AIR CORRESPONDING TO T1
FOR EXAMPLE THE VOLUME OF AIR CORRESPONDING TO 60 DEGREES WOULD BE 981

1020.

FROM FIGURE 3 INPUT THE VOLUME OF AIR CORRESPONDING TO T2

952.

COST IN $/LINEAR FT FOR INSULATED FLEXIBLE DUCT WITH VINYL COATED SPRING STEEL (OR ALUMINUM)

2.50

OF GRILLES REQUIRED

2.

COST PER GRILLE IN DOLLARS

23.

LABOR COST IN $/HR

10.00

NUMBER OF WORKERS REQUIRED

2.

NUMBER OF HOURS WORKERS SHOULD BE EMPLOYED ON JOB

8.0

4. Night Setback

ENTER VALUES FOR THE FOLLOWING:
EXISTING LEVEL OF TEMPERATURE FOR SPACE HEATING

70.

HEATING UNIT EFFICIENCY IN PERCENT (I.E. 80.)

80.

HEATING DEGREE DAYS FOR THE AREA

3680.

NATURAL GAS COST IN $/MCF

2.9965

TOTAL AREA FOR CONDITIONED SPACE IN SQUARE FEET

199500.

ENERGY USED FOR SPACE HEATING IN MILLION BTU/YR
FROM THE NATURAL GAS CONSUMPTION GRAPHS
FOR EXAMPLE 103,000,000 BTU/YR YOU WOULD INPUT AS 103

20000.

DEGREES SETBACK IN DEGREES F

15.

ENERGY SAVINGS IN BTU/SQ.FT.-YR FROM FIGURE 4

35000.

NUMBER OF CHANNELS ON PROGRAMMABLE 7 DAY SEQUENCER

8.

NUMBER OF INSTRUMENTS (SEQUENCERS) REQUIRED

4.

INSTRUMENT COST IN DOLLARS

550.

TOTAL LABOR COST IN DOLLARS/HOUR PER INSTRUMENT

15.

TOTAL LABOR HOURS PER INSTRUMENT

16.

SECTION 3

CREATING A NEW TSO FILE

ADDING MORE ECO'S

A. ALTERING THE DRIVER FILE

B. CREATING NEW FORTRAN MEMBERS

CREATING A NEW TSO FILE

A backup card file was created to enable reloading of the TSO program. This would be necessary if any of the program were accidentally erased or tampered. The purpose of the punched card deck is to enable the program to be quickly brought back on line for use. It eliminates the necessity of reentering each program line individually.

The new file is created using one of the IBM-TSO utilities called TSO Build. The TSO Build utility creates a TSO data set from a punched card deck. The control cards necessary to execute TSO Build are provided in Appendix G.

ADDING MORE ECO'S

The Program may be expanded to include more standardized forms. To accomplish this alterations are required in the driver file and a new Fortran file member must be created for each ECO. The necessary steps for adding a new ECO are outlined below, and the commands for editing procedures are provided in Appendix 4.

A. Altering the Driver File

(1) Type: LOGON U13155A

PROMPT FOR PASSWORD

(2) TYPE: EADC

READY PROMPT

(3) TYPE: EDIT EADC.CLIST

EDIT PROMPT

(4) (a) Expand the menu list (currently lines 510-580)

(b) Add an IF-THEN-ELSE clause

to accommodate the expanded menu. For example these lines would be added between 830 and 840

- IF &ANS1 = 7 THEN DO
- CALL EADC.LOAD (YOURECO)
- END
- ELSE DO

B. Creating New Fortran Members

(1) TYPE: LOGON U13155A

PROMPT FOR PASSWORD

(2) TYPE: EADC

READY PROMPT

(3) TYPE: EDIT EADC.CNTL (YOURECO)

MEMBER NOT FOUND

ASSUMED TO BE NEW

INPUT 00010

(4) ENTER THE FORTRAN PROGRAM

If mistakes are made, the program may be edited using the commands in Appendix H.

(5) After the program is entered, while still in the edit mode,

Type SUBMIT

Type END SAVE

(6) The new FORTRAN member must be put into a LOAD MODULE. To do this

Type: EXEC U13155A.EADC.CNTL (Member Name)

(7) The program is now ready to be used.

SECTION 4

SAMPLES

A. OG&E PEAKS

B. REDUCE COMPRESSED AIR TO MINIMUM REQUIRED

C. MOVE AIR COMPRESSOR INTAKES TO COOLEST LOCATION

D. NIGHT SETBACK

ECO # 1

TITLE: OG&E "PEAKS" PROGRAM FOR A/C LOAD SHEDDING

EXECUTIVE SUMMARY:

OG&E HAS RECENTLY COME UP WITH A NEW ENERGY CONSERVATION OPPORTUNITY OF APPLYING FOR "RIDER FOR LOAD CONTROL (PEAKS PROGRAM)."

ACCORDING TO THIS PROGRAM, OG&E WILL INSTALL A DEVICE TO SHED A/C LOAD BY INTERRUPTING ELECTRIC SERVICE TO THE AIR CONDITIONING COMPRESSOR FOR PERIODS OF NO MORE THAN SEVEN AND ONE-HALF MINUTES OF EACH THIRTY MINUTE PERIOD DURING PEAK LOAD PERIODS, GENERALLY PERIODS WITH AMBIENT TEMPERATURE OF 95 DEGREES F AND ABOVE, FROM JUNE 15 TO SEPTEMBER 15

THE INCENTIVE FOR THIS PROGRAM IS A CREDIT GIVEN ON THE CUSTOMERS BILLS FOR THE THREE REVENUE MONTHS OF JULY, AUGUST, AND SEPTEMBER. THE INFORMATION ON THE RATE OF CREDIT IS GIVEN ON A SEPARATE SHEET ENCLOSED HEREWITH.

EXPERIENCE SHOWS THAT THE CYCLING WILL NOT CAUSE ANY APPRECIABLE LOSS IN COMFORT.

REQUIRED INFORMATION:

A/C UNIT(S)	FLA/RLA* (A)	VOLTAGE (B)	PHASE** CORRECTION FACTOR (C)	KVA= (A)X(B)X(C)/1000
YORK	19.9	208.	1.7320	7.17
YORK	19.9	208.	1.7320	7.17
LENNOX	21.3	208.	1.7320	7.67
LENNOX	21.3	208.	1.7320	7.67
GE	30.0	208.	1.7320	10.81
YORK	32.0	208.	1.7320	11.53
YORK	32.0	208.	1.7320	11.53
LENNOX	21.4	208.	1.7320	7.71
	13.7	208.	1.7320	4.94
	15.0	208.	1.7320	5.40
	15.0	208.	1.7320	5.40

TOTAL KVA= 87.00

CALCULATIONS: (FOR SAVINGS)

(TOTAL KVA OF CONNECTED A/C CAPACITY) X (RATE OF CREDIT/KVA)

X (# OF MONTHS THE CREDIT IS APPLICABLE)

= (87.00 KVA) X ($ 1.82 KVA-MONTH)

X (3. MONTHS/YEAR)

= $ 475.03 /YR

CALCULATIONS: (FOR COST OF IMPLEMENTATION)

SINCE THERE IS NO COST OF IMPLEMENTATION, THE PAYBACK PERIOD IS IMMEDIATE.

* FLA/RLA = FULL LOAD AMPERAGE/RUNNING LOAD AMPERAGE.
** 1.732 FOR 3 PHASE AND 1 FOR SINGLE PHASE

ECO # 2

EPIC ECO CODE 32.1

TITLE: REDUCE THE PRESSURE OF COMPRESSED AIR TO THE MINIMUM REQUIRED.

EXECUTIVE SUMMARY:

THE AUDIT TEAM FEELS THAT YOUR AIR PRESSURE COULD BE LOWERED WITHOUT CAUSING OPERATING PROBLEMS. A REDUCTION IN AIR PRESSURE TO THE MINIMUM REQUIRED LEVEL REDUCES CONSUMPTION OF ENERGY OF THE ELECTRICAL MOTOR DRIVING THE COMPRESSOR. IN YOUR CASE WE RECOMMEND YOU GO FROM 160. TO 120. PSIG, FOR WHICH CALCULATIONS HAVE BEEN MADE TO SHOW THE SAVINGS.

REQUIRED DATA:

GIVEN:

(1) PRESENT AIR COMPRESSOR DISCHARGE PRESSURE : 160. PSIG
(2) TYPE OF COMPRESSOR : SINGLE STAGE RECIPROCATING
(3) SIZE (HP) OF COMPRESSOR : 25. HP
(4) OPERATING HOURS PER YEAR : 8760. HRS
(5) COST OF ELECTRICITY : $.02880/KWH
(6) FUEL ADJUSTMENT COST FACTOR CHARGE : $.00000/KWH
(7) RECOMMENDED AIR COMPRESSOR DISCHARGE PRESSURE : 120. PSIG
(8) LOAD FACTOR : 50.0%

CALCULATIONS (FOR ENERGY AND $ SAVINGS)

(1) FOR A RECOMMENDED AIR COMPRESSOR DISCHARGE PRESSURE OF 120. PSIG (IE, A REDUCTION OF (160. - 120. = 40.PSIG) FIG (1) GIVES A REDUCTION IN BASE HORSEPOWER OF 20.0 %

(2) EFFECTIVE COST OF ELECTRICITY:

= (COST OF ELECTRICITY) + (FUEL ADJUSTMENT FACTOR CHARGE)
= ($ .02880 .KWH) + ($ .00000 /KWH)
= $ .02880 /KWH

(3) SAVINGS IN ENERGY (KWH):

= (% HP SAVINGS/100) X (COMPRESSOR HP) X (OPERATING HRS/YR) X (CONVERSION FACTOR FOR HP TO KW) X (LOAD FACTOR)

= (20.0 /100) X (25. HP) X (8760. HRS/YR.)
X (0.746 KW/HP) (50.0%)
= 16337. KWH/YR

(4) SAVINGS IN ENERGY (BTU):

= (SAVINGS IN KWH/YR) X (CONVERSION FACTOR)

= (16337. KWH/YR) X (3412 BTU/KWH)
= 55743152. BTU/YR.

(5) SAVINGS IN DOLLARS

= (SAVINGS IN KWH) X (EFFECTIVE COST OF ELECTRICITY)

= $ 470.52 /YR

CALCULATIONS (FOR IMPLEMENTATION COST):

SINCE THERE IS NO COST OF IMPLEMENTATION, THE PAYBACK IS IMMEDIATE.

ECO # 3
(EPIC ECO CODE 32.21)

TITLE: INSTALL COMPRESSOR AIR INTAKE IN COOLEST LOCATIONS

EXECUTIVE SUMMARY:

BY INSTALLING THE INTAKE DUCT FOR AN AIR COMPRESSOR IN THE COOLEST LOCATIONS, ONE CAN HAVE H.P. SAVINGS, THEREBY REDUCING THE CONSUMPTION OF THE ENERGY FOR THE PRIME MOVER. USUALLY IT IS THE SAVING IN ELECTRICAL ENERGY OF THE MOTORS DRIVING THE COMPRESSOR. THIS ENERGY SAVING POTENTIAL IS DUE TO THE FACT THAT THE COMPRESSOR IS REQUIRED TO DO LESS WORK IN ORDER TO COMPRESS A CERTAIN AMOUNT OF AIR AT A LOWER TEMPERATURE HAVING A SMALLER VOLUME THAN TO COMPRESS THE SAME AMOUNT OF AIR AT A HIGHER VOLUME. THIS CAN BE DONE EASILY BY INSTALLING AN AIR INTAKE DUCT AT THE COMPRESSOR INTAKE LEADING TO THE OUTSIDE COOLER ATMOSPHERE.

REQUIRED DATA:

GIVEN:
AVERAGE INSIDE AIR TEMP. (T1): 80. DEG F
AVERAGE OUTSIDE AIR TEMP. (T2): 48. DEG F
COMPRESSOR SIZE: 20.0 HP.
OPERATION HOURS: 1150. HRS/YR
ELECTRICITY COST : $ 0.0523 /KWH
% LOAD ON COMPRESSOR: 75. %

MEASURED:
DUCT-WORK LENGTH: 20.0 FT.

CALCULATIONS (FOR ENERGY AND $ SAVINGS):

(1) REFERRING TO FIG.(1) UNDER THE SECOND COLUMN (WITH THE HEADING: INTAKE VOLUME REQUIRED TO DELIVER 1000 CUBIC FEET OF FREE AIR AT 70 DEGREES FAHRENHEIT), THE CORRESPONDING VOLUMES OF AIR CAN BE FOUND AT T1 = 80. DEGREES F AND T2 = 48. DEGREES F AS 1020. CUBIC FEET AND 952. CUBIC FEET RESPECTIVELY.

(2) SAVINGS IN ENERGY:

=(INTAKE VOL. AT T1 - INTAKE VOL. AT T2)/
(INTAKE VOL. AT T1) X 100%

((1020. - 952.)/(1020.)) X 100

= 6.7 % HP SAVING.

(3) SAVINGS IN KWH

= (6.7 % HP SAVINGS) X (% LOAD) X (COMPRESSOR SIZE) X (0.746 KW/HP) X (OPERATING HOURS/YEAR)

= (6.7/100) X (75./100) X (20.0 HP)'X (0.746 KW/HP.) X (1150. HRS/YR)

= 858. KWH/YR

(4) SAVINGS IN BTU:

= (858. KWH/YR) X (3412 BTU/KWH)

= 3. MILLION BTU/YR

(5) SAVINGS IN $:

= (KWH/YR SAVED) X (ELECTRICITY COST)

= (858. KWH/YR) X ($ 0.0523/KWH)

= $ 44.87/YR

CALCULATIONS (FOR IMPLEMENTATION COST):

(1) MATERIAL COST: FOR THE AIR INTAKE DUCT WORK, INSULATED FLEXIBLE DUCT WITH VINYL COATED SPRING STEEL (OR ALUMINUM) CAN BE USED WHICH COSTS ABOUT $ 2.50/ LINEAR FT AND 2. GRILLE(S) WOULD COST APPROXIMATELY $ 46. AT $ 23.0 /GRILLE.

(2) LABOR COST: FOR THE INSTALLATION OF THE DUCT, 2. PERSON(S) MAY BE EMPLOYED AT $ 10./HR FOR ABOUT 8. HOURS.

(3) HENCE TOTAL COST = MATERIAL COST + LABOR COST

=(DUCT COST/LINEAR FT) X (TOTAL LINEAR FT) + (# GRILLES) X (COST OF GRILLE) + (# OF LABORERS) X (# OF HRS. WORKED) X (WAGE/HR)

=($ 2.50/LINEAR FT) X (20.0 FT) + (2. GRILLES) X ($ 46. GRILLE) + (2. LABORERS) X ($ 10./HR) X(8. HRS)

= $ 256.00

CALCULATION (FOR PAYBACK):

(1) SIMPLE PAYBACK = TOTAL COST $ /ANNUAL $ SAVINGS

= 256.00/ 44.87

= 5.7 YRS

NOTE: IN SOME CASES A DAMPER IS REQUIRED SO THAT THE INSIDE AIR IS USED IN THE SUMMER IF IT IS COOLER THAN OUTSIDE

ECO # 4

EPIC CODE #63.44

TITLE: NIGHT-SETBACK

EXECUTIVE SUMMARY:

ENERGY AND THEREBY $ SAVINGS CAN BE REALIZED BY HAVING A NIGHT SETBACK. THIS CAN BE DONE EASILY BY INSTALLING A SEVEN DAY 24 HOURS/DAY PROGRAMMABLE AUTOMATIC NIGHT SETBACK TIMER TO CONTROL THE THERMOSTATS. DURING THE HEATING SEASON, THE TIMER CAN BE SET AT 68 DEGREES FAHRENHEIT FOR NORMAL WORKING (OR OCCUPIED) HOURS AND AT 50 DEGREES (OR LOWER) DURING UNOCCUPIED HOURS (EVENINGS & WEEKENDS) SINCE THE AIR HANDLING UNITS WOULD BE HEATING TO A LOWER TEMPERATURE, LESS ENERGY WOULD BE USED.

MOREOVER, DURING HOT DAYS OF SUMMER, THE TEMPERATURE CAN BE SET FOR AIR CONDITIONERS AT THE NORMAL 78 DEGREES FOR WORKING/OCCUPIED HOURS AND AT SOME TEMPERATURE HIGHER THAN 78 DEGREES FOR UNOCCUPIED HOURS. HOWEVER, THE SELECTION FOR THIS HIGHER TEMPERATURE IS SOMETIMES DEPENDENT UPON FACTORS LIKE DEGREE OF HUMIDITY REQUIREMENT, ETC. THE SAVINGS WOULD BE DIRECTLY PROPORTIONAL TO THE SETTING OF THIS TEMPERATURE CHOSEN FOR THE SUMMER.

FOR YOUR SYSTEM OF PRESENT OPERATING CONDITIONS, CALCULATIONS HAVE BEEN MADE TO SHOW THE SAVINGS ONLY DURING THE HEATING SEASON. HOWEVER, TOTAL SAVINGS WOULD BE EVEN GREATER, DEPENDING UPON THE SET-UP TEMPERATURE CHOSEN FOR SUMMER

REQUIRED DATA:

GIVEN:
(1) YOUR EXISTING LEVEL OF TEMP. FOR SPACE HEATING: 70. DEG. F
(2) HEATING UNIT EFFICIENCY: 80. %
(3) HEATING DEGREE DAYS FOR YOUR AREA: 3680.
(4) NATURAL GAS COST: $ 2.997 /MCF
(5) YOUR TOTAL AREA FOR CONDITIONED SPACE: 199500.SQ. FT.

CALCULATIONS (FOR ENERGY AND $ SAVINGS)

(1) FROM YOUR NATURAL GAS CONSUMPTION GRAPH (PROVIDED IN THE BEGINNING OF THIS REPORT), THE PRESENT ENERGY USED FOR YOUR SPACE HEATING HAS BEEN READ AS 20000.0 MILLION BTU/YR

(2) YOUR PRESENT AVERAGE HEATING CONSUMPTION PER SQUARE FT.

= (ENERGY USED FOR SPACE HEATING) / (CONDITIONED SPACE AREA)

= (20000.0 MILLION BTU/YR.) / (199500. SQ FT)

= 100251. BTU/YR-SQ FT

(3) FOR 3680. HEATING DEGREE DAYS AND 15. DEGREES FAHRENHEIT OF SETBACK AND FOR YOUR PRESENT AVERAGE HEATING CONSUMPTION PER SQ FT OF 100251. BTU/SQ FT-YR; THE GRAPH OF FIG.(1) READS AN ENERGY SAVING OF 35000. BTU/SQ FT-YR'.

(4) YOUR ACTUAL ANNUAL ENERGY SAVINGS WOULD, THEREFORE, BE

= (ENERGY SAVINGS READ FROM GRAPH) X (CONDITIONED SPACE AREA) /(HEATING UNIT EFFICIENCY)

= (35000. BTU/SQ FT-YR) X (199500. SQ FT) /(80. %) = 8728. MILLION BTU

(5) SAVINGS IN NATURAL GAS

= (SAVINGS IN BTU) X (CONVERSION FACTOR)

= (8728. MILLION BTU/YR) X (1 MCF/MILLION BTU)

= 8728. MCF/YR

(6) SAVINGS IN DOLLARS

= (GAS SAVINGS) X (GAS COST)

= (8728. MCF/YR) X ($ 2.997 /MCF)

= $ 26154. /YR

CALCULATIONS (FOR IMPLEMENTATION COST):

(1) INSTRUMENT COST: FOR YOUR SYSTEM A NIGHT SETBACK SEQUENCES 7 DAY PROGRAMMABLE 8. CHANNEL VERSION WOULD COST YOU APPROXIMATELY $ 550.00

(2) LABOR COST: FOR INSTALLATION PURPOSES, SOME MATERIAL AND LABOR WOULD BE REQUIRED WHICH IS ESTIMATED TO BE APPROXIMATELY $ 240.00

(3) COST PER SEQUENCER = INSTRUMENT COST + LABOR COST

= ($ 550.00) + (16.0 HRS.)($ 15.00 /HOUR)

= 790.00 PER SEQUENCER AND 4. SEQUENCER(S) ARE REQUIRED

TOTAL COST = (COST PER SEQUENCER) X (# SEQUENCERS REQUIRED)

TOTAL COST = 790.00 X 4.

= 3160.00

CALCULATIONS (FOR PAYBACK)

SIMPLE PAYBACK = (TOTAL COST IN $) / (ANNUAL SAVINGS)

= ($ 3160.00) / ($ 26154. /YR)

= 0.1 YRS

NOTE: THE CALCULATED PAYBACK PERIOD WOULD BECOME EVEN LESS IF WE ADDED THE SAVINGS IN THE COOLING SEASON TO THE ANNUAL DOLLAR SAVINGS.

CONCLUSION

This research resulted in an interactive computer program which incorporated word processing. The output of the program provides energy conservation opportunities for a specific industry. There are three main benefits of the program. It reduces time spent by the Energy Analysis and Diagnostic Center in preparing standardized ECO's. It also eliminates typing time on the standardized ECO's. Furthermore, it minimizes the time spent by EADC staff members preparing the ECO's, leaving more time for them to spend researching new energy conservation opportunities.

Several areas could be looked at for further research on this project. The computer program could be expanded to include the remaining standardized forms. In addition, the project could be rewritten in a different computer language as new languages are developed which incorporate both word processing and advanced computational capabilities. The IBM/370 was selected for their project over other possible computers because of its quality of print. When the Industrial Engineering Department acquires printer types other than dot matrix the project could be transferred to a micro computer within the department for easy access.

APPENDIX A

CLIST PROGRAM LISTING

```
0010CONTROL PROMPT
0020FREE FILE(FT05F001, FT06F001, FT08F001)
0030ALLOC DA(*) FILE(FT05F001) SHR
0040ALLOC DA(*) FILE(FT06F001) SHR
0050ALLOC FI(FT08F001) DA('U13155A.SCRIPT.DATA') SHR
0060NEWPAGE
0061WRITE
0062WRITE
0063WRITE
0064WRITE
0065WRITE
0066WRITE
0067WRITE
0070BEGIN: WRITE THIS THE ENERGY ANALYSIS AND DIAGNOSTIC CENTER'S
0080WRITE PROGRAM TO CALCULATE STANDARD ENERGY CONSERVATION
0090WRITE OPPORTUNITIES.  THE PROGRAM WILL PROMPT YOU FOR ALL
0100WRITE THE NECESSARY INPUT.
0101WRITE
0102WRITE
0103WRITE
0104WRITE
0105WRITE
0106WRITE PRESS RETURN TO CONTINUE
0107READ &RESPO
0108NEWPAGE
0120WRITE ************************************************
0130WRITE
0140WRITE              YOU MUST INPUT A BLANK SPACE
0150WRITE                 BEFORE EACH DATA ENTRY
0151WRITE               AND INCLUDE A DECIMAL POINT
0152WRITE                  IN ALL NUMERICAL ANSWERS.
0160WRITE
0170WRITE ************************************************
0190WRITE
0200WRITE FOR EXAMPLE IF YOU WANT TO ENTER AN AIR PRESSURE OF 100
0210WRITE PSIG YOU WOULD PRESS THE SPACE BAR AND THEN ENTER
0220WRITE 100. WHEN YOU ARE ASKED FOR A TYPE OF COMPRESSOR
0230WRITE OR LAMP YOU SHOULD INPUT THE NAME.  THE QUESTIONS
0240WRITE OF TYPE ARE REQUESTING ALPHABETIC NOT NUMERIC ANSWERS.
0250WRITE
0260WRITE
0261WRITE IF FOR SOME REASON THERE IS A NUMERICAL INPUT WHICH
0262WRITE DOES NOT REQUIRE A DECIMAL POINT THE PROGRAM WILL TELL
0263WRITE YOU NOT TO USE A DECIMAL.
0264WRITE
0270WRITE
0280WRITE PRESS RETURN TO CONTINUE
0290READ &RESP
0300NEWPAGE
0310WRITE
0320WRITE
0330WRITE ************************************************
0340WRITE
0350WRITE                  THE EADC ECC PROGRAM
0360WRITE                       DOES NOT
0370WRITE                  PROVIDE ANY FIGURES
0380WRITE
0390WRITE        WHEN ASKED TO INPUT DATA FROM A FIGURE YOU MUST EITHER
0400WRITE        HAVE THE FIGURE TO REFER TO OR THE REQUIRED INFORMATION
0410WRITE
0420WRITE         COPIES OF THE FIGURES ARE PROVIDED IN THE USER'S GUIDE
0430WRITE


0440WRITE ************************************************
0450WRITE
0460WRITE
```

```
0470WRITE
0480WRITE PRESS RETURN TO CONTINUE
0490READ &RESP2
0500NEWPAGE
0510WRITE WHICH ECO WOULD YOU LIKE TO EXECUTE?
0520WRITE        1. OKLAHOMA GAS AND ELECTRIC PEAKS PROGRAM
0530WRITE        2. REDUCE COMPRESSED AIR PRESSURE TO THE MINIMUM REQUIRED
0540WRITE        3. MOVE AIR COMPRESSOR INTAKE TO COOLEST LOCATION
0550WRITE        4. NIGHT TIME SETBACK
0560WRITE        5. SWITCH TO ENERGY EFFICIENT FLUORESCENT BULBS
0570WRITE        6. SWITCHING TO MORE EFFICIENT LIGHT SOURCES (HG VAP TO HPS)
0580WRITENE ENTER 1, 2, 3, 4, 5, OR 6:
0590READ &ANS1
0600IF &ANS1 = 1 THEN DO
0610CALL EADC.LOAD(PEAKS)
0620END
0630ELSE DO
0640    IF &ANS1 = 2 THEN DO
0650    CALL 'U13155A.EADC.LOAD(AIRCOMP)'
0660    END
0670    ELSE DO
0680        IF &ANS1 = 3 THEN DO
0690        CALL EADC.LOAD(COMPIN)
0700        END
0710        ELSE DO
0720            IF &ANS1 = 4 THEN DO
0730            CALL EADC.LOAD(SETBACK)
0740            END
0750            ELSE DO
0760                IF &ANS1 = 5 THEN DO
0770                CALL EADC.LOAD(FLUOR)
0780                END
0790                ELSE DO
0800                    IF &ANS1 = 6 THEN DO
0810                    CALL EADC.LOAD(LIGHTS)
0820                    END
0830                    ELSE DO
0840                    GOTO WRONG
0850                    END
0860                END
0870            END
0880        END
0890    END
0900END
0910QUIT: WRITE WOULD YOU LIKE TO EXECUTE ANOTHER ECO?
0920READ &ANS2
0930    IF &ANS2 = YES THEN DO
0940    GOTO BEGIN
0950    END
0960        ELSE DO
0970        GOTO FINISH
0980        END
0990WRONG: WRITE YOU HAVE MADE AN INVALID CHOICE
1000        WRITE DO YOU WANT TO RETURN TO THE BEGINING AND TRY AGAIN?
1010        READ &ANS3
1020            IF &ANS3 = YES THEN DO
1030            GOTO BEGIN
1040                END
1050                ELSE DO
1060                GOTO FINISH
1070                END
1080FINISH: WRITE THIS IS THE END OF THE EADC ECO PROGRAM. YOU MAY
1090WRITE PICK UP YOUR FINAL OUTPUT WITHIN 24 HOURS AT MATH SCIENCES.

1091WRITE THE OUTPUT WILL BE LOCATED IN THE NORTH END OF THE COMPUTER
1092WRITE CENTER (WHERE THE LINE PRINTERS ARE) IN THE 'E' BIN ON THE
1093WRITE NORTH WALL
1094SUBMIT 'U13155A.SCRIPT.CNTL'
1100FREE FILE(FT05F001, FT06F001, FT08F001)
1110END
```

APPENDIX B

MAJOR CLIST COMMANDS

COMMAND		FUNCTION
ALLOCATE	[ALLOC]	Used to specify input and output files or to assign a file number to a dataset.
		Alloc F1(FT08F001) DA('U13155A.SCRIPT.DATA)SHR assigns file number 8 to a dataset named U13155A.SCRIPT.DATA. This enables us to write to that file by using the command WRITE (8,100) where 8 is the file number and 100 is the format statement number.
CALL	[CALL]	Used to load and execute a program. The program being called must be in load module form.
FREE	[FREE]	Is used to release the allocated datasets that are no longer required.
GO TO	[GOTO]	Produces unconditional branching in the program.
IF-THEN-ELSE		Specifies a condition, tests the condition and then takes action according to the results of the test.
NEW PAGE	[NEWPAGE]	Moves the cursor to the top of a new page.
READ		Is used to input variables' values from the terminal. Recognizable values are • a character string • a quoted string • a parenthesized string • null values indicated by two adjacent commas (,,) or quotes ("")
WRITE		Sends text to the terminal screen. Can be used for messages or prompts. The WRITE command specifies that the cursor move to a new line after the text is displayed.
WRITE NR	[WRITENR]	Also sends text to the screen but the cursor does not move to a new line after displaying text.

APPENDIX C

FORTRAN PROGRAM LISTINGS

```
/* TSO FOREGROUND HARDCOPY ****
NAME=J13155A.EADC.CNTL                                    (PEAKS    )

//J13155J   JOB (?,444-33-6666),'EADC',TIME=(0,40),CLASS=A,MSGCLASS=X     00000010
//PASSWORD ?                                                              00000020
// EXEC FORTVCL,REGION.FORT=1000K                                         00000030
//FORT.SYSIN DD *                                                        00000040
      CHARACTER*8 TYPE(20)                                               00000050
      DIMENSION A(20,4)                                                  00000060
      SUM=0.                                                             00000061
      WRITE(6,01)                                                        00000062
01    FORMAT(10X,'WHICH ECO IN THE REPORT WILL THIS BE?',/,              00000063
     110X,'ENTER 1 FOR FIRST, 2 FOR SECOND, 3 FOR THIRD, ETC',/,         00000064
     110X,'THIS NUMBER DOES NOT REQUIRE A DECIMAL POINT')                00000065
      READ(5,*) NUM                                                      00000066
10    WRITE(6,20)                                                        00000070
20    FORMAT(10X,'ENTER VALUES FOR THE FOLLOWING:')                      00000080
      WRITE(6,25)                                                        00000090
25    FORMAT(10X,'NUMBER OF A/C UNITS ',/,                               00000100
     110X,'THIS IS AN INTEGER- DO NOT USE A DECIMAL POINT     ')         00000105
      READ(5,*) N                                                        00000120
      DO  65 I=1,N                                                       00000130
      WRITE(6,29) I                                                      00000131
29    FORMAT(10X,'THIS IS UNIT # ',I2)                                   00000132
      WRITE(6,30)                                                        00000140
30    FORMAT(10X,'TYPE OF A/C UNIT')                                     00000150
      READ(5,35) TYPE(I)                                                 00000160
35    FORMAT(A8)                                                         00000170
      WRITE(6,40)                                                        00000180
40    FORMAT(10X,'FLA/RLA (FULL LOAD AMPERAGE/RUNNING LOAD AMPERAGE)')   00000190
      READ(5,*) A(I,1)                                                   00000200
      WRITE(6,50)                                                        00000210
50    FORMAT(10X,'VOLTAGE')                                              00000220
      READ(5,*) A(I,2)                                                   00000230
      WRITE(6,60)                                                        00000240
60    FORMAT(10X,'PHASE CORRECTION FACTOR ',/,10X,                       00000250
     1'1.0 FOR SINGLE PHASE, AND 1.732 FOR 3 PHASE')                     00000260
      READ(5,*) A(I,3)                                                   00000270
      A(I,4) = A(I,1)*A(I,2)*A(I,3)/1000.                                00000300
      SUM = SUM + A(I,4)                                                 00000301
65    CONTINUE                                                           00000302
      WRITE(6,70)                                                        00000315
70    FORMAT(10X,'RATE OF CREDIT PER KVA IN $/KVA-MONTH')                00000320
      READ(5,*) B                                                        00000330
      WRITE(6,80)                                                        00000340
80    FORMAT(10X,'# OF MONTHS THE CREDIT IS APPLICALBE')                 00000350
      READ(5,*) C                                                        00000360
      WRITE(8,210) NUM                                                   00000400
210   FORMAT('.AC 8',/,'.LL 70',/,'.TM 6',/,'.BM 6',/,                   00000410
     1'.CE ECO #',I2,/,'.SK 2',/,                                        00000420
     1'TITLE: CG&E "PEAKS" PROGRAM FOR A/C LOAD SHEDDING',/,             00000430
     1'.SK 1',/,                                                         00000440
     1'.UP EXECUTIVE SUMMARY:',/,                                        00000450
     1'.SK 2',/,'.IN +5 ',/,                                             00000460
     1'OG&E HAS RECENTLY COME UP WITH A NEW ENERGY CONSERVATION',/,      00000470
     1'OPPORTUNITY OF APPLYING FOR "RIDER FOR LOAD CONTROL',/,           00000480
     1'(PEAKS PROGRAM)."',/)                                             00000490
      WRITE(8,220)                                                       00000500
220   FORMAT('.SK 1',/,                                                  00000510
     1'ACCORDING TO THIS PROGRAM, OG&E WILL INSTALL A DEVICE TO',/,      00000520
     1'SHED A/C LOAD BY INTERRUPTING ELECTRIC SERVICE TO THE AIR',/,     00000530
     1'CONDITIONING COMPRESSOR FOR PERIODS OF NO MORE THAN SEVEN AND',/, 00000540
     1'ONE-HALF MINUTES OF EACH THIRTY MINUTE PERIOD DURING PEAK',/,     00000550
     1'LOAD PERIODS, GENERALLY PERIODS WITH AMBIENT TEMPERATURE',/,      00000560
     1'OF 95 DEGREES F AND ABOVE, FROM JUNE 15 TO SEPTEMBER 15')         00000570
```

```
      WRITE(8,230)                                                      00000580
230   FORMAT('.SK 1',/,                                                 00000590
     1'THE INCENTIVE FOR THIS PROGRAM IS A CREDIT GIVEN ON THE',/,      00000600
     1'CUSTOMERS BILLS FOR THE THREE REVENUE MONTHS OF JULY,',/,        00000610
     1'AUGUST, AND SEPTEMBER.  THE INFORMATION ON THE RATE OF',/,       00000620
     1'CREDIT IS GIVEN ON A SEPARATE SHEET ENCLOSED HEREWITH.',/,       00000630
     1'.SK 1',/,                                                        00000640
     1'EXPERIENCE SHOWS THAT THE CYCLING WILL NOT CAUSE ANY ',/,        00000650
     1'APPRECIABLE LOSS IN COMFORT.')                                   00000660
      WRITE(8,250)                                                      00000670
250   FORMAT('.IN -5',/,'.SK 2',/,                                      00000680
     1'REQUIRED INFORMATION:',/,                                        00000690
     1'.SK 1',/)                                                        00000700
      WRITE(8,299)                                                      00000701
299   FORMAT('.TB 5 18 27 36 50 80',/,'.SK 0',/,'.DC TB ¬',/,'.SK 0',/, 00000702
     1'¬A/C UNIT(S)  FLA/PLA*  VOLTAGE  PHASE**',/,'.SK 0',/,           00000703
     1' ¬ ¬ (A) ¬ (B) ¬ CORRECTION ¬ KVA=',/,'.SK 0',/,                  00000704
     1' ¬ ¬ ¬ ¬ FACTOR (C) ¬ (A)X(B)X(C)/1000',/,'.SK 0',/,             00000705
     1'                                                  ')            00000706
      WRITE(8,300)(TYPE(I),A(I,1),A(I,2),A(I,3),A(I,4),I=1,N)           00000710
300   FORMAT(' ¬ ',A8,' ¬ ',F4.1,' ¬ ',F4.0,' ¬ ',F6.4,' ¬ ',F6.2)      00000720
      WRITE(8,301)                                                      00000721
301   FORMAT('.SK 1',/,                                                 00000722
     1'                                                  '             00000723
     1,/,'.SK 1',/)                                                     00000724
      WRITE(8,350) SUM                                                  00000730
350   FORMAT(39X,' TOTAL KVA= ',F6.2)                                   00000740
      WRITE(8,400) SUM,B,C                                              00000750
400   FORMAT(/,' CALCULATIONS:  (FOR SAVINGS)',/,                       00000760
     1'.SK 1',/,                                                        00000770
     1'.IN +5 ',/,                                                      00000780
     1'(TOTAL KVA OF COMPUTED A/C CAPACITY) X (RATE OF CREDIT/KVA)',/,  00000790
     1'.SK 1',/,                                                        00000800
     1' X (# OF MONTHS THE CREDIT IS APPLICABLE)',/,                    00000810
     1'.SK 1',/,                                                        00000820
     1'= ( ',F6.2,' KVA) X ($ ',F4.2,' KVA-MONTH)',/,                   00000830
     1'.SK 1',/,                                                        00000840
     1' X ( ',F3.0,' MONTHS/YEAR)')                                     00000850
      TOTAL= SUM*B*C                                                    00000860
      WRITE(8,450) TOTAL                                                00000865
450   FORMAT('.SK 1',/,                                                 00000870
     1'= $ ',F7.2,' /YR',/,                                             00000890
     1'.SK 1',/,                                                        00000900
     1'.IN -5',/,                                                       00000910
     1'CALCULATIONS: (FOR COST OF IMPLEMENTATION)',/,                   00000920
     1'.SK 1',/,                                                        00000930
     1'.IN +5 ',/,                                                      00000940
     1'SINCE THERE IS NO COST OF IMPLEMENTATION, THE PAYBACK',/,        00000950
     1'PERIOD IS IMMEDIATE.')                                           00000960
      WRITE(8,962)                                                      00000961
962   FORMAT(/,'.SK 30',/,                                              00000962
     1'* FLA/RLA = FULL LOAD AMPERAGE/RUNNING LOAD AMPERAGE.',/,'.SK 0',00000963
     1/,'** 1.732 FOR 3 PHASE AND 1 FOR SINGLE PHASE')                  00000964
      STOP                                                              00000970
      END                                                               00000980
KED.SYSLMOD DD DISP=SHR,DSN=U13155A.EADC.LOAD(PEAKS),                   00000990
UNIT=3350,VOL=SER=DASD30,SPACE=(TRK,(30,20))                            00001000
                                                                        00001010
                                                                        00001020
                                                                        00001030
```

```
* TSC FORECLOSURE ONE COPY ****
JAMF=U12135A,EADC,CNTL                                    (AIRCOMP )

J12135J  JOB (2,444-33-6666),'EADC',TIME=(,40),CLASS=A,MSGCLASS=X
PASSWORD ?
EXEC FORTVCL,REGION=,PRT=1CC'K
FORT.SYSIN DD *
      DIMENSION TYPE(20)
      WRITE(6,01)
01    FORMAT(10X,'WHICH ECO IN THE REPORT WILL THIS BE?',/,
     110X,'ENTER 1 FOR FIRST, 2 FOR SECOND, 3 FOR THIRD, ETC.',/,
     110X,'THIS NUMBER DOES NOT REQUIRE A DECIMAL POINT.')
      READ(5,*) NUM
      WRITE(6,700)
700   FORMAT(10X,       'ENTER VALUES FOR THE FOLLOWING')
      WRITE(6,900)
900   FORMAT(10X,'PRESENT AIR COMPPESSOR DISCHARGE IN PSIG')
      READ(5,*) A
      WRITE(6,1200)
1200  FORMAT(10X,       'TYPE OF COMPRESSOR')
      READ(5,1301) TYPE
1301  FORMAT(20A)
      WRITE(6,1303)
1303  FORMAT(10X,'SIZE OF COMPRESSOR IN HORSEPOWER')
      READ(5,*) D
      WRITE(6,1306)
1306  FORMAT(10X,'OPERATING HOURS PER YEAR')
      READ(5,*) E
      WRITE(6,1309)
1309  FORMAT(10X,       'COST OF ELECTRICITY IN $/KWH')
      READ(5,*) F
      WRITE(6,1312)
1312  FORMAT(10X,'FUEL ADJUSTMENT COST FACTOR CHARGE IN $/KWH')
      READ(5,*) G
      WRITE(6,1315)
1315  FORMAT(10X,'RECOMMENDED AIR COMPRESSOR DISCHARGE PRESSURE')
      READ(5,*) B
      WRITE(6,1314)
1314  FORMAT(10X,'INPUT THE REDUCTION IN BASE HORSEPOWER FROM FIG.1')
      READ(5,*) X
      WRITE(6,1313)
1313  FORMAT(10X,'% LOAD FACTOR (I.E. 50.)')
      READ(5,*) Z
      H=A-B
      O=F+G
      P=X*D*E*(.746/100.)*Z/100.
      G=P*3412.)
      R=P*C
      WRITE(8,1400) NUM
400   FORMAT('.AD 8',/,'.LL 70',/,'.TM 6',/,'.BM 6',/,
     1'.CE 1 ',/,'.SK 2',/,
     1'.UP ECO #',I2,/,
     1'.SK 1',/,
     1'.CE 1 ',/,
     1'.UP EPIC ECO CODE 32.1',/,
     1'.SK 2',/,
     1'TITLE: REDUCE THE PRESSURE OF COMPRESSED AIR TO THE MINIMUM',/,
     1'REQUIRED.',/,
     1'.SK 2',/,
     1'EXECUTIVE SUMMARY:',/,
     1'.SK 1 ',/)
      WRITE(8,1425),,B
425   FORMAT('.IN +5',/,
     1'THE AUDIT TEAM FEELS THAT YOUR AIR PRESSURE COULD BE LOWERED'
     1,/,'WITHOUT CAUSING OPERATING PROBLEMS.  A REDUCTION IN AIR ',/,
```

```
   1'PRESSURE TO THE MINIMUM REQUIRED LEVEL REDUCES CONSUMPTION ',/,    00000630
   1'OF ENERGY OF THE ELECTRICAL MOTOR DRIVING THE COMPRESSOR.',/,      00000640
   1'IN YOUR CASE WE RECOMMEND YOU GO FROM ',F4.0,' TO ',F4.0,          00000650
   1/,'PSIG. FOR WHICH CALCULATIONS HAVE BEEN MADE TO SHOW',/,          00000660
   1'THE SAVINGS.')                                                     00000670
    WRITE(8,1510)                                                       00000680
10  FORMAT('.SK 2',/,                                                   00000690
   1'.IN -5',/,                                                         00000700
   1'REQUIRED DATA:',/,                                                 00000710
   1'.SK 1',/,                                                          00000720
   1'.IN +5',/,                                                         00000730
   1'GIVEN:',/,                                                         00000740
   1'.SK 1')                                                            00000750
    WRITE(8,1530)A                                                      00000760
30  FORMAT('(1) PRESENT AIR COMPRESSOR DISCHARGE PRESSURE : ',          00000770
   1F4.0,' PSIG',/,                                                     00000780
   1'.SK 0')                                                            00000790
    WRITE(8,1550)TYPE                                                   00000800
50  FORMAT('(2) TYPE OF COMPRESSOR : ',20A4,/,                          00000810
   1'.SK 0',/)                                                          00000820
    WRITE(8,1600)D,E,F                                                  00000830
00  FORMAT('.SK 0',/,'(3) SIZE (HP) OF COMPRESSOR : ',F4.0,             00000840
   1' HP',/,'.SK 0',/,                                                  00000850
   1'(4) OPERATING HOURS PER YEAR : ',F5.0,' HRS'                       00000860
   1/,'.SK 0',/,                                                        00000870
   1'(5) COST OF ELECTRICITY : $',F6.5,'/KWH',/,                        00000880
   1'.SK 0')                                                            00000890
    WRITE(8,1650)G,B,Z                                                  00000900
50  FORMAT('(6) FUEL ADJUSTMENT COST FACTOR CHARGE : $',F6.5,           00000910
   1'/KWH',/,'.SK 0',/,                                                 00000920
   1'(7) RECOMMENDED AIR COMPRESSOR DISCHARGE PRESSURE : ',F4.0,        00000930
   1' PSIG',/,'.SK 0',/,                                                00000940
   1'(8) LOAD FACTOR : ',F4.1,'%',/,'.IN -5',/,                         00000941
   1'.SK 2',/)                                                          00000950
    WRITE(8,1680)B                                                      00000960
80  FORMAT('CALCULATIONS        (FOR ENERGY AND $ SAVINGS)',/,          00000970
   1'.SK 1',/,                                                          00000980
   1'.IN +5',/,                                                         00000990
   1'(1) FOR A RECOMMENDED AIR COMPRESSOR DISCHARGE PRESSURE OF ',      00001000
   1F4.0,' PSIG')                                                       00001010
    WRITE(8,1700)A,B,H,X                                                00001020
00  FORMAT('(I.E. A REDUCTION OF (',F4.0,' - ',F4.0,' = ',F4.0,' PSIG)',00001030
   1/,'FIG (1) GIVES A REDUCTION IN BASE HORSEPOWER OF',F4.1,'  %',/,    00001040
   1'.SK 2')                                                            00001050
    WRITE(8,1725)F,G                                                    00001060
25  FORMAT('(2) EFFECTIVE COST OF ELECTRICITY:',/,                      00001070
   1'.SK 1',/,                                                          00001080
   1'.IN +5',/,                                                         00001090
   1'= (COST OF ELECTRICITY) + (FUEL ADJUSTMENT FACTOR CHARGE)',/       00001100
   1,'.SK 0',/,                                                         00001110
   1'= ($ ',F6.5,' *KWH) + ($ ',F6.5,' /KWH)')                          00001120
    WRITE(8,1750)D                                                      00001130
50  FORMAT('.SK 0',/,                                                   00001140
   1'= $  ',F6.5,' /KWH',/,                                             00001150
   1'.SK 2',/,                                                          00001160
   1'.IN -5',/,                                                         00001170
   1'(3) SAVINGS IN ENERGY (KWH):',/,                                   00001180
   1'.SK 1')                                                            00001190
    WRITE(8,1800)                                                       00001200
10  FORMAT('.IN +5',/,                                                  00001210
   1'= (% HP SAVINGS/100) X (COMPRESSOR HP) X (OPERATING HRS/YR)',/,    00001220
   1'X (CONVERSION FACTOR FOR HP TO KW) X (LOAD FACTOR)',/)             00001230
    WRITE(8,1850)X,D,E,Z,P                                              00001240
50  FORMAT('.SK 0',/,                                                   00001250
   1'= ( ',F4.1,' /100) X ( ',F4.0,' HP) X (',F5.0,' HRS/YR.)',/,       00001260
   1'.SK 0',/,'X (0.746 KW/HP) (',F4.1,'%)',/,'.SK 0',/,                00001270
```

```
   1'= ',F10.0,' KWH/YR',/,                                              00001280
   1'.SK 1',/,                                                           00001290
   1'.IN -5',/,                                                          00001300
   1'.UP',/)                                                             00001310
    WRITE(8,1900)                                                        00001320
00 FORMAT('(4) SAVINGS IN ENERGY (BTU):',/,                              00001330
   1'.SK 1',/,                                                           00001340
   1'.IN +5',/,                                                          00001350
   1'= (SAVINGS IN KWH/YR) X (CONVERSION FACTOR)',/,                     00001360
   1'.SK 0',/)                                                           00001370
    WRITE(8,1950)P,Q                                                     00001380
50 FORMAT('= (  ',F7.0,' KWH/YR) X (3412 BTU/KWH)',/,                    00001390
   1'.SK 0',/,                                                           00001400
   1'= ',F12.0,' BTU/YR.',/,                                             00001410
   1'.IN -5',/,                                                          00001420
   1'.SK 1',/)                                                           00001430
    WRITE(8,2000)                                                        00001440
00 FORMAT('(5)  SAVINGS IN DOLLARS',/,                                   00001450
   1'.IN +5',/,                                                          00001460
   1'.SK 1',/,                                                           00001470
   1'= (SAVINGS IN KWH) X (EFFECTIVE COST OF ELECTRICITY)',/,            00001480
   1'.SK 0',/)                                                           00001490
    WRITE(8,2050)R                                                       00001500
50 FORMAT('= $ ',F10.2,' /YR',/,                                         00001510
   1'.IN -5',/,                                                          00001520
   1'.SK 1',/,                                                           00001530
   1'.IN -5',/)                                                          00001540
    WRITE(8,2100)                                                        00001550
00 FORMAT('CALCULATIONS (FOR IMPLEMENTATION COST):',/,                   00001560
   1'.SK 1',/,                                                           00001570
   1'.IN +5',/,                                                          00001580
   1'SINCE THERE IS NO COST OF IMPLEMENTATION, THE PAYBACK IS',/,        00001590
   1'IMMEDIATE.',/)                                                      00001600
    STOP                                                                 00001610
    END                                                                  00001620
KED.SYSLIOD DD DISP=SHR,DSN=U13155A.EADC.LOAD(AIRCOMP),                  00001630
UNIT=3350,VOL=SER=DASD30,SPACE=(TRK,(30,20))                             00001640
                                                                         00001650
```

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** TSO FOREGROUND HARDCOPY ****
NAME=U13155A.EADC.CNTL                                    (COMPIN   )

//13155J JOB (?,444-33-6666),'EADC',TIME=(0,40),CLASS=A,MSGCLASS=X      00000010
//PASSWORD ?                                                            00000020
//EXEC FORTVCL,REGION.FORT=1000K                                        00000030
//FORT.SYSIN DD *                                                       00000040
      WRITE(6,01)                                                       00000050
01    FORMAT(10X,'WHICH ECO IN THE REPORT WILL THIS BE ?',/,            00000060
     110X,'ENTER 1 FOR FIRST, 2 FOR SECOND, 3 FOR THIRD, ETC',/,        00000070
     110X,'THIS NUMBER DOES NOT REQUIRE A DECIMAL POINT')               00000080
      READ(5,*) NUM                                                     00000090
      WRITE(6,10)                                                       00000100
10    FORMAT(10X,'ENTER VALUES FOR THE FOLLOWING')                      00000110
      WRITE(6,20)                                                       00000120
20    FORMAT(10X,'AVERAGE INSIDE AIR TEMPERATURE (T1) IN ',             00000130
     1'DEGREES FAHRENHEIT')                                             00000140
      READ(5,*) A                                                       00000150
      WRITE(6,30)                                                       00000160
30    FORMAT(10X,'AVERAGE OUTSIDE AIR TEMPERATURE (T2) IN ',            00000170
     1'DEGREES FAHRENHEIT')                                             00000180
      READ(5,*) B                                                       00000190
      WRITE(6,40)                                                       00000200
40    FORMAT(10X,'COMPRESSOR SIZE IN HP')                               00000210
      READ(5,*)C                                                        00000220
      WRITE(6,50)                                                       00000230
50    FORMAT(10X,'OPERATING HOURS PER YEAR')                            00000240
      READ(5,*) D                                                       00000250
      WRITE(6,60)                                                       00000260
60    FORMAT(10X,'ELECTRICITY COST IN $/KWH')                           00000270
      READ(5,*) E                                                       00000280
      WRITE(6,70)                                                       00000290
70    FORMAT(10X,'% LOAD ON COMPRESSOR')                                00000300
      READ(5,*) F                                                       00000310
      WRITE(6,80)                                                       00000320
80    FORMAT(10X,'DUCT-WORK LENGTH IN LINEAR FEET')                     00000330
      READ(5,*) G                                                       00000340
      WRITE(6,91)                                                       00000350
91    FORMAT(10X,'FROM THE SECOND COLUMN IN FIGURE 1 INPUT THE'         00000360
     1,/,10X,'VOLUME OF AIR CORRESPONDING TO T1',/,10X,                 00000370
     1'FOR EXAMPLE THE VOLUME OF AIR CORRESPONDING TO ',/,              00000380
     110X,'60 DEGREES WOULD BE 981.')                                   00000390
      READ(5,*) C                                                       00000400
      WRITE(6,92)                                                       00000410
92    FORMAT(10X,'FROM FIGURE 1 INPUT THE VOLUME OF AIR ',/,            00000420
     110X,'CORRESPONDING TO T2')                                        00000430
      READ(5,*) P                                                       00000440
      WRITE(6,93)                                                       00000450
93    FORMAT(10X,'COST IN $/LINEAR FT FOR INSULATED FLEXIBLE DUCT WITH',00000460
     1/,10X,'VINYL COATED SPRING STEEL (OR ALUMINUM)')                  00000470
      READ(5,*) L                                                       00000480
      WRITE(6,94)                                                       00000490
94    FORMAT(10X,'# OF GRILLES REQUIRED')                               00000500
      READ(5,*) V                                                       00000510
      WRITE(6,95)                                                       00000520
95    FORMAT(10X,'COST PER GRILLE IN DOLLARS')                          00000530
      READ(5,*) X                                                       00000540
      WRITE(6,96)                                                       00000550
96    FORMAT(10X,'LABOR COST IN $/HR')                                  00000560
      READ(5,*) Z                                                       00000570
      WRITE(6,97)                                                       00000580
97    FORMAT(10X,'NUMBER OF WORKERS REQUIRED')                          00000590
      READ(5,*) Y                                                       00000600
      WRITE(6,98)                                                       00000610
98    FORMAT(10X,'NUMBER OF HOURS WORKERS SHOULD BE EMPLOYED ON JOB')   00000620
```

```
      READ(5,*) Z1                                                      00000630
      G=((C-P)*100.)/Q                                                  00000640
      R=(Q/100.)*(F/100.)*C*).745*D                                     00000650
      S=R*3412/1000000.                                                 00000660
      T=R*E                                                             00000670
      W=V*X                                                             00000680
      COST=(U*G)+(V*X)+((Y*Z)*Z1)                                       00000690
      PAY=COST/T                                                        00000700
      WRITE(8,100) NUM                                                  00000710
100   FORMAT('.AD 8',/,'.LL 70',/,'.TM 6',/,'.BM 6',/,                 00000720
     1'.CE ECC #',I2,/,                                                 00000730
     1'.CE (EPIC ECO CODE 32.21)',/,                                    00000740
     1'.SK 2',/,                                                        00000750
     1'TITLE: INSTALL COMPRESSOR AIR INTAKE IN COOLEST LOCATIONS',      00000760
     1/,'.SK 1',/,                                                      00000770
     1'EXECUTIVE SUMMARY:',/,                                           00000780
     1'.SK 1',/,                                                        00000790
     1'.IN +5')                                                         00000800
      WRITE(8,110)                                                      00000810
110   FORMAT('BY INSTALLING THE INTAKE DUCT FOR AN AIR COMPRESSOR',/,   00000820
     1'IN THE COOLEST LOCATIONS, ONE CAN HAVE H.P. SAVINGS,',/,         00000830
     1'THEREBY REDUCING THE CONSUMPTION OF THE ENERGY FOR THE',/,       00000840
     1'PRIME MOVER.  USUALLY IT IS THE SAVING IN ELECTRICAL',/,         00000850
     1'ENERGY OF THE MOTORS DRIVING THE COMPRESSOR.  THIS ENERGY',/,    00000860
     1'SAVING POTENTIAL IS DUE TO THE FACT THAT THE COMPRESSOR',/,      00000870
     1'IS REQUIRED TO DO LESS WORK IN ORDER TO COMPRESS A CERTAIN',/,   00000880
     1'AMOUNT OF AIR AT A LOWER TEMPERATURE HAVING A SMALLER',/,        00000890
     1'VOLUME THAN TO COMPRESS THE SAME AMOUNT OF AIR AT A',/,          00000900
     1'HIGHER VOLUME.  THIS CAN BE DONE EASILY BY INSTALLING',/,        00000910
     1'AN AIR INTAKE DUCT AT THE COMPRESSOR INTAKE LEADING TO',/,       00000920
     1'THE OUTSIDE COOLER ATMOSPHERE.')                                 00000930
      WRITE(8,120) A,B,C,D,E,F                                          00000940
120   FORMAT(/,'.SK 1',/,                                               00000950
     1'REQUIRED DATA:',/,                                               00000960
     1'.SK 1',/,                                                        00000970
     1'.IN +5',/,'GIVEN:',/,'.SK 0',/,                                  00000980
     1'AVERAGE INSIDE AIR TEMP. (T1): ',F4.0,' DEG F',/,'.SK 0',/,      00000990
     1'AVERAGE OUTSIDE AIR TEMP. (T2): ',F4.0,' DEG F',/,'.SK 0',/,     00001000
     1'COMPRESSOR SIZE: ',F5.1,' HP.',/,'.SK 0',/,                      00001010
     1'OPERATION HOURS: ',F5.0,' HRS/YR',/,'.SK 0',/,                   00001020
     1'ELECTRICITY COST : $ ',F6.4,' /KWH',/,'.SK 0',/,                 00001030
     1'% LOAD ON COMPRESSOR: ',F3.0,' %',/,'.SK 1',/)                   00001040
      WRITE(8,130) G                                                    00001050
130   FORMAT('MEASURED:',/,'.SK 0',/,                                   00001060
     1'DUCT-WORK LENGTH:',F5.1,' FT.',/,                                00001070
     1'.SK 1',/,'.IN -5',/,                                             00001080
     1'CALCULATIONS (FOR ENERGY AND $ SAVINGS): ',/,                    00001090
     1'.SK 1')                                                          00001100
      WRITE(8,140) A,B,O,P                                              00001110
140   FORMAT('.IN +5',/,                                                00001120
     1'(1) REFERRING TO FIG.(1) UNDER THE SECOND COLUMN (WITH',/,       00001130
     1'THE HEADING: INTAKE VOLUME REQUIRED TO DELIVER 1000 CUBIC',/,    00001140
     1'FEET OF FREE AIR AT 70 DEGREES FAHRENHEIT), THE CORRESPONDING',  00001150
     1/,'VOLUMES OF AIR CAN BE FOUND AT T1 =',F4.0,' DEGREES F AND',/,  00001160
     1'T2 =',F4.0,' DEGREES F AS ',F5.0,'  CUBIC FEET AND ',F5.0,/,     00001170
     1'CUBIC FEET RESPECTIVELY.',/,'.SK 1',/)                           00001180
      WRITE(8,150)O,P,O,Q                                               00001190
150   FORMAT('(2) SAVINGS IN ENERGY:',/,'.IN +5',/,'.SK 1',/,           00001200
     1'=(INTAKE VOL. AT T1 - INTAKE VOL. AT T2)/',/,                    00001210
     1'.SK 0',/,'(INTAKE VOL. AT T1)  X 100%',/,'.SK 1',/,              00001220
     1'((',F5.0,' - ',F5.0,')/(',F5.0,'))) X 100',/,                    00001230
     1'.SK 1',/,'= ',F4.1,' % HP SAVING.',/,'.SK 1',/)                  00001240
      WRITE(8,160) Q,Q,F,C,D,R                                          00001250
160   FORMAT('.IN -5',/,'.SK 1',/,'(3) SAVINGS IN KWH',/,'.SK 1',/,     00001260
     1'.IN +5',/,                                                       00001270
     1'= (',F4.1,' % HP SAVINGS) X (% LOAD) X (COMPRESSOR SIZE)',/,     00001280
```

```
   1'X (0.746 KW/HP) X (OPERATING HOURS/YEAR)',/,'.SK 1',/,                00001290
   1'= (',F4.1,'/100) X (',F3.0,'/100) X (',F5.1,' HP)'                    00001300
   1'X (0.746 KW/HP.) X (',F5.0,' HRS/YR)',/,'.SK 1',/,                    00001310
   1'= ',F8.0,' KWH/YR')                                                   00001320
     WRITE(8,180) R,S,R,E,T                                                00001330
80 FORMAT('.IN -5',/,'.SK 1',/,'(4) SAVINGS IN BTU:',/,'.IN +5',/,        00001340
   1'.SK 1',/,'= (',F8.0,' KWH/YR) X (3412 BTU/KWH)',/,'.SK 1',/,          00001350
   1'= ',F6.0,' MILLION BTU/YR',/,'.SK 2',/,'.IN -5',/,                    00001360
   1'(5) SAVINGS IN $:',/,'.SK 1',/,'.IN +5',/,                            00001370
   1'= (KWH/YR SAVED) X (ELECTRICITY COST)',/,                             00001380
   1'.SK 1',/,                                                             00001390
   1'= (',F8.0,' KWH/YR) X ($ ',F6.4,'/KWH)',/,                            00001400
   1'.SK 1',/,                                                             00001410
   1'= $',F7.2,'/YR',/,'.SK 2')                                            00001420
     WRITE(8,210) U,V,W,X,Y,Z,Z1                                           00001430
210 FORMAT('.IN -5',/,'(3) CALCULATION (FOR INSTALLATION COST):',/,        00001440
   1'.IN +5',/,                                                            00001450
   1'.SK 1',/,'(1) MATERIAL COST: FOR THE AIR INTAKE DUCT, ',              00001460
   1/,'INSULATED FLEXIBLE DUCT WITH VINYL COATED SPRING STEEL',/,          00001470
   1'(OR ALUMINUM) CAN BE USED WHICH COSTS ABOUT $',F5.2,'/ LINEAR FT',    00001480
   1,/,'AND ',F2.0,' GRILLE(S) WOULD COST APPROXIMATELY $ ',F4.0,/,        00001490
   1'AT $ ',F5.1,' /GRILLE.',/,                                            00001500
   1'.SK 1',/,'(2) LABOR COST:',/,                                         00001510
   1'FOR THE INSTALLATION OF THE DUCT, ',F2.0,' PERSON(S) MAY BE',/,       00001520
   1'EMPLOYED AT $ ',F3.0,'/HR FOR ABOUT ',F2.0,' HOURS.',/,'.SK 1')       00001530
     WRITE(8,240) U,G,V,W,Y,Z,Z1,COST                                      00001540
240 FORMAT('(3) HENCE TOTAL COST = MATERIAL COST + LABOR COST',/,          00001550
   1'.IN +5',/,'.SK 1',/,                                                  00001560
   1'=(DUCT COST/LINEAR FT) X (TOTAL LINEAR FT) +',/,                      00001570
   1' (# GRILLES) X (COST OF GRILLE) + (# OF LABORERS)',/,                 00001580
   1' X (# OF HRS. WORKED) X (WAGE/HR)',/,'.SK 1',/,                       00001590
   1'=($ ',F5.2,'/LINEAR FT) X (',F5.1,' FT) + (',F2.0,' GRILLES)',/,      00001600
   1' X ($ ',F4.0,' GRILLE) + (',F2.0,' LABORERS) X ($ ',F3.0,'/HR)',/     00001610
   1,' X(',F2.0,' HRS)',/,'.SK 1',/,                                       00001620
   1'= $ ',F7.2)                                                           00001630
     WRITE(8,230) COST,T,PAY                                               00001640
230 FORMAT('.IN -10',/,'.SK 3',/,'CALCULATION (FOR PAYBACK):',/,          00001650
   1'.SK 1',/,'(1) SIMPLE PAYBACK = TOTAL COST $ / ANNUAL $ SAVINGS',/,    00001660
   1'.SK 1',/,'.IN +5',/,'= ',F7.2,'/',F7.2,/,' .SK 1',/,                  00001670
   1'= ',F4.1,' YRS',/,                                                    00001671
   1'.IN -5',/,'.SK 8',/,                                                  00001680
   1'NOTE: IN SOME CASES A DAMPER IS REQUIRED SO THAT THE INSIDE AIR',     00001690
   1/,'IS USED IN THE SUMMER IF IT IS COOLER THAN OUTSIDE')                00001700
     STOP                                                                  00001710
     END                                                                   00001720
//GO.SYSLMOD DD DISP=SHR,DSN=U13155A.EACC.LOAD(COMPIN),                   00001730
//         UNIT=3350,VOL=SER=DASD30,SPACE=(TRK,(30,20))                   00001740
//GO.IN +5',/,                                                            00001750
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* TSO FOREGROUND HARDCOPY ****
AME=U13155A.EADC.CNTL                                    (SETBACK )

13155J  JOB (?,444-33-5665),'EADC',TIME=(0,40),CLASS=A,MSGCLASS=X      00000010
ASSWORD ?                                                              00000020
EXEC FORTVCL,REGION.FORT=1000K                                         00000030
ORT.SYSIN DD *                                                         00000040
    WRITE(6,01)                                                        00000050
01  FORMAT(10X,'WHICH ECO IN THE REPORT WILL THIS BE?',/,              00000060
   110X,'ENTER 1 FOR FIRST, 2 FOR SECOND, 3 FOR THIRD, ETC.',/,        00000070
   110X,'THIS NUMBER DOES NOT REQUIRE A DECIMAL POINT')                00000080
    READ(5,*) NUM                                                      00000090
    WRITE(6,10)                                                        00000100
0   FORMAT(10X,'ENTER VALUES FOR THE FOLLOWING:')                      00000110
    WRITE(6,20)                                                        00000120
20  FORMAT(10X,'EXISTING LEVEL OF TEMPERATURE FOR SPACE HEATING')      00000130
    READ(5,*)A                                                         00000140
    WRITE(6,30)                                                        00000150
30  FORMAT(10X,'HEATING UNIT EFFICIENCY IN PERCENT (IE 80.)')          00000160
    READ(5,*)B                                                         00000170
    WRITE(6,40)                                                        00000180
40  FORMAT(10X,'HEATING DEGREE DAYS FOR THE AREA')                     00000190
    READ(5,*)C                                                         00000200
    WRITE(6,50)                                                        00000210
50  FORMAT(10X,'NATURAL GAS COST IN $/MCF')                            00000220
    READ(5,*)D                                                         00000230
    WRITE(6,70)                                                        00000240
70  FORMAT(10X,'TOTAL AREA FOR CONDITIONED SPACE IN SQUARE FEET')      00000250
    READ(5,*)F                                                         00000260
    WRITE(6,80)                                                        00000270
80  FORMAT(10X,'ENERGY USED FOR SPACE HEATING IN MILLION BTU/YR',/,    00000280
   110X,'FROM THE NATURAL GAS CONSUMPTION GRAPHS',/,                   00000290
   110X,'FOR EXAMPLE 103,000,000 BTU/YR  YOU WOULD INPUT AS 103.')     00000300
    READ(5,*)G                                                         00000310
    WRITE(6,90)                                                        00000320
90  FORMAT(10X,'DEGREES SETBACK IN DEGREES F')                         00000330
    READ(5,*)H                                                         00000340
    WRITE(6,100)                                                       00000350
00  FORMAT(10X,'ENERGY SAVINGS IN BTU/SQ.FT.-YR FROM FIGURE 1')        00000360
    READ(5,*)X                                                         00000370
    WRITE(6,106)                                                       00000380
06  FORMAT(10X,'NUMBER OF CHANNELS ON PROGRAMMABLE 7 DAY SEQUENCER')   00000390
    READ(5,*)S                                                         00000400
    WRITE(6,105)                                                       00000410
05  FORMAT(10X,'NUMBER OF INSTRUMENTS (SEQUENCERS) REQUIRED')          00000420
    READ(5,*) SEQ                                                      00000430
    WRITE(6,107)                                                       00000440
07  FORMAT(//,10X,'INSTRUMENT COST IN DOLLARS')                        00000450
    READ(5,*)T                                                         00000460
    WRITE(6,103)                                                       00000470
08  FORMAT(10X,'TOTAL LABOR COST IN DOLLARS/HOUR PER INSTRUMENT')      00000480
    READ(5,*)U1                                                        00000490
    WRITE(6,109)                                                       00000500
09  FORMAT(10X,'TOTAL LABOR HOURS PER INSTRUMENT')                     00000510
    READ(5,*) U2                                                       00000520
    O=(G/F)*1000000.                                                   00000530
    P=((X*F)/(B/100.))/1000000.                                        00000540
    R=P*D                                                              00000550
    U=U1*U2                                                            00000560
    V=T+U                                                              00000570
    SUM=V*SEQ                                                          00000580
    W=SUM/R                                                            00000590
    WRITE(8,111)                                                       00000600
11  FORMAT(/,'.AD 8',/,'.LL 70',/,'.TM 6',/,'.BM 6')                   00000610
    WRITE(8,110) NUM                                                   00000620
```

```
110 FORMAT(',CE ECC #',I2,/,                                            00000630
   1'.SK 1',/,                                                          00000640
   1'.CE EPIC CODE #63.44',/,                                           00000650
   1'.SK 2',/,                                                          00000660
   1'TITLE: NIGHT-SETBACK',/,                                           00000670
   1'.SK 1',/,                                                          00000680
   1'EXECUTIVE SUMMARY:',/,                                             00000690
   1'.SK 1',/,                                                          00000700
   1'.IN +5',/)                                                         00000710
    WRITE(8,120)                                                        00000720
120 FORMAT('ENERGY AND THEREBY $ SAVINGS CAN BE REALIZED BY HAVING',    00000730
   1/,'A NIGHT SETBACK.  THIS CAN BE DONE EASILY BY INSTALLING',/,      00000740
   1'A SEVEN DAY 24 HOURS/DAY PROGRAMMABLE AUTOMATIC NIGHT SETBACK',    00000750
   1/,'TIMER TO CONTROL THE THERMOSTATS.  DURING THE HEATING',/,        00000760
   1'SEASON, THE TIMER CAN BE SET AT 68 DEGREES FAHRENHEIT FOR',/,      00000770
   1'NORMAL WORKING (OR OCCUPIED) HOURS AND AT 50 DEGREES',/,           00000780
   1'(OR LOWER) DURING UNOCCUPIED HOURS (EVENINGS & WEEKENDS)',/,       00000790
   1'SINCE THE AIR HANDLING UNITS WOULD BE HEATING TO A LOWER',/,       00000800
   1'TEMPERATURE, LESS ENERGY WOULD BE USED.')                          00000810
    WRITE(8,130)                                                        00000820
130 FORMAT(/,'.SK 1',/,                                                 00000830
   1'MOREOVER, DURING HOT DAYS OF SUMMER, THE TEMPERATURE CAN',/,       00000840
   1'BE SET FOR AIR CONDITIONERS AT THE NORMAL 78 DEGREES FOR',/,       00000850
   1'WORKING/OCCUPIED HOURS AND AT SOME TEMPERATURE HIGHER THAN',/,     00000860
   1'78 DEGREES FOR UNOCCUPIED HOURS.  HOWEVER, THE SELECTION',/,       00000870
   1'FOR THIS HIGHER TEMPERATURE IS SOMETIMES DEPENDENT UPON',/,        00000880
   1'FACTORS LIKE DEGREE OF HUMIDITY REQUIREMENT, ETC.  THE',/,         00000890
   1'SAVINGS WOULD BE DIRECTLY PROPORTIONAL TO THE SETTING',/,          00000900
   1'OF THIS TEMPERATURE CHOSEN FOR THE SUMMER.')                       00000910
    WRITE(8,140)                                                        00000920
140 FORMAT(/,'.SK 1',/,                                                 00000930
   1'FOR YOUR SYSTEM OF PRESENT OPERATING CONDITIONS, CALCULATIONS',    00000940
   1/,'HAVE BEEN MADE TO SHOW THE SAVINGS ONLY DURING THE HEATING',/,   00000950
   1'SEASON.  HOWEVER, TOTAL SAVINGS WOULD BE EVEN GREATER.',/,         00000960
   1'DEPENDING UPON THE SET-UP TEMPERATURE CHOSEN FOR SUMMER',/,        00000970
   1'.SK 2',/,                                                          00000980
   1'.IN -5',/,                                                         00000990
   1'REQUIRED DATA:',/,                                                 00001000
   1'.SK 1',/,                                                          00001010
   1'.IN +5')                                                           00001020
    WRITE(8,150) A,B,C,D,F                                              00001030
150 FORMAT('GIVEN: ',/,'.SK 0',/,                                       00001040
   1'(1) YOUR EXISTING LEVEL OF TEMP. FOR SPACE HEATING: ',F3.0,        00001050
   1' DEG. F',/,'.SK 0',/,                                              00001060
   1'(2) HEATING UNIT EFFICIENCY: ',F3.0,' %',/,'.SK 0',/,              00001070
   1'(3) HEATING DEGREE DAYS FOR YOUR AREA: ',F5.0,/,'.SK 0',/,         00001080
   1'(4) NATURAL GAS COST: $ ',F5.3,' /MCF',/,'.SK 0',/,                00001090
   1'(5) YOUR TOTAL AREA FOR CONDITIONED SPACE:  ',F8.0,'SQ. FT.',      00001100
   1/,'.SK 1',/,'.IN -5',/)                                             00001110
    WRITE(8,160) G,G,F,D                                                00001120
160 FORMAT('CALCULATIONS (FOR ENERGY AND $ SAVINGS)',/,                 00001130
   1'.SK 1',/,'.IN +5',/,                                               00001140
   1'(1) FROM YOUR NATURAL GAS CONSUMPTION GRAPH (PROVIDED IN THE',/,   00001150
   1'BEGINNING OF THIS REPORT), THE PRESENT ENERGY USED FOR YOUR',/,     00001160
   1'SPACE HEATING HAS BEEN READ AS',F7.1,' MILLION BTU/YR',/,          00001170
   1'.SK 2',/,                                                          00001180
   1'(2) YOUR PRESENT AVERAGE HEATING CONSUMPTION PER SQUARE FT.',/,    00001190
   1'.SK 1',/,                                                          00001200
   1'= (ENERGY USED FOR SPACE HEATING) / (CONDITIONED SPACE AREA)'      00001210
   1,/,'.SK 1',/,                                                       00001220
   1'= ( ',F7.1,' MILLION BTU/YR.) / ( ',F8.0,' SQ FT)',/,'.SK 1',/,    00001230
   1'= ',F10.0,' BTU/YR-SQ FT',/,'.SK 2',/)                             00001240
    WRITE(8,170) C,H,D,X                                                00001250
170 FORMAT('(3) FOR ',F5.0,' HEATING DEGREE DAYS AND ',F3.0,/,          00001260
   1'DEGREES FAHRENHEIT OF SETBACK AND FOR YOUR PRESENT AVERAGE',/,     00001270
   1'HEATING CONSUMPTION PER SQ FT OF ',F8.0,' BTU/SQ FT-YR; THE',/,    00001280
```

```
     1'GRAPH OF FIG.(1) READS AN ENERGY SAVING OF ',F8.0,' BTU/SQ FT-YR'00001290
    1,'.',/,'.SK 2',/,                                                  00001300
     1'(4) YOUR ACTUAL ANNUAL ENERGY SAVINGS WOULD, THEREFORE, BE',/,   00001310
     1'.SK 1',/,                                                        00001320
     1'= (ENERGY SAVINGS READ FROM GRAPH) X (CONDITIONED SPACE AREA)',/,00001330
     1'/(HEATING UNIT EFFICIENCY)'                                      00001340
     1,/,'.SK 1')                                                       00001350
      WRITE(8,180) X,F,B,P,P,P                                          00001360
 60  FORMAT('= (',F8.0,' BTU/SQ FT-YR) X (',F2.0,' SQ FT)',/,'.SK 0',/,00001370
     1'/(',F3.0,' %)',/,                                               00001380
     1'= ',F5.0,' MILLION BTU',/,'.SK 2',/,                            00001390
     1'(5) SAVINGS IN NATURAL GAS',/,'.SK 1',/,                        00001400
     1'= (SAVINGS IN BTU) X (CONVERSION FACTOR)',/,'.SK 1',/,          00001410
     1'= (',F5.0,' MILLION BTU/YR) X (1 MCF/MILLION BTU)',/,'.SK 1',/, 00001420
     1'= ',F5.0,' MCF/YR',/,'.SK 2')                                   00001430
      WRITE(8,190) P,D,R,S,T                                           00001440
 90  FORMAT('(6) SAVINGS IN DOLLARS',/,'.SK 1',/,                      00001450
     1'= (GAS SAVINGS) X (GAS COST)',/,'.SK 1',/,                      00001460
     1'= (',F5.0,' MCF/YR) X ($ ',F5.3,' /MCF)',/,'.SK 1',/,           00001470
     1'= $ ',F6.0,' /YR',/,'.SK 2',/,'.IN -5',/,                       00001480
     1'CALCULATIONS (FOR IMPLEMENTATION COST):',/,'.SK 1',/,'.IN +5',  00001490
    1/,'(1) INSTRUMENT COST: FOR YOUR SYSTEM A NIGHT SETBACK SEQUENCES'00001500
     1,/,'7 DAY PROGRAMMABLE ',F3.0,' CHANNEL VERSION WOULD COST YOU',/,00001510
    1'APPROXIMATELY $ ',F8.2,/,'.SK 1')                                00001520
      WRITE(8,200) U,T,U2,U1,V,SEQ,V,SEQ,SUM                           00001530
 00  FORMAT('(2) LABOR COST: FOR INSTALLATION PURPOSES, SOME MATERIA.',00001540
     1/,'AND LABOR WOULD BE REQUIRED WHICH IS ESTIMATED TO BE ',/,      00001550
     1'APPROXIMATELY',/,'.SK 0',/,'$ ',F7.2,/,'.SK 2',/,               00001560
     1'(3) COST PER SEQUENCER = INSTRUMENT COST + LABOR COST',/,'.SK 1',00001570
     1/,'= ($ ',F8.2,') + (',F4.1,' HRS.)($ ',F5.2,' /HOUR)',/,'.SK 1',/00001580
     1,'=',F8.2,' PER SEQUENCER AND',F3.0,' SEQUENCER(S) ARE REQUIRED'  00001590
     1,/,'.SK 1',/,                                                    00001591
     1'TOTAL COST = (COST PER SEQUENCER) X (# SEQUENCERS REQUIRED)',/,  00001600
     1'.SK 1',/,                                                       00001609
     1'TOTAL COST =',F8.2,' X',F3.0,/,'.SK 1',/,                       00001610
     1'= ',F9.2,/,'.SK 2',/)                                           00001620
      WRITE(8,210) SUM,R,W                                             00001630
 10  FORMAT(/,'.IN -5',/,'CALCULATIONS (FOR PAYBACK)',/,'.SK 1',/,     00001640
     1'.IN +5',/,'SIMPLE PAYBACK = (TOTAL COST IN $) / (ANNUAL SAVINGS)'00001650
     1,/,'.SK 1',/,'= ($ ',F8.2,') / ($ ',F6.0,' /YR)',/,              00001660
     1'.SK 1',/,'= ',F4.1,' YRS',/,'.SK 2',/,                          00001670
     1'NOTE: THE CALCULATED PAYBACK PERIOD WOULD BECOME EVEN LESS IF',/,00001680
     1'WE ADDED THE SAVINGS IN THE COOLING SEASON TO THE ANNUAL DOLLAR',00001690
     1/,'SAVINGS.')                                                    00001700
      STOP                                                             00001710
      END                                                              00001720
KED.SYSLMOD DD DISP=SHR,DSN=U13155A.EADC.LOAD(SETBACK),                00001730
UNIT=3350,VOL=SER=DASD30,SPACE=(TRK,(30,20))                           00001740
                                                                       00001750
```

APPENDIX D

MAJOR FORTRAN COMMANDS

COMMAND	FUNCTION
FORMAT	specifies record length, field width, and variable type (real, integer, exponent). A format statement must accompany each READ and WRITE statements. The parts are:

```
100  FORMAT (I2,2F4.2)

                    composition of input/output record

          statement number (required for format statement)
```

READ . . . . . used to transfer information from the terminal to the computer. The parts of the statement are:

```
10  READ (5,100) A,B,G

                        list of variables whose values
                        are to be read in

                    FORMAT statement number

               input device number (five)

          optional statement number
```

WRITE . . . . . used to transmit information out of the computer to an output device or file the parts of the WRITE statement are:

```
20  WRITE (6,120) I,J,Z,X1

                        list of variables whose values
                        are to be written out

                     FORMAT statement number

                output device number (file)

          optional statement number
```

APPENDIX E

SCRIPT PROGRAM LISTINGS

```
**** TSO FOREGROUND HARDCOPY ****
DS NAME=J13155A.SCRIPT.DATA

.AD 8
.LL 70
.TM 6
.BM 6
.CE ECO # 1
.SK 2
TITLE: OG&E "PEAKS" PROGRAM FOR A/C LOAD SHEDDING
.SK 1
.UP EXECUTIVE SUMMARY:
.SK 2
.IN +5
OG&E HAS RECENTLY COME UP WITH A NEW ENERGY CONSERVATION
OPPORTUNITY OF APPLYING FOR "RIDER FOR LOAD CONTROL
(PEAKS PROGRAM)."

.SK 1
ACCORDING TO THIS PROGRAM, OG&E WILL INSTALL A DEVICE TO
SHED A/C LOAD BY INTERRUPTING ELECTRIC SERVICE TO THE AIR
CONDITIONING COMPRESSOR FOR PERIODS OF NO MORE THAN SEVEN AND
ONE-HALF MINUTES OF EACH THIRTY MINUTE PERIOD DURING PEAK
LOAD PERIODS, GENERALLY PERIODS WITH AMBIENT TEMPERATURE
OF 95 DEGREES F AND ABOVE, FROM JUNE 15 TO SEPTEMBER 15
.SK 1
THE INCENTIVE FOR THIS PROGRAM IS A CREDIT GIVEN ON THE
CUSTOMERS BILLS FOR THE THREE REVENUE MONTHS OF JULY,
AUGUST, AND SEPTEMBER. THE INFORMATION ON THE RATE OF
CREDIT IS GIVEN ON A SEPARATE SHEET ENCLOSED HEREWITH.
.SK 1
EXPERIENCE SHOWS THAT THE CYCLING WILL NOT CAUSE ANY
APPRECIABLE LOSS IN COMFORT.
.IN -5
.SK 2
REQUIRED INFORMATION:
.SK 1

.TB 5 18 27 36 50 80
.SK 0
.DC TB ¬
.SK 0
¬A/C UNIT(S)  ¬ FLA/RLA* ¬ VOLTAGE ¬ PHASE**
.SK 0
 ¬ ¬ (A) ¬ (B) ¬ CORRECTION ¬ KVA=
.SK 0
 ¬ ¬ ¬ ¬ FACTOR (C) ¬ (A)X(B)X(C)/1000
.SK 0
 ¬  YORK     ¬ 19.9 ¬ 208. ¬ 1.7320 ¬   7.17
 ¬  YORK     ¬ 19.9 ¬ 208. ¬ 1.7320 ¬   7.17
 ¬  LENNOX   ¬ 21.3 ¬ 208. ¬ 1.7320 ¬   7.67
 ¬  LENNOX   ¬ 21.3 ¬ 208. ¬ 1.7320 ¬   7.67
 ¬  GE       ¬ 30.0 ¬ 208. ¬ 1.7320 ¬  10.81
 ¬  YORK     ¬ 32.0 ¬ 208. ¬ 1.7320 ¬  11.53
 ¬  YORK     ¬ 32.0 ¬ 208. ¬ 1.7320 ¬  11.53
 ¬  LENNOX   ¬ 21.4 ¬ 208. ¬ 1.7320 ¬   7.71
 ¬           ¬ 13.7 ¬ 208. ¬ 1.7320 ¬   4.94
 ¬           ¬ 15.0 ¬ 208. ¬ 1.7320 ¬   5.40
 ¬           ¬ 15.0 ¬ 208. ¬ 1.7320 ¬   5.40
.SK 1
.SK 1

                                    TOTAL KVA=  87.00
```

CALCULATIONS: (FOR SAVINGS)
.SK 1
.IN +5
(TOTAL KVA OF CONNECTED A/C CAPACITY) X (RATE OF CREDIT/KVA)
.SK 1
X (# OF MONTHS THE CREDIT IS APPLICABLE)
.SK 1
= (87.00 KVA) X ($ 1.82 KVA-MONTH)
.SK 1
X (3. MONTHS/YEAR)
.SK 1
= $ 475.03 /YR
.SK 1
.IN -5
CALCULATIONS: (FOR COST OF IMPLEMENTATION)
.SK 1
.IN +5
SINCE THERE IS NO COST OF IMPLEMENTATION, THE PAYBACK PERIOD IS IMMEDIATE.

.SK 30
* FLA/RLA = FULL LOAD AMPERAGE/RUNNING LOAD AMPERAGE.
.SK 0
** 1.732 FOR 3 PHASE AND 1 FOR SINGLE PHASE

```
**** TSO FOREGROUND HARDCOPY ****
DSNAME=U13155A.SCRIPT.DATA

.AD 8
.LL 70
.TM 6
.BM 6
.CE 1
.SK 2
.UP ECO # 2
.SK 1
.CE 1
.UP EPIC ECO CODE 32.1
.SK 2
TITLE: REDUCE THE PRESSURE OF COMPRESSED AIR TO THE MINIMUM
REQUIRED.
.SK 2
EXECUTIVE SUMMARY:
.SK 1

.IN +5
THE AUDIT TEAM FEELS THAT YOUR AIR PRESSURE COULD BE LOWERED
WITHOUT CAUSING OPERATING PROBLEMS.  A REDUCTION IN AIR
PRESSURE TO THE MINIMUM REQUIRED LEVEL REDUCES CONSUMPTION
OF ENERGY OF THE ELECTRICAL MOTOR DRIVING THE COMPRESSOR.
IN YOUR CASE WE RECOMMEND YOU GO FROM 160. TO 120.
PSIG. FOR WHICH CALCULATIONS HAVE BEEN MADE TO SHOW
THE SAVINGS.
.SK 2
.IN -5
REQUIRED DATA:
.SK 1
.IN +5
GIVEN:
.SK 1
(1) PRESENT AIR COMPRESSOR DISCHARGE PRESSURE : 160. PSIG
.SK 0
(2) TYPE OF COMPRESSOR : SINGLE STAGE RECIPROCATING
.SK 0
(3) SIZE (HP) OF COMPRESSOR : 25. HP
.SK 0
(4) OPERATING HOURS PER YEAR : 8760. HRS
.SK 0
(5) COST OF ELECTRICITY : $.02880/KWH
.SK 0
(6) FUEL ADJUSTMENT COST FACTOR CHARGE : $.00000/KWH
.SK 0
(7) RECOMMENDED AIR COMPRESSOR DISCHARGE PRESSURE : 120. PSIG
.SK 0
(8) LOAD FACTOR : 80.0%
.IN -5
.SK 2

CALCULATIONS          (FOR ENERGY AND $ SAVINGS)
.SK 1
.IN +5
(1) FOR A RECOMMENDED AIR COMPRESSOR DISCHARGE PRESSURE OF 120. PSIG
(IE. A REDUCTION OF (160. - 120. =  40.PSIG)
FIG (1) GIVES A REDUCTION IN BASE HORSEPOWER OF 20.0  %
.SK 2
(2) EFFECTIVE COST OF ELECTRICITY:
.SK 1
.IN +5
= (COST OF ELECTRICITY) + (FUEL ADJUSTMENT FACTOR CHARGE)
.SK 0
```

= ($ .02880 /KWH) + ($ .00000 /KWH)
.SK 0
= $ .02880 /KWH
.SK 2
.IN -5
(3) SAVINGS IN ENERGY (KWH):
.SK 1
.IN +5
= (% HP SAVINGS/100) X (COMPRESSOR HP) X (OPERATING HRS/YR)
X (CONVERSION FACTOR FOR HP TO KW) X (LOAD FACTOR)

.SK 0
= (20.0 /100) X (25. HP) X (8760. HRS/YR.)
.SK 0
X (0.746 KW/HP) (50.0%)
.SK 0
= 16337. KWH/YR
.SK 1
.IN -5
.UP

(4) SAVINGS IN ENERGY (BTU):
.SK 1
.IN +5
= (SAVINGS IN KWH/YR) X (CONVERSION FACTOR)
.SK 0

= (16337. KWH/YR) X (3412 BTU/KWH)
.SK 0
= 55743152. BTU/YR.
.IN -5
.SK 1

(5) SAVINGS IN DOLLARS
.IN +5
.SK 1
= (SAVINGS IN KWH) X (EFFECTIVE COST OF ELECTRICITY)
.SK 0

= $ 470.52 /YR
.IN -5
.SK 1
.IN -5

CALCULATIONS (FOR IMPLEMENTATION COST):
.SK 1
.IN +5
SINCE THERE IS NO COST OF IMPLEMENTATION, THE PAYBACK IS
IMMEDIATE.

```
**** TSO FOREGROUND HARDCOPY ****
DSNAME=U13155A.SCRIPT.DATA

.AC 8
.LL 70
.TM 6
.BM 6
.CE ECC # 3
.CE (EPIC ECO CODE 32.21)
.SK 2
TITLE: INSTALL COMPRESSOR AIR INTAKE IN COOLEST LOCATIONS
.SK 1
EXECUTIVE SUMMARY:
.SK 1
.IN +5
BY INSTALLING THE INTAKE DUCT FOR AN AIR COMPRESSOR
IN THE COOLEST LOCATIONS, ONE CAN HAVE H.P. SAVINGS,
THEREBY REDUCING THE CONSUMPTION OF THE ENERGY FOR THE
PRIME MOVER. USUALLY IT IS THE SAVING IN ELECTRICAL
ENERGY OF THE MOTORS DRIVING THE COMPRESSOR. THIS ENERGY
SAVING POTENTIAL IS DUE TO THE FACT THAT THE COMPRESSOR
IS REQUIRED TO DO LESS WORK IN ORDER TO COMPRESS A CERTAIN
AMOUNT OF AIR AT A LOWER TEMPERATURE HAVING A SMALLER
VOLUME THAN TO COMPRESS THE SAME AMOUNT OF AIR AT A
HIGHER VOLUME. THIS CAN BE DONE EASILY BY INSTALLING
AN AIR INTAKE DUCT AT THE COMPRESSOR INTAKE LEADING TO
THE OUTSIDE COOLER ATMOSPHERE.

.SK 1
REQUIRED DATA:
.SK 1
.IN +5
GIVEN:
.SK 0
AVERAGE INSIDE AIR TEMP. (T1):  80. DEG F
.SK 0
AVERAGE OUTSIDE AIR TEMP. (T2):  48. DEG F
.SK 0
COMPRESSOR SIZE:  20.0 HP.
.SK 0
OPERATION HOURS: 1150. HRS/YR
.SK 0
ELECTRICITY COST : $ 0.0523 /KWH
.SK 0
% LOAD ON COMPRESSOR: 75. %
.SK 1

MEASURED:
.SK 0
DUCT-WORK LENGTH: 20.0 FT.
.SK 1
.IN -5
CALCULATIONS (FOR ENERGY AND $ SAVINGS):
.SK 1
.IN +5
(1) REFERRING TO FIG.(1) UNDER THE SECOND COLUMN (WITH
THE HEADING: INTAKE VOLUME REQUIRED TO DELIVER 1000 CUBIC
FEET OF FREE AIR AT 70 DEGREES FAHRENHEIT), THE CORRESPONDING
VOLUMES OF AIR CAN BE FOUND AT T1 = 80. DEGREES F AND
T2 = 48. DEGREES F AS 1020.  CUBIC FEET AND  952.
CUBIC FEET RESPECTIVELY.
.SK 1

(2) SAVINGS IN ENERGY:
.IN +5
```

```
.SK 1
=(INTAKE VOL. AT T1 - INTAKE VOL. AT T2)/
.SK 0
(INTAKE VOL. AT T1)  X 100%
.SK 1
((1020. -  952.)/(1020.)) X 100
.SK 1
=   6.7 % HP SAVING.
.SK 1

.IN -5
.SK 1
(3) SAVINGS IN KWH
.SK 1
.IN +5
= ( 6.7 % HP SAVINGS) X (% LOAD) X (COMPRESSOR SIZE)
X (0.746 KW/HP) X (OPERATING HOURS/YEAR)
.SK 1
= ( 6.7/100) X (75./100) X ( 20.0 HP) X (0.746 KW/HP.) X (1150. HRS/YR)
.SK 1
=      858. KWH/YR
.IN -5
.SK 1
(4) SAVINGS IN BTU:
.IN +5
.SK 1
= (    858. KWH/YR) X (3412 BTU/KWH)
.SK 1
=      3. MILLION BTU/YR
.SK 2
.IN -5
(5) SAVINGS IN $:
.SK 1
.IN +5
= (KWH/YR SAVED) X (ELECTRICITY COST)
.SK 1
= (    858. KWH/YR) X ($ 0.0523/KWH)
.SK 1
= $  44.87/YR
.SK 2
.IN -5
CALCULATIONS (FOR IMPLEMENTATION COST):
.IN +5
.SK 1
(1) MATERIAL COST: FOR THE AIR INTAKE DUCT WORK,
INSULATED FLEXIBLE DUCT WITH VINYL COATED SPRING STEEL
(OR ALUMINUM) CAN BE USED WHICH COSTS ABOUT $ 2.50/ LINEAR FT
AND 2. GRILLE(S) WOULD COST APPROXIMATELY $  46.
AT $  23.0 /GRILLE.
.SK 1
(2) LABOR COST:
FOR THE INSTALLATION OF THE DUCT, 2. PERSON(S) MAY BE
EMPLOYED AT $ 10./HR FOR ABOUT 8. HOURS.
.SK 1
(3) HENCE TOTAL COST = MATERIAL COST + LABOR COST
.IN +5
.SK 1
=(DUCT COST/LINEAR FT) X (TOTAL LINEAR FT) +
 (# GRILLES) X (COST OF GRILLE) + (# OF LABORERS)
 X (# OF HRS. WORKED) X (WAGE/HR)
.SK 1
=($  2.50/LINEAR FT) X ( 20.0 FT) + (2. GRILLES)
 X ($  46. GRILLE) + (2. LABORERS) X ($ 10./HR)
 X(8. HRS)
.SK 1
= $  256.00
```

```
•IN -10
•SK 3
CALCULATION (FOR PAYBACK):
•SK 1
(1) SIMPLE PAYEACK = TOTAL COST $ /ANNUAL $ SAVINGS
•SK 1
•IN +5
=  256.00/  44.87
•SK 1
=  5.7 YRS
•IN -5
•SK 8
NOTE: IN SOME CASES A DAMPER IS REQUIRED SO THAT THE INSIDE AIR
IS USED IN THE SUMMER IF IT IS COOLER THAN OUTSIDE
```

```
**** TSO FOREGROUND HARDCOPY ****
DSNAME=U13155A.SCRIPT.DATA

.AD 8
.LL 70
.TM 6
.BM 6
.CE ECO # 4
.SK 1
.CE EPIC CODE #63.44
.SK 2
TITLE: NIGHT-SETBACK
.SK 1
EXECUTIVE SUMMARY:
.SK 1
.IN +5

ENERGY AND THEREBY $ SAVINGS CAN BE REALIZED BY HAVING
A NIGHT SETBACK.  THIS CAN BE DONE EASILY BY INSTALLING
A SEVEN DAY 24 HOURS/DAY PROGRAMMABLE AUTOMATIC NIGHT SETBACK
TIMER TO CONTROL THE THERMOSTATS.  DURING THE HEATING
SEASON, THE TIMER CAN BE SET AT 68 DEGREES FAHRENHEIT FOR
NORMAL WORKING (OR OCCUPIED) HOURS AND AT 50 DEGREES
(OR LOWER) DURING UNOCCUPIED HOURS (EVENINGS & WEEKENDS)
SINCE THE AIR HANDLING UNITS WOULD BE HEATING TO A LOWER
TEMPERATURE, LESS ENERGY WOULD BE USED.

.SK 1
MOREOVER, DURING HOT DAYS OF SUMMER, THE TEMPERATURE CAN
BE SET FOR AIR CONDITIONERS AT THE NORMAL 78 DEGREES FOR
WORKING/OCCUPIED HOURS AND AT SOME TEMPERATURE HIGHER THAN
78 DEGREES FOR UNOCCUPIED HOURS.  HOWEVER, THE SELECTION
FOR THIS HIGHER TEMPERATURE IS SOMETIMES DEPENDENT UPON
FACTORS LIKE DEGREE OF HUMIDITY REQUIREMENT, ETC.  THE
SAVINGS WOULD BE DIRECTLY PROPORTIONAL TO THE SETTING
OF THIS TEMPERATURE CHOSEN FOR THE SUMMER.

.SK 1
FOR YOUR SYSTEM OF PRESENT OPERATING CONDITIONS, CALCULATIONS
HAVE BEEN MADE TO SHOW THE SAVINGS ONLY DURING THE HEATING
SEASON.  HOWEVER, TOTAL SAVINGS WOULD BE EVEN GREATER,
DEPENDING UPON THE SET-UP TEMPERATURE CHOSEN FOR SUMMER
.SK 2
.IN -5
REQUIRED DATA:
.SK 1
.IN +5
GIVEN:
.SK 0
(1) YOUR EXISTING LEVEL OF TEMP. FOR SPACE HEATING: 70. DEG. F
.SK 0
(2) HEATING UNIT EFFICIENCY: 80. %
.SK 0
(3) HEATING DEGREE DAYS FOR YOUR AREA: 3660.
.SK 0
(4) NATURAL GAS COST: $ 2.997 /MCF
.SK 0
(5) YOUR TOTAL AREA FOR CONDITIONED SPACE:  199500.SQ. FT.
.SK 1
.IN -5

CALCULATIONS (FOR ENERGY AND $ SAVINGS)
.SK 1
.IN +5
```

(1) FROM YOUR NATURAL GAS CONSUMPTION GRAPH (PROVIDED IN THE BEGINNING OF THIS REPORT), THE PRESENT ENERGY USED FOR YOUR SPACE HEATING HAS BEEN READ AS 20000 MILLION BTU/YR
.SK 2
(2) YOUR PRESENT AVERAGE HEATING CONSUMPTION PER SQUARE FT.
.SK 1
= (ENERGY USED FOR SPACE HEATING) / (CONDITIONED SPACE AREA)
.SK 1
= (20000 MILLION BTU/YR.) / (199500. SQ FT)
.SK 1
= 100251. BTU/YR-SQ FT
.SK 2

(3) FOR 3680. HEATING DEGREE DAYS AND 15. DEGREES FAHRENHEIT OF SETBACK AND FOR YOUR PRESENT AVERAGE HEATING CONSUMPTION PER SQ FT OF 100251. BTU/SQ FT-YR; THE GRAPH OF FIG.(1) READS AN ENERGY SAVING OF 35000. BTU/SQ FT-YR'.
.SK 2
(4) YOUR ACTUAL ANNUAL ENERGY SAVINGS WOULD, THEREFORE, BE
.SK 1
= (ENERGY SAVINGS READ FROM GRAPH) X (CONDITIONED SPACE AREA) /(HEATING UNIT EFFICIENCY)
.SK 1
= (35000. BTU/SQ FT-YR) X (199500. SQ FT)
.SK 0
/(80. %)
= 8728. MILLION ETU
.SK 2
(5) SAVINGS IN NATURAL GAS
.SK 1
= (SAVINGS IN ETU) X (CONVERSION FACTOR)
.SK 1
= (8728. MILLION BTU/YR) X (1 MCF/MILLION BTU)
.SK 1
= 8728. MCF/YR
.SK 2
(6) SAVINGS IN DOLLARS
.SK 1
= (GAS SAVINGS) X (GAS COST)
.SK 1
= (8728. MCF/YR) X ($ 2.997 /MCF)
.SK 1
= $ 26154. /YR
.SK 2
.IN -5
CALCULATIONS (FOR IMPLEMENTATION COST):
.SK 1
.IN +5
(1) INSTRUMENT COST: FOR YOUR SYSTEM A NIGHT SETBACK SEQUENCES 7 DAY PROGRAMMABLE 8. CHANNEL VERSION WOULD COST YOU APPROXIMATELY $ 550.00
.SK 1
(2) LABOR COST: FOR INSTALLATION PURPOSES, SOME MATERIAL AND LABOR WOULD BE REQUIRED WHICH IS ESTIMATED TO BE APPROXIMATELY
.SK 0
$ 240.00
.SK 2
(3) COST PER SEQUENCER = INSTRUMENT COST + LABOR COST
.SK 1
= ($ 550.00) + (16.0 HRS.)($ 15.00 /HOUR)
.SK 1
= 790.00 PER SEQUENCER AND 4. SEQUENCER(S) ARE REQUIRED
.SK 1
TOTAL COST = (COST PER SEQUENCER) X (# SEQUENCERS REQUIRED)
.SK 1

TOTAL COST = 790.00 X 4.
.SK 1
= 3160.00
.SK 2

.IN -5
CALCULATIONS (FOR PAYBACK)
.SK 1
.IN +5
SIMPLE PAYBACK = (TOTAL COST IN $) / (ANNUAL SAVINGS)
.SK 1
= ($ 3160.00) / ($ 26154. /YR)
.SK 1
= 0.12 YRS
.SK 2
NOTE: THE CALCULATED PAYBACK PERIOD WOULD BECOME EVEN LESS IF WE ADDED THE SAVINGS IN THE COOLING SEASON TO THE ANNUAL DOLLAR SAVINGS.

APPENDIX F

MAJOR SCRIPT COMMANDS

For 8½" x 11" paper there are 10 characters per inch, 6 vertical lines per inch, and 66 lines per page.

COMMAND		FUNCTION
adjust	[.ad]	Used once at the beginning of the program it defines the left hand margin. .ad 10 - provides a 1" left margin
bottom margin	[.bm]	Specifies the bottom margin. It is used once at the beginning of the document. .bm 6 - provides a 1" bottom margin
center	[.ce]	Centers a line of text. May be used with on/off commands to center multiple lines of test. .ce ECO #1 - places ECO #1 in the center of the page .ce on • • lines of text • .ce off - centers all lines of text appearing between the on and off commands.
indent	[.in]	Indent the left and/or right margins. The indentation continues until another indent command is encountered. .in 5, -5 causes both margins to be indented five spaces .in 5 causes the left margin to be indented five spaces .in, *, -5 causes the text to be indented five spaces from the right side of the output line, and the left margin to remain unchanged.

line length	[.ll]	Specifies the number of characters per line. This sets the length of the output line. .ll 60 sets the line length at 60 characters of 6 inches
skip	[.sk]	Produces blank lines. .sk 2 produces 2 blank lines
top margin	[.tm]	Specifies the top margin. The command is used once at the beginning of the program. .tm 9 produces a 1½" top margin
upper case	[.up]	Produces a line of capitalized text. Can be used with on/off commands. .up eco prints ECO
under score	[.us]	Underscores a line of text for emphasis. Also accepts on/off commands. .us ECO prints <u>ECO</u>

APPENDIX G

TSO BUILD

The control cards listed below will create a TSO file from a punched card deck. The TSO data set will have the TSO user ID prefixed to the data set name. The control cards contain the name for the second member of the control file. Other member names are listed following the JCL.

```
//W13155T JOB (13155, 111-22-3333), 'EADC', TIME = (0.40)
/*PASSWORD EADC
//STEP1 EXEC TSOBUILD,
//NAME = 'U13155A.EADC (AIRCOMP).CNTL'
//CARDS DD DATA, DLM = @@
      o
      o  CARD DECK - DO NOT INCLUDE PASSWORD CARD HERE
      o
@@
//
```

OTHER NAMES

'U13155A.EADC.CNTL (PEAKS)'

'U13155A.EADC.CNTL (LIGHTS)

'U13155A.EADC.CNTL (SETBACK)'

'U13155A.EADC.CNTL (BULBS)'

'U13155A.EADC.CNTL (FLUOR)'

APPENDIX H

EDIT COMMANDS

COMMAND	FUNCTION
CHANGE	Changes a string of characters in a single line or range of lines Change 100 'old' 'new' will change the word old to new on line 100 Change 10 100 'A' 'E' will change every A appearing anywhere in lines 10 through 100 (inclusive) to an E
DELETE	used to delete a single line or a range of lines DELETE 10 deletes only line 10 DELETE 10 100 removes lines 10 through 100, inclusive
END	to return to ready mode and end edit session
INPUT	Allows the user to stop entering EDIT sub-commands and start entering lines of input data. For example, if the user wishes to enter new lines of data at the bottom of the data set
LIST	Displays an entire program, a single line or a range of lines being edited LIST displays the entire data set LIST 10 displays line number 10 LIST 10 100 displays lines 10 through 100, inclusive

COMMAND	FUNCTION
RENUM	Assigns new line numbers to the data set in increments of 10
SAVE	Retains the current copy of the data set being edited.
VERIFY	Automatically displays a line of text modified by using the CHANGE command. Allows the user to view the changed line. To stop displaying line changes enter: VERIFY OFF Note: OFF is the default. Verify must be turned on for use.

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References at bottom of figures.

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Oklahoma State University Computer Center, System/370 User's Manual, June, 1982.

IBM. OS/VS2 TSO, Fifth Edition (June, 1978).

Personal Correspondence. Eldean Bahm, University Computing Center, Oklahoma State University.

Personal Correspondence. Janice Hansen, University Computing Center, Oklahoma State University.