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STATES APPLICATIONS MODEL (SAM)

USER'S GUIDE

January 4, 1979

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STES APPLICATIONS MODEL (SAM)
USER'S GUIDE

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ABSTRACT

This document is a user's guide for the STES Applications Model (SAM) which can be used to identify industrial applications which are good candidates for Solar Total Energy Systems (STES). SAM computes and ranks equivalent cost ratio and calculates fuel displacement potential by geographic location (50 states) and by industrial application (140 three digit SIC categories) for seven time periods (from 1985 to 2015 in five year increments). SAM is written in FORTRAN for the FTN compiler on the CDC 7600 computer.

1. INTRODUCTION

This document is a user's guide for the STES Applications Model (SAM) which can be used to identify industrial applications which are good candidates for STES. SAM computes equivalent cost ratio (ECR) and fuel displacement (FD) by fuel type for all combinations of 140 industries, 50 states, and seven future time periods between 1985 and 2015. It aggregates STES energy displacement potential by state, industry, and fuel type. It also ranks the ECR values by state or by industry to indicate those applications which are economically viable STES candidates.

SAM consists of two computer programs - SAM Data Generation Program (SAMDGP) and SAM Report Generation Program (SAMRGP) which are written in FORTRAN for the FTN compiler on the CDC 7600 computer. SAMDGP computes ECR and FD potential for each application based on the median size of STES for that industry and the median value of insolation for a given state. These evaluation parameters for every application in every state for seven time periods make up the SAM data base which is stored on tape. Simplifying assumptions required for developing a manageable data base are listed in Table 1-1. SAMRGP ranks a subset of the SAM data base by ECR and state or industry and generates reports and an output tape. The output tape from SAMDGP or SAMRGP may be used as input to the Market Penetration Model (MPM) program, a companion program for evaluating actual STES market penetration.

This user's guide is intended to furnish all the information needed for an experienced programmer to run these programs given the source decks and input tapes. Information for running SAMDGP and SAMRGP can be found in Sections 2 and 3, respectively. Subsection "Program Description" discusses the program structure, equations, size, timing, and limitations. Subsection "Program Inputs" describes the contents and format of each input file along with input variable names, their defaults, and the range of values. Input for a sample case is also included. Subsection "Program Outputs" describes

the contents and format of each output file and report along with a sample case output. Subsection "Control Cards and Deck Structures" contains a description of the deck setup and a sample case deck. Source listings for SAMDGP and SAMRGP are in Appendices A and B, respectively. Appendix C contains a brief description of the preprocessor programs for SAM.

Table 1-1. SAM Data Base Assumptions

Assumption	Reference
Energy use and competing fuel prices predictable functions of time	Reference 4
Curve fit approximations for STES costs as a function of size and time period	Chapter III of Reference 2
Industries categorized into three basic phasing patterns	Section IV-C of Reference 1 and Table VI-9 of Reference 2
Industry T/E ratio independent of plant size or location	Table VI-9 of Reference 2
Constant median STES size within an industry group (SIC-Level 2), invariant with location and time period	Table VI-15 of Reference 2
Fuel type use a function of location rather than industry	Reference 4
Industry (SIC-Level 3) energy use fractions in each state invariant with time	Section VI-B. 1.c of Reference 2

2. SAM DATA GENERATION PROGRAM (SAMDGP)

2.1 SAMDGP Description

The basic function of SAMDGP is to build a data base containing ECR and FD potential by geographic location (50 states) for various industries (140 three digit SIC categories) for seven time periods (1985, 1990, ..., 2015). See Figure 2-1 for an input/output diagram and Figure 2-2 which shows how SAM fits into the overall Aerospace model. The data on applications location and energy use were derived from the 1974 Survey of Manufacturers and updated to reflect the Sherman H. Clark forecast of energy use by industry and state in the 1985 through 2015 time period. Since not every industry is located in each of the 50 states, there were many gaps in the state-industry matrix. Out of 7000 possible combinations, ECR and FD data were computed for approximately 2000 of these. Eight industries were excluded from the calculations because they required temperatures above 600°F which is not suitable for the STES configuration described in this study. These industries have the following SIC codes: 291, 321, 322, 324, 325, 331, 332, and 333. The data base which SAMDGP computes and writes on tape contains the following values for each industry in each state: ECR, fuel displacement percentage, T/E ratio for displaced energy, fuel displaced for thermal energy by fuel type, fuel displaced for electric energy by fuel type, total fuel displaced for the thermal and electric energy, and percent fuel displaced for thermal and electric energy. The following paragraphs provide information on SAMDGP requirements, limitations, structure, functions and equations.

2.1.1 SAMDGP Structure and Functions

The structure of SAMDGP is a main program and four subroutines- COMPUTE, NTRPLAT, PRNTOUT, HEADING.

The main program has several functions - initializing values, reading input data, calling most of the subroutines and writing the output tape. Some variables initialized by the main program are average daily

Figure 2-1. SAMDGP Input/Output Diagram

Figure 2-2. SAM in the Aerospace Model

direct insolation (I); application names and SIC codes; tables for ECR, FD and T/E ratio of energy displaced by STES (R) versus I; median turbine size; state names and abbreviations. The main program reads in the following inputs: NAMELIST inputs; phasing pattern, fraction absorption cooling, and T/E demand ratio for each industry; levelized thermal and electric energy prices by state for seven time periods; fuel mix percentages for electric and thermal energy by state for seven time periods; energy demands for each industry in every state. The main program writes the output tape which is the SAM data base tape.

Subroutine COMPUTE performs most of the computations. Section 2.1.2 contains all the equations which appear in COMPUTE. COMPUTE calls subroutine NTRPLAT and also prints intermediate printout if desired.

Subroutine NTRPLAT performs linear interpolation between T/E demand curves to compute ECR, FD, and R. NTRPLAT is called by COMPUTE.

Subroutine PRNTOUT writes summary reports for fuel displaced by thermal energy, electric energy, and both for each state and each industry.

Subroutine HEADING prints title, date and time at the start of the output report.

2.1.2 SAMDGP Equations

The following notation is used in SAMDGP:

E_t boiler efficiency (fraction)

E_u utility efficiency (fraction)

EMI (j,i) total Btu's of energy demand by a given industry j in a given state i (Btu's/year)

TEDMD thermal to electric energy demand ratio after absorption cooling. If absorption cooling is zero, then $TEDMDVC = TEDMD$ (fraction)

R thermal to electric ratio of energy displaced by STES. R is obtained from the STES simulation results. It is not the T/E ratio of an industry demand (fraction)

CEF (i,t) levelized electric energy price for year t in location i (mills/kilowatt-hour)

CTF (i,t) levelized thermal energy price for year t in location i (\$/million Btu's)

C fraction of total electric demand which is changed to absorption thermal demand (fraction)

ALPHA ratio of coefficient of performance for vapor compression cooling to coefficient of performance for absorption cooling (fraction)

TEDMDVC thermal to electric energy demand ratio before absorption cooling is introduced (fraction)

CTI levelized thermal energy prices used in STES simulation for developing polynomial performance relationships as functions of T/E demand ratio, insolation and phasing pattern (\$/million Btu's)

CEI levelized electric energy prices used in STES simulation for developing polynomial performance relationships as functions of T/E demand ratio, insolation and phasing pattern (mills/kilowatt-hour)

ACR the after-tax annualized cost rate of STES for a user group
 (fraction)

FCR the fixed charge rate used in the ideal STES simulation
 (fraction)

ECIF (t,ig) the STES capital cost modification factor for year t and
 median STES size for industry ig (ratio)

FMT (i,t,f) fractions of industrial thermal energy fuel mixes used for
 location i, time period t, and fuel type f (fraction)

FME (i,t,f) fractions of industrial electric energy fuel mixes used for
 location i, time period t, and fuel type f (fraction)

The following logic and equations appear in SAM:

Compute ratio of boiler efficiency to utilities power generation efficiency:

$$E = E_t / E_u \quad (2-1)$$

Compute the electric demand for industry j in location i:

$$AFE = EMI(j,i) / (1 + TEDMD) \quad (2-2)$$

Compute the thermal demand for industry j in location i:

$$AFT = EMI(j,i) - AFE \quad (2-3)$$

Compute ratio of levelized electric to thermal costs for location i and year t:

$$BETA = CEF(i,t) / CTF(i,t) \quad (2-4)$$

If there is absorption cooling for an industry, then save the T/E demand ratio in TEDMDVC and recompute the T/E demand ratio for absorption cooling:

$$\text{TEDMD} = (\text{TEDMD} + C \cdot \text{ALPHA}) / (1 - C) \quad (2-5)$$

If there is absorption cooling, then recompute the amount of fuel required for electric energy:

$$\text{AFE} = \text{AFT} / \text{TEDMD} \quad (2-6)$$

Compute ECR by linear interpolation between the polynomial curves above and below the T/E demand ratio; i.e., for T/E demand value TEDMD between x_k and x_j ($x_k \leq \text{TEDMD} \leq x_j$), then do the following linear interpolation:

$$\text{ECR} = y_k + (y_j - y_k) \frac{\text{TEDMD} - x_k}{x_j - x_k} \quad (2-7)$$

where

$$y_j = a_{ij} + b_{ij}I + c_{ij}I^2$$

$$y_k = a_{ik} + b_{ik}I + c_{ik}I^2$$

for phasing pattern i and average daily direct insolation I.

If there is absorption cooling, then recompute ECR by:

$$\text{ECR} = \text{ECR} * (\text{TEDMD} + (1 - C) * \text{BETA}) / (\text{TEDMDVC} + \text{BETA}) \quad (2-8)$$

If all the electric demand is used for vapor compression cooling, then $C = 0$, $\text{TEDMDVC} = \text{TEDMD}$, and the new ECR is the same as the old ECR. Varying fractions of C gives different percentage change from vapor compression electric cooling to absorption thermal cooling.

Compute the T/E ratio for displaced energy (R) using linear interpolation between polynomial curves as in equation (2-7) above.

Recompute ECR for effect of energy prices, STES capital costs and cost of money:

$$ECR = \frac{ECR(CTI \cdot R + CEI)}{CTF(i,t) \cdot R + CEF(i,t)} * ECIF(t,ig) * \frac{ACR}{FCR} \quad (2-9)$$

Compute FD using linear interpolation between polynomial curves as in equation (2-7) above.

Compute percent fuel displaced for thermal energy:

$$TFDT = FD \cdot R / (E + R) * (E + TEDMD) / TEDMD \quad (2-10)$$

Compute percent fuel displaced for electric energy:

$$TFDE = FD * (E + TEDMD) / (E + R) \quad (2-11)$$

Compute the amount of fuel displaced for thermal energy:

$$TAFDT = TFDT * AFT / 100 \quad (2-12)$$

Compute the amount of fuel displaced for electric energy:

$$TAFDE = TFDE * AFE / 100 \quad (2-13)$$

Compute the amount of each fuel type displaced for thermal energy for location i and future year t:

$$AFDT(f) = TAFDT * FMT(i,t,f) \quad (2-14)$$

Compute the amount of each fuel type displaced for electric energy for location i and future year t:

$$AFDE(f) = TAFDE * FME(i,t,f) \quad (2-15)$$

where f is one of six fuel types.

Accumulate amount of fuel displaced for thermal energy by application:

$$SAFDTJ(j) = SAFDTJ(j) + TAFDT \quad (2-16)$$

where j is one of 140 applications.

Accumulate amount of fuel displaced for electric energy by application:

$$SAFDEJ(j) = SAFDEJ(j) + TAFDE \quad (2-17)$$

where j is one of 140 applications.

Accumulate amount of fuel displaced for thermal energy by location:

$$SAFDTI(i) = SAFDTI(i) + TAFDT \quad (2-18)$$

where i is one of 50 locations.

Accumulate amount of fuel displaced for electric energy by location:

$$SAFDEI(i) = SAFDEI(i) + TAFDE \quad (2-19)$$

where i is one of 50 locations.

Accumulate amount of fuel displaced for thermal energy for each fuel type by application:

$$SFDTJ(j,f) = SFDTJ(j,f) + AFDT(f) \quad (2-20)$$

Accumulate amount of fuel displaced for thermal energy for each fuel type by location:

$$SFDTI(i,f) = SFDTI(i,f) + AFDT(f) \quad (2-21)$$

Accumulate amount of fuel displaced for electric energy for each fuel type by application:

$$SFDEJ(j,f) = SFDEJ(j,f) + AFDE(f) \quad (2-22)$$

Accumulate amount of fuel displaced for electric energy for each fuel type by location:

$$SFDEI(i,f) = SFDEI(i,f) + AFDE(f) \quad (2-23)$$

2.1.3 SAMDGP Requirements and Limitations

SAMDGP is written in FORTRAN for the FTN compiler on the CDC 7600 computer. It is approximately 1300 cards in length, requires 51K sixty bit words of memory, and uses one nine track 1600 BPI tape drive. When no intermediate printout is requested, SAMDGP takes approximately 15 seconds to run from the source deck and prints out approximately 100 pages of output reports. SAMDGP uses system utility subprograms DATE and TIME. This version of the program performs computations for industrial applications. The program is presently structured for 50 locations (states), 140 applications (industries), and seven time periods (1985, 1990, ..., 2015). To facilitate parametric studies, more variables could be included in the NAMELIST inputs thereby overriding values that are preset in the program. The program will need modifications and additions to process commercial and residential applications. Some major considerations would include:

- (a) New energy demand matrices for residential and commercial applications for the seven time periods 1985, 1990, 1995, 2000, 2005, 2010, and 2015.
- (b) New thermal energy fuel mixes for residential and commercial applications from Sherman H. Clark Associates data base.
- (c) Electric energy fuel mixes for residential and commercial applications to remain unchanged (same as for industrial applications).

- (d) Use levelized thermal and electric energy prices of residential and commercial applications from Sherman H. Clark Associates data base.
- (e) New economic and financial framework for calculating annualized STES costs and competing energy prices.
- (f) New polynomial relationships for STES performance for residential and commercial applications (ECR, PD, and R versus I).
- (g) Generalize program to input application names rather than using industrial application names.
- (h) SAM equations may need changing for applications other than industrial.

2.2 SAMDGP Inputs

The inputs to SAMDGP are two magnetic tapes (tape 3 and tape 4), three card decks in the input stream (tape 5), and preprocessed input data.

2.2.1 Tape 3 - Industrial Energy Demand Data

Tape 3 contains energy demands in trillion Btu's for every industry in every state for each of seven time periods (1985, 1990, ..., 2015). A sample of Tape 3 data for year 2015 appears in Figure 2-3. The tape is in binary format with 50 values per record. The fifty values pertain to the 50 states in alphabetical order. Tape 3 contains 140 records (one for each industry) for each time period or 980 records on the tape. The first record contains data for the industry with SIC code 201 which is "Meat Products". The second record is for SIC code 202 and the last record is for SIC code 399. Not all 3 digit numbers between 201 and 399 are represented. In the program refer to array APPCODE for the SIC codes that are used and to array APP for the corresponding industry names. Energy demands are read into two

Industrial Energy Demand for 2015

SIC	STATES																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
201	3.9	0.0	.2	3.1	6.5	14.4	0.0	1.0	3.4	6.0	0.0	3.9	7.6	2.2	18.1	6.9	3.3
202	.7	0.0	.2	.7	4.9	1.3	.5	0.0	1.6	.8	0.0	3.8	2.0	1.4	2.9	.8	2.8
203	.8	0.0	0.0	5.0	52.7	0.0	0.0	1.4	53.0	2.5	2.7	72.6	4.7	3.9	1.2	0.0	0.0
204	4.5	0.0	0.0	5.2	13.9	0.0	0.0	0.0	3.4	4.7	0.0	0.0	41.3	20.2	67.3	18.4	2.2
205	1.1	0.0	.2	.5	5.2	4.1	1.1	0.0	2.5	3.0	0.0	0.0	3.0	1.3	.4	.6	2.2
206	0.0	0.0	0.0	0.0	83.3	0.0	0.0	0.0	26.3	15.3	24.4	0.0	8.6	.9	0.0	0.0	0.0
207	3.4	0.0	.7	7.9	11.9	0.0	0.0	0.0	2.5	9.0	0.0	0.0	18.0	6.2	11.4	5.2	14.8
208	.8	0.0	.7	0.0	14.5	0.0	.5	0.0	10.9	6.0	0.0	0.0	6.2	5.9	2.6	5.0	29.9
209	.5	13.8	0.0	0.0	6.7	0.0	.4	0.0	3.2	1.1	.6	0.0	2.3	.9	0.0	0.0	2.1
211	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.5
212	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
213	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.3
214	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6
221	6.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
222	5.9	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	10.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
223	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
224	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
225	0.0	0.0	0.0	0.0	2.2	0.0	1.2	0.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
226	0.0	0.0	0.0	0.0	.6	0.0	4.0	0.0	0.0	8.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
227	1.5	0.0	0.0	0.0	4.1	0.0	0.0	0.0	0.0	39.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
228	8.7	0.0	0.0	0.0	.6	0.0	1.0	0.0	0.0	18.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
229	3.5	0.0	0.0	0.0	1.8	0.0	2.2	0.0	0.0	11.0	0.0	0.0	.9	0.0	0.0	0.0	0.0
231	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	.4	0.0	0.0	0.0	2.2
232	2.3	0.0	0.0	.7	.6	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	.4	0.0	0.0	1.5
233	0.0	0.0	0.0	0.0	7.4	0.0	0.0	0.0	1.8	0.0	0.0	0.0	.5	.7	0.0	0.0	0.0
234	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
235	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
236	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
238	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
239	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	5.1	0.0	0.0	1.1	0.0	0.0	0.0	0.0
241	5.1	28.9	0.0	14.9	6.6	0.0	0.0	0.0	5.1	7.2	0.0	14.8	0.0	0.0	0.0	0.0	0.0
242	8.0	0.0	0.0	10.0	16.9	7.9	0.0	0.0	3.2	5.4	0.0	20.2	0.0	1.2	0.0	0.0	7.0
243	6.7	0.0	0.0	10.3	6.4	2.7	0.0	0.0	0.0	3.9	0.0	10.4	0.0	2.5	.6	0.0	1.4
244	0.0	0.0	0.0	.9	.8	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	.6	0.0	0.0	3.8
245	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.3	18.7	0.0	0.0	0.0	7.9	2.8	3.6	0.0
249	0.0	0.0	0.0	3.3	7.2	0.0	0.0	0.0	3.2	2.3	0.0	2.5	.8	.4	0.0	0.0	1.4
251	.9	0.0	0.0	2.5	4.3	0.0	.6	0.0	1.4	1.9	0.0	0.0	1.8	3.1	0.0	0.0	1.8
252	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.7	0.0	0.0	0.0	0.0
253	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
254	1.4	0.0	0.0	0.0	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	.8	0.0	0.0	0.0
259	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3	0.0	0.0	0.0	0.0
261	0.0	0.0	0.0	0.0	20.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
262	68.8	0.0	0.0	31.8	10.0	0.0	2.6	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0
263	44.8	0.0	0.0	0.0	21.6	0.0	5.1	0.0	86.4	99.8	0.0	0.0	6.1	5.4	0.0	0.0	0.0
264	3.4	0.0	0.0	0.0	5.9	0.0	.4	0.0	0.0	5.1	0.0	0.0	3.4	1.9	1.6	0.0	1.3
265	1.2	0.0	0.0	1.1	11.6	4.5	1.6	1.1	5.6	7.9	0.0	0.0	7.1	3.5	2.0	2.5	4.8
266	0.0	0.0	0.0	0.0	4.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	24.1	0.0	0.0	0.0	0.0
271	.9	0.0	0.0	0.0	2.0	3.1	.6	0.0	2.5	.9	0.0	0.0	1.3	.5	.7	.9	1.6
272	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0
273	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.6	1.6	0.0	0.0	0.0
274	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
275	0.0	0.0	0.0	0.0	9.7	3.8	2.0	0.0	3.1	1.1	0.0	0.0	10.4	2.3	.8	1.1	4.0
276	0.0	0.0	0.0	0.0	4.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0
277	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
278	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.6	0.0	0.0	0.0	0.0
279	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.8	0.0	0.0	0.0	0.0
281	79.3	0.0	0.0	152.2	56.5	0.0	0.0	37.4	40.4	52.0	0.0	0.0	29.7	29.4	11.2	63.4	0.0
282	85.0	0.0	0.0	0.0	9.8	0.0	4.5	31.8	0.0	13.3	0.0	0.0	36.3	0.0	0.0	0.0	115.9
283	0.0	0.0	0.0	0.0	8.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.2	24.2	1.7	0.0	0.0
284	0.0	0.0	0.0	0.0	16.9	0.0	1.8	0.0	0.0	0.0	0.0	0.0	11.5	0.0	1.1	0.0	0.0
285	0.0	0.0	0.0	0.0	2.9	0.0	0.0	0.0	0.0	2.7	0.0	0.0	3.4	.7	0.0	1.3	4.9
286	0.0	0.0	0.0	0.0	39.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	23.3	7.1	0.0	0.0	0.0
287	0.0	0.0	0.0	59.1	44.2	0.0	0.0	0.0	108.3	33.1	0.0	0.0	12.0	9.6	77.1	0.0	5.5
289	1.6	0.0	1.3	1.5	15.1	0.0	1.0	0.0	4.8	5.2	0.0	0.0	13.6	2.7	0.0	14.9	0.0
291	0.0	0.0	0.0	0.0	240.2	29.8	0.0	0.0	0.0	0.0	0.0	0.0	54.1	8.0	0.0	76.7	0.0
295	0.0	0.0	0.0	4.9	18.8	0.0	2.7	0.0	4.7	5.6	0.0	0.0	6.1	3.6	0.0	0.0	0.0
299	0.0	0.0	0.0	0.0	99.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	42.8	0.0	0.0	0.0	0.0
301	28.4	0.0	0.0	6.2	19.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.8	0.0	0.0	0.0	0.0
302	.2	0.0	.0	.1	.3	0.0	.1	0.0	.1	.1	0.0	0.0	.1	.2	.2	.1	.2
304	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0

Figure 2-3. Sample Tape 3 Input

Industrial Energy Demand for 2015

306	0.0	0.0	0.0	0.0	4.8	0.0	8.1	0.0	0.0	2.6	0.0	0.0	1.0	9.1	0.0	0.0	0.0
307	0.0	0.0	0.0	1.0	16.3	0.0	3.6	0.0	6.6	4.7	0.0	0.0	11.0	8.7	12.1	0.0	6.4
311	0.0	0.0	0.0	0.0	.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.9	0.0	0.0	0.0	0.0
313	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
314	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
315	0.0	0.0	0.0	.0	.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.0	0.0	.0	0.0	0.0
316	0.0	0.0	0.0	.0	.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.1	0.0	.0	0.0	0.0
317	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
321	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
322	0.0	0.0	0.0	0.0	58.0	0.0	0.0	0.0	22.3	0.0	0.0	0.0	33.3	35.8	0.0	0.0	21.0
323	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3	0.0	0.0	0.0	0.0
324	46.4	0.0	0.0	0.0	107.3	0.0	0.0	0.0	0.0	21.8	0.0	0.0	10.7	22.6	43.0	44.4	0.0
325	8.3	0.0	0.0	7.0	11.7	22.0	0.0	0.0	0.0	28.0	0.0	0.0	3.2	2.5	6.5	0.0	16.1
326	0.0	0.0	0.0	0.0	10.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	1.5	0.0	0.0	2.6
327	8.3	0.0	0.0	6.8	20.7	20.2	3.0	0.0	27.5	20.5	0.0	16.1	14.1	17.6	13.7	8.5	5.4
328	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
329	28.3	0.0	0.0	3.7	26.7	7.4	0.0	0.0	0.0	13.9	0.0	0.0	5.4	12.5	0.0	0.0	0.0
331	103.4	0.0	0.0	0.0	80.2	0.0	8.4	0.0	0.0	0.0	0.0	0.0	168.9	357.7	0.0	0.0	0.0
332	46.1	0.0	0.0	0.0	17.9	0.0	4.6	0.0	0.0	3.1	0.0	0.0	24.3	24.2	9.1	5.9	0.0
333	0.0	0.0	115.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.3	0.0	0.0	0.0	0.0
334	11.7	0.0	0.0	0.0	27.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.9	11.5	0.0	0.0	0.0
335	0.0	0.0	6.3	10.0	33.8	0.0	38.0	0.0	3.2	32.3	0.0	0.0	41.7	73.4	0.0	2.2	71.6
336	0.0	0.0	0.0	1.8	15.1	0.0	2.5	0.0	0.0	0.0	0.0	0.0	6.0	0.0	0.0	0.0	3.8
339	2.8	0.0	0.0	0.0	15.3	0.0	3.6	0.0	0.0	0.0	0.0	0.0	6.5	6.3	0.0	0.0	0.0
341	0.0	0.0	0.0	0.0	13.4	0.0	0.0	0.0	5.8	2.0	0.0	0.0	4.8	2.7	0.0	0.0	0.0
342	0.0	0.0	0.0	0.0	3.3	0.0	4.2	0.0	0.0	0.0	0.0	0.0	4.5	1.8	0.0	0.0	2.1
343	0.0	0.0	0.0	0.0	5.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.6	0.0	0.0	0.0
344	6.9	0.0	.4	1.6	9.4	3.1	1.7	0.0	9.0	4.6	0.0	0.0	5.6	4.3	2.0	3.5	1.7
345	2.5	0.0	0.0	0.0	3.9	0.0	2.4	0.0	0.0	0.0	0.0	0.0	5.8	2.1	0.0	0.0	0.0
346	1.3	0.0	0.0	0.0	17.7	0.0	2.4	0.0	0.0	1.3	0.0	0.0	20.9	14.9	0.0	0.0	4.9
347	0.0	0.0	0.0	0.0	13.4	0.0	1.4	0.0	0.0	0.0	0.0	0.0	5.8	4.2	0.0	0.0	4.2
348	0.0	0.0	0.0	1.7	9.9	0.0	5.9	0.0	0.0	1.9	0.0	0.0	0.0	2.1	0.0	0.0	0.0
349	6.2	0.0	0.0	.9	8.0	3.7	2.0	0.0	1.5	1.1	0.0	0.0	7.9	4.6	2.4	0.0	13.9
351	0.0	0.0	0.0	0.0	2.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.9	0.0	0.0	0.0	0.0
352	0.0	0.0	0.0	0.0	.9	4.4	0.0	0.0	0.0	1.3	0.0	0.0	14.5	4.1	29.7	3.7	0.0
353	.9	0.0	0.0	0.0	2.0	6.3	0.0	0.0	0.0	.9	0.0	0.0	17.0	2.0	11.6	.9	3.4
354	0.0	0.0	0.0	0.0	3.2	0.0	4.0	0.0	0.0	0.0	0.0	0.0	6.3	1.7	.8	0.0	0.0
355	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	1.5	1.0	0.0	0.0	1.9	1.7	.8	0.0	0.0
356	2.1	0.0	0.0	0.0	4.8	0.0	6.6	0.0	0.0	1.1	0.0	0.0	4.7	6.3	.8	2.1	4.0
357	0.0	0.0	0.0	0.0	10.8	0.0	.9	0.0	2.1	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.0
358	1.0	0.0	0.0	.9	0.0	0.0	.6	0.0	0.0	1.0	0.0	0.0	3.4	2.8	.8	0.0	11.5
359	1.9	0.0	0.0	0.0	4.5	7.1	1.3	0.0	1.5	1.0	0.0	0.0	1.9	2.7	.8	1.0	1.9
361	0.0	0.0	0.0	0.0	1.9	0.0	1.6	0.0	0.0	3.9	0.0	0.0	1.4	0.0	0.0	0.0	2.4
362	0.0	0.0	0.0	3.6	3.0	0.0	.8	0.0	0.0	0.0	0.0	0.0	2.5	5.0	0.0	0.0	9.9
363	0.0	0.0	0.0	1.9	3.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.5	0.0	5.6	0.0	29.8
364	1.1	0.0	0.0	1.0	2.5	0.0	.7	0.0	0.0	1.1	0.0	0.0	2.9	6.6	0.0	0.0	6.2
365	0.0	0.0	0.0	0.0	3.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1	6.1	0.0	0.0	0.0
366	1.1	0.0	.5	1.0	12.8	0.0	1.4	0.0	0.0	0.0	0.0	0.0	8.0	3.1	0.0	0.0	0.0
367	0.0	0.0	2.3	0.0	16.7	0.0	1.5	0.0	0.0	0.0	0.0	0.0	3.9	5.7	.9	0.0	2.2
369	0.0	0.0	0.0	0.0	1.9	0.0	.8	0.0	0.0	1.3	0.0	0.0	1.4	12.8	0.0	0.0	0.0
371	3.3	0.0	0.0	1.0	14.5	4.1	.7	6.7	0.0	0.0	0.0	0.0	7.6	38.9	4.3	0.0	21.2
372	0.0	0.0	0.0	0.0	27.8	0.0	16.3	0.0	7.9	0.0	0.0	0.0	.8	0.0	0.0	8.6	0.0
373	1.4	0.0	0.0	0.0	3.3	0.0	0.0	0.0	2.1	0.0	0.0	0.0	0.0	.8	0.0	0.0	0.0
374	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.2	1.7	0.0	0.0	0.0
375	.1	0.0	.0	.0	.4	.1	.1	.0	.1	.1	0.0	0.0	.1	.3	.0	.1	.1
376	6.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
379	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.8	0.0	0.0	0.0
381	0.0	0.0	0.0	0.0	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.9	0.0	0.0	0.0	0.0
382	0.0	0.0	0.0	0.0	9.7	0.0	3.2	0.0	0.0	0.0	0.0	0.0	4.8	1.4	0.0	0.0	0.0
383	0.0	0.0	0.0	0.0	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
384	0.0	0.0	0.0	0.0	2.4	0.0	1.0	0.0	0.0	0.0	0.0	0.0	1.8	0.0	0.0	0.0	0.0
385	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
386	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	0.0	0.0	0.0	0.0
387	0.0	0.0	0.0	0.0	0.0	0.0	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
391	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
393	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.7	1.0	0.0	0.0	0.0
394	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	1.7	0.0	0.0	2.4	0.0	1.2	0.0	3.0
395	0.0	0.0	0.0	0.0	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.9	0.0	0.0	0.0	0.0
396	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
399	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	0.0	0.0	2.6	1.0	0.0	1.7	0.0

STATE TOTALS

678.9 42.7 128.2 367.51596.9 150.1 175.3 79.4 501.0 586.7 27.7 144.3 952.7 897.7 369.9 284.0 673.8

Figure 2-3. Sample Tape 3 Input (Cont'd)

Industrial Energy Demand for 2015

SIC	STATES																	
	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	
201	1.0	.6	6.2	2.0	3.1	0.0	10.6	0.0	2.6	17.0	0.0	0.0	1.1	8.7	1.7	2.7	0.0	
202	.6	0.0	2.3	1.0	1.9	10.6	1.0	2.1	0.0	1.9	0.0	0.0	.7	0.0	4.4	.9	6.1	
203	1.3	5.1	4.8	1.1	4.7	5.6	0.0	0.0	0.0	0.0	0.0	0.0	3.8	0.0	6.6	0.0	25.7	
204	1.9	0.0	3.5	.8	7.3	4.6	3.0	13.5	5.2	37.7	0.0	0.0	.9	0.0	3.9	1.8	0.0	
205	1.0	.6	0.0	1.2	1.7	1.2	0.0	1.6	0.0	.9	0.0	0.0	1.9	0.0	0.0	3.2	0.0	
206	68.1	0.0	0.0	11.4	0.0	49.5	0.0	.9	0.0	0.0	0.0	0.0	2.4	0.0	13.7	0.0	0.0	
207	4.4	0.0	5.4	0.0	1.3	14.1	22.9	1.5	0.0	0.0	0.0	0.0	3.6	0.0	0.0	4.9	0.0	
208	2.1	0.0	11.5	1.7	3.3	10.1	0.0	7.9	0.0	0.0	0.0	0.0	4.0	0.0	4.9	2.7	0.0	
209	3.2	1.2	2.5	1.5	0.0	1.7	0.0	1.2	0.0	.9	0.0	0.0	3.3	8.5	2.8	.4	0.0	
211	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.9	0.0	
212	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
213	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.3	0.0	
214	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7	0.0	
221	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.1	0.0	
222	0.0	.8	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	.3	0.0	.3	24.8	0.0	
223	0.0	4.7	0.0	3.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	.6	0.0	0.0	
224	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.6	0.0	0.0	
225	0.0	0.0	0.0	4.6	0.0	0.0	2.5	0.0	0.0	0.0	0.0	1.3	3.2	0.0	4.8	49.7	0.0	
226	0.0	0.0	0.0	7.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	0.0	1.0	27.7	0.0	
227	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	
228	0.0	.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.3	0.0	0.0	38.6	0.0	
229	0.0	0.0	0.0	8.2	.6	1.2	0.0	0.0	0.0	0.0	0.0	0.0	2.2	0.0	3.0	5.6	0.0	
231	0.0	0.0	0.0	.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.4	0.0	3.0	0.0	0.0	
232	.6	0.0	1.2	.5	0.0	0.0	4.1	.9	0.0	0.0	0.0	0.0	.3	0.0	1.0	1.2	0.0	
233	0.0	0.0	0.0	.8	0.0	0.0	0.0	.7	0.0	0.0	0.0	0.0	.9	0.0	4.6	1.0	0.0	
234	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.4	0.0	.5	0.0	0.0	
235	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
236	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.7	0.0	0.0	
238	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.1	0.0	0.0	
239	0.0	0.0	0.0	1.4	2.4	0.0	2.6	.6	0.0	0.0	0.0	0.0	1.8	0.0	2.1	4.0	0.0	
241	1.4	5.6	0.0	0.0	.9	0.0	6.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8	0.0	
242	3.7	0.0	2.3	0.0	2.5	3.7	27.2	.8	20.2	0.0	0.0	1.0	0.0	11.2	1.2	11.2	0.0	
243	6.3	0.0	1.2	.5	1.1	0.0	14.0	.4	6.9	0.0	0.0	0.0	.6	0.0	.6	3.6	0.0	
244	0.0	0.0	0.0	1.4	1.0	1.0	0.0	.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
245	0.0	0.0	0.0	0.0	3.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.9	0.0	
249	1.2	1.6	2.2	0.0	3.2	2.9	61.2	0.0	0.0	0.0	0.0	2.0	.5	0.0	.9	5.2	0.0	
251	0.0	0.0	0.0	2.0	1.4	0.0	0.0	.5	0.0	0.0	0.0	1.3	.3	0.0	2.4	13.5	0.0	
252	0.0	0.0	0.0	0.0	3.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	1.6	0.0	
253	0.0	0.0	0.0	0.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
254	0.0	0.0	0.0	1.0	2.9	1.5	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	2.5	1.2	0.0	
259	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
261	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
262	34.0	97.5	0.0	18.5	23.3	30.8	0.0	0.0	0.0	0.0	0.0	27.7	4.7	0.0	21.1	34.9	0.0	
263	57.4	0.0	0.0	0.0	20.3	0.0	0.0	0.0	0.0	0.0	0.0	3.2	6.3	0.0	11.5	29.6	0.0	
264	.6	7.6	0.0	6.9	2.4	0.0	3.7	.8	0.0	0.0	0.0	2.9	3.7	0.0	0.0	0.0	0.0	
265	2.1	0.0	5.8	0.0	4.4	3.8	3.3	3.6	0.0	0.0	0.0	0.0	6.1	0.0	6.9	4.1	0.0	
266	0.0	0.0	0.0	0.0	0.0	46.1	0.0	0.0	0.0	0.0	0.0	0.0	11.4	0.0	0.0	0.0	0.0	
271	.7	0.0	1.3	1.2	1.3	.9	0.0	.5	0.0	0.0	0.0	0.0	.6	0.0	2.2	1.4	0.0	
272	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0	
273	0.0	0.0	2.3	2.1	.7	0.0	0.0	.8	0.0	0.0	0.0	0.0	0.0	0.0	1.9	0.0	0.0	
274	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.0	
275	0.0	0.0	6.5	3.0	2.1	3.2	0.0	1.2	0.0	0.0	0.0	1.5	3.6	0.0	6.3	1.7	0.0	
276	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
277	0.0	0.0	0.0	2.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
278	0.0	0.0	0.0	1.0	.7	0.0	0.0	.8	0.0	0.0	0.0	0.0	.6	0.0	1.3	0.0	0.0	
279	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6	0.0	0.0	
281	295.1	0.0	72.2	2.2	67.8	0.0	0.0	19.1	0.0	0.0	0.0	0.0	30.8	0.0	58.5	0.0	0.0	
282	68.6	0.0	24.1	21.9	32.2	0.0	41.2	0.0	0.0	0.0	0.0	0.0	18.5	0.0	6.6	106.7	0.0	
283	0.0	0.0	0.0	3.1	0.0	0.0	0.0	8.7	0.0	3.7	0.0	0.0	45.1	0.0	23.1	7.0	0.0	
284	0.0	0.0	21.3	3.9	0.0	1.4	0.0	3.1	0.0	0.0	0.0	0.0	11.9	0.0	0.0	1.1	0.0	
285	0.0	0.0	0.0	.9	2.5	1.3	0.0	0.0	0.0	0.0	0.0	0.0	2.9	0.0	2.7	0.0	0.0	
286	742.0	0.0	0.0	4.1	63.5	0.0	0.0	7.3	0.0	0.0	0.0	0.0	86.7	0.0	31.5	0.0	0.0	
287	223.6	0.0	2.2	0.0	0.0	0.0	0.0	16.4	0.0	93.2	0.0	0.0	2.1	0.0	0.0	27.8	0.0	
289	48.1	0.0	0.0	11.5	13.0	0.0	0.0	13.0	0.0	0.0	0.0	0.0	8.6	0.0	7.6	1.3	0.0	
291	327.0	0.0	0.0	0.0	9.2	0.0	0.0	0.0	57.1	0.0	0.0	0.0	20.8	0.0	0.0	0.0	0.0	
295	2.7	0.0	11.6	0.0	2.1	0.0	5.7	4.2	0.0	0.0	0.0	0.0	5.6	0.0	4.1	4.3	0.0	
299	67.9	0.0	0.0	0.0	8.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.1	0.0	0.0	0.0	0.0	
301	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.5	0.0	
302	0.0	.0	.1	.2	.1	.0	.2	.0	0.0	.0	0.0	.0	.1	0.0	.1	.1	0.0	
304	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

Figure 2-3. Sample Tape 3 Input (Cont'd)

Industrial Energy Demand for 2015

306	0.0	0.0	0.0	6.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	0.0	2.1	1.0	0.0
307	0.0	3.6	5.2	9.4	12.2	4.5	6.0	2.5	0.0	0.0	0.0	0.0	9.2	0.0	12.8	4.5	0.0
311	0.0	3.8	0.0	4.1	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.4	0.0	1.0	0.0	0.0
313	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
314	0.0	2.4	0.0	1.5	0.0	0.0	0.0	.6	0.0	0.0	0.0	1.5	0.0	0.0	.9	0.0	0.0
315	0.0	.1	0.0	.1	.0	.0	0.0	.0	0.0	0.0	0.0	.1	.0	0.0	0.0	.0	0.0
316	0.0	.3	0.0	.2	.1	.1	0.0	.1	0.0	0.0	0.0	.3	.1	0.0	0.0	.0	0.0
317	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	1.3	0.0	0.0
321	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
322	11.5	0.0	0.0	0.0	0.0	0.0	18.2	0.0	0.0	0.0	0.0	0.0	38.2	0.0	18.0	25.5	0.0
323	0.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.3	1.6	0.0
324	32.5	0.0	50.1	0.0	49.9	0.0	0.0	51.0	0.0	0.0	0.0	0.0	0.0	0.0	32.8	0.0	0.0
325	0.0	0.0	7.1	0.0	0.0	0.0	26.4	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.7	0.0
326	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6	0.0	2.9	0.0	0.0
327	19.6	0.0	14.4	5.3	13.0	4.7	14.9	30.7	38.4	6.2	37.7	0.0	5.6	57.2	9.5	3.8	0.0
328	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
329	1.7	0.0	15.9	7.2	9.7	4.2	43.4	4.1	0.0	0.0	7.6	2.9	13.1	0.0	9.1	0.0	0.0
331	0.0	0.0	0.0	2.0	96.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.4	0.0	62.2	0.0	0.0
332	0.0	0.0	2.2	3.1	73.2	4.4	0.0	6.6	0.0	0.0	0.0	0.0	0.0	0.0	9.9	3.5	0.0
333	0.0	0.0	0.0	0.0	0.0	0.0	0.0	54.2	0.0	0.0	0.0	0.0	33.1	0.0	87.1	0.0	0.0
334	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.9	0.0	5.0	0.0	0.0
335	0.0	0.0	0.0	10.8	18.7	0.0	0.0	3.7	0.0	0.0	0.0	0.0	16.6	0.0	34.6	0.0	0.0
336	0.0	0.0	0.0	0.0	13.8	6.0	0.0	3.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0
339	0.0	0.0	0.0	0.0	26.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.4	0.0	0.0	0.0	0.0
341	.8	0.0	6.0	1.4	0.0	3.0	0.0	6.6	0.0	0.0	0.0	0.0	4.8	0.0	1.2	0.0	0.0
342	0.0	0.0	0.0	6.1	6.0	1.1	0.0	.6	0.0	0.0	0.0	0.0	1.6	0.0	4.2	.9	0.0
343	0.0	0.0	0.0	0.0	5.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.4	0.0	0.0
344	2.9	0.0	2.7	2.5	4.3	2.7	6.9	3.0	0.0	2.9	0.0	1.2	1.3	0.0	4.1	2.8	0.0
345	0.0	0.0	0.0	2.7	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	1.1	0.0	0.0
346	0.0	0.0	0.0	10.8	39.6	2.6	6.8	0.0	0.0	0.0	0.0	0.0	2.9	0.0	6.5	0.0	0.0
347	.9	0.0	0.0	1.5	3.3	3.3	0.0	1.9	0.0	0.0	0.0	0.0	1.6	0.0	3.7	1.8	0.0
348	0.0	0.0	0.0	1.3	0.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0
349	0.0	0.0	0.0	2.9	4.7	1.1	2.8	1.2	0.0	1.7	0.0	0.0	2.4	0.0	2.7	1.7	0.0
351	0.0	0.0	0.0	0.0	9.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
352	0.0	0.0	0.0	0.0	2.5	2.5	6.5	.7	0.0	6.2	0.0	0.0	0.0	0.0	0.0	1.0	0.0
353	1.5	0.0	0.0	0.0	6.1	3.6	4.7	.5	0.0	0.0	0.0	0.0	.7	0.0	1.1	0.0	0.0
354	0.0	0.0	0.0	3.7	12.5	1.1	0.0	.6	0.0	0.0	0.0	1.4	.8	0.0	3.1	2.5	0.0
355	0.0	0.0	13.9	6.3	1.5	0.0	0.0	0.0	0.0	0.0	0.0	1.4	2.6	0.0	2.5	2.4	0.0
356	0.0	0.0	0.0	2.2	4.6	3.2	0.0	1.2	0.0	1.7	0.0	1.4	5.8	0.0	4.8	.8	0.0
357	0.0	0.0	0.0	4.0	.7	7.2	0.0	0.0	0.0	0.0	0.0	0.0	.5	0.0	5.4	1.1	0.0
358	0.0	0.0	3.1	.7	3.0	4.1	0.0	1.1	0.0	0.0	0.0	0.0	1.5	0.0	10.2	.8	0.0
359	0.0	0.0	0.0	0.0	3.9	3.0	0.0	2.2	0.0	0.0	0.0	0.0	1.1	0.0	4.2	0.0	0.0
361	0.0	0.0	0.0	0.0	0.0	0.0	3.3	.7	0.0	0.0	0.0	0.0	.5	0.0	.5	2.0	0.0
362	0.0	0.0	0.0	3.7	3.2	1.3	6.9	3.0	0.0	0.0	0.0	0.0	.5	0.0	16.0	8.4	0.0
363	0.0	0.0	0.0	0.0	3.6	0.0	2.8	0.0	0.0	0.0	0.0	0.0	.8	0.0	1.3	.8	0.0
364	0.0	0.0	0.0	3.0	.5	1.1	5.7	1.8	0.0	0.0	0.0	0.0	2.4	0.0	2.7	1.7	0.0
365	0.0	0.0	0.0	0.0	0.0	.7	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	1.2	0.0	0.0
366	0.0	0.0	.6	4.7	0.0	1.1	0.0	1.9	0.0	0.0	0.0	0.0	2.9	0.0	6.6	0.0	0.0
367	0.0	1.2	0.0	4.8	0.0	1.2	0.0	0.0	0.0	1.9	0.0	1.6	2.6	0.0	11.2	1.9	0.0
369	0.0	0.0	0.0	.9	3.6	1.2	0.0	.7	0.0	0.0	0.0	0.0	1.8	0.0	1.0	1.0	0.0
371	0.0	0.0	0.0	3.2	177.4	2.2	0.0	17.7	0.0	0.0	0.0	0.0	5.0	0.0	13.7	1.8	0.0
372	0.0	0.0	1.7	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	5.0	0.0	0.0
373	3.6	0.0	0.0	3.0	.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0	2.4	0.0	0.0
374	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
375	.0	0.0	.1	.1	1.1	.0	.1	.1	0.0	0.0	0.0	.0	.1	.1	.1	.0	0.0
376	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
379	0.0	0.0	0.0	0.0	1.3	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
381	0.0	0.0	0.0	1.6	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0	1.0	0.0	0.0
382	0.0	0.0	0.0	5.4	1.3	0.0	0.0	1.4	0.0	0.0	0.0	0.0	1.0	0.0	2.2	2.0	0.0
383	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0
384	0.0	0.0	0.0	1.1	0.0	0.0	0.0	.9	0.0	0.0	0.0	0.0	2.4	0.0	2.7	0.0	0.0
385	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.1	0.0	0.0
386	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.9	0.0	0.0	0.0	0.0	2.4	0.0	50.9	0.0	0.0
387	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0
391	0.0	0.0	0.0	2.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0	0.0
393	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.8	0.0	0.0
394	0.0	0.0	0.0	3.4	1.6	3.2	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	4.1	0.0	0.0
395	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.9	0.0	0.0	0.0	0.0
396	0.0	0.0	0.0	.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.5	0.0	.5	0.0	0.0
399	0.0	0.0	0.0	2.4	1.7	3.5	0.0	1.0	0.0	0.0	0.0	0.0	2.6	0.0	5.8	1.4	0.0
STATE TOTALS																	
2041.7 137.6 321.6 274.6 938.0 288.9 365.3 345.5 130.4 175.9 45.3 55.9 523.3 85.6 763.4 558.6 31.8																	

Figure 2-3. Sample Tape 3 Input (Cont'd)

Industrial Energy Demand for 2015

SIC	STATES																	TOTALS
	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50		
201	2.4	1.9	1.5	2.7	0.0	1.2	8.0	2.2	6.6	5.3	0.0	3.5	0.0	0.0	6.2	0.0	179.3	
202	3.0	.8	1.5	2.0	0.0	.4	4.2	1.0	1.5	5.2	8.6	.8	.7	0.0	15.5	0.0	103.1	
203	4.6	.8	10.2	5.8	0.0	0.0	0.0	1.5	6.4	0.0	0.0	1.6	6.8	.3	8.4	0.0	305.5	
204	6.7	2.5	3.0	5.8	0.0	0.0	0.0	3.0	19.7	5.3	0.0	1.6	1.1	0.0	5.7	0.0	339.5	
205	2.6	.6	1.5	4.0	.5	.6	0.0	1.9	2.8	0.0	0.0	0.0	.5	.2	3.3	0.0	57.0	
206	4.1	0.0	0.0	15.9	0.0	0.0	0.0	1.1	14.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	340.6	
207	5.8	2.8	1.1	1.7	0.0	2.8	0.0	12.5	14.3	0.0	0.0	2.4	0.0	0.0	0.0	0.0	192.7	
208	5.6	0.0	0.0	4.8	0.0	0.0	0.0	1.6	8.2	0.0	0.0	2.2	4.0	0.0	21.9	0.0	179.6	
209	.9	.6	2.2	1.3	0.0	0.0	0.0	1.4	5.4	0.0	0.0	1.1	.5	0.0	1.4	0.0	73.7	
211	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.4	
212	0.0	0.0	0.0	.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.9	
213	0.0	0.0	0.0	.0	0.0	0.0	0.0	.0	0.0	0.0	0.0	.2	0.0	0.0	0.0	0.0	.9	
214	0.0	0.0	0.0	.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.5	
221	0.0	0.0	0.0	0.0	0.0	14.7	0.0	0.0	.3	0.0	0.0	.8	0.0	0.0	0.0	0.0	52.1	
222	0.0	0.0	0.0	1.2	.6	32.9	0.0	1.0	0.0	0.0	0.0	8.7	0.0	0.0	0.0	0.0	90.2	
223	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.4	
224	0.0	0.0	0.0	.5	2.3	0.0	0.0	0.0	0.0	0.0	0.0	.9	0.0	0.0	0.0	0.0	5.6	
225	.4	0.0	0.0	7.0	3.1	10.2	0.0	4.3	0.0	0.0	0.0	5.7	0.0	0.0	1.6	0.0	103.1	
226	0.0	0.0	0.0	1.5	5.3	66.8	0.0	1.0	0.0	0.0	0.0	7.5	0.0	0.0	0.0	0.0	135.7	
227	0.0	1.7	0.0	1.5	0.0	4.2	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	56.7	
228	0.0	0.0	0.0	.9	.7	9.6	0.0	1.6	0.0	0.0	0.0	.5	0.0	0.0	0.0	0.0	81.8	
229	3.4	0.0	0.0	2.3	2.0	6.4	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	55.7	
231	.5	0.0	0.0	1.4	0.0	0.0	0.0	.8	0.0	0.0	0.0	.8	0.0	0.0	0.0	0.0	11.6	
232	0.0	.8	0.0	1.5	0.0	.8	0.0	2.0	2.5	0.0	0.0	.5	0.0	0.0	0.0	0.0	24.6	
233	.5	0.0	0.0	2.8	0.0	1.3	0.0	1.6	2.0	5.6	0.0	.8	0.0	0.0	0.0	0.0	32.9	
234	0.0	0.0	0.0	.4	0.0	0.0	0.0	0.0	.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.7	
235	0.0	0.0	0.0	.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2	
236	0.0	0.0	0.0	.3	0.0	.9	0.0	0.0	.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8	
238	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.1	
239	.4	0.0	0.0	1.5	0.0	10.8	0.0	.6	0.0	0.0	0.0	1.3	0.0	0.0	.8	0.0	38.1	
241	0.0	0.0	27.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	10.8	0.0	.7	0.0	144.3	
242	1.9	0.0	24.1	4.0	0.0	9.7	0.0	3.4	0.0	0.0	0.0	4.5	6.4	4.0	1.8	0.0	224.5	
243	.6	0.0	33.6	.9	0.0	1.7	0.0	.5	2.5	0.0	0.0	1.0	4.0	0.0	3.1	0.0	128.1	
244	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.8	0.0	11.9	
245	1.5	0.0	0.0	2.8	0.0	0.0	0.0	0.0	2.9	0.0	0.0	0.0	0.0	0.0	3.0	0.0	58.5	
249	.6	0.0	16.1	2.0	0.0	3.9	0.0	1.9	1.8	0.0	0.0	3.9	.7	0.0	3.0	0.0	135.9	
251	0.0	0.0	0.0	1.8	0.0	0.0	0.0	7.9	1.5	0.0	0.0	5.7	0.0	0.0	2.3	0.0	58.9	
252	2.4	0.0	0.0	2.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.0	
253	.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	6.4	
254	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.4	
259	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	6.4	
261	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	77.3	0.0	0.0	0.0	97.8	
262	18.3	0.0	53.2	25.1	0.0	0.0	0.0	18.0	0.0	0.0	0.0	0.0	22.5	0.0	110.9	0.0	654.8	
263	14.8	0.0	24.9	8.1	0.0	57.3	0.0	0.0	26.6	0.0	0.0	39.9	15.5	0.0	0.0	0.0	584.7	
264	2.1	0.0	0.0	2.7	0.0	2.3	0.0	1.4	1.2	0.0	5.3	.5	1.0	0.0	7.5	0.0	75.6	
265	6.9	0.0	1.7	6.9	0.0	5.5	0.0	2.5	0.0	0.0	0.0	2.6	0.0	0.0	5.2	0.0	126.1	
266	0.0	0.0	0.0	9.5	0.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.7	
271	1.1	.9	0.0	1.0	0.0	0.0	0.0	.6	2.1	0.0	0.0	.6	.4	0.0	.7	0.0	32.6	
272	0.0	0.0	0.0	.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.5	
273	.6	0.0	0.0	.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	12.4	
274	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	
275	4.0	0.0	0.0	4.1	.9	0.0	0.0	1.4	7.0	5.0	0.0	1.4	0.0	.4	3.5	0.0	95.1	
276	1.3	0.0	0.0	1.2	0.0	0.0	0.0	0.0	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.6	
277	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3	
278	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	
279	.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.3	
281	157.0	0.0	0.0	30.2	0.0	0.0	0.0	197.8	357.2	0.0	0.0	9.8	37.8	41.4	0.0	0.0	1928.5	
282	24.4	0.0	.0	28.7	0.0	132.9	0.0	119.3	362.8	0.0	0.0	130.5	0.0	34.2	2.3	0.0	1451.8	
283	1.8	0.0	0.0	14.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	154.5	
284	9.3	0.0	0.0	7.6	0.0	1.5	0.0	.9	5.7	0.0	0.0	0.0	0.0	0.0	4.6	0.0	103.5	
285	2.7	0.0	0.0	1.5	0.0	0.0	0.0	0.0	2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	32.4	
286	21.2	0.0	1.6	29.8	2.4	0.0	0.0	0.01877.5	0.0	0.0	0.0	0.0	0.0	111.4	2.4	0.0	3051.5	
287	21.8	0.0	0.0	1.7	0.0	1.6	0.0	44.3	166.1	0.0	0.0	1.0	0.0	0.0	0.0	0.0	950.7	
289	29.7	0.0	4.3	6.4	0.0	0.0	0.0	0.0	63.5	7.6	0.0	0.0	.8	2.6	15.0	0.0	294.7	
291	23.3	116.0	0.0	33.3	0.0	0.0	0.0	0.01187.0	73.6	0.0	0.0	0.0	0.0	0.0	0.0	113.3	2369.3	
295	10.8	0.0	0.0	3.8	0.0	0.0	0.0	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	104.1	
299	6.8	0.0	0.0	12.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	243.5	
301	48.5	24.0	0.0	10.6	0.0	0.0	0.0	15.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	168.1	
302	.5	.1	0.0	.2	.0	.1	0.0	.1	.1	0.0	.1	.2	.0	.0	.1	0.0	4.2	
304	23.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27.0	

Figure 2-3. Sample Tape 3 Input (Cont'd)

Industrial Energy Demand for 2015

306	16.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	56.8
307	16.5	1.2	0.0	14.0	2.8	12.2	0.0	5.1	11.0	0.0	0.0	17.5	.5	0.0	6.5	0.0	227.5
311	0.0	0.0	0.0	1.4	0.0	0.0	0.0	.8	0.0	0.0	0.0	0.0	0.0	0.0	6.8	0.0	21.2
313	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2
314	.5	0.0	0.0	.9	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0	.9	0.0	10.7
315	.0	0.0	0.0	.0	0.0	0.0	0.0	.0	0.0	0.0	0.0	.0	0.0	0.0	.1	0.0	.5
316	.0	0.0	0.0	.1	0.0	0.0	0.0	.1	0.0	0.0	0.0	.0	0.0	0.0	.3	0.0	1.9
317	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5
321	0.0	39.4	0.0	36.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	32.9	0.0	0.0	122.1
322	32.5	21.0	0.0	35.5	9.2	0.0	0.0	0.0	18.1	0.0	0.0	0.0	0.0	20.4	0.0	0.0	418.6
323	3.4	0.0	0.0	5.5	0.0	0.0	0.0	1.3	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.8
324	29.1	25.1	0.0	59.3	0.0	0.0	0.0	28.1	139.5	0.0	0.0	0.0	11.1	0.0	0.0	0.0	804.5
325	20.0	0.0	0.0	9.9	0.0	0.0	0.0	0.0	12.6	0.0	0.0	5.2	0.0	0.0	0.0	0.0	208.3
326	7.4	0.0	0.0	5.3	0.0	0.0	0.0	1.8	3.3	0.0	0.0	0.0	0.0	2.6	2.2	0.0	47.1
327	26.0	6.1	8.6	15.0	.8	4.1	2.7	5.5	43.1	39.1	0.0	22.2	4.0	2.9	9.3	0.0	632.4
328	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0
329	29.4	0.0	0.0	15.6	0.0	0.0	0.0	1.4	21.1	0.0	0.0	4.9	0.0	3.2	2.6	0.0	294.9
331	399.5	0.0	0.0	442.1	0.0	24.8	0.0	0.0	145.0	0.0	0.0	0.0	6.9	59.9	5.5	0.0	1968.1
332	50.4	0.0	9.6	25.2	0.0	0.0	0.0	7.7	21.6	0.0	0.0	20.8	1.4	.6	38.7	0.0	414.2
333	0.0	0.0	0.0	87.7	0.0	0.0	0.0	0.0	904.2	0.0	0.0	0.0	348.0	0.0	0.0	0.0	1638.0
334	15.0	0.0	0.0	5.8	0.0	0.0	0.0	0.0	12.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	115.2
335	27.9	0.0	0.0	24.2	9.2	2.4	0.0	40.5	9.1	0.0	0.0	10.5	15.9	0.0	7.3	0.0	543.8
336	18.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.3	0.0	93.6
339	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	68.7
341	2.5	0.0	1.3	2.3	0.0	0.0	0.0	0.0	4.0	0.0	0.0	.7	.9	0.0	4.9	0.0	69.1
342	7.4	0.0	1.4	1.7	0.0	0.0	0.0	.7	0.0	0.0	0.0	0.0	0.0	1.3	1.8	0.0	50.8
343	0.0	0.0	0.0	5.4	0.0	0.0	0.0	2.3	2.9	0.0	0.0	0.0	0.0	0.0	8.6	0.0	43.8
344	10.3	3.8	0.0	7.9	0.0	1.0	0.0	5.1	12.9	4.0	0.0	2.4	.8	0.0	5.1	0.0	144.3
345	5.9	0.0	0.0	3.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.4
346	35.7	0.0	0.0	10.6	2.1	0.0	0.0	1.7	9.5	0.0	0.0	0.0	0.0	0.0	27.7	0.0	220.1
347	4.6	0.0	0.0	2.6	1.8	0.0	0.0	0.0	9.0	0.0	0.0	0.0	0.0	0.0	2.7	0.0	67.9
348	0.0	0.0	0.0	5.8	0.0	0.0	0.0	0.0	13.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	58.9
349	7.0	1.1	0.0	11.8	0.0	0.0	0.0	2.0	6.9	0.0	0.0	.7	.5	.4	2.6	0.0	106.5
351	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	28.0	0.0	50.1
352	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.2	0.0	87.2
353	7.8	3.8	0.0	4.1	0.0	1.0	0.0	0.0	28.3	4.1	0.0	.6	.4	.3	9.5	0.0	123.2
354	11.9	0.0	0.0	5.7	.9	1.1	0.0	.7	.9	0.0	8.0	0.0	0.0	0.0	2.6	0.0	73.5
355	2.9	0.0	0.0	2.7	.8	0.0	0.0	.7	.8	0.0	0.0	0.0	.5	0.0	4.1	0.0	52.5
356	14.0	1.1	0.0	5.7	0.0	3.4	0.0	1.4	2.6	0.0	0.0	2.1	0.0	0.0	6.0	0.0	94.5
357	4.7	0.0	0.0	1.1	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	41.3
358	12.7	3.3	0.0	1.6	0.0	1.1	0.0	2.6	2.5	0.0	0.0	.7	0.0	0.0	3.3	0.0	74.3
359	8.7	0.0	0.0	1.5	0.0	0.0	0.0	1.3	2.4	4.6	0.0	3.3	.5	0.0	0.0	0.0	62.4
361	.5	0.0	0.0	5.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.8	0.0	0.0	2.1	0.0	27.0
362	10.4	0.0	0.0	8.7	0.0	1.4	0.0	0.0	0.0	0.0	0.0	.9	0.0	0.0	16.2	0.0	105.3
363	8.8	0.0	0.0	1.2	0.0	1.1	0.0	0.0	.9	0.0	0.0	0.0	0.0	0.0	4.3	0.0	73.6
364	6.3	0.0	0.0	3.4	.9	0.0	0.0	.7	.9	0.0	0.0	0.0	0.0	0.0	.9	0.0	54.1
365	0.0	0.0	0.0	1.1	0.0	0.0	0.0	.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.7
366	.9	2.4	0.0	1.3	0.0	1.2	0.0	.7	4.6	0.0	0.0	3.0	0.0	0.0	0.0	0.0	68.0
367	1.9	0.0	0.0	7.6	0.0	3.8	0.0	0.0	3.8	0.0	0.0	3.1	0.0	0.0	.9	0.0	80.8
369	3.1	0.0	0.0	1.9	1.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	40.3
371	48.9	0.0	0.0	6.1	0.0	0.0	0.0	3.6	7.3	0.0	0.0	0.0	.6	0.0	25.9	0.0	416.1
372	10.8	0.0	0.0	2.9	0.0	0.0	0.0	0.0	14.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	98.8
373	0.0	0.0	1.9	1.1	0.0	0.0	0.0	.9	5.8	0.0	0.0	.7	0.0	1.2	0.0	0.0	30.4
374	1.9	0.0	0.0	11.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.4
375	.4	0.0	.0	.1	.0	.0	0.0	.0	.2	.2	0.0	.1	.1	0.0	.2	0.0	4.9
376	2.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.1
379	.6	0.0	0.0	1.1	0.0	0.0	0.0	0.0	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.5
381	0.0	0.0	0.0	.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.9
382	3.2	0.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	39.6
383	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0
384	.7	0.0	0.0	1.9	1.3	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.2
385	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.1
386	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	57.8
387	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2
391	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.4
393	.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2
394	2.0	0.0	0.0	1.9	1.3	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6	0.0	31.7
395	1.0	0.0	0.0	1.8	0.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.3
396	0.0	0.0	0.0	.5	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.1
399	3.6	1.9	0.0	8.1	0.0	0.0	0.0	2.3	0.0	0.0	0.0	0.0	0.0	0.0	4.3	0.0	46.4
STATE TOTALS																	
1416.8 264.0 230.31253.8 52.2 438.9 14.9 591.15646.8 159.6 21.9 345.5 583.7 319.1 517.3 113.3																	

Figure 2-3. Sample Tape 3 Input (Cont'd)

dimensional array EMI(140, 50) which is reused for each time period in order to minimize computer memory requirements. Tape 3 is generated by a preprocessor program called Calculation of Energy Demands (CED) which is described in Appendix C.

2.2.2 Tape 4 - Fuel Mix Data

Tape 4 contains fuel mix fractions for electric and thermal energy by state and time period. A sample of Tape 4 data appears in Figure 2-4. This data is derived from Sherman H. Clark data and the tape is generated by the Levelized Electric and Fuel Costs (LEAFC) program, also described in Appendix C. The tape is in binary format with 10 values per record. The first 6 values are fuel mix fractions for electric energy. They are natural gas, coal, nuclear, hydroelectric, other, and oil. The next four values are fuel mix fractions for thermal energy. They are natural gas, coal, oil, and other. There are 50 records for each of seven time periods or 350 records on the tape. Each group of 50 records refers to the 50 states. The states appear in the order provided by Sherman H. Clark and Associates which is not alphabetical. (See Table 2-1 for ordering of states.) Fuel mix fractions are read into arrays FME(50,7,6) for electric energy and FMT (50,7,4) for thermal energy.

2.2.3 Tape 5 - The Input Stream

The input stream contains 3 card decks - NAMELIST inputs, industry characteristics inputs and energy price forecast inputs. Sample Tape 5 inputs appear in Figure 2-5.

The NAMELIST inputs are in a group called IN and include the following variables:

ACR after-tax annualized cost rate for a user group. (default = .12)

ALPHA ratio of coefficient of performance for vapor compression cooling to absorption cooling. (default = 5)

FUEL MIX FRACTIONS FOR 1985

	I-----ELECTRIC ENERGY-----						II-----THERMAL ENERGY-----I					
	NAT'L	GAS	COAL	NUCLEAR	HYDRO	OTHER	OIL	NAT'L	GAS	COAL	OIL	OTHER
CT		0.00	.17	.46	.01	0.00	.36		.01	.09	.87	.03
ME		0.00		.49	.17	0.00	.35		.03	.01	.94	.01
MA		0.00	.18	.18	.01	0.00	.63		.05	.04	.68	.04
NH		0.00	.17	.62	.10	0.00	.11		.05	.01	.92	.02
RI		0.00	0.00	.82	0.00	0.00	.18		.14	.01	.82	.02
VT		0.00	.01	.72	.24	0.00	.04		.24	.01	.72	.02
NJ		0.00	.30	.42	0.00	0.00	.28		.23	.02	.57	.17
NY		0.00	.16	.23	.21	0.00	.35		.30	.10	.58	.03
PA		0.00	.64	.28	.01	0.00	.07		.48	.20	.20	.11
IL		0.00	.67	.29	.00	0.00	.04		.52	.16	.17	.16
IN		0.00	.89	.11	.01	0.00	.01		.36	.25	.27	.12
MI		0.00	.61	.29	.01	0.00	.03		.64	.25	.08	.03
OH		0.00	.88	.10	0.00	0.00	.01		.40	.28	.22	.09
WI		0.00	.73	.22	.03	0.00	.01		.55	.37	.05	.03
IA		0.00	.88	.07	.03	.00	.01		.89	.07	.02	.01
KS		0.00	.81	.10	0.00	0.00	.09		.72	.01	.10	.17
MN		0.00	.69	.27	.02	0.00	.02		.62	.08	.21	.09
MO		0.00	.85	.11	.03	0.00	.01		.69	.11	.11	.09
NB		0.00	.57	.33	.06	0.00	.04		.84	.05	.09	.01
ND		0.00	.80	0.00	.20	0.00	.00		0.00	.48	.28	.25
SD		0.00	.40	0.00	.59	0.00	.01		.71	.14	.10	.05
DE		0.00	.50	0.00	0.00	0.00	.50		.12	.04	.42	.42
FL		0.00	.42	.18	.00	0.00	.39		.81	.00	.16	.03
GA		0.00	.65	.23	.06	0.00	.07		.56	.05	.37	.03
MD		0.00	.43	.30	.05	0.00	.23		.08	.17	.71	.04
NC		0.00	.67	.25	.08	0.00	.01		.19	.19	.56	.06
SC		0.00	.35	.53	.08	0.00	.05		.43	.21	.32	.04
VA		0.00	.28	.42	.02	0.00	.28		.08	.34	.54	.04
WV		0.00	.99	0.00	.01	0.00	.00		.20	.70	.06	.03
KY		0.00	.96	0.00	.04	0.00	.00		.50	.24	.11	.15
TN		0.00	.66	.19	.12	0.00	.01		.73	.10	.12	.06
AL		0.00	.58	.26	.15	0.00	.01		.68	.15	.14	.03
MS		0.00	.58	.19	0.00	0.00	.23		.62	.01	.20	.17
OK		.16	.30	0.00	.10	0.00	.45		.58	.00	.16	.26
AR		.02	.24	.44	.15	0.00	.15		.24	.11	.62	.03
LA		.12	.44	.20	0.00	0.00	.24		.38	.06	.43	.12
TX		.14	.44	.10	.01	.00	.30		.39	.11	.35	.15
AZ		0.00	.50	.14	.23	0.00	.12		.28	.10	.61	.01
CO		0.00	.86	.06	.05	0.00	.03		.39	.27	.28	.06
ID		0.00	0.00	0.00	.94	0.00	.06		.36	.33	.28	.02
MT		0.00	.42	0.00	.53	.00	.00		.15	.08	.58	.18
NV		0.00	.86	0.00	.09	0.00	.05		.86	.06	.06	.03
NM		0.00	.95	0.00	.00	0.00	.04		.78	0.00	.16	.06
UT		0.00	.90	0.00	.10	0.00	.01		.28	.17	.44	.12
WY		0.00	.95	0.00	.05	0.00	.00		.31	.16	.38	.15
CA		0.03	.05	.14	.19	.05	.57		.69	.02	.09	.20
OR		0.00	.12	.19	.70	.00	0.00		.48	.03	.20	.29
WA		0.00	.13	.14	.73	0.00	.00		.43	.05	.29	.23
AK		.61	.18	0.00	.10	0.00	.12		.63	.19	.12	.06
HI		0.00	0.00	0.00	.00	.01	.99		.16	0.00	.56	.28

Figure 2-4. Sample Tape 4 Input

FUEL MIX FRACTIONS FOR 1990

I-----ELECTRIC ENERGY-----					II-----THERMAL ENERGY-----					I		
	NAT'L	GAS	COAL	NUCLEAR	HYDRO	OTHER	OIL	NAT'L	GAS	COAL	OIL	OTHER
CT		0.00	.41	.35	.01	0.00	.22		.02	.03	.87	.03
ME		0.00	0.00	.59	.13	0.00	.28		.06	.01	.92	.01
MA		0.00	.25	.27	.01	0.00	.48		.05	.05	.87	.03
NH		0.00	.17	.65	.10	0.00	.08		.06	.01	.91	.02
RI		0.00	0.00	.91	0.00	0.00	.09		.20	.01	.77	.02
VT		0.00	.01	.72	.24	0.00	.04		.24	.01	.73	.02
NJ		0.00	.36	.46	0.00	0.00	.18		.30	.02	.51	.17
NY		0.00	.23	.33	.18	0.00	.26		.41	.09	.48	.02
PA		0.00	.63	.31	.01	0.00	.05		.58	.17	.15	.11
IL		0.00	.65	.32	.00	0.00	.03		.35	.32	.17	.16
IN		0.00	.84	.15	.00	0.00	.01		.28	.35	.26	.11
MI		0.00	.60	.32	.01	0.00	.06		.51	.38	.08	.03
OH		0.00	.80	.20	0.00	0.00	.01		.32	.36	.22	.09
WI		0.00	.70	.27	.03	0.00	.01		.37	.55	.05	.03
IA		0.00	.76	.21	.02	.00	.01		.88	.09	.02	.01
KS		0.00	.76	.17	0.00	0.00	.06		.77	.01	.06	.16
MN		0.00	.65	.31	.01	0.00	.02		.55	.16	.20	.08
MO		0.00	.79	.18	.02	0.00	.01		.62	.19	.11	.08
NB		0.00	.56	.36	.05	0.00	.03		.69	.22	.08	.01
ND		0.00	.82	0.00	.18	0.00	.00		0.00	.50	.27	.23
SD		0.00	.47	0.00	.52	0.00	.01		.36	.50	.09	.05
DE		0.00	.69	0.00	0.00	0.00	.31		.11	.08	.41	.41
FL		0.00	.46	.27	.00	0.00	.27		.83	.00	.14	.03
GA		0.00	.61	.29	.05	0.00	.06		.54	.10	.34	.02
MD		0.00	.46	.35	.04	0.00	.15		.07	.20	.69	.04
NC		0.00	.63	.30	.06	0.00	.00		.17	.24	.54	.06
SC		0.00	.38	.52	.06	0.00	.03		.41	.25	.30	.03
VA		0.00	.35	.45	.02	0.00	.19		.07	.37	.52	.04
WV		0.00	.99	0.00	.01	0.00	.00		.26	.65	.06	.03
KY		0.00	.96	0.00	.03	0.00	.00		.33	.42	.11	.15
TN		0.00	.65	.24	.10	0.00	.01		.66	.16	.12	.06
AL		0.00	.57	.31	.12	0.00	.09		.55	.30	.13	.03
MS		0.00	.58	.26	0.00	0.00	.16		.45	.21	.18	.15
OK		0.00	.43	.10	.09	0.00	.38		.61	.00	.12	.26
AR		0.00	.29	.48	.12	0.00	.10		.18	.21	.58	.03
LA		0.00	.46	.28	0.00	0.00	.26		.36	.09	.43	.12
TX		0.00	.51	.23	.01	.00	.24		.41	.12	.34	.14
AZ		0.00	.50	.20	.20	0.00	.09		.26	.21	.53	.00
CO		0.00	.89	.05	.04	0.00	.02		.34	.34	.25	.06
ID		0.00	.13	0.00	.82	0.00	.05		.31	.42	.25	.02
MT		0.00	.49	0.00	.51	.00	.00		.14	.18	.52	.16
NV		0.00	.88	0.00	.08	0.00	.04		.66	.26	.05	.03
NM		0.00	.97	0.00	.00	0.00	.03		.74	.04	.14	.05
UT		0.00	.91	0.00	.08	0.00	.01		.23	.27	.39	.10
WY		0.00	.95	0.00	.04	0.00	.00		.27	.26	.34	.13
CA		0.00	.19	.26	.14	.04	.38		.72	.02	.07	.19
OR		0.00	.19	.24	.57	.00	0.00		.52	.02	.18	.28
WA		0.00	.17	.17	.66	0.00	.00		.45	.05	.28	.22
AK		.54	.23	0.00	.12	0.00	.11		.67	.17	.11	.05
HI		0.00	0.00	0.00	.00	.01	.99		.16	0.00	.59	.25

Figure 2-4. Sample Tape 4 Input (Cont'd)

FUEL MIX FRACTIONS FOR 1995

I-----ELECTRIC ENERGY-----						II-----THERMAL ENERGY-----						I
	NAT'L	GAS	COAL	NUCLEAR	HYDRO	OTHER	OIL	NAT'L	GAS	COAL	OIL	OTHER
CT		0.00	.50	.34	.01	0.00	.16		.02	.03	.87	.03
ME		0.00	0.00	.66	.11	0.00	.23		.06	.01	.91	.01
MA		0.00	.29	.34	.01	0.00	.36		.05	.05	.87	.03
NH		0.00	.17	.65	.10	0.00	.08		.07	.01	.90	.02
RI		0.00	0.00	.96	0.00	0.00	.04		.24	.01	.73	.02
VT		0.00	0.00	.87	.13	0.00	0.00	0.00		.01	.96	.02
NJ		0.00	.40	.47	0.00	0.00	.13		.32	.02	.50	.16
NY		0.00	.28	.35	.16	0.00	.21		.43	.09	.45	.02
PA		0.00	.63	.32	.01	0.00	.04		.60	.17	.13	.10
IL		0.00	.63	.35	.00	0.00	.02		.19	.48	.17	.16
IN		0.00	.79	.20	.00	0.00	.01		.22	.41	.26	.11
MI		0.00	.59	.35	.01	0.00	.05		.34	.54	.08	.03
OH		0.00	.75	.24	0.00	0.00	.01		.27	.41	.22	.09
WI		0.00	.67	.30	.02	0.00	.01		.00	.92	.05	.03
IA		0.00	.71	.26	.02	0.00	.01		.81	.16	.02	.01
KS		0.00	.72	.23	0.00	0.00	.05		.62	.10	.13	.15
MN		0.00	.63	.35	.01	0.00	.01		.39	.33	.19	.08
MO		0.00	.74	.23	.02	0.00	.01		.54	.28	.10	.08
NB		0.00	.55	.39	.04	0.00	.02		.55	.35	.08	.01
ND		0.00	.83	0.00	.16	0.00	.00	0.00		.52	.25	.22
SD		0.00	.53	0.00	.46	0.00	.01		.30	.57	.09	.04
DE		0.00	.79	0.00	0.00	0.00	.21		.08	.14	.39	.39
FL		0.00	.48	.32	.00	0.00	.19		.85	.00	.12	.02
GA		0.00	.60	.33	.04	0.00	.03		.53	.14	.31	.02
MD		0.00	.47	.39	.03	0.00	.11		.05	.24	.67	.04
NC		0.00	.61	.33	.05	0.00	.00		.15	.27	.52	.05
SC		0.00	.40	.52	.05	0.00	.03		.40	.28	.29	.03
VA		0.00	.39	.47	.01	0.00	.13		.05	.40	.51	.04
WV		0.00	.99	0.00	.01	0.00	.00		.22	.70	.06	.03
KY		0.00	.97	0.00	.03	0.00	.00		.27	.48	.11	.15
TN		0.00	.63	.27	.09	0.00	.01		.69	.13	.12	.06
AL		0.00	.55	.33	.11	0.00	.00		.52	.34	.12	.03
MS		0.00	.58	.30	0.00	0.00	.12		.38	.32	.16	.14
OK		0.00	.41	.19	.08	0.00	.31		.57	.00	.15	.27
AR		0.00	.30	.51	.11	0.00	.08		.13	.29	.55	.03
LA		0.00	.47	.33	0.00	0.00	.20		.29	.15	.45	.12
TX		0.00	.51	.28	.01	0.00	.20		.33	.17	.37	.13
AZ		0.00	.50	.25	.18	0.00	.07		.09	.41	.49	.00
CO		0.00	.91	.04	.03	0.00	.01		.10	.60	.24	.06
ID		0.00	.26	0.00	.70	0.00	.04		.21	.55	.23	.02
MT		0.00	.53	0.00	.47	0.00	.00		.05	.33	.47	.15
NV		0.00	.89	0.00	.08	0.00	.03		.15	.78	.05	.02
NM		0.00	.97	0.00	.00	0.00	.03		.58	.23	.13	.05
UT		0.00	.93	0.00	.07	0.00	.00		.09	.46	.36	.09
WY		0.00	.96	0.00	.04	0.00	.00		.15	.43	.30	.12
CA		0.00	.26	.32	.11	.04	.27		.53	.02	.27	.17
OR		0.00	.24	.28	.48	0.00	0.00	0.00	.57	.02	.13	.28
WA		0.00	.19	.20	.61	0.00	.00		.48	.04	.26	.21
AK		.43	.33	0.00	.15	0.00	.10		.70	.17	.09	.04
HI		0.00	0.00	0.00	.00	.01	.99		.16	0.00	.60	.24

Figure 2-4. Sample Tape 4 Input (Cont'd)

FUEL MIX FRACTIONS FOR 2000

	I-----ELECTRIC ENERGY-----					II-----THERMAL ENERGY-----I						
	NAT'L	GAS	CCAL	NUCLEAR	HYDRO	OTHER	OIL	NAT'L	GAS	COAL	OIL	OTHER
CT	0.00		.56	.37	.00	0.00	.06		.05	.08	.85	.03
ME	0.00		0.00	.71	.09	0.00	.19		.07	.01	.90	.01
MA	0.00		.35	.49	.01	0.00	.16		.04	.07	.85	.03
NH	0.00		.17	.72	.08	0.00	.03		.05	.01	.91	.02
RI	0.00		0.00	.98	0.00	0.00	.02		.23	.01	.69	.02
VT	0.00		0.00	.89	.11	0.00	0.00	0.00		.01	.96	.02
NJ	0.00		.42	.48	0.00	0.00	.09		.25	.11	.48	.16
NY	0.00		.32	.39	.14	0.00	.15		.37	.17	.44	.02
PA	0.00		.61	.35	.01	0.00	.03		.54	.23	.12	.10
IL	0.00		.61	.37	.00	0.00	.02		.08	.53	.18	.16
IN	0.00		.75	.24	.00	0.00	.00		.12	.52	.25	.11
MI	0.00		.58	.37	.01	0.00	.04		.14	.75	.08	.03
OH	0.00		.72	.29	0.00	0.00	.01		.15	.54	.22	.09
WI	0.00		.64	.33	.02	0.00	.01	0.00		.93	.05	.02
IA	0.00		.68	.30	.02	0.00	.01		.60	.37	.02	.01
KS	0.00		.69	.26	0.00	0.00	.04		.38	.23	.24	.14
MN	0.00		.61	.37	.01	0.00	.01		.20	.54	.19	.08
MO	0.00		.71	.27	.02	0.00	.01		.29	.54	.10	.03
NB	0.00		.55	.40	.04	0.00	.01		.31	.61	.07	.01
ND	0.00		.85	0.00	.15	0.00	.00	0.00		.54	.25	.22
SD	0.00		.59	0.00	.41	0.00	.00	0.00		.88	.08	.04
DE	0.00		.84	0.00	0.00	0.00	.16		.05	.20	.33	.37
FL	0.00		.50	.36	.00	0.00	.14		.77	.09	.11	.02
GA	0.00		.59	.35	.03	0.00	.02		.41	.29	.29	.02
MD	0.00		.48	.41	.03	0.00	.08		.03	.28	.66	.04
NC	0.00		.59	.36	.05	0.00	.00		.07	.37	.50	.05
SC	0.00		.42	.52	.04	0.00	.02		.30	.39	.27	.03
VA	0.00		.41	.48	.01	0.00	.09		.02	.44	.50	.04
WV	0.00		.39	0.00	.00	0.00	.00		.14	.77	.06	.03
KY	0.00		.37	0.00	.03	0.00	.00		.18	.56	.11	.15
TN	0.00		.61	.30	.08	0.00	.01		.71	.14	.10	.06
AL	0.00		.55	.35	.10	0.00	.00		.47	.39	.11	.02
MS	0.00		.57	.34	0.00	0.00	.09		.31	.42	.15	.12
OK	0.00		.43	.24	.07	0.00	.26		.31	.03	.39	.28
AR	0.00		.32	.54	.09	0.00	.05		.04	.40	.53	.03
LA	0.00		.49	.37	0.00	0.00	.15		.18	.21	.49	.12
TX	0.00		.51	.32	.01	0.00	.17		.20	.25	.42	.12
AZ	0.00		.50	.29	.16	0.00	.05	0.00		.55	.44	.00
CO	0.00		.85	.11	.03	0.00	.01	0.00		.72	.22	.05
ID	0.00		.26	0.00	.70	0.00	.03	0.00		.78	.21	.02
MT	0.00		.53	0.00	.42	0.00	.00	0.00		.43	.43	.14
NV	0.00		.91	0.00	.07	0.00	.02	0.00		.93	.05	.02
NM	0.00		.93	0.00	.00	0.00	.02	.22		.61	.13	.05
UT	0.00		.94	0.00	.06	0.00	.00	0.00		.59	.33	.09
WY	0.00		.96	0.00	.04	0.00	.00	0.00		.61	.28	.11
CA	0.00		.33	.37	.09	.03	.19	.35		.02	.46	.16
OR	0.00		.27	.31	.41	.00	0.00	.35		.25	.12	.28
WA	0.00		.22	.22	.56	0.00	.00	.29		.24	.27	.20
AK	.24	.54	0.00	0.00	.16	0.00	.07	.70		.18	.09	.04
HI	0.00	0.00	0.00	0.00	.00	.01	.99	.17	0.00	.61		.22

Figure 2-4. Sample Tape 4 Input (Cont'd)

FUEL MIX FRACTIONS FOR 2005

I-----ELECTRIC ENERGY-----					II-----THERMAL ENERGY-----I							
	NAT'L	GAS	COAL	NUCLEAR	HYDRO	OTHER	OIL	NAT'L	GAS	COAL	OIL	OTHER
CT	0.00	.00	.29	.63	.01	0.00	.07	.02	.02	.08	.88	.03
ME	0.00	0.00	0.00	.76	.08	0.00	.16	.06	.06	.01	.92	.01
MA	0.00	.35	.55	.54	.01	0.00	.10	.02	.11	.84	.84	.03
NH	0.00	.20	.72	.72	.07	0.00	.02	.10	.01	.86	.86	.03
RI	0.00	0.00	0.00	1.00	0.00	0.00	0.00	.26	.01	.70	.70	.02
VT	0.00	0.00	0.00	.91	.09	0.00	0.00	0.00	.01	.96	.96	.03
NJ	0.00	.41	.51	.51	0.00	0.00	.08	.19	.18	.47	.47	.16
NY	0.00	.32	.43	.43	.13	0.00	.13	.30	.26	.42	.42	.02
PA	0.00	.59	.39	.39	.01	0.00	.93	.48	.30	.12	.12	.10
IL	0.00	.57	.41	.41	.00	0.00	.91	.04	.61	.18	.18	.17
IN	0.00	.70	.29	.29	.00	0.00	.90	.07	.59	.24	.24	.10
MI	0.00	.55	.41	.41	.01	0.00	.93	.04	.85	.08	.08	.03
OH	0.00	.67	.33	.33	0.00	0.00	.90	.08	.60	.22	.22	.09
WI	0.00	.60	.37	.37	.02	0.00	.90	0.00	.93	.04	.04	.02
IA	0.00	.63	.36	.36	.01	0.00	.90	.59	.39	.02	.02	.01
KS	0.00	.64	.33	.33	0.00	0.00	.93	.37	.24	.26	.26	.14
MN	0.00	.56	.42	.42	.01	0.00	.91	.19	.55	.18	.18	.03
MO	0.00	.65	.33	.33	.01	0.00	.90	.29	.54	.10	.10	.07
NB	0.00	.51	.44	.44	.03	0.00	.91	.26	.66	.06	.06	.01
ND	0.00	.85	0.00	0.00	.15	0.00	.90	0.00	.54	.24	.24	.21
SD	0.00	.61	0.00	0.00	.39	0.00	.90	0.00	.83	.08	.08	.04
DE	0.00	.88	0.00	0.00	0.00	0.00	.12	.04	.24	.36	.36	.36
FL	0.00	.48	.42	.42	.09	0.00	.10	.62	.26	.10	.10	.02
GA	0.00	.55	.40	.40	.03	0.00	.02	.31	.41	.27	.27	.02
MD	0.00	.46	.46	.46	.02	0.00	.96	0.00	.32	.64	.64	.04
NC	0.00	.56	.40	.40	.04	0.00	.90	.00	.46	.43	.43	.05
SC	0.00	.41	.54	.54	.04	0.00	.91	.22	.43	.26	.26	.03
VA	0.00	.40	.52	.52	.01	0.00	.97	0.00	.47	.49	.49	.04
WV	0.00	.99	0.00	0.00	.00	0.00	.90	.09	.83	.06	.06	.03
KY	0.00	.98	0.00	0.00	.02	0.00	.90	.13	.62	.10	.10	.15
TN	0.00	.58	.35	.35	.07	0.00	.90	.73	.12	.10	.10	.06
AL	0.00	.52	.39	.39	.09	0.00	.90	.44	.44	.10	.10	.02
MS	0.00	.55	.33	.33	0.00	0.00	.97	.27	.43	.14	.14	.11
OK	0.00	.42	.33	.33	.06	0.00	.19	0.00	.29	.43	.43	.23
AR	0.00	.32	.57	.57	.07	0.00	.64	0.00	.46	.51	.51	.03
LA	0.00	.46	.42	.42	0.00	0.00	.11	.07	.26	.55	.55	.11
TX	0.00	.49	.39	.39	.01	0.00	.12	.07	.33	.48	.48	.11
AZ	0.00	.48	.34	.34	.14	0.00	.04	0.00	.59	.40	.40	.00
CO	0.00	.80	.17	.17	.03	0.00	.91	0.00	.74	.21	.21	.05
ID	0.00	.44	0.00	0.00	.53	0.00	.93	0.00	.79	.19	.19	.01
MT	0.00	.62	0.00	0.00	.38	0.00	.90	0.00	.48	.40	.40	.13
NV	0.00	.92	0.00	0.00	.06	0.00	.92	0.00	.94	.04	.04	.02
NM	0.00	.98	0.00	0.00	.00	0.00	.92	.11	.73	.12	.12	.04
UT	0.00	.95	0.00	0.00	.05	0.00	.90	0.00	.62	.30	.30	.08
WY	0.00	.96	0.00	0.00	.04	0.00	.90	0.00	.64	.26	.26	.10
CA	0.00	.33	.42	.42	.07	.03	.14	.21	.02	.61	.61	.16
OR	0.00	.28	.36	.36	.36	0.00	0.00	.33	.23	.12	.12	.28
WA	0.00	.23	.28	.28	.49	0.00	.90	.25	.29	.26	.26	.20
AK	.11	.69	0.00	0.00	.16	0.00	.04	.67	.21	.09	.09	.03
HI	0.00	0.00	0.00	0.00	.00	.01	.99	.16	0.00	.60	.60	.24

Figure 2-4. Sample Tape 4 Input (Cont'd)

FUEL MIX FRACTIONS FOR 2010

	I-----ELECTRIC ENERGY-----					II-----THERMAL ENERGY-----I				
	NAT'L GAS	COAL	NUCLEAR	HYDRO	OTHER	OIL	NAT'L GAS	COAL	OIL	OTHER
CT	0.00	.30	.65	.01	0.00	.04	.03	.08	.85	.03
ME	0.00	0.00	.83	.07	0.00	.11	.05	.01	.93	.01
MA	0.00	.36	.53	.01	0.00	.06	.02	.12	.83	.03
NH	0.00	.20	.73	.06	0.00	.01	.07	.01	.89	.03
RI	0.00	0.00	1.00	0.00	0.00	0.00	.26	.01	.70	.02
VT	0.00	0.00	.93	.07	0.00	0.00	0.00	.01	.96	.03
NJ	0.00	.41	.53	0.00	0.00	.06	.17	.22	.46	.15
NY	0.00	.32	.46	.12	0.00	.10	.26	.31	.41	.02
PA	0.00	.55	.42	.01	0.00	.02	.42	.35	.12	.10
IL	0.00	.54	.45	.00	0.00	.01	.02	.62	.18	.17
IN	0.00	.65	.34	.00	0.00	.00	.03	.64	.23	.10
MI	0.00	.52	.45	.01	0.00	.02	.01	.87	.08	.03
OH	0.00	.62	.37	0.00	0.00	.00	.03	.65	.22	.09
WI	0.00	.57	.42	.02	0.00	.00	.01	.92	.04	.02
IA	0.00	.58	.41	.01	.00	.00	.57	.40	.01	.01
KS	0.00	.59	.39	0.00	0.00	.02	.23	.31	.33	.13
MN	0.00	.52	.47	.01	0.00	.00	.18	.57	.18	.07
MO	0.00	.61	.38	.01	0.00	.00	.28	.56	.09	.07
NB	0.00	.48	.48	.03	0.00	.01	.21	.72	.06	.01
ND	0.00	.65	0.00	.15	0.00	.00	0.00	.55	.24	.21
SD	0.00	.64	0.00	.35	0.00	.00	0.00	.88	.08	.04
DE	0.00	.92	0.00	0.00	0.00	.00	.04	.26	.35	.35
FL	0.00	.46	.47	.00	0.00	.07	.51	.38	.10	.02
GA	0.00	.52	.44	.03	0.00	.01	.24	.49	.25	.02
MD	0.00	.45	.49	.02	0.00	.04	0.00	.32	.64	.04
NC	0.00	.53	.44	.04	0.00	.00	0.00	.88	.47	.05
SC	0.00	.39	.55	.03	0.00	.01	.18	.54	.26	.03
VA	0.00	.40	.55	.01	0.00	.04	0.00	.48	.48	.04
WV	0.00	.99	0.00	.00	0.00	.00	.00	.91	.06	.03
KY	0.00	.98	0.00	.02	0.00	.00	.05	.70	.11	.15
TN	0.00	.54	.39	.06	0.00	.00	.75	.13	.05	.06
AL	0.00	.49	.43	.03	0.00	.00	.42	.47	.10	.02
MS	0.00	.52	.42	0.00	0.00	.06	.20	.57	.13	.11
OK	0.00	.42	.41	.05	0.00	.13	0.00	.28	.42	.29
AR	0.00	.32	.59	.06	0.00	.03	0.00	.48	.50	.03
LA	0.00	.45	.47	0.00	0.00	.08	.05	.29	.55	.11
TX	0.00	.47	.45	.00	.00	.09	.05	.35	.49	.10
AZ	0.00	.46	.39	.12	0.00	.03	.03	.60	.37	.00
CO	0.00	.75	.22	.02	0.00	.01	0.00	.75	.20	.05
ID	0.00	.55	0.00	.43	0.00	.02	0.00	.80	.18	.01
MT	0.00	.66	0.00	.33	.00	.00	0.00	.51	.37	.12
NV	0.00	.93	0.00	.05	0.00	.01	0.00	.94	.04	.02
NM	0.00	.98	0.00	.00	0.00	.02	.26	.59	.11	.04
UT	0.00	.95	0.00	.04	0.00	.00	0.00	.65	.28	.07
WY	0.00	.95	0.00	.04	0.00	.00	0.00	.67	.24	.09
CA	0.00	.33	.47	.06	.03	.11	.03	.02	.80	.15
OR	0.00	.28	.39	.32	.00	0.00	.30	.30	.12	.08
WA	0.00	.24	.32	.44	0.00	.00	.21	.33	.26	.19
AK	.03	.79	0.00	.15	0.00	.03	.65	.23	.09	.03
HI	0.00	0.00	0.00	.00	.01	.93	.15	0.00	.62	.22

Figure 2-4. Sample Tape 4 Input (Cont'd)

FUEL MIX FRACTIONS FOR 2015

	I-----ELECTRIC ENERGY-----I					II-----THERMAL ENERGY-----I				
	NAT'L GAS	COAL	NUCLEAR	HYDRO	OTHER	OIL	NAT'L GAS	COAL	OIL	OTHER
CT	2.00	.29	.62	.00	0.00	.09	.07	.08	.83	.03
ME	0.00	0.00	.88	.06	0.00	.06	.05	.01	.93	.01
MA	0.00	.36	.61	.00	0.00	.02	.03	.12	.82	.03
NH	0.00	.26	.69	.04	0.00	0.00	.02	.01	.93	.04
RI	0.00	0.00	1.00	0.00	0.00	0.00	.32	.02	.65	.02
VT	0.00	0.00	.94	.06	0.00	0.00	0.00	.02	.95	.04
NJ	0.00	.40	.55	0.00	0.00	.05	.14	.27	.45	.15
NY	0.00	.32	.49	.11	0.00	.08	.23	.35	.40	.02
PA	0.00	.52	.45	.00	0.00	.02	.37	.40	.12	.10
IL	0.00	.50	.49	.00	0.00	.01	.03	.60	.19	.18
IN	0.00	.61	.39	.00	0.00	.00	0.00	.67	.23	.10
MI	0.00	.50	.48	.01	0.00	.02	0.00	.89	.08	.03
OH	0.00	.58	.41	0.00	0.00	.00	0.00	.68	.23	.10
WI	0.00	.53	.45	.01	0.00	.00	.03	.91	.04	.02
IA	0.00	.53	.45	.01	.00	.00	.56	.41	.01	.01
KS	0.00	.55	.43	0.00	0.00	.01	.09	.39	.39	.12
MN	0.00	.49	.50	.01	0.00	.00	.17	.59	.17	.07
MO	0.00	.57	.42	.01	0.00	.00	.26	.57	.09	.07
NB	0.00	.46	.51	.02	0.00	.01	.16	.77	.06	.01
ND	0.00	.86	0.00	.14	0.00	.00	0.00	.55	.24	.21
SD	0.00	.66	0.00	.34	0.00	.00	0.00	.88	.08	.04
DE	0.00	.95	0.00	0.00	0.00	.05	.04	.28	.34	.34
FL	0.00	.45	.51	.00	0.00	.04	.43	.46	.09	.02
GA	0.00	.49	.48	.02	0.00	.01	.20	.54	.24	.02
MD	0.00	.43	.53	.02	0.00	.02	0.00	.34	.63	.04
NC	0.00	.50	.47	.03	0.00	.00	0.00	.49	.46	.05
SC	0.00	.38	.58	.03	0.00	.01	.13	.58	.25	.03
VA	0.00	.39	.58	.01	0.00	.03	0.00	.50	.47	.04
WV	0.00	.99	0.00	.00	0.00	.00	0.00	.92	.06	.03
KY	0.00	.98	0.00	.02	0.00	.00	0.00	.74	.11	.15
TN	0.00	.51	.43	.05	0.00	.00	.22	.05	.06	.07
AL	0.00	.47	.46	.07	0.00	.00	.39	.50	.09	.02
MS	0.00	.50	.46	0.00	0.00	.05	.16	.62	.12	.10
OK	0.00	.41	.47	.04	0.00	.08	0.00	.27	.42	.31
AR	0.00	.31	.62	.05	0.00	.02	0.00	.48	.49	.02
LA	0.00	.43	.51	0.00	0.00	.06	.04	.30	.55	.11
TX	0.00	.45	.50	.00	.00	.05	.03	.37	.50	.10
AZ	0.00	.44	.43	.10	0.00	.02	.13	.56	.30	.00
CO	0.00	.71	.26	.02	0.00	.01	.03	.69	.19	.05
ID	0.00	.62	0.00	.36	0.00	.02	.01	.81	.17	.01
MT	0.00	.70	0.00	.30	.00	.00	.02	.52	.35	.11
NV	0.00	.94	0.00	.05	0.00	.01	0.00	.94	.04	.02
NM	0.00	.99	0.00	.00	0.00	.01	.35	.50	.11	.04
UT	0.00	.96	0.00	.04	0.00	.00	0.00	.67	.26	.07
WY	0.00	.95	0.00	.04	0.00	.00	0.00	.62	.23	.09
CA	0.00	.34	.51	.05	.02	.07	0.00	.03	.83	.14
OR	0.00	.29	.42	.29	.03	0.00	.28	.32	.12	.28
WA	0.00	.24	.35	.40	0.00	.00	.17	.38	.26	.19
AK	0.00	.68	.18	.13	0.00	.03	.60	.29	.09	.03
HI	0.00	0.00	.19	.00	.02	.20	.15	0.00	.64	.21

Figure 2-4. Sample Tape 4 Input (Cont'd)

Table 2-1. Sherman H. Clark Ordering of States

New England	Mountain
Connecticut	Arizona
Maine	Colorado
Massachusetts	Idaho
New Hampshire	Montana
Rhode Island	Nevada
Vermont	New Mexico
	Utah
Middle Atlantic	Wyoming
New Jersey	Pacific
New York	California
Pennsylvania	Oregon
	Washington
East North Central	Alaska
Illinois	Hawaii
Indiana	
Michigan	
Ohio	
Wisconsin	
West North Central	
Iowa	
Kansas	
Minnesota	
Missouri	
Nebraska	
North Dakota	
South Dakota	
South Atlantic	
Delaware	
Florida	
Georgia	
Maryland and Washington, D.C.	
North Carolina	
South Carolina	
Virginia	
West Virginia	
East South Central	
Kentucky	
Tennessee	
Alabama	
Mississippi	
West South Central	
Oklahoma	
Arkansas	
Louisiana	
Texas	

CEI levelized electric energy prices used in STES simulation for developing polynomial performance relationships as functions of T/E demand ratio, insulation and phasing pattern in units of mills per kilowatt-hour. (default = 44)

CTI levelized thermal energy prices used in STES simulation for developing polynomial performance relationships as functions of T/E demand ratio, insulation and phasing pattern in units of dollars per million Btu's. (default = 5)

ET boiler efficiency. (default = .8)

EU utility efficiency. (default = .3)

FCR fixed charge rate used in the ideal STES simulation. (default = .15)

IPRINT intermediate print flag. If IPRINT is 0, then no intermediate printout is printed. If IPRINT is 1, then six lines are printed for each application in each state for each time period. This intermediate printout contains ECR and FD parameters. Warning: Approximately 2000 pages of output are generated when IPRINT is 1. (default = 0)

TITLE a 30 character title that appears at the start of the output. (default = BASELINE TEST CASE)

The NAMELIST inputs are followed by the industry characteristics inputs which are a deck of 140 cards, one for each industry, containing phasing pattern, T/E demand ratio, and fraction absorption cooling. Phasing pattern appears in columns 39 and 40 in F2.0 format. Allowable values for phasing pattern are 1, 2, or 3. T/E demand ratio is in columns 41 to 50 in F10.1 format. Fraction absorption cooling is in columns 51 to 52 in F2.0 format. The cards must be in order by SIC code; i.e., the first card contains data for industry 201 and the last card contains data for industry 399. Note that these industry characteristics are used for all states and all time periods.

The last input stream deck is the energy price forecast inputs, which are derived from the Sherman H. Clark price data by the LEAPC program (See Appendix C). This deck contains 100 cards with 2 cards for each state. The first card gives 30-year levelized electric prices for 7 time periods starting at year 1985, 1990, 1995, 2000, 2005, 2010, and 2015. This card contains the state abbreviation in columns 1 and 2 followed by the

NAMELIST and Industry Characteristics Inputs

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$IN
  ACR=.12, ALPHA=5., CEI=44., CTI=5., ET=.8, EU=.3, FCR=.15,
  IPRINT=0, TITLE(1)=10HBASELINE T, TITLE(2)=10HEST CASE ,
$END
201MEAT PRODUCTS 1 3.6
202DAIRY PRODUCTS 1 4.5
203PRESERVED FRUITS AND VEGETABLES 1 6.7
204GRAIN MILL PRODUCTS 1 5.6
205BAKERY PRODUCTS 1 5.2
206SUGAR, CONFECTIONERY PRODUCTS 3 12.7
207FATS AND OILS 1 8.6
208BEVERAGES 1 6.4
209MISC. FOODS, KINDRED PRODUCTS 1 4.2
211CIGARETTES 1 5.1
212CIGARS 1 1.0
213CHEWING AND SMOKING TOBACCO 1 5.0
214TOBACCO STEMMING AND REDRYING 1 4.5
221WEAVING MILLS, COTTON 1 1.2
222WEAVING MILLS, MANMADE FIBER 1 1.3
223WEAVING, FINISHING MILLS, WOOL 1 3.4
224NARROW FABRIC MILLS 1 2.2
225KNITTING MILLS 1 3.2
226TEXTILE FINISHING, EXCEPT WOOL 1 9.3
227FLOOR COVERING MILLS 1 7.7
228YARN AND THREAD MILLS 1 .9
229MISCELLANEOUS TEXTILE GOODS 1 2.8
231MEN'S AND BOYS' SUITS AND COATS 1 2.8
232MEN'S AND BOYS' FURNISHINGS 1 1.8
233WOMEN'S AND MISSES' OUTERWEAR 1 2.0
234WOMEN'S, CHILDREN'S UNDERGARMS 1 1.1
235HATS, CAPS, AND MILLINERY 1 2.7
236CHILDREN'S OUTERWEAR 1 1.1
238MISC. APPAREL AND ACCESSORIES 1 1.8
239MISC. FABRICATED TEXTILE PRODS 1 3.1
241LOGGING CAMPS, LOG CONTRACTORS 1 50.6
242SAWMILLS AND PLANING MILLS 1 2.4
243MILLWORK, PLYWOOD, STRUC. MEMBS 1 3.4
244WOOD CONTAINERS 1 3.5
245WOOD BUILDINGS AND MOBILE HOMES 1 5.4
249MISCELLANEOUS WOOD PRODUCTS 1 4.6
251HOUSEHOLD FURNITURE 1 2.7
252OFFICE FURNITURE 1 3.6
253PUBLIC BLDG., RELATED FURNITURE 1 3.6
254PARTITIONS AND FIXTURES 1 4.0
259MISC. FURNITURE AND FIXTURES 1 4.9
261PULPMILLS 1 3.6
262PAPERMILLS, EXC. BUILDING PAPER 1 3.5
263PAPERBOARD MILLS 1 4.8
264MISC. CONVERTED PAPER PRODUCTS 1 2.8
265PAPERBOARD CONTAINERS AND BOXES 1 3.4
266BUILDING PAPER AND BOARD MILLS 1 8.6
271NEWSPAPERS 1 1.3
272PERIODICALS 1 .7
273BOOKS 1 2.1
274MISCELLANEOUS PUBLISHING 1 2.1
275COMMERCIAL PRINTING 1 2.7
276MANIFOLD BUSINESS FORMS 1 1.6
277GREETING CARD PUBLISHING 1 1.1
278BLANKBOOKS AND BOOKBINDING 1 1.7
279PRINTING TRADE SERVICES 1 1.1
281INDUSTRIAL INORGANIC CHEMICALS 1 1.7
282PLASTICS MATERIALS, SYNTHETICS 1 7.3
283DRUGS 1 4.8
284SOAPS, CLEANERS, TOILET GOODS 1 7.1
285PAINTS AND ALLIED PRODUCTS 1 4.3
286INDUSTRIAL ORGANIC CHEMICALS 1 8.7
287AGRICULTURAL CHEMICALS 1 10.2
289MISCELLANEOUS CHEMICAL PRODUCTS 1 11.2
291PETROLEUM REFINING 1 15.8
295PAVING AND ROOFING MATERIALS 1 15.8
299MISC. PETROLEUM, COAL PRODUCTS 1 18.8
301TIRES AND INNER TUBES 3 4.3
302RUBBER AND PLASTICS FOOTWEAR 3 2.4

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Figure 2-5. Sample Tape 5 Input

Industry Characteristics Input

304RUBBER, PLASTICS HOSE, BELTING	3	5.2
306FABRICATED RUBBER PRODUCTS, NEC	1	3.9
307MISCELLANEOUS PLASTICS PRODUCTS	1	2.0
311LEATHER TANNING AND FINISHING	1	11.3
313BOOT, SHOE CUT STOCK, FINDINGS	1	1.9
314FOOTWEAR, EXCEPT RUBBER	1	1.3
315LEATHER GLOVES AND MITTENS	1	4.4
316LUGGAGE	1	2.0
317WOMEN'S HANDBAGS AND PURSES	1	1.2
321FLAT GLASS	3	14.5
322GLASS, PRESSED OR BLOWN	3	9.4
323PRODUCTS OF PURCHASED GLASS	3	4.5
324CEMENT, HYDRAULIC	3	13.6
325STRUCTURAL CLAY PRODUCTS	3	24.7
326POTTERY AND RELATED PRODUCTS	3	10.8
327CONCRETE, GYPSUM, PLASTER PRODS	3	20.1
328CUT STONE AND STONE PRODUCTS	3	2.8
329MISC. NONMETALLIC MINERAL PRODS	3	2.6
331BLAST FURNACE, BASIC STEEL PROD	3	5.2
332IRON AND STEEL FOUNDRIES	3	3.7
333PRIMARY NONFERROUS METALS	3	.6
334SECONDARY NONFERROUS METALS	3	14.1
335NONFERROUS ROLLING AND DRAWING	3	3.4
336NONFERROUS FOUNDRIES	3	4.8
339MISC. PRIMARY METAL PRODUCTS	3	5.7
341METAL CANS, SHIPPING CONTAINERS	1	4.9
342CUTLERY, HANDTOOLS AND HARDWARE	1	3.7
343PLUMBING, HEATING, EXCEPT ELEC	1	4.7
344FABRICATED STRUC. METAL PRODS	1	3.6
345SCREW MACHINE PROD., BOLTS, ETC	1	2.7
346METAL FORGINGS AND STAMPINGS	1	4.6
347METAL SERVICES, NEC	1	3.3
348ORDNANCE AND ACCESSORIES, NEC	1	3.7
349MISC. FABRICATED METAL PRODUCTS	1	3.0
351ENGINES AND TURBINES	1	3.0
352FARM AND GARDEN MACHINERY	1	5.5
353CONSTRUCTION, RELATED MACHINERY	1	3.7
354METALWORKING MACHINERY	1	2.6
355SPECIAL INDUSTRY MACHINERY	1	3.0
356GENERAL INDUSTRIAL MACHINERY	1	3.0
357OFFICE AND COMPUTING MACHINES	1	1.1
358REFRIGERATION AND SERVICE MACH	1	3.5
359MISC. MACHINERY, EXC. ELEC	1	3.2
361ELECTRIC DISTRIBUTING EQUIPMENT	1	2.0
362ELECTRICAL INDUSTRIAL APPARATUS	1	2.1
363HOUSEHOLD APPLIANCES	1	3.6
364ELEC. LIGHTING, WIRING EQUIP	1	2.8
365RADIO, TV RECEIVING EQUIPMENT	1	2.2
366COMMUNICATION EQUIPMENT	1	1.3
367ELECTRONIC COMPONENTS, ACCESS	1	1.2
369MISC. ELEC. EQUIPMENT, SUPPLIES	1	2.1
371MOTOR VEHICLES AND EQUIPMENT	1	3.5
372AIRCRAFT AND PARTS	1	2.0
373SHIP, BOAT BUILDING, REPAIRING	1	2.3
374RAILROAD EQUIPMENT	1	1.3
375MOTORCYCLES, BICYCLES, PARTS	1	2.8
376GUIDED MISSILES, SPACE VEHICLES	1	1.3
379TRANSPORTATION EQUIPMENT, NEC	1	3.2
381ENGINEERING, SCIENTIFIC INSTRU	1	1.8
382MEASURING, CONTROLLING DEVICES	1	1.6
383OPTICAL INSTRUMENTS AND LENSES	1	1.6
384MEDICAL INSTRUMENTS, SUPPLIES	1	2.4
385OPHTHALMIC GOODS	1	4.4
386PHOTOGRAPHIC EQUIP., SUPPLIES	1	8.4
387WATCHES, CLOCKS, AND WATCHCASES	1	2.1
391JEWELRY, SILVER AND PLATED WARE	1	2.8
393MUSICAL INSTRUMENTS	1	3.7
394TOYS AND SPORTING GOODS	1	2.5
395PENS, OFFICE AND ART GOODS	1	2.6
396COSTUME JEWELRY AND NOTIONS	1	1.9
399MISCELLANEOUS MANUFACTURES	1	3.5

Figure 2-5. Sample Tape 5 Input (Cont'd)

Energy Price Forecast Inputs

NC	44.12	49.17	53.82	57.96	61.44	63.94	64.98
NC	3.70	3.93	4.07	4.11	4.16	4.24	4.28
SC	39.29	45.21	50.62	55.37	59.27	61.96	63.00
SC	3.67	3.95	4.10	4.12	4.15	4.20	4.23
VA	40.57	45.52	50.26	54.38	57.62	59.95	60.99
VA	3.52	3.78	3.98	4.11	4.20	4.29	4.33
WV	50.49	56.73	62.67	68.17	72.68	75.78	77.00
WV	2.93	3.24	3.43	3.56	3.69	3.81	3.88
KY	43.79	49.27	54.47	59.17	63.02	65.78	67.00
KY	2.87	2.98	3.04	3.05	3.09	3.12	3.15
TN	38.66	43.10	47.35	51.18	54.28	56.30	57.00
TN	3.81	4.20	4.46	4.56	4.61	4.65	4.70
AL	36.94	41.93	46.65	50.96	54.44	56.94	57.99
AL	3.34	3.56	3.69	3.73	3.75	3.79	3.80
MS	42.13	46.13	50.02	53.55	56.62	58.95	60.00
MS	3.33	3.44	3.47	3.45	3.44	3.45	3.46
OK	45.65	50.19	53.79	57.17	60.04	62.13	63.00
OK	3.75	4.03	4.09	3.93	3.69	3.76	3.79
AR	36.77	41.11	45.44	49.38	52.62	54.96	56.01
AR	3.46	3.56	3.60	3.59	3.63	3.69	3.72
LA	43.67	48.07	51.86	55.56	58.63	60.97	62.01
LA	3.59	3.83	3.95	3.96	3.95	3.98	3.99
TX	43.84	47.76	51.24	54.60	57.54	59.77	60.99
TX	3.54	3.77	3.85	3.83	3.81	3.85	3.87
AZ	41.14	45.75	50.41	54.79	58.45	60.97	62.01
AZ	3.10	3.13	3.06	3.06	3.15	3.26	3.32
CO	40.68	45.68	50.41	54.88	58.92	61.96	63.00
CO	2.41	2.46	2.36	2.43	2.61	2.76	2.87
ID	24.00	28.96	33.72	38.41	42.85	45.78	47.00
ID	2.40	2.45	2.38	2.32	2.46	2.58	2.63
MT	30.23	34.94	39.00	42.96	46.44	48.95	50.00
MT	3.12	3.14	3.10	3.09	3.14	3.20	3.23
NV	34.06	39.34	44.43	49.33	53.67	56.77	57.99
NV	2.29	2.15	1.81	1.85	2.03	2.18	2.24
NM	39.57	45.17	50.64	55.92	60.49	63.76	64.98
NM	3.06	3.20	3.06	2.87	3.03	3.31	3.43
UT	41.98	46.47	50.97	55.15	58.69	61.14	62.01
UT	2.75	2.75	2.65	2.64	2.73	2.80	2.83
WY	36.06	40.73	44.59	48.36	52.03	54.79	56.01
WY	2.83	2.72	2.63	2.58	2.68	2.76	2.79
CA	42.28	46.45	50.21	53.34	56.04	58.14	59.01
CA	4.21	4.52	4.69	4.74	4.72	4.71	4.72
OR	29.97	34.07	37.55	40.78	43.46	45.31	46.01
OR	3.89	4.10	4.14	4.00	4.04	4.09	4.12
WA	25.89	30.41	34.15	37.41	40.21	42.13	43.00
WA	3.94	4.11	4.14	4.01	4.00	4.02	4.02
AK	26.19	27.16	28.04	28.80	29.41	29.83	30.00
AK	1.52	1.68	1.85	2.05	2.24	2.38	2.43
HI	3.93	69.40	74.33	78.47	81.73	84.02	84.98
HI	5.33	5.64	5.89	6.02	6.07	6.10	6.11

Figure 2-5. Sample Tape 5 Input (Cont'd)

Energy Price Forecast Inputs

CT	44.61	49.35	53.60	57.37	60.61	62.95	63.99
CT	4.14	4.43	4.66	4.77	4.80	4.83	4.85
ME	37.52	42.01	46.17	49.95	53.44	55.95	57.00
ME	3.80	4.04	4.23	4.33	4.37	4.39	4.39
MA	53.27	57.84	62.00	65.75	68.87	71.14	72.01
MA	4.15	4.42	4.61	4.69	4.70	4.72	4.74
NH	35.99	42.17	48.48	54.59	59.83	63.42	64.98
NH	4.18	4.47	4.67	4.75	4.76	4.75	4.75
RI	45.88	50.42	54.56	58.54	62.27	64.96	66.01
RI	4.24	4.57	4.79	4.89	4.90	4.93	4.95
VT	42.07	49.40	56.30	61.40	65.61	68.61	70.00
VT	4.22	4.47	4.59	4.69	4.70	4.70	4.70
NJ	48.66	54.85	60.47	65.39	69.60	72.60	73.99
NJ	4.26	4.54	4.68	4.66	4.62	4.63	4.63
NY	45.73	51.72	57.44	62.58	66.84	69.77	70.99
NY	4.17	4.48	4.64	4.63	4.60	4.61	4.62
PA	43.58	49.32	54.62	59.58	63.84	66.77	67.99
PA	4.09	4.44	4.61	4.61	4.60	4.61	4.62
IL	43.83	49.32	54.40	59.00	63.02	65.78	67.00
IL	3.20	3.29	3.33	3.41	3.54	3.65	3.71
IN	44.12	49.17	53.82	57.96	61.44	63.94	64.98
IN	3.29	3.46	3.55	3.58	3.64	3.70	3.74
MI	41.22	46.29	50.97	55.15	58.69	61.14	62.01
MI	3.17	3.25	3.23	3.21	3.30	3.42	3.47
OH	44.65	49.79	54.46	58.72	62.27	64.96	66.01
OH	3.36	3.53	3.61	3.61	3.66	3.71	3.75
WI	45.95	50.57	55.02	58.99	62.03	64.11	64.98
WI	2.64	2.73	2.76	3.00	3.21	3.37	3.45
IA	46.30	51.56	56.63	61.38	65.28	67.96	69.01
IA	3.72	4.09	4.19	4.14	4.21	4.26	4.29
KS	43.62	48.66	53.39	57.54	61.26	63.94	64.98
KS	3.99	4.30	4.30	4.18	4.13	4.06	4.02
MN	44.78	49.74	54.40	58.79	62.45	64.96	66.01
MN	3.39	3.57	3.56	3.54	3.65	3.73	3.78
MO	44.67	50.04	54.96	59.36	63.26	65.95	67.00
MO	3.43	3.65	3.67	3.59	3.71	3.79	3.83
NB	42.55	48.78	54.07	58.36	62.03	64.79	66.01
NB	3.51	3.62	3.56	3.43	3.48	3.52	3.55
ND	42.23	46.65	50.85	54.78	58.21	60.79	62.01
ND	2.60	2.83	3.04	3.23	3.38	3.50	3.55
SD	37.25	42.95	48.28	52.93	56.84	59.77	60.99
SD	2.72	2.76	2.80	2.77	2.98	3.14	3.21
DE	54.75	60.75	66.04	70.76	74.86	77.79	79.01
DE	3.95	4.17	4.30	4.36	4.41	4.46	4.49
FL	45.53	49.72	53.85	57.55	60.61	62.95	63.99
FL	4.65	5.00	5.10	4.98	4.83	4.78	4.77
GA	40.11	45.12	49.67	53.76	57.34	59.91	60.99
GA	3.85	4.13	4.24	4.22	4.21	4.24	4.27
MD	42.54	47.88	52.89	57.35	61.01	63.76	64.98
MD	3.79	4.04	4.22	4.32	4.38	4.44	4.46

Figure 2-5. Sample Tape 5 Input (Cont'd)

electric prices in mills per kilowatt hours for 7 time periods in 7F10.2 format in columns 11 to 80. The second card gives 30-year levelized thermal energy prices for the same 7 time periods. This card contains the state abbreviation in columns 1 and 2 followed by the thermal prices in dollars per million Btu's for 7 time periods in 7F10.2 format in columns 11 to 80. All price data are in 1977 dollars.

2.2.4 Preprocessed Input Data

The preprocessed input data consists of industry names and SIC codes, insolation values, tables of quadratic coefficients, a table of ECR modification factors and a table of median turbine size for industry groups. The industry names and SIC codes in Table 2-2 were extracted from the 1974 Survey of Manufacturers tape. Table 2-3 contains the daily direct insolation (I) by state. Data from a forthcoming Solar Energy Handbook by Dr. A. D. Watt was used to develop the insolation values on a state basis. Tables 2-4, 2-5, and 2-6 contain quadratic coefficients for ECR, FD, and R versus I for three phasing patterns and eight T/E demand ratios. These coefficients were computed by fitting a quadratic curve to STES output. Table 2-7 contains ECR modification factors as a function of time and turbine size. For example, ECR modification factor 2.12 corresponds to time period $t = 1985$ and turbine size = 500 kWe for some industry group ig . This factor is to be multiplied by the ECR value obtained from STES simulation of 500 kWe turbine to obtain the modified ECR (see equation 2-9). This table is based upon an original cost of \$2690/kWe for an ideal STES (with most favorable T/E demand ratio) at Albuquerque insolation. Table 2-8 contains median turbine size for each two digit SIC category. See Reference 2, page VI-27 paragraph 1 for assumptions leading to the median turbine size for each industry. See Reference 2, pages VI-3 through VI-12 for further details of how the input data is derived.

2.3 SAMDGP Outputs

The outputs of SAMDGP are a magnetic tape (tape 2) and printed output.

Table 2-2. Industry Name and SIC Codes

201MEAT PRODUCTS	306FABRICATED RUBBER PRODUCTS, NEC
202DAIRY PRODUCTS	307MISCELLANEOUS PLASTICS PRODUCTS
203PRESERVED FRUITS AND VEGETABLES	311LEATHER TANNING AND FINISHING
204GRAIN MILL PRODUCTS	312BOOT, SHOE, CUT STOCK, FINDINGS
205BAKERY PRODUCTS	314FOOTWEAR, EXCEPT RUBBER
206SUGAR, CONFECTIONERY PRODUCTS	315LEATHER GLOVES AND MITTENS
207FATS AND OILS	316LUGGAGE
208BEVERAGES	317WOMEN'S HANDBAGS AND PURSES
209MISC. FOODS, KINDRED PRODUCTS	321FLAT GLASS
211CIGARETTES	322GLASS, PRESSED OR BLOWN
212CIGARS	323PRODUCTS OF PURCHASED GLASS
213CHEWING AND SMOKING TOBACCO	324CEMENT, HYDRAULIC
214TOBACCO STEMMING AND REDRYING	325STRUCTURAL CLAY PRODUCTS
221WEAVING MILLS, COTTON	326POTTERY AND RELATED PRODUCTS
222WEAVING MILLS, MANMADE FIBER	327CONCRETE, GYPSUM, PLASTER PRODS
223WEAVING, FINISHING MILLS, WOOL	328CUT STONE AND STONE PRODUCTS
224NARROW FABRIC MILLS	329MISC. NONMETALLIC MINERAL PRODS
225KNITTING MILLS	331RAST FURNACE, BASIC STEEL PROD
226TEXTILE FINISHING, EXCEPT WOOL	332IRON AND STEEL FOUNDRIES
227FLOOR COVERING MILLS	333PRIMARY NONFERROUS METALS
228YARN AND THREAD MILLS	334SECONDARY NONFERROUS METALS
229MISCELLANEOUS TEXTILE GOODS	335NONFERROUS ROLLING AND DRAWING
231MEN'S AND BOYS' SUITS AND COATS	336NONFERROUS FOUNDRIES
232MEN'S AND BOYS' FURNISHINGS	339MISC. PRIMARY METAL PRODUCTS
233WOMEN'S AND MISSES' OUTERWEAR	341METAL CANS, SHIPPING CONTAINERS
234WOMEN'S, CHILDREN'S UNDERGARMS	342CUTLERY, HANDTOOLS AND HARDWARE
235SHATS, CAPS, AND MILLINERY	343PLUMBING, HEATING, EXCEPT ELEC
236CHILDREN'S OUTERWEAR	344FABRICATED STRUC. METAL PRODS
238MISC. APPAREL AND ACCESSORIES	345SCREW MACHINE PROD., BOLTS, ETC
239MISC. FABRICATED TEXTILE PRODS	346METAL FORGINGS AND STAMPINGS
241LOGGING CAMPS, LOG CONTRACTORS	347METAL SERVICES, NEC
242SAWMILLS AND PLANING MILLS	348ORDNANCE AND ACCESSORIES, NEC
243MILLWORK, PLYWOOD, STRUC. MEMRS	349MISC. FABRICATED METAL PRODUCTS
244WOOD CONTAINERS	351ENGINES AND TURBINES
245WOOD BUILDINGS AND MOBILE HOMES	352FARM AND GARDEN MACHINERY
249MISCELLANEOUS WOOD PRODUCTS	353CONSTRUCTION, RELATED MACHINERY
251HOUSEHOLD FURNITURE	354METALWORKING MACHINERY
252OFFICE FURNITURE	355SPECIAL INDUSTRY MACHINERY
253PUBLIC BLDG., RELATED FURNITURE	356GENERAL INDUSTRIAL MACHINERY
254PARTITIONS AND FIXTURES	357OFFICE AND COMPUTING MACHINES
259MISC. FURNITURE AND FIXTURES	358REFRIGERATION AND SERVICE MACH
261PULPMILLS	359MISC. MACHINERY, EXC. ELEC
262PAPERMILLS, ETC. BUILDING PAPER	361ELECTRIC DISTRIBUTING EQUIPMENT
263PAPERBOARD MILLS	362ELECTRICAL INDUSTRIAL APPARATUS
264MISC. CONVERTED PAPER PRODUCTS	363HOUSEHOLD APPLIANCES
265PAPERBOARD CONTAINERS AND BOXES	364ELEC. LIGHTING, WIRING EQUIP
266BUILDING PAPER AND BOARD MILLS	365RADIO, TV RECEIVING EQUIPMENT
271NEWSPAPERS	366COMMUNICATION EQUIPMENT
272PERIODICALS	367ELECTRONIC COMPONENTS, ACCESS
273BOOKS	369MISC. ELEC. EQUIPMENT, SUPPLIES
274MISCELLANEOUS PUBLISHING	371MOTOR VEHICLES AND EQUIPMENT
275COMMERCIAL PRINTING	372AIRCRAFT AND PARTS
276MANIFOLD BUSINESS FORMS	373SHIP, BOAT BUILDING, REPAIRING
277GREETING CARD PUBLISHING	374RAILROAD EQUIPMENT
278BLANKBOOKS AND BOOKBINDING	375MOTORCYCLES, BICYCLES, PARTS
279PRINTING TRADE SERVICES	376GUIDED MISSILES, SPACE VEHICLES
281INDUSTRIAL INORGANIC CHEMICALS	377TRANSPORTATION EQUIPMENT, NEC
282PLASTICS MATERIALS, SYNTHETICS	381ENGINEERING, SCIENTIFIC INSTRUM
283DRUGS	382MEASURING, CONTROLLING DEVICES
284SOAPS, CLEANERS, TOILET GOODS	383OPTICAL INSTRUMENTS AND LENSES
285PAINTS AND ALLIED PRODUCTS	384MEDICAL INSTRUMENTS, SUPPLIES
286INDUSTRIAL ORGANIC CHEMICALS	385OPHTHALMIC GOODS
287AGRICULTURAL CHEMICALS	386PHOTOGRAPHIC EQUIP., SUPPLIES
289MISCELLANEOUS CHEMICAL PRODUCTS	387WATCHES, CLOCKS, AND WATERCASES
291PETROLEUM REFINING	389JEWELRY, SILVER AND PLATED WARE
295PAVING AND ROOFING MATERIALS	391MUSICAL INSTRUMENTS
299MISC. PETROLEUM, COAL PRODUCTS	394TOYS AND SPORTING GOODS
301TIRES AND INNER TIRES	395PENS, OFFICE AND ART GOODS
302RUBBER AND PLASTICS FOOTWEAR	396COSTUME JEWELRY AND NOTIONS
304RUBBER, PLASTICS HOSE, BELTING	399MISCELLANEOUS MANUFACTURES

Table 2-3. Statewide Daily Direct Insolation Values
(in kWh/m²-day) for the STES Analysis

City	Direct Insolation	Total Hemispheric Insolation	City	Direct Insolation	Total Hemispheric Insolation
Alabama	4.0	4.6	Nebraska	5.5	4.6
Alaska	3.6	2.5	Nevada	6.5	5.3
Arizona	7.5	5.9	New Hampshire	3.6	3.8
Arkansas	4.8	4.6	New Jersey	3.9	3.9
California	6.5	5.3	New Mexico	6.5	5.4
Colorado	6.0	5.0	New York	3.8	3.8
Connecticut	3.9	3.8	North Carolina	3.7	4.6
Delaware	3.8	4.1	North Dakota	5.0	4.2
Florida	4.1	5.2	Ohio	4.0	4.0
Georgia	4.0	4.7	Oklahoma	5.5	4.8
Hawaii	6.7	5.6	Oregon	3.7	4.5
Idaho	5.1	4.6	Pennsylvania	3.7	3.8
Illinois	4.1	4.0	Rhode Island	4.0	4.0
Indiana	4.3	4.0	South Carolina	4.0	4.6
Iowa	4.7	4.2	South Dakota	5.0	4.4
Kansas	5.6	4.7	Tennessee	4.0	4.4
Kentucky	4.0	4.2	Texas	5.0	5.2
Louisiana	4.0	4.8	Utah	5.8	5.0
Maine	3.7	3.8	Vermont	3.6	3.5
Maryland	3.6	4.1	Virginia	3.6	4.2
Massachusetts	4.0	4.0	Washington	3.2	4.0
Michigan	3.7	3.7	West Virginia	3.5	4.1
Minnesota	4.5	4.0	Wisconsin	4.0	3.7
Mississippi	4.3	4.7	Wyoming	5.5	4.7
Missouri	5.0	4.3	Puerto Rico	6.3	5.6
Montana	5.0	4.2	District of Columbia	3.6	4.1

Note: All contiguous United States values are from data of A. D. Watt; Alaska, Hawaii, and Puerto Rico estimates are based upon U. S. Department of Commerce data.

Table 2-4. Equivalent Cost Ratio (ECR) vs Average Daily
Direct Insolation (I), $ECR = A + B * I + C * I^2$

Phasing Pattern 1

T/E Demand Ratio	A	B	C
3.6444	2.515	-0.276	0.009
3.0000	2.674	-0.307	0.011
2.0000	2.907	-0.335	0.013
1.0000	3.214	-0.244	0.003
0.5000	4.619	-0.396	0.010
0.2500	8.778	-1.328	0.066
0.1250	10.933	-1.813	0.096
0.0625	11.869	-2.008	0.107

Phasing Pattern 2

T/E Demand Ratio	A	B	C
5.4667	2.387	-0.254	0.007
4.5000	2.519	-0.286	0.010
3.0000	2.715	-0.325	0.013
1.5000	2.874	-0.309	0.011
0.7500	3.366	-0.257	0.005
0.3750	5.506	-0.585	0.021
0.1875	8.000	-1.043	0.046
0.0937	9.787	-1.413	0.067

Phasing Pattern 3

T/E Demand Ratio	A	B	C
3.6444	2.557	-0.302	0.011
3.0000	2.519	-0.286	0.010
2.0000	2.727	-0.330	0.013
1.0000	2.874	-0.309	0.011
0.5000	3.336	-0.244	0.004
0.2500	5.506	-0.585	0.021
0.1250	8.247	-1.117	0.051
0.0625	9.725	-1.405	0.067

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Table 2-6. T/E Ratio of Displaced Energy (R) vs Average
Daily Direct Insolation (I), $R = A + B \cdot I + C \cdot I^2$

Phasing Pattern 1

T/E Demand Ratio	A	B	C
3.6444	5.003	2.024	-0.228
3.0000	7.553	-0.411	0.013
2.0000	3.503	0.861	-0.091
1.0000	6.176	-1.259	0.104
0.5000	1.618	-0.097	-0.001
0.2500	0.027	0.068	-0.005
0.1250	-0.028	0.029	-0.002
0.6250	0.430	-0.108	0.007

Phasing Pattern 2

T/E Demand Ratio	A	B	C
5.4667	12.340	-1.039	0.080
4.5000	8.611	0.214	-0.031
3.0000	0.432	3.166	-0.315
1.5000	6.635	-0.546	0.020
0.7500	1.703	0.227	-0.030
0.3750	2.001	-0.264	0.012
0.1875	1.195	-0.286	0.018
0.0937	1.244	-0.368	0.028

Phasing Pattern 3

T/E Demand Ratio	A	B	C
3.6444	12.025	-1.016	0.082
3.0000	7.966	0.330	-0.034
2.0000	-0.250	3.424	-0.337
1.0000	2.660	0.884	-0.097
0.5000	2.746	-1.367	0.251
0.2500	1.377	-0.090	-0.000
0.1250	1.234	-0.295	0.018
0.0625	3.963	-1.138	0.081

Table 2-7. ECR Modification Factor as Function of Turbine Size and Time

ECR MODIFICATION FACTOR
 BASED ON $\text{COST}_{\text{SIM}} = \$2690^*/\text{kW}_e$

	1985	1990	1995	2000-2015
10 KW	4.73	3.15	2.30	1.71
100 KW	2.59	1.59	1.14	0.85
500 KW	2.12	1.24	0.88	0.66
1 MW	1.93	1.14	0.81	0.60
10 MW	1.46	.81	.55	.37

* Total STES Cost for 500 kW_e Ideal Size (Albuquerque)

Table 2-8. Median Turbine Size for Industry Groups

SIC Code	Industry Group	Median Turbine Size (kWe)
20	Food/Kindred Products	240
21	Tobacco	292
22	Textile	250
23	Apparel	32
24	Lumber and Wood	147
25	Furniture and Fix	64.2
26	Paper and Allied	2000
27	Printing and Publish	43.4
28	Chemical and Allied Products	3650
29	Petroleum and Coal	1900
30	Rubber, Misc.	77.0
31	Leather and Leather Products	76
32	Stone, Clay, Glass	262
33	Primary Metal	1880
34	Fabricated Metal	122
35	Machinery	88.5
36	Electric, Electronic Equipment	153
37	Transportation	165
38	Instruments	85
39	Misc. Manufacturing	90

2.3.1 Tape 2 Output

Tape 2 is the SAM data base which contains ECR and FD information for every industry in every state. The tape is in binary format with seventeen values per record. See Table 2-9 for variables on the SAM data base tape. The data is in order by SIC code; i.e., all the state data for the first industry (SIC code 201) comes first, then all the data for the second industry (SIC code 202) comes next, etc. This tape contains seven files, one for each time period - 1985, 1990, ..., 2015.

2.3.2 Printed Output

Printed output consists of a title, list of input options, intermediate printout, and summary reports. The title is the first line at the beginning of the printed output. It contains the input title and the date and time. This is followed by a list of all the input options chosen (See NAMELIST inputs in Section 2.2.3). Figure 2-6 is a sample first page of the printed output.

```

                                     BASELINE TEST CASE                22.46      08/21/78
ACR =      .120E+00
ALPHA =    .500E+01
CEI =      .440E+02
CTI =      .500E+01
ET =       .800E+00
EU =       .300E+00
FCR =      .150E+00
IPRINT =    1
TITLE = BASELINE TEST CASE
```

Figure 2-6. Sample First Page of Printed Output (SAMDGP)

Intermediate printout is generated only when input option IPRINT is set to 1. Intermediate printout consists of six lines for each application in each state for each time period (See Figure 2-7). Information printed includes location and application names, ECR, FD percentage, T/E ratio for displaced energy, percent fuel displaced for thermal and electric energy, and quantity of fuel displaced in Btu's for each fuel type. Data appears in order by SIC code - SIC code 201 first, 202 next, etc. Note that

Table 2-9. Variables on SAM Data Base Tape

I	Location index (1 to 50)
J	Industry index (1 to 140)
ECR	ECR
FD	FD percentage
TFDT	Percent fuel displaced for thermal energy
TFDE	Percent fuel displaced for electric energy
AFDT (1 to 4)	Amount of fuel displaced for thermal energy in Btu's for fuels natural gas, oil, coal, and other
AFDE (1 to 6)	Amount of fuel displaced for electric energy in Btu's for fuels natural gas, oil, coal, nuclear, hydroelectric, and other
R	T/E ratio for displaced energy

intermediate printout takes up approximately 2000 pages and it is usually not desired.

Summary reports are always output by SAMDGP. For each of seven time periods, there are six summary reports:

1. Thermal energy displaced by location.
2. Electric energy displaced by location.
3. Combined thermal and electric energy displaced by location.
4. Thermal energy displaced by application.
5. Electric energy displaced by application.
6. Combined thermal and electric energy displaced by application.

The thermal to electric ratio of energy displaced by STES is given by polynomials obtained from STES simulation. It also provides polynomials for percents of total fuel displacement. This then enables one to calculate the amounts of thermal and electric energy displaced by STES. Details of this are given in Reference 2 page VI-18.

Each report contains energy in Btu's by fuel type and the total for all fuel types. See Tables 2-10 and 2-11 for sample summary reports.

2.4 SAMDGP Deck Structure and Control Cards

Figure 2-8 shows the deck structure for SAMDGP. The first three cards are installation dependent and are concerned with programmer identification, accounting numbers, and computer resources required for running the job. Cards 4 and 5 ask for the two inputs tapes. The next card notifies the system that an output tape will need poststaging at the end of the job. The next card directs printed output to the IBM 3800 printer at Aerospace. The MAP card requests that a load map be printed. The FTN card requests a compile using the Fortran Extended compiler with maximum optimization and a long symbolic reference map. The LDSET card specifies that memory is to be preset to zeros. The LGO card executes SAMDGP and requests that the print limit be increased to 130,000 lines.

LOCATION = ARIZONA APPLICATION = MEAT PRODUCTS

FUEL DISP		FUEL DISPLACED		APPLICATION = MEAT PRODUCTS						
ECR	PER CENT	R	PER CENT	BTU	NATL GAS	OIL	COAL	NUCLEAR	HYDROELEC	OTHER
2.63	65.63	7.21	THERM 83.39	1.32E+11	3.70E+10	8.04E+10	1.35E+10			7.12E+08
			ELECT 41.64	1.83E+10	0.	2.25E+09	9.19E+09	2.64E+09	4.19E+09	0.
			TOTAL	1.50E+11	3.70E+10	8.27E+10	2.27E+10	2.64E+09	4.19E+09	7.12E+08

LOCATION = ARKANSAS APPLICATION = MEAT PRODUCTS

FUEL DISP		FUEL DISPLACED		APPLICATION = MEAT PRODUCTS						
ECR	PER CENT	R	PER CENT	BTU	NATL GAS	OIL	COAL	NUCLEAR	HYDROELEC	OTHER
3.76	48.03	9.22	THERM 64.84	1.29E+12	3.15E+11	7.95E+11	1.42E+11			3.98E+10
			ELECT 25.32	1.40E+11	2.61E+09	2.17E+11	3.30E+10	6.20E+10	2.09E+10	0.
			TOTAL	1.43E+12	3.18E+11	8.17E+11	1.75E+11	6.20E+10	2.09E+10	3.98E+10

LOCATION = CALIFORNIA APPLICATION = MEAT PRODUCTS

FUEL DISP		FUEL DISPLACED		APPLICATION = MEAT PRODUCTS						
ECR	PER CENT	R	PER CENT	BTU	NATL GAS	OIL	COAL	NUCLEAR	HYDROELEC	OTHER
2.46	58.45	8.31	THERM 77.03	2.65E+12	1.83E+12	2.39E+11	4.15E+10			5.34E+11
			ELECT 33.36	3.19E+11	0.	1.81E+11	1.53E+10	4.59E+10	6.11E+10	1.53E+10
			TOTAL	2.97E+12	1.83E+12	4.20E+11	5.68E+10	4.59E+10	6.11E+10	5.49E+11

LOCATION = COLORADO APPLICATION = MEAT PRODUCTS

FUEL DISP		FUEL DISPLACED		APPLICATION = MEAT PRODUCTS						
ECR	PER CENT	R	PER CENT	BTU	NATL GAS	OIL	COAL	NUCLEAR	HYDROELEC	OTHER
3.95	55.15	8.71	THERM 73.49	5.61E+12	2.19E+12	1.54E+12	1.52E+12			3.61E+11
			ELECT 30.39	6.45E+11	0.	1.67E+10	5.58E+11	3.98E+10	3.06E+10	0.
			TOTAL	6.26E+12	2.19E+12	1.56E+12	2.08E+12	3.98E+10	3.06E+10	3.61E+11

LOCATION = DELAWARE APPLICATION = MEAT PRODUCTS

FUEL DISP		FUEL DISPLACED		APPLICATION = MEAT PRODUCTS						
ECR	PER CENT	R	PER CENT	BTU	NATL GAS	OIL	COAL	NUCLEAR	HYDROELEC	OTHER
3.49	42.95	9.18	THERM 57.93	4.88E+11	5.63E+10	2.06E+11	2.06E+10			2.05E+11
			ELECT 22.72	5.32E+10	0.	2.64E+10	2.68E+10	0.	0.	0.
			TOTAL	5.41E+11	5.63E+10	2.33E+11	4.74E+10	0.	0.	2.05E+11

LOCATION = FLORIDA APPLICATION = MEAT PRODUCTS

FUEL DISP		FUEL DISPLACED		APPLICATION = MEAT PRODUCTS						
ECR	PER CENT	R	PER CENT	BTU	NATL GAS	OIL	COAL	NUCLEAR	HYDROELEC	OTHER
3.13	44.39	9.24	THERM 59.96	9.85E+11	7.95E+11	1.59E+11	4.54E+09			2.72E+10
			ELECT 23.37	1.07E+11	0.	4.20E+10	4.52E+10	1.93E+10	2.53E+08	0.
			TOTAL	1.09E+12	7.95E+11	2.01E+11	4.97E+10	1.93E+10	2.53E+08	2.72E+10

Figure 2-7. Sample Intermediate Printout from SAMDGP

Table 2-10. SAMDGP Summary Report by Location

AMOUNT OF FUEL DISPLACED BY LOCATION FOR THERMAL AND ELECTRIC ENERGY IN BTU							1985
LOCATION	TOTAL	NATL GAS	OIL	COAL	NUCLEAR	HYDROELEC	OTHER
ALABAMA	.1408E+15	.8484E+14	.1776E+14	.2805E+14	.3977E+13	.2240E+13	.3928E+13
ALASKA	.9046E+13	.5720E+13	.1113E+13	.1682E+13	0.	.3040E+11	.5007E+12
ARIZONA	.5049E+13	.1248E+13	.2786E+13	.7629E+12	.8819E+11	.1400E+12	.2399E+11
ARKANSAS	.1231E+15	.2692E+14	.6939E+14	.1526E+14	.6104E+13	.2058E+13	.3363E+13
CALIFORNIA	.3346E+15	.2092E+15	.4573E+14	.6298E+13	.4683E+13	.6242E+13	.6244E+14
COLORADO	.3323E+14	.1152E+14	.8233E+13	.1117E+14	.2242E+12	.1725E+12	.1903E+13
CONNECTICUT	.5553E+14	.4259E+12	.4532E+14	.5308E+13	.2912E+13	.7862E+11	.1491E+13
DELAWARE	.2937E+14	.3011E+13	.1267E+14	.2751E+13	0.	0.	.1094E+14
FLORIDA	.1301E+15	.9693E+14	.2330E+14	.4765E+13	.1795E+13	.2357E+11	.3323E+13
GEORGIA	.1524E+15	.7681E+14	.5171E+14	.1616E+14	.3326E+13	.8181E+12	.3562E+13
HAWAII	.6949E+13	.1022E+13	.4083E+13	0.	0.	.1189E+10	.1843E+13
IDAHO	.4308E+14	.1463E+14	.1164E+14	.1349E+14	0.	.2460E+13	.8608E+12
ILLINOIS	.2372E+15	.1125E+15	.3713E+14	.4790E+14	.5834E+13	.1877E+11	.3390E+14
INDIANA	.1310E+15	.4271E+14	.3231E+14	.4091E+14	.1370E+13	.6794E+11	.1365E+14
IOWA	.9958E+14	.8332E+14	.1911E+13	.1232E+14	.4666E+12	.1882E+12	.1375E+13
KANSAS	.5068E+14	.3230E+14	.4885E+13	.5165E+13	.5925E+12	0.	.7745E+13
KENTUCKY	.1329E+15	.6145E+14	.1329E+14	.3913E+14	0.	.4448E+12	.1859E+14
LOUISIANA	.4131E+15	.1524E+15	.1738E+15	.3446E+14	.4806E+13	0.	.4771E+14
MAINE	.4627E+14	.1407E+13	.4071E+14	.5025E+12	.2347E+13	.8019E+12	.5025E+12
MARYLAND	.8409E+14	.6037E+13	.5525E+14	.1674E+14	.2620E+13	.4174E+12	.3019E+13
MASSACHUSETTS	.9443E+14	.4585E+13	.8018E+14	.4750E+13	.1846E+13	.1236E+12	.2947E+13
MICHIGAN	.2430E+15	.1398E+15	.1986E+14	.6900E+14	.6773E+13	.3369E+12	.7210E+13
MINNESOTA	.9259E+14	.5276E+14	.1829E+14	.1184E+14	.2077E+13	.1427E+12	.7481E+13
MISSISSIPPI	.8952E+14	.5094E+14	.1818E+14	.5240E+13	.1434E+13	0.	.1372E+14
MISSOURI	.7294E+14	.4584E+14	.7606E+13	.1280E+14	.7112E+12	.1717E+12	.5815E+13
MONTANA	.1542E+14	.2131E+13	.8031E+13	.1804E+13	0.	.8953E+12	.2556E+13
NEBRASKA	.5610E+14	.4483E+14	.5062E+13	.4349E+13	.8994E+12	.1730E+12	.7934E+12
NEVADA	.1076E+14	.8725E+13	.6024E+12	.1272E+13	0.	.7792E+11	.2815E+12
NEW HAMPSHIRE	.1827E+14	.7942E+12	.1513E+14	.4836E+12	.1291E+13	.2079E+12	.3666E+12
NEW JERSEY	.1552E+15	.3326E+14	.8491E+14	.6876E+13	.5166E+13	0.	.2494E+14
NEW MEXICO	.2807E+14	.2001E+14	.4130E+13	.2453E+13	0.	.6807E+10	.1477E+13
NEW YORK	.2053E+15	.5521E+14	.1135E+15	.2134E+14	.5987E+13	.4563E+13	.4646E+13
NORTH CAROLINA	.1571E+15	.2705E+14	.7833E+14	.3799E+14	.4166E+13	.1336E+13	.8233E+13
NORTH DAKOTA	.1169E+14	0.	.3114E+13	.5728E+13	0.	.1037E+12	.2747E+13
OHIO	.2910E+15	.1048E+15	.5879E+14	.9965E+14	.3171E+13	0.	.2459E+14
OKLAHOMA	.1820E+14	.9799E+13	.3423E+13	.6053E+12	0.	.1742E+12	.4196E+13
OREGON	.7594E+14	.3325E+14	.1384E+14	.2962E+13	.1177E+13	.4406E+13	.2031E+14
PENNSYLVANIA	.1688E+15	.7307E+14	.3223E+14	.4209E+14	.4783E+13	.1425E+12	.1652E+14
RHODE ISLAND	.1454E+14	.1863E+13	.1086E+14	.1902E+12	.1319E+13	0.	.3042E+12
SOUTH CAROLINA	.1206E+15	.4755E+14	.3544E+14	.2698E+14	.5773E+13	.8441E+12	.4014E+13
SOUTH DAKOTA	.4833E+13	.3165E+13	.4257E+12	.7948E+12	0.	.2366E+12	.2110E+12
TENNESSEE	.1825E+15	.1188E+15	.1919E+14	.2929E+14	.3851E+13	.2303E+13	.9083E+13
TEXAS	.7442E+15	.2843E+15	.2596E+15	.9148E+14	.3766E+13	.3616E+12	.1047E+15
UTAH	.2088E+14	.5295E+13	.8408E+13	.4807E+13	0.	.1789E+12	.2195E+13
VERMONT	.6253E+13	.1343E+13	.4054E+13	.7271E+11	.4887E+12	.1606E+12	.1343E+12
VIRGINIA	.1117E+15	.8406E+13	.5756E+14	.3762E+14	.3689E+13	.1865E+12	.4203E+13
WASHINGTON	.7122E+14	.2728E+14	.1857E+14	.4079E+13	.1007E+13	.5272E+13	.1501E+14
WEST VIRGINIA	.7139E+14	.1356E+14	.4296E+13	.5160E+14	0.	.2663E+11	.1916E+13
WISCONSIN	.1592E+15	.7862E+14	.7795E+13	.6494E+14	.3364E+13	.4595E+12	.4045E+13
WYOMING	0.	0.	0.	0.	0.	0.	0.
TOTAL	.5570E+16	.2321E+16	.1644E+16	.9459E+15	.1039E+15	.3909E+14	.5153E+15

Table 2-11. SAMDGP Summary Report by Application

AMOUNT OF FUEL DISPLACED BY APPLICATION FOR THERMAL AND ELECTRIC ENERGY IN BTU

1985

APPLICATION	TOTAL	NATL GAS	OIL	COAL	NUCLEAR	HYDROELEC	OTHER
MEAT PRODUCTS	.7495E+14	.3818E+14	.1634E+14	.1301E+14	.1226E+13	.7022E+12	.5491E+13
DAIRY PRODUCTS	.5424E+14	.2362E+14	.1372E+14	.1119E+14	.7356E+12	.5021E+12	.4468E+13
PRESERVED FRUITS AND VEGETABLE	.9803E+14	.4441E+14	.2446E+14	.1709E+14	.5181E+12	.1183E+13	.1036E+14
GRAIN MILL PRODUCTS	.1116E+15	.6845E+14	.1752E+14	.1535E+14	.9514E+12	.2824E+12	.9030E+13
BAKERY PRODUCTS	.2906E+14	.1347E+14	.7485E+13	.4864E+13	.3280E+12	.1166E+12	.2795E+13
SUGAR, CONFECTIONERY PRODUCTS	.7445E+14	.3547E+14	.2268E+14	.5805E+13	.8731E+12	.3594E+12	.9266E+13
FATS AND OILS	.6559E+14	.3420E+14	.1546E+14	.8262E+13	.3571E+12	.9466E+11	.7216E+13
BEVERAGES	.6460E+14	.3107E+14	.1495E+14	.1160E+14	.4597E+12	.1659E+12	.6354E+13
MISC. FOODS, KINDRED PRODUCTS	.3154E+14	.1555E+14	.8560E+13	.3894E+13	.3709E+12	.1940E+12	.2979E+13
CIGARETTES	.7015E+13	.2373E+13	.2107E+13	.1747E+13	.4620E+11	.2341E+11	.7189E+12
CIGARS	.4921E+12	.2617E+12	.1030E+12	.8257E+11	.2656E+11	.4997E+09	.1775E+11
CHEWING AND SMOKING TOBACCO	.4518E+12	.1331E+12	.1549E+12	.1189E+12	.5106E+10	.1282E+10	.3850E+11
TOBACCO STEMMING AND REDRYING	.2636E+13	.8963E+12	.7683E+12	.6719E+12	.2241E+11	.1013E+11	.2668E+12
WEAVING MILLS, COTTON	.2121E+14	.7195E+13	.6328E+13	.5095E+13	.1577E+13	.3815E+12	.6319E+12
WEAVING MILLS, MANMADE FIBER	.3102E+14	.8163E+13	.1115E+14	.7677E+13	.2509E+13	.4744E+12	.1046E+13
WEAVING, FINISHING MILLS, WOOL	.3962E+13	.2339E+12	.3296E+13	.1415E+12	.1631E+12	.4389E+11	.8291E+11
NARROW FABRIC MILLS	.2182E+13	.5268E+12	.1083E+13	.3107E+12	.1755E+12	.1878E+11	.6698E+11
KNITTING MILLS	.3442E+14	.8620E+13	.1531E+14	.6962E+13	.1304E+13	.2898E+12	.1934E+13
TEXTILE FINISHING, EXCEPT WOOL	.4328E+14	.1313E+14	.1996E+14	.7612E+13	.4652E+12	.6652E+11	.2037E+13
FLOOR COVERING MILLS	.1866E+14	.9973E+13	.5846E+13	.1636E+13	.1426E+12	.4608E+11	.1014E+13
YARN AND THREAD MILLS	.2694E+14	.7017E+13	.8816E+13	.7374E+13	.2205E+13	.6124E+12	.9188E+12
MISCELLANEOUS TEXTILE GOODS	.1782E+14	.5534E+13	.7649E+13	.2836E+13	.7460E+12	.1527E+12	.8999E+12
MEN'S AND BOYS' SUITS AND COAT	.4087E+13	.1362E+13	.1448E+13	.8304E+12	.1267E+12	.4785E+11	.2724E+12
MEN'S AND BOYS' FURNISHINGS	.8883E+13	.3629E+13	.2478E+13	.1637E+13	.3135E+12	.9218E+11	.7332E+12
WOMEN'S AND MISSES' OUTERWEAR	.1179E+14	.4563E+13	.3722E+13	.1862E+13	.3537E+12	.1988E+12	.1095E+13
WOMEN'S, CHILDREN'S UNDERGARMS	.2184E+13	.8525E+12	.5796E+12	.4580E+12	.1359E+12	.4888E+11	.1096E+12
HATS, CAPS, AND MILLINERY	.8762E+12	.4563E+12	.1143E+12	.2093E+12	.2243E+11	.2638E+10	.7125E+11
CHILDREN'S OUTERWEAR	.1534E+13	.5927E+12	.4809E+12	.2654E+12	.1049E+12	.2653E+11	.6327E+11
MISC. APPAREL AND ACCESSORIES	.1676E+13	.4195E+12	.9036E+12	.1813E+12	.7761E+11	.5915E+11	.3531E+11
MISC. FABRICATED TEXTILE PRODS	.1254E+14	.4697E+13	.4062E+13	.2381E+13	.5309E+12	.1029E+12	.7716E+12
LOGGING CAMPS, LOG CONTRACTORS	.3679E+14	.1677E+14	.1123E+14	.4448E+13	.2827E+11	.5281E+11	.4262E+13
SAWMILLS AND PLANING MILLS	.6985E+14	.2754E+14	.1821E+14	.1266E+14	.1753E+13	.2711E+13	.6966E+13
MILLWORK, PLYWOOD, STRUC. MEMB	.3933E+14	.1559E+14	.1097E+14	.5378E+13	.8315E+12	.1475E+13	.5094E+13
WOOD CONTAINERS	.3909E+13	.1652E+13	.1010E+13	.8324E+12	.6382E+11	.2099E+11	.3301E+12
WOOD BUILDINGS AND MOBILE HOME	.8590E+13	.4529E+13	.2022E+13	.1415E+13	.8375E+11	.1517E+11	.5246E+12
MISCELLANEOUS WOOD PRODUCTS	.3994E+14	.1943E+14	.1022E+14	.4079E+13	.5866E+12	.3469E+12	.5274E+13
HOUSEHOLD FURNITURE	.2206E+14	.7576E+13	.7356E+13	.4687E+13	.7934E+12	.2488E+12	.1396E+13
OFFICE FURNITURE	.4239E+13	.1854E+13	.9749E+12	.9675E+12	.9816E+11	.2573E+11	.3189E+12
PUBLIC BLDG., RELATED FURNITUR	.2284E+13	.1003E+13	.5001E+12	.6233E+12	.6626E+11	.1147E+11	.8018E+11
PARTITIONS AND FIXTURES	.6326E+13	.2736E+13	.1888E+13	.9915E+12	.1339E+12	.4103E+11	.5363E+12
MISC. FURNITURE AND FIXTURES	.2244E+13	.1172E+13	.2359E+12	.6196E+12	.3543E+11	.1852E+10	.1785E+12
PULPMILLS	.4561E+14	.2041E+14	.1042E+14	.2136E+13	.6576E+12	.2693E+13	.9298E+13
PAPERMILLS, EXC. BUILDING PAPE	.3080E+15	.1127E+15	.1067E+15	.5410E+14	.9042E+13	.4805E+13	.2058E+14
PAPERBOARD MILLS	.2749E+15	.1244E+15	.8549E+14	.3913E+14	.4431E+13	.1647E+13	.1986E+14
MISC. CONVERTED PAPER PRODUCTS	.3652E+14	.1313E+14	.1292E+14	.6017E+13	.1456E+13	.3863E+12	.2611E+13
PAPERBOARD CONTAINERS AND BOXE	.3820E+14	.1606E+14	.1042E+14	.7081E+13	.9527E+12	.2692E+12	.3414E+13
BUILDING PAPER AND BOARD MILLS	.2914E+14	.1494E+14	.6971E+13	.3374E+13	.2247E+12	.1496E+11	.3614E+13
NEWSPAPERS	.1244E+14	.4488E+13	.3544E+13	.2841E+13	.5140E+12	.1694E+12	.8845E+12
PERIODICALS	.1618E+13	.4968E+12	.3906E+12	.4527E+12	.1391E+12	.4307E+11	.9579E+11
BOOKS	.4501E+13	.1228E+13	.1854E+13	.1001E+13	.1509E+12	.3560E+11	.2307E+12

```

$ROUT1 76
$PGMR4
$PARAM E81205 7 0001
STAGE(TAPE3,VSN=10467)
STAGE(TAPE4,VSN=11140)
STAGE(TAPE2,POST)
DISPOSE,OUTPUT,*PR,ST=IBMIBM.
MAP(ON)
FTN(OPT,R)
LDSET(PRESET=ZERO)
LGO(PL=130000)
789*

```

```

.
SOURCE DECK
.

```

```

789*
.

```

```

NAMELIST INPUT OPTIONS
.

```

```

PHASING PATTERN, T/E DEMAND RATIO, AND
FRACTION ABSORPTION COOLING FOR 140 APPLICATIONS
.

```

```

THERMAL AND ELECTRIC ENERGY PRICES FOR 7 TIME PERIODS FOR EACH STATE
.

```

```

789*
6789*

```

```

* MULTIPLE PUNCH IN COLUMN 1

```

Figure 2-8. Sample SAMDGP Deck Structure and Control Cards

3. SAM REPORT GENERATION PROGRAM (SAMRGP)

3.1 SAMRGP Description

The basic function of SAMRGP is to read the SAM data base tape, print sorted reports, and generate an output tape which is used by the Market Penetration Model (MPM). The reports apply to a subset of the SAM data base which is selected via input options which specify the year and the minimum and maximum values for ECR and for consecutively numbered locations and applications. Data in the reports is sorted either by location or application depending upon the input option chosen. Any number of cases may be generated in a single run. The following paragraphs provide information on SAMRGP requirements, limitations, structure, functions and equations.

3.1.1 SAMRGP Structure and Functions

The structure of SAMRGP is a main program and seven subroutines- LCREAT, LEMPT, LDEST, LFILER, LREMV, PRNTOUT, and HEADING.

The main program has several functions - initializing values, reading input options and the SAM data base tape, accumulating values for summary reports, printing the sorted data, and calling all the subroutines. Some variables initialized by the main program are application names and SIC codes, state names, and input option default values. The main program reads in the NAMELIST inputs which define the type of sorting desired, the year desired, and the windows of interest with respect to ECR values, locations, and applications. The main program performs positioning of the SAM data base tape to the year of interest, then it reads and stores in memory all data for that year. The main program also accumulates the fuel displacement for all industries within the windows of interest.

Subroutines LCREAT, LEMPT, LDEST, LFILER, and LREMV sort the data in ascending order by ECR and by location or industry, whichever is chosen.

Subroutine PRNTOUT writes summary reports for fuel displaced by thermal energy, electric energy, and both for each state and each industry.

Subroutine HEADING prints title, date, and time at the start of each output report.

3.1.2 SAMRGP Equations

The following notation is used in SAMRGP:

- TAFDT Amount of fuel displaced for thermal energy for industry j in location i.
- TAFDE Amount of fuel displaced for electric energy for industry j in location i.
- AFDT(f) Amount of fuel type f displaced for thermal energy for location i and future year t.
- AFDE(f) Amount of fuel type f displaced for electric energy for location i and future year t.

The following logic and equations appear in SAMRGP:

Accumulate amount of fuel displaced for thermal energy by application:

$$\text{SAFDTJ}(j) = \text{SAFDTJ}(j) + \text{TAFDT} \quad (3-1)$$

where j is one of 140 applications.

Accumulate amount of fuel displaced for electric energy by application:

$$\text{SAFDEJ}(j) = \text{SAFDEJ}(j) + \text{TAFDE} \quad (3-2)$$

where j is one of 140 applications.

Accumulate amount of fuel displaced for thermal energy by location:

$$\text{SAFDTI}(i) = \text{SAFDTI}(i) + \text{TAFDT} \quad (3-3)$$

where i is one of 50 locations.

Accumulate amount of fuel displaced for electric energy by location:

$$\text{SAFDEI}(i) = \text{SAFDEI}(i) + \text{TAFDE} \quad (3-4)$$

where i is one of 50 locations.

Accumulate amount of fuel displaced for thermal energy for each fuel type by application:

$$SFDTJ(j,f) = SFDTJ(j,f) + AFDT(f) \quad (3-5)$$

Accumulate amount of fuel displaced for thermal energy for each fuel type by location:

$$SFDTI(i,f) = SFDTI(i,f) + AFDT(f) \quad (3-6)$$

Accumulate amount of fuel displaced for electric energy for each fuel type by application:

$$SFDEJ(j,f) = SFDEJ(j,f) + AFDE(f) \quad (3-7)$$

Accumulate amount of fuel displaced for electric energy for each fuel type by location:

$$SFDEI(i,f) = SFDEI(i,f) + AFDE(f) \quad (3-8)$$

3.1.3 SAMRGP Requirements and Limitations

SAMRGP is written in FORTRAN for the FTN compiler on the CDC 7600 computer. It is approximately 1200 cards in length, requires 125K sixty bit words of small core memory (SCM) and 211K sixty bit words of large core memory (LCM), and uses one nine track 1600 BPI tape drive. Job time varies with number of cases requested and input options chosen. SAMRGP uses system utility subprograms DATE and TIME.

3.2 SAMRGP Inputs

The inputs to SAMRGP are one magnetic tape (tape 1) and a card deck in the input stream (tape 5).

3.2.1 Tape 1 - SAMDGP Output Data

Tape 1 is the SAM data base which contains ECR and FD information for every industry in every state. This tape is output by SAMDGP. See Section 2.3.1 for a more detailed description of the tape.

3.2.2 Tape 5 - The Input Stream

The input stream contains the NAMELIST inputs with one set of NAMELIST inputs for each report desired.

The NAMELIST inputs are in a group called IN and include the following variables:

NILO, NIHI	The minimum and maximum numeric values for the locations of interest. These numbers are integers. Defaults are 1 and 50 respectively, which means that all 50 states are desired.
NJLO, NJHI	The minimum and maximum numeric values for the applications of interest. These numbers are integers. Defaults are 1 and 140 respectively, which means that all 140 industries are desired.
ECRLO, ECRHI	The minimum and maximum values for ECR, which define the ECR window of interest. These numbers are real variables. Defaults are .9 and 1.0 respectively, which means that only applications having an ECR greater than or equal to .9 and less than or equal to 1.0 are desired.
SORT	The type of sorting desired. SORT is a real variable containing character information. Two choices for sorting are available - state or industry. The default is state, which means that all the industries in a state are sorted in ascending order by ECR and then printed out. This is done for every state.
YEAR	The year desired, which must have one of the following values: 1985, 1990, 1995, 2000, 2005, 2010, 2015. The default is 1985. YEAR is a real variable containing character information.
TITLE	A 30 character title that appears at the start of each case. TITLE is a real array with default value BASELINE TEST CASE.

Note that the above variables are preset to their default values at the start of a run. They are not reset to the defaults prior to each case.

Figure 3-1 contains sample case input for Tape 5 - the input stream. Namelist variables NILO, NIHI, NJLO, and NJHI assume their default values of 1, 50, 1, and 140 respectively. This deck setup requests two cases. The first case is sorting by state for all states and all industries with ECR values from 0. to 1. for year 1995. The SORT variable for case one assumes the default value of "STATE". The second case is the same as the first, except that sorting is done by industry.

```
$IN  
  ECRLO=0.,  
  ECRHI=1.0,  
  YEAR="1995",  
$END  
$IN  
  SORT="INDUSTRY",  
$END
```

Figure 3-1. Sample Tape 5 Input (SAMRGP)

3.3 SAMRGP Outputs

The outputs of SAMRGP are a magnetic tape (tape 2) and printed output.

3.3.1 Tape 2 Output

Tape 2 is a subset of the SAM data base containing one file for each case requested. Only those industries that are in the desired range with respect to ECR value, location, application and year are written to the tape. Note that this tape is written prior to sorting. Tape 2 has the same format as the SAM data base tape; i.e., it is in binary format with seventeen values per record and contains the variables in Table 2-9. When SAMRGP is run with the two cases shown in Figure 3-1, then tape 2 will contain the data from Figure 3-3 on file one and the data from Figure 3-4 on file two.

3.3.2 Printed Output

Printed output always consists of a title, list of input options, summary reports, and detailed reports. The title is the first line at the beginning of each case of printed output. It contains the input title and the date and time. This is followed by a list of all the input options chosen (See NAMELIST inputs in Section 3.2.2). Figure 3-2 is a sample first page of the printed output which one obtains using case one inputs in Figure 3-1.

BASELINE TEST CASE		16.32	07/07/78
<hr/>			
SORT =STATE			
NILO =	1		
NIHI =	50		
NJLO =	1		
NJHI =	140		
ECRLO =	0.00		
ECRHI =	1.00		
<hr/>			
YEAR =	1995		

Figure 3-2. Sample First Page of Printed Output (SAMRGP)

There are six summary reports for each case. These are the same as the SAMDGP summary reports (See Section 2.3.2) except that only those industries that are chosen via the input options are included. The subset of the SAM data base chosen is reflected in the titles of each summary report (See Tables 3-1 and 3-2 for sample summary report generated using case one inputs in Figure 3-1).

The detailed reports follow the summary reports. The detailed reports itemize each industry that falls in the desired ranges for ECR, etc. There are six lines for each industry. Note that the detailed reports are similar to the intermediate printout of SAMDGP except that they are sorted by state or industry and the title reflects the subset of the SAM data base selected. Figure 3-3 is a sample state sort and Figure 3-4 is a sample industry sort which are output for case one and case two, respectively in Figure 3-1.

APPLICATIONS WITHIN STATES SORTED BY STATE FOR YEAR 1995
STATES 1 TO 50, APPLICATIONS 1 TO 140, AND ECR VALUES 0.000 TO 1.000

LOCATION = CALIFORNIA												APPLICATION = SOAPS, CLEANERS, TOILET GOODS											
FUEL DISP			FUEL DISPLACED			NATL GAS		OIL		COAL		NUCLEAR HYDROELEC		OTHER									
ECR	PER CENT	R	PER CENT	BTU																			
.68	58.30	25.14	THERM	72.51	7.31E+12	3.88E+12	2.01E+12	1.43E+11							1.27E+12								
			ELECT	20.48	2.91E+11	0.	7.82E+10	7.66E+10	9.27E+10	3.22E+10	1.09E+10												
			TOTAL		7.60E+12	3.88E+12	2.08E+12	2.20E+11	9.27E+10	3.22E+10	1.29E+12												
LOCATION = CALIFORNIA												APPLICATION = PLASTICS MATERIALS, SYNTHETICS											
FUEL DISP			FUEL DISPLACED			NATL GAS		OIL		COAL		NUCLEAR HYDROELEC		OTHER									
ECR	PER CENT	R	PER CENT	BTU																			
.68	58.30	26.10	THERM	72.22	3.74E+12	1.99E+12	1.03E+12	7.34E+10						6.53E+11									
			ELECT	20.20	1.43E+11	0.	3.86E+10	3.78E+10	4.57E+10	1.59E+10	5.36E+09												
			TOTAL		3.89E+12	1.99E+12	1.07E+12	1.11E+11	4.57E+10	1.59E+10	6.58E+11												
LOCATION = CALIFORNIA												APPLICATION = NONFERROUS FOUNDRIES											
FUEL DISP			FUEL DISPLACED			NATL GAS		OIL		COAL		NUCLEAR HYDROELEC		OTHER									
ECR	PER CENT	R	PER CENT	BTU																			
.68	43.47	9.26	THERM	52.50	4.11E+12	2.18E+12	1.13E+12	8.05E+10						7.17E+11									
			ELECT	27.20	4.43E+11	0.	1.19E+11	1.17E+11	1.41E+11	4.91E+10	1.66E+10												
			TOTAL		4.55E+12	2.18E+12	1.25E+12	1.97E+11	1.41E+11	4.91E+10	7.33E+11												
LOCATION = CALIFORNIA												APPLICATION = MISC. PRIMARY METAL PRODUCTS											
FUEL DISP			FUEL DISPLACED			NATL GAS		OIL		COAL		NUCLEAR HYDROELEC		OTHER									
ECR	PER CENT	R	PER CENT	BTU																			
.68	43.47	9.56	THERM	49.88	3.95E+12	2.10E+12	1.08E+12	7.75E+10						6.90E+11									
			ELECT	29.75	4.13E+11	0.	1.11E+11	1.09E+11	1.32E+11	4.58E+10	1.55E+10												
			TOTAL		4.36E+12	2.10E+12	1.20E+12	1.86E+11	1.32E+11	4.58E+10	7.05E+11												
LOCATION = CALIFORNIA												APPLICATION = INDUSTRIAL ORGANIC CHEMICALS											
FUEL DISP			FUEL DISPLACED			NATL GAS		OIL		COAL		NUCLEAR HYDROELEC		OTHER									
ECR	PER CENT	R	PER CENT	BTU																			
.68	58.30	32.83	THERM	70.45	1.77E+13	9.42E+12	4.87E+12	3.48E+11						3.10E+12									
			ELECT	18.67	5.40E+11	0.	1.45E+11	1.42E+11	1.72E+11	5.99E+10	2.02E+10												
			TOTAL		1.83E+13	9.42E+12	5.01E+12	4.90E+11	1.72E+11	5.99E+10	3.12E+12												
LOCATION = CALIFORNIA												APPLICATION = AGRICULTURAL CHEMICALS											
FUEL DISP			FUEL DISPLACED			NATL GAS		OIL		COAL		NUCLEAR HYDROELEC		OTHER									
ECR	PER CENT	R	PER CENT	BTU																			
.68	58.30	40.05	THERM	68.95	1.78E+13	9.47E+12	4.89E+12	3.50E+11						3.11E+12									
			ELECT	17.56	4.45E+11	0.	1.20E+11	1.17E+11	1.42E+11	4.93E+10	1.66E+10												
			TOTAL		1.83E+13	9.47E+12	5.01E+12	4.67E+11	1.42E+11	4.93E+10	3.13E+12												

Figure 3-3. SAMRGP Output for State Sorting (Partial)

APPLICATIONS WITHIN STATES SORTED BY INDUSTRY FOR YEAR 1995
 STATES 1 TO 50, APPLICATIONS 1 TO 140, AND ECR VALUES 0.000 TO 1.000

APPLICATION = PRESERVED FRUITS AND VEGETABLE LOCATION = HAWAII										
ECR	FUEL DISP PER CENT	R	FUEL DISPLACED PER CENT	BTU	NATL GAS	OIL	COAL	NUCLEAR	HYDROELEC	OTHER
.73	59.71	22.31	THERM 74.56	1.23E+12	2.00E+11	7.42E+11	0.	0.	1.02E+08	2.90E+11
			ELECT 22.39	5.52E+10	0.	5.46E+10	0.	0.	1.02E+08	5.09E+08
			TOTAL	1.29E+12	2.00E+11	7.96E+11	0.	0.	1.02E+08	2.91E+11
APPLICATION = PRESERVED FRUITS AND VEGETABLE LOCATION = CALIFORNIA										
ECR	FUEL DISP PER CENT	R	FUEL DISPLACED PER CENT	BTU	NATL GAS	OIL	COAL	NUCLEAR	HYDROELEC	OTHER
.96	58.30	23.22	THERM 73.11	2.42E+13	1.28E+13	6.63E+12	4.74E+11	0.	0.	4.22E+12
			ELECT 21.10	1.04E+12	0.	2.80E+11	2.74E+11	3.32E+11	1.15E+11	3.89E+10
			TOTAL	2.52E+13	1.28E+13	6.91E+12	7.48E+11	3.32E+11	1.15E+11	4.25E+12
APPLICATION = GRAIN MILL PRODUCTS LOCATION = CALIFORNIA										
ECR	FUEL DISP PER CENT	R	FUEL DISPLACED PER CENT	BTU	NATL GAS	OIL	COAL	NUCLEAR	HYDROELEC	OTHER
.96	58.30	17.93	THERM 74.92	6.03E+12	3.20E+12	1.65E+12	1.18E+11	0.	0.	1.05E+12
			ELECT 23.40	3.36E+11	0.	9.04E+10	8.87E+10	1.07E+11	3.73E+10	1.26E+10
			TOTAL	6.36E+12	3.20E+12	1.75E+12	2.07E+11	1.07E+11	3.73E+10	1.06E+12
APPLICATION = BAKERY PRODUCTS LOCATION = CALIFORNIA										
ECR	FUEL DISP PER CENT	R	FUEL DISPLACED PER CENT	BTU	NATL GAS	OIL	COAL	NUCLEAR	HYDROELEC	OTHER
.96	58.30	16.01	THERM 75.60	2.99E+12	1.59E+12	8.20E+11	5.86E+10	0.	0.	5.21E+11
			ELECT 24.56	1.87E+11	0.	5.02E+10	4.92E+10	5.96E+10	2.07E+10	6.98E+09
			TOTAL	3.17E+12	1.59E+12	8.70E+11	1.08E+11	5.96E+10	2.07E+10	5.28E+11
APPLICATION = SUGAR, CONFECTIONERY PRODUCTS LOCATION = HAWAII										
ECR	FUEL DISP PER CENT	R	FUEL DISPLACED PER CENT	BTU	NATL GAS	OIL	COAL	NUCLEAR	HYDROELEC	OTHER
.68	44.77	12.38	THERM 44.58	6.63E+12	1.08E+12	3.99E+12	0.	0.	0.	1.56E+12
			ELECT 45.71	5.35E+11	0.	5.30E+11	0.	0.	9.88E+08	4.94E+09
			TOTAL	7.17E+12	1.08E+12	4.52E+12	0.	0.	9.88E+08	1.57E+12
APPLICATION = SUGAR, CONFECTIONERY PRODUCTS LOCATION = CALIFORNIA										
ECR	FUEL DISP PER CENT	R	FUEL DISPLACED PER CENT	BTU	NATL GAS	OIL	COAL	NUCLEAR	HYDROELEC	OTHER
.91	43.47	11.85	THERM 42.93	2.25E+13	1.19E+13	6.17E+12	4.41E+11	0.	0.	3.92E+12
			ELECT 46.01	1.90E+12	0.	5.10E+11	5.00E+11	6.05E+11	2.10E+11	7.09E+10
			TOTAL	2.44E+13	1.19E+13	6.68E+12	9.40E+11	6.05E+11	2.10E+11	3.99E+12

Figure 3-4. SAMRGP Output for Industry Sorting (Partial)

Table 3-1. SAMRGP Summary Report by Location

AMOUNT OF THERMAL AND ELECTRIC ENERGY DISPLACED (IN BTU'S) BY LOCATION FOR YEAR 1995,
STATES 1 TO 50, APPLICATIONS 1 TO 140, AND ECR VALUES 0.000 TO 1.000

LOCATION	TOTAL	NATL GAS	OIL	COAL	NUCLEAR	HYDROELEC	OTHER
ALABAMA	0.	0.	0.	0.	0.	0.	0.
ALASKA	0.	0.	0.	0.	0.	0.	0.
ARIZONA	.3051E+13	.2608E+12	.1387E+13	.1278E+13	.6452E+11	.4721E+11	.1304E+11
ARKANSAS	0.	0.	0.	0.	0.	0.	0.
CALIFORNIA	.2903E+15	.1431E+15	.7958E+14	.1080E+14	.6675E+13	.2318E+13	.4779E+14
COLORADO	0.	0.	0.	0.	0.	0.	0.
CONNECTICUT	.1618E+14	.2402E+12	.1313E+14	.1899E+13	.4768E+12	.8830E+10	.4203E+12
DELAWARE	0.	0.	0.	0.	0.	0.	0.
FLORIDA	.7782E+14	.6359E+14	.9414E+13	.1946E+13	.1112E+13	.5291E+10	.1750E+13
GEORGIA	0.	0.	0.	0.	0.	0.	0.
HAWAII	.8808E+13	.1329E+13	.5543E+13	0.	0.	.1145E+10	.1935E+13
IDAHO	0.	0.	0.	0.	0.	0.	0.
ILLINOIS	0.	0.	0.	0.	0.	0.	0.
INDIANA	0.	0.	0.	0.	0.	0.	0.
IOWA	.3052E+14	.2390E+14	.5118E+12	.5483E+13	.2231E+12	.1603E+11	.3802E+12
KANSAS	.3272E+14	.1740E+14	.3816E+13	.6185E+13	.1106E+13	0.	.4215E+13
KENTUCKY	0.	0.	0.	0.	0.	0.	0.
LOUISIANA	0.	0.	0.	0.	0.	0.	0.
MAINE	0.	0.	0.	0.	0.	0.	0.
MARYLAND	0.	0.	0.	0.	0.	0.	0.
MASSACHUSETTS	.3268E+14	.1483E+13	.2718E+14	.2219E+13	.8026E+12	.1928E+11	.9675E+12
MICHIGAN	0.	0.	0.	0.	0.	0.	0.
MINNESOTA	0.	0.	0.	0.	0.	0.	0.
MISSISSIPPI	0.	0.	0.	0.	0.	0.	0.
MISSOURI	.5464E+13	.2733E+13	.5256E+12	.1701E+13	.9319E+11	.7747E+10	.4040E+12
MONTANA	0.	0.	0.	0.	0.	0.	0.
NEBRASKA	.1402E+13	.7207E+12	.1017E+12	.5270E+12	.3253E+11	.3612E+10	.1602E+11
NEVADA	0.	0.	0.	0.	0.	0.	0.
NEW HAMPSHIRE	0.	0.	0.	0.	0.	0.	0.
NEW JERSEY	.9055E+14	.2728E+14	.4336E+14	.3629E+13	.2096E+13	0.	.1419E+14
NEW MEXICO	0.	0.	0.	0.	0.	0.	0.
NEW YORK	.5271E+14	.2132E+14	.2296E+14	.5403E+13	.1303E+13	.5661E+12	.1151E+13
NORTH CAROLINA	0.	0.	0.	0.	0.	0.	0.
NORTH DAKOTA	0.	0.	0.	0.	0.	0.	0.
OHIO	0.	0.	0.	0.	0.	0.	0.
OKLAHOMA	0.	0.	0.	0.	0.	0.	0.
OREGON	0.	0.	0.	0.	0.	0.	0.
PENNSYLVANIA	.1822E+14	.1047E+14	.2223E+13	.3457E+13	.2616E+12	.5587E+10	.1805E+13
RHODE ISLAND	.3522E+13	.7677E+12	.2370E+13	.4570E+11	.2654E+12	0.	.7311E+11
SOUTH CAROLINA	0.	0.	0.	0.	0.	0.	0.
SOUTH DAKOTA	0.	0.	0.	0.	0.	0.	0.
TENNESSEE	0.	0.	0.	0.	0.	0.	0.
TEXAS	.1096E+15	.3517E+14	.3952E+14	.2042E+14	.1077E+13	.2821E+11	.1338E+14
UTAH	0.	0.	0.	0.	0.	0.	0.
VERMONT	0.	0.	0.	0.	0.	0.	0.
VIRGINIA	0.	0.	0.	0.	0.	0.	0.
WASHINGTON	0.	0.	0.	0.	0.	0.	0.
WEST VIRGINIA	0.	0.	0.	0.	0.	0.	0.
WISCONSIN	0.	0.	0.	0.	0.	0.	0.
WYOMING	0.	0.	0.	0.	0.	0.	0.
TOTAL	.7735E+15	.3498E+15	.2516E+15	.6499E+14	.1559E+14	.3027E+13	.8849E+14

Table 3-2. SAMRGP Summary Report by Application

AMOUNT OF THERMAL AND ELECTRIC ENERGY DISPLACED (IN BTU'S) BY APPLICATION FOR YEAR 1995,
STATES 1 TO 50, APPLICATIONS 1 TO 140, AND ECR VALUES 0.000 TO 1.000

APPLICATION	TOTAL	NATL GAS	OIL	COAL	NUCLEAR	HYDROELEC	OTHER
MEAT PRODUCTS	.3506E+13	.1663E+13	.9605E+12	.1607E+12	.1201E+12	.4172E+11	.5603E+12
DAIRY PRODUCTS	.3119E+13	.1536E+13	.8548E+12	.1170E+12	.7295E+11	.2533E+11	.5129E+12
PRESERVED FRUITS AND VEGETABLE	.2648E+14	.1303E+14	.7707E+13	.7479E+12	.3320E+12	.1154E+12	.4545E+13
GRAIN MILL PRODUCTS	.5364E+13	.3203E+13	.1745E+13	.2068E+12	.1073E+12	.3725E+11	.1064E+13
BAKERY PRODUCTS	.3174E+13	.1587E+13	.8703E+12	.1078E+12	.5956E+11	.2068E+11	.5283E+12
SUGAR, CONFECTIONERY PRODUCTS	.3153E+14	.1301E+14	.1120E+14	.9404E+12	.6049E+12	.2110E+12	.5559E+13
FATS AND OILS	.5585E+13	.2879E+13	.1532E+13	.1504E+12	.5343E+11	.1856E+11	.9517E+12
BEVERAGES	.7021E+13	.3567E+13	.1926E+13	.2129E+12	.9837E+11	.3416E+11	.1183E+13
MISC. FOODS, KINDRED PRODUCTS	.4117E+13	.1888E+13	.1256E+13	.1491E+12	.9842E+11	.3423E+11	.6910E+12
CIGARETTES	0.	0.	0.	0.	0.	0.	0.
CIGARS	0.	0.	0.	0.	0.	0.	0.
CHEWING AND SMOKING TOBACCO	0.	0.	0.	0.	0.	0.	0.
TOBACCO STEMMING AND REDRYING	0.	0.	0.	0.	0.	0.	0.
WEAVING MILLS, COTTON	0.	0.	0.	0.	0.	0.	0.
WEAVING MILLS, MANMADE FIBER	0.	0.	0.	0.	0.	0.	0.
WEAVING, FINISHING MILLS, WOOL	0.	0.	0.	0.	0.	0.	0.
NARROW FABRIC MILLS	0.	0.	0.	0.	0.	0.	0.
KNITTING MILLS	.1041E+13	.4783E+12	.2850E+12	.5480E+11	.4495E+11	.1561E+11	.1623E+12
TEXTILE FINISHING, EXCEPT WOOL	.2834E+12	.1465E+12	.7775E+11	.7441E+10	.2463E+10	.8552E+09	.4840E+11
FLOOR COVERING MILLS	.2039E+13	.1046E+13	.5594E+12	.5714E+11	.2242E+11	.7785E+10	.3463E+12
YARN AND THREAD MILLS	0.	0.	0.	0.	0.	0.	0.
MISCELLANEOUS TEXTILE GOODS	.8125E+12	.3642E+12	.2223E+12	.4695E+11	.4055E+11	.1408E+11	.1244E+12
MEN'S AND BOYS' SUITS AND COAT	0.	0.	0.	0.	0.	0.	0.
MEN'S AND BOYS' FURNISHINGS	0.	0.	0.	0.	0.	0.	0.
WOMEN'S AND MISSES' OUTERWEAR	0.	0.	0.	0.	0.	0.	0.
WOMEN'S, CHILDREN'S UNDERGARMS	0.	0.	0.	0.	0.	0.	0.
HATS, CAPS, AND MILLINERY	0.	0.	0.	0.	0.	0.	0.
CHILDREN'S OUTERWEAR	0.	0.	0.	0.	0.	0.	0.
MISC. APPAREL AND ACCESSORIES	0.	0.	0.	0.	0.	0.	0.
MISC. FABRICATED TEXTILE PRODS	0.	0.	0.	0.	0.	0.	0.
LOGGING CAMPS, LOG CONTRACTORS	0.	0.	0.	0.	0.	0.	0.
SAWMILLS AND PLANING MILLS	0.	0.	0.	0.	0.	0.	0.
MILLWORK, PLYWOOD, STRUC. MEMB	0.	0.	0.	0.	0.	0.	0.
WOOD CONTAINERS	.3612E+12	.1702E+12	.9894E+11	.1707E+11	.1305E+11	.4532E+10	.5743E+11
WOOD BUILDINGS AND MOBILE HOME	0.	0.	0.	0.	0.	0.	0.
MISCELLANEOUS WOOD PRODUCTS	0.	0.	0.	0.	0.	0.	0.
HOUSEHOLD FURNITURE	0.	0.	0.	0.	0.	0.	0.
OFFICE FURNITURE	0.	0.	0.	0.	0.	0.	0.
PUBLIC BLDG., RELATED FURNITUR	0.	0.	0.	0.	0.	0.	0.
PARTITIONS AND FIXTURES	0.	0.	0.	0.	0.	0.	0.
MISC. FURNITURE AND FIXTURES	0.	0.	0.	0.	0.	0.	0.
PULPMILLS	.1313E+14	.6226E+13	.3595E+13	.6014E+12	.4497E+12	.1562E+12	.2097E+13
PAPERMILLS, EXC. BUILDING PAPE	.3206E+14	.8761E+13	.1721E+14	.2669E+13	.1191E+13	.2780E+12	.1953E+13
PAPERBOARD MILLS	.5653E+14	.3946E+14	.1022E+14	.1937E+13	.1161E+13	.1024E+12	.3652E+13
MISC. CONVERTED PAPER PRODUCTS	.1027E+14	.2947E+13	.4862E+13	.8990E+12	.5333E+12	.6885E+11	.9555E+12
PAPERBOARD CONTAINERS AND BOXE	.1395E+14	.6651E+13	.4071E+13	.1158E+13	.5429E+12	.1161E+12	.1413E+13
BUILDING PAPER AND BOARD MILLS	.1920E+13	.9897E+12	.5267E+12	.5170E+11	.1837E+11	.6379E+10	.3272E+12
NEWSPAPERS	0.	0.	0.	0.	0.	0.	0.
PERIODICALS	0.	0.	0.	0.	0.	0.	0.
BOOKS	0.	0.	0.	0.	0.	0.	0.

3.4 SAMRGP Deck Structure and Control Cards

Figure 3-5 shows the deck structure for SAMRGP. The first three cards are installation dependent and are concerned with programmer identification, accounting numbers, and computer resources required for running the job. Card 4 causes the input tape, which is the SAM data base tape, to be staged. The fifth card notifies the system that an output tape will need poststaging at the end of the job. The next card directs printed output to the IBM 3800 printer at Aerospace. The PTN card requests a compile using the Fortran Extended compiler with maximum optimization and a long symbolic reference map. The LDSET card specifies that memory is to be preset to zeros. The purpose of the next five cards is to load and execute the program reducing the computer resources so that available Large Core Memory (LCM) is not exceeded. The LOAD card loads the program into the LGO file. The NOGO card writes the loaded program onto file SAM2. The RETURN card causes the LGO file to be detached from the job thereby reducing the resources required by the job. The REQUEST card sets the transfer size for the SAM data base tape to the minimum LCM buffer size. The SAM2 card executes the program with a print limit of 100,000 lines.

```

$ROUT1  76
$PGMR4
$PARAM   E81205      7      0001
STAGE(TAPE1,NT,PE,VSN=15306)
STAGE(TAPE2,POST)
DISPOSE,OUTPUT,*PR,ST=IBMIBM.
FTN(OPT=2,R=3)
LDSET(PRESET=ZERO)
LOAD(LG0)
NOGO(SAM2)
RETURN(LG0)
REQUEST(TAPE1,T)
SAM2(PL=100000)
789*

```

SOURCE DECK

```

789*

```

NAMelist INPUT OPTIONS

```

789*
6789*

```

* MULTIPLE PUNCH IN COLUMN 1

Figure 3-5. Sample SAMRGP Deck Structure and Control Cards

4. **BIBLIOGRAPHY**

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APPENDIX A - SAMDGP Source Listing

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1      PROGRAM SAMDGP (INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT,
      *TAPE2,TAPE3,TAPE4)
C
C      SAMDGP - SOLAR TOTAL ENERGY APPLICATION MODEL (SAM) DATA
C      GENERATOR PROGRAM
5      DEVELOPED MAR 1978 BY BRUCE TIMMER
C      OF THE SYSTEMS SIMULATION AND ANALYSIS DEPARTMENT
C      AND BY ANNE TIMMER
C      OF THE DATA REDUCTION DEPARTMENT
10     BOTH OF THE AEROSPACE CORPORATION.
C
C      SAMDGP GENERATES A DATA BASE CONTAINING EQUIVALENT COST RATIOS
C      AND ASSOCIATED MARKETING PARAMETERS BY GEOGRAPHIC LOCATION
C      (50 STATES) AND BY INDUSTRY (140 3-DIGIT SIC CATEGORIES).
15
C      INPUT CONSISTS OF PHASING PATTERN, T/E DEMAND RATIO, AND
C      FRACTION ABSORPTION COOLING FOR 140 INDUSTRIES; FUEL MIX
C      PERCENTAGES FOR ELECTRIC AND THERMAL ENERGY BY STATE FOR
C      7 TIME PERIODS (1985,1990,...,2015); ENERGY DEMANDS FOR
20     EACH INDUSTRY IN EACH STATE FOR 7 TIME PERIODS.
C
C      OUTPUT CONSISTS OF A SAM DATA BASE TAPE CONTAINING 7 FILES
C      OF DATA, ONE FOR EACH TIME PERIOD, AND VARIOUS REPORTS.
C
25     INTEGER FP, APPCODE
      REAL LEVCOST
      DOUBLE LOC, FUEL
      DIMENSION FAC(140),ISTA(50),LEVCOST(7),PP(140),STABBR(50),
      * TEDR(140),TITLE(3)
30     COMMON /INPUTS/
      * ACR, ADDI(50), ALPHA, APP(3,140), APPCODE(140), C, CEF(50,7),
      * CEI, CTF(50,7), CTI, DIECR(3,8,3),
      * DIFD(3,8,3), DIR(3,8,3), ECIFARY(8,5), EMI(140,50), ET, EU,
      * FCR, FME(50,7,6), FMT(50,7,4), FP, IPRINT, LOC(50), TE(3,8),
35     * TEDMD, TIM(7), TRBSIZS(20)
      COMMON /OUTPUTS/ R,
1      AFDE(6), AFDT(4), ECR, FD,
2      SAFDEI(50),SAFDEJ(140),SAFDTI(50),SAFD TJ(140),
3      SFDEI(50,6),SFDEJ(140,6),SFD TI(50,6),SFD TJ(140,6),
40     4 TAFDE, TAFDT, TFDE, TFDT
      NAMELIST /IN/ ACR, ALPHA, CEI, CTI, ET, EU, FCR, IPRINT, TITLE
C
C      ACR IS AFTER-TAX ANNUALIZED COST RATE FOR A USER GROUP
C
45     DATA ACR /.12/
C
C      ADDI IS AVERAGE DAILY DIRECT INSOLATION FOR 50 STATES.
C
50     DATA ADDI
      1/ 4.0, 3.6, 7.5, 4.8, 6.5, 6.0,
      2 3.9, 3.8, 4.1, 4.0, 6.7, 5.1,
      3 4.1, 4.3, 4.7, 5.6, 4.0, 4.0,
      4 3.7, 3.6, 4.0, 3.7, 4.5, 4.3,

```

55 5 5.0, 5.0, 5.5, 6.5, 3.6, 3.9,
 6 6.5, 3.8, 3.7, 5.0, 4.0, 5.5,
 7 3.7, 3.7, 4.0, 4.0, 5.0, 4.0,
 8 5.0, 5.8, 3.6, 3.6, 3.2, 3.5,
 9 4.0, 5.5 /

60 C ALPHA IS RATIO OF COEFFICIENT OF PERFORMANCE FOR VAPOR
 C COMPRESSION COOLING TO ABSORPTION COOLING = $4/.8 = 5$.
 C

 C DATA ALPHA /5./

65 C APP IS TABLE CONTAINING NAMES FOR 140 APPLICATIONS.
 C

 C DATA (APP(IA),IA=1,60,3) / 30HMEAT PRODUCTS

70 2 30HDAIRY PRODUCTS ,
 3 30HPRESERVED FRUITS AND VEGETABLE ,
 4 30HGRAIN MILL PRODUCTS ,
 5 30HBAKERY PRODUCTS ,
 6 30HSUGAR, CONFECTIONERY PRODUCTS ,
 7 30HFATS AND OILS ,
 8 30HBEVERAGES ,
 9 30HMISC. FOODS, KINDRED PRODUCTS ,
 A 30HCIGARETTES ,
 1 30HCIGARS ,
 2 30HCHEWING AND SMOKING TOBACCO ,
 3 30HTOBACCO STEMMING AND REDRYING ,
 4 30HWEAVING MILLS, COTTON ,
 5 30HWEAV>G MILLS, MANMADE FIBER ,
 6 30HWEAVING, FINISHING MILLS, WOOL ,
 7 30HNARROW FABRIC MILLS ,
 8 30HKNITTING MILLS ,
 9 30HTEXTILE FINISHING, EXCEPT WOOL ,
 A 30HFLOOR COVERING MILLS /

 C DATA (APP(IA),IA=61,120,3) / 30HYARN AND THREAD MILLS

90 2 30HMISCELLANEOUS TEXTILE GOODS ,
 3 30HMEN>S AND BOYS> SUITS AND COAT ,
 4 30HMEN>S AND BOYS> FURNISHINGS ,
 5 30HWOMEN>S AND MISSES> OUTERWEAR ,
 6 30HWOMEN>S, CHILDREN>S UNDERGARMS ,
 7 30HHATS, CAPS, AND MILLINERY ,
 8 30HCHILDREN>S OUTERWEAR ,
 9 30HMISC. APPAREL AND ACCESSORIES ,
 A 30HMISC. FABRICATED TEXTILE PRODS ,
 1 30HLOGGING CAMPS, LOG CONTRACTORS ,
 2 30HSAWMILLS AND PLANING MTLS ,
 3 30HMILLWORK, PLYWOOD, STRUC. MEMB ,
 4 30HWOOD CONTAINERS ,
 5 30HWOOD BUILDINGS AND MOBILE HOME ,
 6 30HMISCELLANEOUS WOOD PRODUCTS ,
 7 30HHOUSEHOLD FURNITURE ,
 8 30HOFFICE FURNITURE ,
 9 30HPUBLIC BLDG., RELATED FURNITUR ,
 A 30HPARTITIONS AND FIXTURES /

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DATA (APP(IA),IA=121,180,3) /30HMISC. FURNITURE AND FIXTURES ,
2 30HPULPMILLS ,
3 30HPAPERMILLS, EXC. BUILDING PAPE,
110 4 30HPAPERBOARD MILLS ,
5 30HMISC. CONVERTED PAPER PRODUCTS,
6 30HPAPERBOARD CONTAINERS AND BOXE,
7 30HBUILDING PAPER AND BOARD MILLS,
8 30HNEWSPAPERS ,
115 9 30HPERIODICALS ,
A 30HBOOKS ,
1 30HMISCELLANEOUS PUBLISHING ,
2 30HCOMMERCIAL PRINTING ,
3 30HMANIFOLD BUSINESS FORMS ,
120 4 30HGREETING CARD PUBLISHING ,
5 30HBLANKBOOKS AND BOOKBINDING ,
6 30HPRINTING TRADE SERVICES ,
7 30HINDUSTRIAL INORGANIC CHEMICALS,
8 30HPLASTICS MATERIALS, SYNTHETICS,
125 9 30HDRUGS ,
A 30HSOAP, CLEANERS, TOILET GOODS /
DATA (APP(IA),IA=181,240,3) /30HPAINTS AND ALLIED PRODUCTS ,
2 30HINDUSTRIAL ORGANIC CHEMICALS ,
3 30HAGRICULTURAL CHEMICALS ,
130 4 30HMISCELLANEOUS CHEMICAL PRODUCT,
5 30HPETROLEUM REFINING ,
6 30HPAVING AND ROOFING MATERIALS ,
7 30HMISC. PETROLEUM, COAL PRODUCTS,
8 30HTIRES AND INNER TUBES ,
135 9 30HRUBBER AND PLASTICS FOOTWEAR ,
A 30HRUBBER, PLASTICS HOSE, BELTING,
1 30HFABRICATED RUBBER PRODUCTS, NE,
2 30HMISCELLANEOUS PLASTICS PRODUCT,
3 30HLEATHER TANNING AND FINISHING ,
140 4 30HBOOT, SHOE CUT STOCK, FINDINGS,
5 30HFOOTWEAR, EXCEPT RUBBER ,
6 30HLEATHER GLOVES AND MITTENS ,
7 30HILUGGAGE ,
8 30HWOMEN'S HANDBAGS AND PURSES ,
145 9 30HFLAT GLASS ,
A 30HGLASS, PRESSED OR BLOWN /
DATA (APP(IA),IA=241,300,3) /30HPRODUCTS OF PURCHASED GLASS ,
2 30HCEMENT, HYDRAULIC ,
3 30HSTRUCTURAL CLAY PRODUCTS ,
150 4 30HPOTTERY AND RELATED PRODUCTS ,
5 30HCONCRETE, GYPSUM, PLASTER PROD,
6 30HCUT STONE AND STONE PRODUCTS ,
7 30HMISC. NONMETALLIC MINERAL PROD,
8 30HBLAST FURNACE, BASIC STEEL PRO,
155 9 30HIRON AND STEEL FOUNDRIES ,
A 30HPRIMARY NONFERROUS METALS ,
1 30HSECONDARY NONFERROUS METALS ,
2 30HNONFERROUS ROLLING AND DRAWING,
3 30HNONFERROUS FOUNDRIES ,

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160      4 30HMISC. PRIMARY METAL PRODUCTS ,
        5 30HMETAL CANS, SHIPPING CONTAINER,
        6 30HCUTLERY, HANDTOOLS AND HARDWAR,
        7 30HPLUMBING, HEATING, EXCEPT ELEC,
        8 30HFABRICATED STRUC. METAL PRODS ,
165      9 30HSCREW MACHINE PROD., BOLTS, ET,
        A 30HMETAL FORGINGS AND STAMPINGS /
          DATA (APP(IA),IA=301,360,3) /30HMETAL SERVICES, NEC
        2 30HORDNANCE AND ACCESSORIES, NEC ,
        3 30HMISC. FABRICATED METAL PRODUCT,
170      4 30HENGINES AND TURBINES
        5 30HFARM AND GARDEN MACHINERY ,
        6 30HCONSTRUCTION, RELATED MACHINER,
        7 30HMETALWORKING MACHINERY ,
        8 30HSPECIAL INDUSTRY MACHINERY ,
175      9 30HGENERAL INDUSTRIAL MACHINERY ,
        A 30HOFFICE AND COMPUTING MACHINES ,
        1 30HREFRIGERATION AND SERVICE MACH,
        2 30HMISC. MACHINERY, EXC. ELEC ,
        3 30HELECTRIC DISTRIBUTING EQUIPMEN,
180      4 30HELECTRICAL INDUSTRIAL APPARATU,
        5 30HHOUSEHOLD APPLIANCES ,
        6 30HELEC. LIGHTING, WIRING EQUIP ,
        7 30HRADIO, TV RECEIVING EQUIPMENT ,
        8 30HCOMMUNICATION EQUIPMENT ,
185      9 30HELECTRONIC COMPONENTS, ACCESS ,
        A 30HMISC. ELEC. EQUIPMENT, SUPPLIE/
          DATA (APP(IA),IA=361,420,3) /30HMOTOR VEHICLES AND EQUIPMENT ,
        2 30HAIRCRAFT AND PARTS ,
        3 30HSHIP, BOAT BUILDING, REPAIRING,
190      4 30HRAILROAD EQUIPMENT ,
        5 30HMOTORCYCLES, BICYCLES, PARTS ,
        6 30HGUIDED MISSILES, SPACE VEHICLE,
        7 30HTRANSPORTATION EQUIPMENT, NEC ,
        8 30HENGINEERING, SCIENTIFIC INSTRU,
195      9 30HMEASURING, CONTROLLING DEVICES,
        A 30HOPTICAL INSTRUMENTS AND LENSES,
        1 30HMEDICAL INSTRUMENTS, SUPPLIES ,
        2 30HOPHTHALMIC GOODS ,
        3 30HPHOTOGRAPHIC EQUIP., SUPPLIES ,
200      4 30HWATCHES, CLOCKS, AND WATCHCASE,
        5 30HJEWELRY, SILVER AND PLATED WAR,
        6 30HMUSICAL INSTRUMENTS ,
        7 30HTOYS AND SPORTING GOODS ,
        8 30HPPFNS, OFFICE AND ART GOODS ,
205      9 30HCOSTUME JEWELRY AND NOTIONS ,
        A 30HMISCELLANEOUS MANUFACTURES /
      C
      C
      C
210      DATA APPCODE /
        1 201, 202, 203, 204, 205, 206, 207, 208, 209, 211,
        1 212, 213, 214, 221, 222, 223, 224, 225, 226, 227,

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APPCODE IS TABLE OF 3-DIGIT SIC CODES FOR THE 140 APPLICATIONS

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215      1  228, 229, 231, 232, 233, 234, 235, 236, 238, 239,
      1  241, 242, 243, 244, 245, 249, 251, 252, 253, 254,
      1  259, 261, 262, 263, 264, 265, 266, 271, 272, 273,
      1  274, 275, 276, 277, 278, 279, 281, 282, 283, 284,
      1  285, 286, 287, 289, 291, 295, 299, 301, 302, 304,
      1  306, 307, 311, 313, 314, 315, 316, 317, 321, 322,
      1  323, 324, 325, 326, 327, 328, 329, 331, 332, 333,
220      1  334, 335, 336, 339, 341, 342, 343, 344, 345, 346,
      1  347, 348, 349, 351, 352, 353, 354, 355, 356, 357,
      1  358, 359, 361, 362, 363, 364, 365, 366, 367, 369,
      1  371, 372, 373, 374, 375, 376, 379, 381, 382, 383,
      1  384, 385, 386, 387, 391, 393, 394, 395, 396, 399/

225      C
      C      CTI IS LEVELIZED THERMAL ENERGY COSTS USED IN IDEAL STES
      C      SIMULATION. ($/MBTU)
      C
230      DATA CTI /5.0/
      C
      C      CEI IS LEVELIZED ELECTRICAL ENERGY COSTS USED IN IDEAL STES
      C      SIMULATION. (MILLS/KWH)
      C
235      DATA CEI /44.0/
      C
      C      DIECR IS TABLE OF ECR VS. ADDI CURVES FOR 8 T/E DEMAND
      C      RATIOS AND 3 PHASING PATTERNS.
      C      ECR IS EQUIVALENT COST RATIO.
      C
240      DATA (DIECR(K),K=1,57) /
      * 2.515      , -0.276      , 0.009      ,
      * 2.674      , -0.307      , 0.011      ,
      * 2.907      , -0.335      , 0.013      ,
      * 3.214      , -0.244      , 0.003      ,
245      * 4.619      , -0.396      , 0.010      ,
      1 8.778      , -1.328      , 0.066      ,
      1 10.933     , -1.813      , 0.096      ,
      1 11.869     , -2.008      , 0.107      ,
      * 2.387      , -0.254      , 0.007      ,
250      * 2.519      , -0.286      , 0.010      ,
      * 2.715      , -0.325      , 0.013      ,
      * 2.874      , -0.309      , 0.011      ,
      * 3.366      , -0.257      , 0.005      ,
      1 5.506      , -0.585      , 0.021      ,
255      1 8.000      , -1.043      , 0.046      ,
      1 9.787      , -1.413      , 0.06681     ,
      * 2.557      , -0.302      , 0.011      ,
      * 2.519      , -0.286      , 0.010      ,
      * 2.727      , -0.330      , 0.013      ,
260      DATA (DIECR(K),K=58,72) /
      * 2.874      , -0.309      , 0.011      ,
      * 3.336      , -0.244      , 0.004      ,
      1 5.506      , -0.585      , 0.021      ,
      1 8.247      , -1.117      , 0.051      ,
265      1 9.725      , -1.405      , 0.067      ,

```

C
C
C
C
C

DIFD IS TABLE OF FD VS ADDI CURVES FOR 8 T/E DEMAND RATIOS
AND 3 PHASING PATTERNS.
FD IS FUEL DISPLACEMENT PERCENTAGE.

270

DATA (DIFD(K),K=1,57) /

	*32.514	, 0.977	, 0.460	,
	* 7.147	,11.842	, -0.561	,
	*28.555	, 2.496	, 0.181	,
275	*-9.068	,19.175	, -1.550	,
	*19.957	, 5.328	, -0.177	,
	2 -200.780	,68.843	, -4.339	,
	2 -130.236	,50.381	, -3.171	,
	2 -178.174	,63.877	, -4.094	,
280	* 57.563	, -9.202	, 1.272	,
	*30.000	, 1.283	, 0.375	,
	*15.427	, 7.781	, -0.306	,
	*27.244	, 1.846	, 0.232	,
	* 24.015	, 3.522	, -0.048	,
285	2 -149.741	,52.263	, -3.469	,
	2 -239.272	,77.822	, -5.128	,
	2 -155.6	,53.83	, -3.335	,
	* 58.377	, -10.861	, 1.318	,
	* 31.327	, -0.873	, 0.464	,
290	* 21.491	, 3.068	, 0.009	/
	DATA (DIFD(K),K=58,72) /			
	* 38.152	, -4.669	, 0.640	,
	* 29.761	, -1.367	, 0.251	,
	2 -4.037	,6.609	, -0.291	,
295	2 -100.324	,32.664	, -1.845	,
	2 -133.292	,44.842	, -2.850	/

C
C
C
C
C

DIR IS TABLE OF R VS. ADDI CURVES FOR 8 T/E DEMAND RATIOS
AND 3 PHASING PATTERNS.
R IS T/E RATIO FOR DISPLACED ENERGY.

300

DATA (DIR(K),K=1,57) /

	* 5.003	, 2.024	, -0.228	,
	* 7.550	, -0.411	, 0.013	,
305	* 3.503	, 0.861	, -0.091	,
	* 6.176	, -1.259	, 0.104	,
	* 1.618	, -0.097	, -0.001	,
	3 0.027	,0.068	, -0.005	,
	3 -0.028	,0.029	, -0.002	,
310	3 0.430	, -0.108	, 0.007	,
	* 12.340	, -1.039	, 0.080	,
	* 8.611	, 0.214	, -0.031	,
	* 0.432	, 3.166	, -0.315	,
	x 6.635	, -0.546	, 0.020	,
315	* 1.703	, 0.227	, -0.030	,
	3 2.001	, -0.264	, 0.012	,
	3 1.195	, -0.286	, 0.018	,
	3 1.244	, -0.3683	, 0.02781	,

PROGRAM SAMDGP

76/76 OPT=2

FTN 4.6+428B

08/21/78 22.46.12\$

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320      * 12.025      , -1.016      , 0.082      ,
      * 7.966      , 0.330      , -0.034      ,
      * -0.250      , 3.424      , -0.337      /
      DATA (DIR(K),K=58,72) /
      * 2.660      , 0.884      , -0.097      ,
      * 2.746      , -1.367      , 0.251      ,
325      3 1.377      , -.090      , -0.000      ,
      3 1.234      , -0.295      , 0.018      ,
      3 3.963      , -1.138      , 0.081      /

C
C      ECIFARY IS ECR MODIFICATION FACTOR WHICH IS A FUNCTION OF TIME
330      AND MEDIAN TURBINE SIZE (WHICH IS A FUNCTION OF INDUSTRY
      GROUP)

      DATA ECIFARY /10.,      4.73,      3.15,      2.30,      4*1.71,
1      100.,      2.59,      1.59,      1.14,      4* .85,
335      2      500.,      2.12,      1.24,      .88,      4* .66,
      3      1000.,      1.93,      1.14,      .81,      4* .60,
      4      10000.,      1.46,      .81,      .55,      4* .37 /

C
C      ET IS BOILER EFFICIENCY.
340      DATA ET /.8/

C
C      EU IS UTILITY EFFICIENCY.
345      DATA EU /.3/

C
C      FCR IS FIXED CHARGE RATE USED IN THE IDEAL STES SIMULATION
      DATA FCR /.15/

350      C
      C      IPRINT IS INTERMEDIATE PRINT FLAG. IF IPRINT = 0, NO
      C      INTERMEDIATE PRINTOUT IS PRINTED. IF IPRINT = 1, SEVERAL
      C      LINES OF PRINTOUT FOR EACH APPLICATION IN EACH STATE AND
      C      FOR EACH TIME PERIOD APPEAR ON THE OUTPUT LISTING.
355      C
      DATA IPRINT /0/

C
C      ISTA IS TABLE OF CORRESPONDENCE BETWEEN SHERMAN CLARK
360      ORDERING OF THE 50 STATES AND ALPHABETICAL ORDER.

      DATA ISTA /7,19,21,29,39,45,30,32,38,13,14,22,35,49,15,16,23,25
1      ,27,34,41,8,9,10,20,33,40,46,48,17,42,1,24,36,4,18,43,3,6,12
2      ,26,28,31,44,50,5,37,47,2,11/

C
C      LOC IS TABLE CONTAINING NAMES FOR 50 STATES.
365      C
      DATA (LOC(ILOC),ILOC=1,36,1)
      1/20HALABAMA      ,      20HALASKA      ,
370      2 20HARIZONA      ,      20HARKANSAS      ,
      3 20HCALIFORNIA      ,      20HCOLORADO      ,
      4 20HCONNECTICUT      ,      20HDELAWARE      ,

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375 5 20HFLORIDA , 20HGEORGIA ,
6 20HHAWAII , 20HIDAHO ,
7 20HILLINOIS , 20HINDIANA ,
8 20HIOWA , 20HKANSAS ,
9 20HKENTUCKY , 20HLOUISIANA ,
A 20HMAINE , 20HMARYLAND ,
B 20HMASSACHUSETTS , 20HMICHIGAN ,
C 20HMINNESOTA , 20HMISSISSIPPI ,
380 D 20HMISSOURI , 20HMONTANA ,
E 20HNEBRASKA , 20HNEVADA ,
F 20HNEW HAMPSHIRE , 20HNEW JERSEY ,
G 20HNEW MEXICO , 20HNEW YORK ,
H 20HNORTH CAROLINA , 20HNORTH DAKOTA ,
385 I 20HOHIO , 20HOKLAHOMA ,
DATA (LOC(ILOC),ILOC=37,50,1)
1/20HOREGON , 20HPENNSYLVANIA ,
2 20HRHODE ISLAND , 20HSOUTH CAROLINA ,
3 20HSOUTH DAKOTA , 20HTENNESSEE ,
390 4 20HTEXAS , 20HUTAH ,
5 20HVERMONT , 20HVIRGINIA ,
6 20HWASHINGTON , 20HWEST VIRGINIA ,
7 20HWISCONSIN , 20HWYOMING ,
C
395 C 50 STATE ABBREVIATIONS IN ALPHABETICAL ORDER
C
DATA STABBR /
12HAL, 2HAK, 2HAZ, 2HAR, 2HCA, 2HCO, 2HCT, 2HDE, 2HFL, 2HGA,
22HHI, 2HID, 2HIL, 2HIN, 2HIA, 2HKS, 2HKY, 2HLA, 2HME, 2HMD,
400 32HMA, 2HMI, 2HMN, 2HMS, 2HMO, 2HMT, 2HNB, 2HNV, 2HNH, 2HNJ,
42HNM, 2HNY, 2HNC, 2HND, 2HOH, 2HOK, 2HOR, 2HPA, 2HRI, 2HSC,
52HSD, 2HTN, 2HTX, 2HUT, 2HVA, 2HWA, 2HWV, 2HWI, 2HWY /
C
C TE IS TABLE OF THERMAL/ELECTRIC (T/E) RATIOS (8 T/E RATIOS
405 C FOR EACH OF 3 PHASING PATTERNS.
C
DATA TE
1/ 3.6444, 5.4667, 3.6444,
2 3.0000, 4.5000, 3.0000,
410 3 2.0000, 3.0000, 2.0000,
4 1.0000, 1.5000, 1.0000,
5 .5000, .7500, .5000,
6 .2500, .3750, .2500,
7 .1250, .1875, .1250,
415 8 .0625, .0937, .0625 /
C
C TIM IS TABLE CONTAINING NAMES FOR 7 TIME PERIODS
C
DATA TIM / 4H1985, 4H1990, 4H1995, 4H2000, 4H2005, 4H2010, 4H2015/
420 C
C TITLE IS 30 CHARACTER TITLE THAT APPEARS AT START OF PRINTOUT
C
DATA TITLE / 10HBASELINE T, 10HEST CASE , 10H /
C

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425      C      TRBSIZE IS MEDIAN TURBINE SIZE IN KWE FOR INDUSTRY GROUPS
      C      20, 21, ..., 39
      C
      DATA TRBSIZE /      240.,      292.,      250.,      32.,      147.,
1      64.2,      2000.,      43.4,      3650.,      1900.,      77.,
430      2      76.,      262.,      1880.,      122.,      88.5,      153.,
      3      165.,      85.,      90. /
      C
      C *****
      C      PROGRAM STARTS HERE
      C *****
435      C *****
      C      READ NAMELIST INPUTS
      C
      READ(5,IN)
      C
      C
      C      IF EOF READ, TERMINATE EXECUTION, OTHERWISE WRITE TITLE
      C      AND PRINT BACK NAMELIST VALUES.
      C
      IF (EOF(5)) 220,10
445      10 CONTINUE
      CALL HEADING (TITLE)
      WRITE (6,15) ACR, ALPHA, CEI, CTI, ET, EU, FCR, IPRINT, TITLE
      15 FORMAT(/* ACR = *,E13.3,/* ALPHA = *,E11.3,/* CEI = *,E13.3,
450      /* CTI = *,E13.3,/* ET = *,E14.3,/* EU = *,E14.3,
      /* FCR = *,E13.3,/* IPRINT = *,I10,/* TITLE = *,1X,3A10)
      C
      C      READ IN PHASING PATTERN, FRACTION ABSORPTION COOLING AND
      C      T/E DEMAND RATIO FOR EACH INDUSTRY FROM TAPE 5.
      C
455      DO 30 I=1,140
      READ (5,20) PP(I),TEDR(I),FAC(I)
      20 FORMAT (38X,F2.0,F10.1,F2.0)
      30 CONTINUE
      C
460      C      READ LEVELIZED THERMAL AND ELECTRIC ENERGY PRICES BY STATE
      C      FOR 7 TIME PERIODS
      C      IT IS ASSUMED THAT THE LEVELIZED COST INPUT CARDS ARE PAIRS OF
      C      CARDS FOR THE SAME STATE WITH ELECTRIC COSTS ON THE 1ST CARD
      C      AND THERMAL COSTS ON THE 2ND CARD.
465      C
      40 CONTINUE
      READ (5,50) STABBR,LEVCOST
      50 FORMAT (A2,8X,7F10.0)
      IF (EOF(5)) 110,60
470      C
      C      MATCH UP STATE ABBREVIATION TO DETERMINE STATE.
      C
      60 IST=0
      DO 70 ILOC=1,50
475      IF (STABBR.EQ. STABBR(ILOC)) IST=ILOC
      IF (IST.NE. 0) GO TO 90
      70 CONTINUE

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00370

PROGRAM SAMDGP

76/76

OPT=2

FTN 4.6+428B

08/21/78 22.46.129

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DO 130 J=1,6
SFDEJ(I,J)=0.
SFDTJ(I,J)=0.
535 130 CONTINUE
140 CONTINUE
DO 160 I=1,50
SAFDEI(I)=0.
SAFDTI(I)=0.
DO 150 J=1,6
540 SFDEI(I,J)=0.
SFDTI(I,J)=0.
150 CONTINUE
160 CONTINUE
NUM=0
545 WRITE (6,170)
170 FORMAT (1H1)
C
C LOOP ON INDUSTRY
C
550 DO 200 J=1,140
C
C READ IN ENERGY DEMANDS FOR 50 STATES FOR INDUSTRY J.
C
READ (3) (EMI(J,I),I=1,50)
555 C
C IF INDUSTRY WITH HIGH TEMPERATURE LIMITATION, DO NOT PROCESS.
C
IF (J.EQ. 65 .O. J.EQ. 79 .O. J.EQ. 80 .O. J.EQ. 82 .O.
1 J.EQ. 83 .O. J.EQ. 88 .O. J.EQ. 89 .O. J.EQ. 90) GO TO 200
560 C
C CONVERT EMI VALUES FROM TRILLION BTUS TO BTUS.
C
DO 180 I=1,50
EMI(J,I)=EMI(J,I)*1.E12
565 180 CONTINUE
C
C LOOP ON STATE
C
DO 190 I=1,50
570 C
C IF THERE IS NO ENERGY DEMAND FOR THIS INDUSTRY IN STATE I
C THEN SKIP.
C
IF (EMI(J,I).EQ. 0.) GO TO 190
575 C
C STORE PHASING PATTERN (FP), FRACTION ABSORPTION COOLING (C),
C AND T/E DEMAND RATIO (TEDMD).
C
FP=PP(J)
580 C=FAC(J)
TEDMD=TEDR(J)
C
C CALL SUBROUTINE COMPUTE TO PERFORM CALCULATIONS

```

00500

PROGRAM SAMDGP

76/76 OPT=2

FTN 4.6+428B

08/21/78 22.46.129

```

585      C      CALL COMPUTE (J,I,IT)
          C
          C      WRITE OUTPUTS FOR APPLICATION J, LOCATION I, TIME PERIOD IT
          C
          C      WRITE (2) I,J,ECR,FD,TFOT,TFDE,(AFDT(L),L=1,4),AFDE,R
590      NUM=NUM+1
          C
          C      SKIP TO NEW PAGE
          C
          C      IF (MOD(NUM,7) .EQ. 0 .A. IPRINT .NE. 0) WRITE (6,170)
595      190 CONTINUE
          200 CONTINUE
          C
          C      CALL SUBROUTINE PRNTOUT TO PRINT OUT THERMAL AND ELECTRIC
          C      DISPLACEMENT SUMMARIES BY LOCATION AND BY APPLICATION
600      C
          C      CALL PRNTOUT (IT)
          C      ENDFILE 2
          210 CONTINUE
          220 CONTINUE
605      ENDFILE 2
          STOP
          END

```

00660
00670

CARD NR. SEVERITY DETAILS DIAGNOSIS OF PROBLEM

67	I	MEAT PRO	CONSTANT LENGTH .GT. VARIABLE LENGTH, CONSTANT TRUNCATED.
67	I	DAIRY PR	CONSTANT LENGTH .GT. VARIABLE LENGTH, CONSTANT TRUNCATED.
67	I	PRESERVE	CONSTANT LENGTH .GT. VARIABLE LENGTH, CONSTANT TRUNCATED.
67	I	GRAIN MI	CONSTANT LENGTH .GT. VARIABLE LENGTH, CONSTANT TRUNCATED.
67	I	BAKERY P	CONSTANT LENGTH .GT. VARIABLE LENGTH, CONSTANT TRUNCATED.
67	I	SUGAR, C	CONSTANT LENGTH .GT. VARIABLE LENGTH, CONSTANT TRUNCATED.
67	I	FATS AND	CONSTANT LENGTH .GT. VARIABLE LENGTH, CONSTANT TRUNCATED.
67	I	BEVERAGE	CONSTANT LENGTH .GT. VARIABLE LENGTH, CONSTANT TRUNCATED.
67	I	MISC. FO	CONSTANT LENGTH .GT. VARIABLE LENGTH, CONSTANT TRUNCATED.
67	I	CIGARETT	CONSTANT LENGTH .GT. VARIABLE LENGTH, CONSTANT TRUNCATED.
67	I	CIGARS	CONSTANT LENGTH .GT. VARIABLE LENGTH, CONSTANT TRUNCATED.
67	I	CHEWING	CONSTANT LENGTH .GT. VARIABLE LENGTH, CONSTANT TRUNCATED.
67	I	TOBACCO	CONSTANT LENGTH .GT. VARIABLE LENGTH, CONSTANT TRUNCATED.
67	I	WEAVING	CONSTANT LENGTH .GT. VARIABLE LENGTH, CONSTANT TRUNCATED.
67	I	WEAV>G M	CONSTANT LENGTH .GT. VARIABLE LENGTH, CONSTANT TRUNCATED.
67	I	WEAVING,	CONSTANT LENGTH .GT. VARIABLE LENGTH, CONSTANT TRUNCATED.
67	I	NARROW F	CONSTANT LENGTH .GT. VARIABLE LENGTH, CONSTANT TRUNCATED.
67	I	KNITTING	CONSTANT LENGTH .GT. VARIABLE LENGTH, CONSTANT TRUNCATED.
67	I	TEXTILE	CONSTANT LENGTH .GT. VARIABLE LENGTH, CONSTANT TRUNCATED.
67	I	FLOOR CO	HOLLERITH CONSTANT .GT. 10 CHARACTERS, EXCESS CHARACTERS INITIALIZED INTO SUCCEEDIN
87	I	YARN AND	CONSTANT LENGTH .GT. VARIABLE LENGTH, CONSTANT TRUNCATED.
87	I	MISCELLA	CONSTANT LENGTH .GT. VARIABLE LENGTH, CONSTANT TRUNCATED.
87	I	MEN>S AN	CONSTANT LENGTH .GT. VARIABLE LENGTH, CONSTANT TRUNCATED.

```

1      SUBROUTINE COMPUTE(J,I,IT)                                00680
      C
      C      COMPUTE CALCULATES ECR AND ELECTRIC AND THERMAL FUEL
      C      DISPLACEMENT VALUES FOR AN APPLICATION IN A STATE IN A
5      C      PARTICULAR TIME PERIOD. THESE VALUES ARE PRINTED OUT IF
      C      PRINT FLAG IPRINT IS NON-ZERO.
      C
      REAL NTRPLAT
      INTEGER FP, APPCODE                                00190
      DOUBLE LOC, FUEL
      DIMENSION SAFD(6)
      COMMON /INPUTS/
      *   ACR, ADDI(50), ALPHA, APP(3,140), APPCODE(140), C, CEF(50,7),
      *   CEI, CTF(50,7), CTI, DIECR(3,8,3),
15      *   DIFD(3,8,3), DIR(3,8,3), ECIFARY(8,5), EMI(140,50), ET, EU,
      *   FCR, FME(50,7,6), FMT(50,7,4), FP, IPRINT, LOC(50), TE(3,8),
      *   TEDMD, TIM(7), TRBSIZS(20)
      COMMON /OUTPUTS/ R,
20      1   AFDE(6),      AFDT(4),      ECR,      FD,      00210
      2   SAFDEI(50),SAFDEJ(140),SAFDTI(50),SAFD TJ(140),
      3   SFDEI(50,6),SFDEJ(140,6),SFD TI(50,6),SFD TJ(140,6),
      4   TAFDE,      TAFDT,      TFDE,      TFDT
      EXTERNAL NTRPLAT
      DATA IFIRST /0/
25      IF (IFIRST .GT. 0) GO TO 20
      IFIRST = 1
      C
      C      COMPUTE E, RATIO OF BOILER EFFICIENCY TO
      C      UTILITIES POWER GENERATION EFFICIENCY                                00330
30      C
      C      E=ET/EU                                00360
      C
      C      CONVERT THERMAL ENERGY PRICES FROM DOLLARS PER MILLION BTU
      C      TO DOLLARS PER BTU AND
35      C      ELECTRIC ENERGY PRICES FROM MILLS PER KWH TO DOLLARS PER BTU
      C
      CTI = CTI*1E-6
      CEI = CEI*1E-3/3413.
      DO 10 ITIM=1,7
40      DO 10 ILOC=1,50
      CTF(ILOC,ITIM) = CTF(ILOC,ITIM)*1E-6
      CEF(ILOC,ITIM) = CEF(ILOC,ITIM)*1E-3/3413.
      10 CONTINUE
      20 CONTINUE
45      C
      C      COMPUTE AFE, ELECTRIC DEMAND FOR INDUSTRY J AND LOCATION I
      C
      AFE = EMI(J,I)/(1+TEDMD)
      C
      C      COMPUTE AFT, THERMAL DEMAND FOR INDUSTRY J AND LOCATION I
50      C
      AFT = EMI(J,I)-AFE
      C

```

00840

SUBROUTINE COMPUTE 76/76 OPT=2 FTN 4.6+428B 08/21/78 22.46.126

```

55      C      COMPUTE BETA, RATIO OF LEVELIZED ELECTRIC TO THERMAL COSTS
      C      BETA = CEF(I,IT)/CTF(I,IT)
      C      00880
      C      IF THERE IS ABSORPTION COOLING FOR
      C      APPLICATION J, LOCATION I, TIME PERIOD IT,
60      C      THEN RE-COMPUTE T/E DEMAND RATIO
      C      STORE T/E DEMAND FOR VAPOR COMPRESSION IN TEDMDVC
      C      IF (C.NE.0) TEDMDVC = TEDMD
      C      IF (C.NE.0) TEDMD = (TEDMD+C*ALPHA)/(1-C)
65      C      IF (C.NE.0) AFE = APT/TEDMD
      C      00930
      C      INTERPOLATE TO GET ECR
      C      ECR = NTRPLAT(1,J,I)
      C      00950
70      C      00960
      C      IF THERE IS ABSORPTION COOLING FOR
      C      APPLICATION J, LOCATION I, TIME PERIOD IT,
      C      THEN RE-COMPUTE ECR
75      C      IF (C.NE.0) ECR = ECR*(TEDMD+(1-C)*BETA)/(TEDMDVC+BETA)
      C      01020
      C      INTERPOLATE TO GET R
      C      R = NTRPLAT(2,J,I)
      C      01040
80      C      RE-COMPUTE ECR FOR EFFECT OF ENERGY PRICES, STES CAPITAL COSTS
      C      AND COST OF MONEY
      C      FIRST GET THE INDUSTRY GROUP (VALUES ARE 20 - 39)
85      C      INDGRP = INT(APPCODE(J)/10.)
      C      GET MEDIAN TURBINE SIZE FOR INDUSTRY GROUP
      C      TRBSIZ = TRBSIZS(INDGRP-19)
90      C      INTERPOLATE TO GET ECR MODIFICATION FACTOR
      C      ISIZE = 0
95      C      DO 50 ISIZES=2,5
      C      IF (TRBSIZ.LE.ECIFARY(1,ISIZES)) ISIZE = ISIZES
      C      IF (ISIZE.NE.0) GO TO 70
      C      50 CONTINUE
      C      WRITE (6,60) TRBSIZ,ECIFARY(1,1),ECIFARY(1,5)
100      C      60 FORMAT (* TURBINE SIZE *,F10.1,* NOT IN RANGE *,2F10.0)
      C      STOP
      C      70 CONTINUE
      C      ECIF = ECIFARY(IT+1,ISIZE-1)+(TRBSIZ-ECIFARY(1,ISIZE-1))/
105      C      1 (ECIFARY(1,ISIZE)-ECIFARY(1,ISIZE-1))*
      C      2 (ECIFARY(IT+1,ISIZE)-ECIFARY(IT+1,ISIZE-1))
      C      ECR = (ECR*(CTI*R+CEI))/(CTF(I,IT)*R+CEF(I,IT))*ECIF*ACR/FCR

```


SUBROUTINE COMPUTE

76/76

OPT=2

FTN 4.6+428B

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```
C
C      INTERPOLATE TO GET FD                                01160
C
110  C      FD = NTRPLAT(3,J,I)                                01190
C
C      COMPUTE PER CENT FUEL DISPLACED FOR THERMAL ENERGY
C
C       $TFDT = FD * R / (E + R) * (E + TEDMD) / TEDMD$           01210
115  C      COMPUTE PER CENT FUEL DISPLACED FOR ELECTRIC ENERGY 01220
C
C       $TFDE = FD * (E + TEDMD) / (E + R)$                     01240
120  C      COMPUTE AMOUNT OF FUEL DISPLACED FOR THERMAL ENERGY 01250
C
C       $TAFDT = TFDT * AFT / 100.$                                 01280
C
C      COMPUTE AMOUNT OF FUEL DISPLACED FOR ELECTRIC ENERGY
125  C
C       $TAFDE = TFDE * AFE / 100.$                                 01310
C
C      COMPUTE AMOUNT OF EACH FUEL TYPE DISPLACED
130  C      DO 90 NF=1,4
C
C      COMPUTE AMOUNT OF FUEL NF DISPLACED FOR THERMAL ENERGY 01340
C
C       $AFDT(NF) = TAFDT * FMT(I,IT,NF)$ 
135  C      90 CONTINUE
C
C      COMPUTE AMOUNT OF FUEL NF DISPLACED FOR ELECTRIC ENERGY 01370
C
C
C      DO 100 NF=1,6
140  C       $AFDE(NF) = TAFDE * FME(I,IT,NF)$ 
C      100 CONTINUE
C
C      ACCUMULATE AMOUNT OF FUEL DISPLACED FOR THERMAL ENERGY 01410
C      BY APPLICATION.
145  C
C       $SAFDTJ(J) = SAFDTJ(J) + TAFDT$                             01440
C
C      ACCUMULATE AMOUNT OF FUEL DISPLACED FOR ELECTRIC ENERGY 01450
C      BY APPLICATION
150  C
C       $SAFDEJ(J) = SAFDEJ(J) + TAFDE$                             01480
C
C      ACCUMULATE AMOUNT OF FUEL DISPLACED FOR THERMAL ENERGY 01490
C      BY LOCATION
155  C
C       $SAFDTI(I) = SAFDTI(I) + TAFDT$                             01520
C
C      ACCUMULATE AMOUNT OF FUEL DISPLACED FOR ELECTRIC ENERGY 01530
C      BY LOCATION
```

SUBROUTINE COMPUTE

76/76 OPT=2

FTN 4.6+428B

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160      C      SAFDEI(I) = SAFDEI(I)+TAFDE      01560
          DO 110 NF=1,6
      C
      C      ACCUMULATE AMOUNT OF FUEL DISPLACED FOR THERMAL ENERGY FOR
165      C      EACH FUEL TYPE BY APPLICATION
      C      SFDTJ(J,NF) = SFDTJ(J,NF)+AFDT(NF)
      C
      C      ACCUMULATE AMOUNT OF FUEL DISPLACED FOR THERMAL ENERGY FOR
170      C      EACH FUEL TYPE BY LOCATION
      C      SFDTI(I,NF) = SFDTI(I,NF)+AFDT(NF)
      C
      C      ACCUMULATE AMOUNT OF FUEL DISPLACED FOR ELECTRIC ENERGY FOR
175      C      EACH FUEL TYPE BY APPLICATION
      C      SFDEJ(J,NF) = SFDEJ(J,NF)+AFDE(NF)
      C
      C      ACCUMULATE AMOUNT OF FUEL DISPLACED FOR ELECTRIC ENERGY FOR
180      C      EACH FUEL TYPE BY LOCATION
      C      SFDEI(I,NF) = SFDEI(I,NF)+AFDE(NF)
110 CONTINUE
      SAFD(1) = AFDT(1) + AFDE(1)
185      SAFD(2) = AFDT(2) + AFDE(2)
      SAFD(3) = AFDT(3)+AFDE(3)
      SAFD(4)=AFDE(4)
      SAFD(5)=AFDE(5)
      SAFD(6) = AFDT(4)+AFDE(6)
190      TAFD = TAFDT+TAFDE
      IF (IPRINT .NE. 0)
        1WRITE (6,160) LOC(I),(APP(K,J),K=1,3),ECR,FD,R,TFDT,TAFDT,
        2 (AFDT(L),L=1,4), TFDE, TAFDE,
        3 AFDE, TAFD, SAFD
195      160 FORMAT (//* LOCATION = *,2A10,17X,*APPLICATION = *,3A10,
        1 /11X,*FUEL DISP*,15X,*FUEL DISPLACEU*,
        2 /7X,*ECR*,2X,*PER CENT*,5X,*R*,5X,*PER CENT      BTU NATL GAS*,
        3 6X,* OIL      COAL      NUCLEAR HYDROELEC      OTHER*,
        4 /F10.2,F10.2,F6.2,* THERM*,F7.2,1X,4(1PE9.2,1X),20X,E9.2,/26X,
200      5 * ELECT*,0PF7.2,
        6 1X,7(1PE9.2,1X),/26X,* TOTAL*,8X,7(E9.2,1X))
      RETURN      01570
      END      01580

```

SYMBOLIC REFERENCE MAP (R=2)

```

1      REAL FUNCTION NTRPLAT(MODE,J,I)
      C
      C      NTRPLAT PERFORMS LINEAR INTERPOLATION BETWEEN T/E DEMAND
      C      CURVES - I.E. ONE POINT IS FOUND ON THE T/E DEMAND CURVE
      C      BELOW THE T/E DEMAND DESIRED AND ANOTHER POINT ON THE
5      C      CURVE ABOVE IT AND THEN LINEAR INTERPOLATION IS PERFORMED.
      C      VALUES FOR ECR, R, AND FD ARE COMPUTED IN THIS MANNER.
      C
      INTEGER FP, APPCODE                                00190
      DOUBLE LOC, FUEL
      COMMON /INPUTS/
      *   ACR, ADDI(50), ALPHA, APP(3,140), APPCODE(140), C, CEF(50,7),
      *   CEI, CTF(50,7), CTI, DIECR(3,8,3),
      *   DIFD(3,8,3), DIR(3,8,3), ECIFARY(8,5), EMI(140,50), ET, EU,
15      *   FCR, FME(50,7,6), FMT(50,7,4), FP, IPRINT, LOC(50), TE(3,8),
      *   TEDMD, TIM(7), TRBSIZS(20)
      C
      C      LOCATE THE 2 T/E DEMAND RATIOS (ITE1,ITE2) BETWEEN WHICH LIES
      C      THE T/E DEMAND FOR APPLICATION J
      C      TE ARRAY ASSUMED TO BE IN DESCENDING ORDER
20      C
      ITE1 = 0
      DO 10 ITE=1,7
      IF (TEDMD.LE.TE(FP,ITE) .AND. TEDMD.GE.TE(FP,ITE+1))
25      ITE1 = ITE
      IF (ITE1.NE. 0) GO TO 20
10      CONTINUE
      IF (TEDMD.GT.TE(FP,1)) ITE1=1
      IF (TEDMD.LT.TE(FP,8)) ITE1=7
30      ITE2=ITE1+1
      C
      C      COMPUTE VALUES FOR ECR, R, ECI, AND FD AT T/E RATIOS ABOVE
      C      AND BELOW THE ONE DESIRED
      C
35      GO TO (30,40,50) MODE
      C
      C      ECR VALUES
      C
40      VALUE1 = DIECR(1,ITE1,FP)+ADDI(I)*DIECR(2,ITE1,FP)
      1   +ADDI(I)*ADDI(I)*DIECR(3,ITE1,FP)
      VALUE2 = DIECR(1,ITE2,FP) + ADDI(I)*DIECR(2,ITE2,FP)
      1   +ADDI(I)*ADDI(I)*DIECR(3,ITE2,FP)
      IF (TEDMD .LE. TE(FP,1)) GO TO 70
      C
      C      IF T/E RATIO IS GREATER THAN TE(FP,1), THEN USE ECR VALUE AT
      C      TE(FP,1)
      C
      NTRPLAT = VALUE1
      RETURN
50      C
      C      R VALUES
      C
40      VALUE1 = DIR(1,ITE1,FP)+ADDI(I)*DIR(2,ITE1,FP)

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SUBROUTINE PRNTOUT

76/76

OPT=2

FTN 4.6+428B

08/21/78 22.46.12*

1

SUBROUTINE PRNTOUT (IT)

C
C
C
C
C

PRNTOUT WRITES SUMMARY REPORTS FOR FUEL DISPLACED BY THERMAL
ENERGY, ELECTRIC ENERGY, AND BOTH FOR EACH STATE AND EACH
INDUSTRY.

5

INTEGER FP, APPCODE

00190

DOUBLE LOC, FUEL

DIMENSION SSFDTI(4), SSFDEI(6), SFDI(6), SSFDI(6)

10

DIMENSION SSFDTJ(4), SSFDEJ(6), SFDJ(6), SSFDJ(6)

COMMON /INPUTS/

* ACR, ADDI(50), ALPHA, APP(3,140), APPCODE(140), C, CEF(50,7),

* CEI, CTF(50,7), CTI, DIECR(3,8,3),

* DIFD(3,8,3), DIR(3,8,3), ECIFARY(8,5), EMI(140,50), ET, EU,

15

* FCR, FME(50,7,6), FMT(50,7,4), FP, IPRINT, LOC(50), TE(3,8),

* TEDMD, TIM(7), TRBSIZS(20)

COMMON /OUTPUTS/ R,

* AFDE(6), AFDT(4), ECR, FD,

* SAFDEI(50), SAFDEJ(140), SAFDTI(50), SAFDTJ(140),

20

* SFDEI(50,6), SFDEJ(140,6), SFDTI(50,6), SFDTJ(140,6),

* TAFDE, TAFDT, TFDE, TFDT

02580

C
C
C
C

PRINT OUT SUMMATION OF AMOUNT OF FUEL DISPLACED
BY THERMAL ENERGY AND ELECTRIC ENERGY FOR ALL LOCATIONS

25

WRITE (6,10) TIM(IT)

10 FORMAT(*1*,1X,*AMOUNT OF FUEL DISPLACED BY LOCATION *,

* *FOR THERMAL ENERGY IN BTU*,9X,A10,///,

* 2X,*LOCATION*,18X,*TOTAL*,

30

* 3X,*NATL GAS OIL COAL OTHER*)

SSAFDTI = 0

DO 20 K=1,4

SSFDTI(K) = 0

20 CONTINUE

35

DO 50 I=1,50

WRITE (6,30) LOC(I), SAFDTI(I), (SFDTI(I,K),K=1,4)

30 FORMAT (2X,2A10,5E11.4)

SSAFDTI = SSAFDTI+SAFDTI(I)

DO 40 K=1,4

40

SSFDTI(K) = SSFDTI(K)+SFDTI(I,K)

40 CONTINUE

50 CONTINUE

WRITE (6,60) SSAFDTI,(SSFDTI(K),K=1,4)

60 FORMAT(/2X,*TOTAL*,15X,5E11.4)

45

WRITE (6,70) TIM(IT)

70 FORMAT(*1*,1X,*AMOUNT OF FUEL DISPLACED BY LOCATION *,

* *FOR ELECTRIC ENERGY IN BTU*,30X,A10,///,

* 2X,*LOCATION*,18X,*TOTAL*,3X,*NATL GAS OIL*,

50

* 4X,* COAL NUCLEAR HYDROELEC OTHER*)

SSAFDEI = 0

DO 80 K=1,6

SSFDEI(K) = 0

80 CONTINUE

SUBROUTINE PRNTOUT

76/76

OPT=2

FTN 4.6+428B

08/21/78 22.46.12*

```

55      DO 110 I=1,50
        WRITE (6,90) LOC(I), SAFDEI(I), (SFDEI(I,K),K=1,6)
90      FORMAT (2X,2A10,7E11.4)
        SSAFDEI = SSAFDEI+SAFDEI(I)
        DO 100 K=1,6
          SSFDEI(K) = SSFDEI(K)+SFDEI(I,K)
60      100 CONTINUE
        110 CONTINUE
        WRITE (6,120) SSAFDEI,(SSFDEI(K),K=1,6)
        120 FORMAT(/2X,*TOTAL*,15X,7E11.4)

65      C
        C      PRINT SUMMATION OF AMOUNT OF FUEL DISPLACED FOR THERMAL AND
        C      ELECTRIC ENERGY COMBINED FOR ALL LOCATIONS
        C
        WRITE (6,130) TIM(IT)
130     FORMAT(*1*,1X,*AMOUNT OF FUEL DISPLACED BY LOCATION *,
70      *   *FOR THERMAL AND ELECTRIC ENERGY IN BTU*,18X,A10,///,
        * 2X,*LOCATION*,18X,*TOTAL*,3X,*NATL GAS      OIL*,
        * 4X,* COAL      NUCLEAR      HYDROELEC      OTHER*)
        SSAFDI = 0
        DO 140 K=1,6
75      SSFDI(K) = 0
        140 CONTINUE
        DO 170 I=1,50
          SAFDI = SAFDI(I)+SAFDEI(I)
          DO 150 K=1,3
80      SFDI(K) = SFDI(I,K)+SFDEI(I,K)
          150 CONTINUE
          SFDI(4) = SFDEI(I,4)
          SFDI(5) = SFDEI(I,5)
          SFDI(6) = SFDI(I,4)+SFDEI(I,6)
85      WRITE (6,90) LOC(I), SAFDI, (SFDI(K),K=1,6)
          SSAFDI = SSAFDI+SAFDI
          DO 160 K=1,6
            SSFDI(K) = SSFDI(K)+SFDI(K)
          160 CONTINUE
90      170 CONTINUE
          WRITE (6,120) SSAFDI,(SSFDI(K),K=1,6)

        C
        C      PRINT OUT SUMMATION OF AMOUNT OF FUEL DISPLACED
        C      BY THERMAL ENERGY AND ELECTRIC ENERGY FOR ALL APPLICATIONS
        C
95      SSAFDI = 0
        DO 180 K=1,4
          SSFDI(K) = 0
        180 CONTINUE
        DO 230 L=1,140,50
100     WRITE (6,190) TIM(IT)
        190 FORMAT(*1*,1X,*AMOUNT OF FUEL DISPLACED BY APPLICATION *,
        *   *FOR THERMAL ENERGY IN BTU*,16X,A10,///,
        * 2X,*APPLICATION*,25X,*TOTAL*,
105     * 3X,*NATL GAS      OIL      COAL      OTHER*)
        DO 220 M=1,50

```

02680

```

      J = L+M-1
      IF (J.GT.140) GO TO 230
      WRITE (6,200) (APP(K,J),K=1,3), SAFDTJ(J), (SFDTJ(J,K),K=1,4)
110      200 FORMAT (2X,3A10,5E11.4)
      SSFADTJ = SSFADTJ+SAFDTJ(J)
      DO 210 K=1,4
      SSFDTJ(K) = SSFDTJ(K)+SFDTJ(J,K)
115      210 CONTINUE
      220 CONTINUE
      230 CONTINUE
      WRITE (6,240) SSFADTJ, (SSFDTJ(K),K=1,4)
120      240 FORMAT (/2X,*TOTAL*,25X,5E11.4)
      SSFDEJ = 0
      DO 250 K=1,6
      SSFDEJ(K) = 0
      250 CONTINUE
      DO 300 L=1,140,50
      WRITE (6,260) TIM(IT)
125      260 FORMAT(*1*,1X,*AMOUNT OF FUEL DISPLACED BY APPLICATION *,
      * *FOR ELECTRIC ENERGY IN BTU*,37X,A10,///,
      * 2X,*APPLICATION*,25X,*TOTAL*,3X,*NATL GAS OIL*,
      * 4X,* COAL NUCLEAR HYDROELEC OTHER*)
      DO 290 M=1,50
130      J = L+M-1
      IF (J.GT.140) GO TO 300
      WRITE (6,270) (APP(K,J),K=1,3), SAFDEJ(J), (SFDEJ(J,K),K=1,6)
      270 FORMAT (2X,3A10,7E11.4)
      SSFADJ = SSFADJ+SAFDEJ(J)
135      DO 280 K=1,6
      SSFDEJ(K) = SSFDEJ(K)+SFDEJ(J,K)
      280 CONTINUE
      290 CONTINUE
      300 CONTINUE
140      WRITE (6,310) SSFADJ, (SSFDEJ(K),K=1,6)
      310 FORMAT (/2X,*TOTAL*,25X,7E11.4)
      C
      C PRINT SUMMATION OF AMOUNT OF FUEL DISPLACED FOR THERMAL AND
      C ELECTRIC ENERGY COMBINED FOR ALL APPLICATIONS.
145      C
      SSFADJ = 0
      DO 320 K=1,6
      SSFDEJ(K) = 0
      320 CONTINUE
150      DO 370 L=1,140,50
      WRITE (6,330) TIM(IT)
      330 FORMAT(*1*,1X,*AMOUNT OF FUEL DISPLACED BY APPLICATION *,
      * *FOR THERMAL AND ELECTRIC ENERGY IN BTU*,25X,A10,///,
      * 2X,*APPLICATION*,25X,*TOTAL*,3X,*NATL GAS OIL*,
155      * 4X,* COAL NUCLEAR HYDROELEC OTHER*)
      DO 360 M=1,50
      J = L+M-1
      IF (J.GT.140) GO TO 370
      SAFDJ = SAFDTJ(J)+SAFDEJ(J)

```

SUBROUTINE PRNTOUT 76/76 OPT=2

FTN 4.6+428B

08/21/78 22.46.124

```

160      DO 340 K=1,3
          SFDJ(K) = SFDJ(J,K)+SFDEJ(J,K)
          340 CONTINUE
          SFDJ(4) = SFDEJ(J,4)
          SFDJ(5) = SFDEJ(J,5)
165      SFDJ(6) = SFDJ(J,4)+SFDEJ(J,6)
          WRITE(6,270) (APP(K,J),K=1,3), SAFDJ, (SFDJ(K),K=1,6)
          SSAFDJ = SSAFDJ+SAFDJ
          DO 350 K=1,6
              SSFSDJ(K) = SSFSDJ(K)+SFDJ(K)
170      350 CONTINUE
          360 CONTINUE
          370 CONTINUE
          WRITE(6,310) SSAFDJ, (SSFSDJ(K),K=1,6)
          RETURN
175      END

```

02780

02790

SYMBOLIC REFERENCE MAP (R=2)

ENTRY POINTS DEF LINE REFERENCES
 3 PRNTOUT 1 174

VARIABLES	SN	TYPE	RELOCATION	REFS			
0 ACR		REAL	INPUTS	REFS	11		
1 ADDI		REAL	ARRAY	INPUTS	REFS	11	
1 AFDE		REAL	ARRAY	OUTPUTS	REFS	17	
7 AFDT		REAL	ARRAY	OUTPUTS	REFS	17	
63 ALPHA		REAL	INPUTS	REFS	11		
64 APP		REAL	ARRAY	INPUTS	REFS	11	
730 APPCODE		INTEGER	ARRAY	INPUTS	REFS	7	109 11 132 166
1144 C		REAL	INPUTS	REFS	11		
1145 CEF		REAL	ARRAY	INPUTS	REFS	11	
1703 CEI		REAL	INPUTS	REFS	11		
1704 CTF		REAL	ARRAY	INPUTS	REFS	11	
2442 CTI		REAL	INPUTS	REFS	11		
2443 DIECR		REAL	ARRAY	INPUTS	REFS	11	
2553 DIFD		REAL	ARRAY	INPUTS	REFS	11	
2663 DIR		REAL	ARRAY	INPUTS	REFS	11	
2773 ECIFARY		REAL	ARRAY	INPUTS	REFS	11	
13 ECR		REAL	OUTPUTS	REFS	17		
3043 EMI		REAL	ARRAY	INPUTS	REFS	11	
20573 ET		REAL	INPUTS	REFS	11		
20574 EU		REAL	INPUTS	REFS	11		
20575 FCR		REAL	INPUTS	REFS	11		
14 FD		REAL	OUTPUTS	REFS	17		
20576 FME		REAL	ARRAY	INPUTS	REFS	11	
24662 FMT		REAL	ARRAY	INPUTS	REFS	11	
27452 FP		INTEGER	INPUTS	REFS	7	11	
1013 FUEL	*	DOUBLE	*UNDEF	REFS	8		

SUBROUTINE HEADING 76/76 OPT=2

FTN 4.6+428B

08/21/78 22.46.12*

```

1      SUBROUTINE HEADING (TITLE)
      C
      C      HEADING SKIPS TO NEW PAGE AND PRINTS TITLE, DATE,
      C      AND TIME
5      C
      DIMENSION TITLE(3)
      CALL DATE(TODAY)
      CALL TIME(NOW)
      WRITE (6,10) TITLE, NOW, TODAY
10     10 FORMAT (1H1,29X,3A10,12X,A6,4X,A10)
      RETURN
      END

```

SYMBOLIC REFERENCE MAP (R=2)

ENTRY POINTS	DEF LINE	REFERENCES
3 HEADING	1	11

VARIABLES	SN	TYPE	RELOCATION	REFS	8	9	DEFINED	1
33 NOW		INTEGER		REFS	6	9		
0 TITLE		REAL	ARRAY F.P.	REFS	7	9		
32 TODAY		REAL		REFS				

FILE NAMES	MODE	WRITES
TAPE6	FMT	9

EXTERNALS	TYPE	ARGS	REFERENCES
DATE		1	7
TIME		1	8

STATEMENT LABELS	DEF LINE	REFERENCES
26 10 FMT	10	9

STATISTICS	34B	28
PROGRAM LENGTH		

• **Appendix B - SAMRGP Source Listing**

```

1      PROGRAM SAMRGP (INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT,TAPE1,TAPE2)
      C
      C      SAMRGP - SOLAR TOTAL ENERGY APPLICATION MODEL (SAM)
      C      C      REPORT GENERATOR PROGRAM
5      C
      C      DEVELOPED FROM NOV 1977 TO MAR 1978 BY BRUCE TIMMER
      C      C      OF THE SYSTEMS SIMULATION AND ANALYSIS DEPARTMENT
      C      C      AND BY ANNE TIMMER
      C      C      OF THE DATA REDUCTION DEPARTMENT
10     C      BOTH OF THE AEROSPACE CORPORATION.
      C
      C      SAMRGP RANKS EQUIVALENT COST RATIOS (ECR(S) IN ASCENDING
      C      C      ORDER BY STATE OR INDUSTRY AND WRITES REPORTS.
15     C
      C      INPUT CONSISTS OF SAM DATA BASE TAPE, TYPE OF SORT DESIRED,
      C      C      ECR WINDOW OF INTEREST, STATES OF INTEREST, INDUSTRIES OF
      C      C      INTEREST, AND YEAR OF INTEREST.
      C
      C      OUTPUT CONSISTS OF A SUBSET OF THE SAM DATA BASE
20     C      AND VARIOUS REPORTS.
      C
      C
      C      INTEGER FEMPT, FFULL, PRED, SUCC, TENT
      C      REAL NDUSTRY
25     C
      C      ECR IS EQUIVALENT COST RATIO.
      C
      C      FD IS FUEL DISPLACEMENT PERCENTAGE.
      C
      C      TFDT IS PER CENT FUEL DISPLACED FOR THERMAL ENERGY.
30     C
      C      TFDE IS PER CENT FUEL DISPLACED FOR ELECTRIC ENERGY.
      C
      C      R IS T/E RATIO FOR DISPLACED ENERGY.
      C
35     DIMENSION ECR(140,50),FD(140,50),TFDT(140,50),TFDE(140,50)
      C      1 ,R(140,50),TITLE(3)
      C      COMMON /OUTPUT/
40     * APP(3,140),ECRLO,ECRHI,LOC(50),NILO,NIHI,NJLO,NJHI
      C      * ,SAFDEI(50),SAFDEJ(140),SAFDTI(50),SAFDTJ(140)
      C      * ,SFDEI(50,6),SFDEJ(140,6),SFDTI(50,6),SFDTJ(140,6)
      C      * ,TIM(7)
      C
      C      SAFD IS THE AMOUNT OF FUEL DISPLACED FOR ELECTRIC AND
      C      C      THERMAL ENERGY COMBINED FOR 6 FUEL TYPES.
45     C
      C      DIMENSION SAFD(6)
      C      DOUBLE LOC
      C      DIMENSION LLOC(2,50)
      C      EQUIVALENCE (LOC,LLOC)
50     COMMON /SET/ NREC, FEMPT, FFULL, LFULL, PRED(140), SUCC(140),
      C      1 RANK(140), TENT(140)
      C      COMMON /SRT/ STATE, NDUSTRY
      C

```


	2	30HCHEWING AND SMOKING TOBACCO	,
	3	30HTOBACCO STEMMING AND REDRYING	,
	4	30HWEAVING MILLS, COTTON	,
110	5	30HWEAV>G MILLS, MANMADE FIBER	,
	6	30HWEAVING, FINISHING MILLS, WOOL	,
	7	30HNARROW FABRIC MILLS	,
	8	30HKNITTING MILLS	,
	9	30HTEXTILE FINISHING, EXCEPT WOOL	,
115	A	30HFLOOR COVERING MILLS	/
		DATA (APP(IA),IA=61,120,3) / 30HYARN AND THREAD MILLS	,
	2	30HMISCELLANEOUS TEXTILE GOODS	,
	3	30HMEN>S AND BOYS> SUITS AND COAT	,
	4	30HMEN>S AND BOYS> FURNISHINGS	,
120	5	30HWOMEN>S AND MISSES> OUTERWEAR	,
	6	30HWOMEN>S, CHILDREN>S UNDERGARMS	,
	7	30HHATS, CAPS, AND MILLINERY	,
	8	30HCHILDREN>S OUTERWEAR	,
	9	30HMISC. APPAREL AND ACCESSORIES	,
125	A	30HMISC. FABRICATED TEXTILE PRODS	,
	1	30HLOGGING CAMPS, LOG CONTRACTORS	,
	2	30HSAWMILLS AND PLANING MILLS	,
	3	30HMILLWORK, PLYWOOD, STRUC. MEMB	,
	4	30HWOOD CONTAINERS	,
130	5	30HWOOD BUILDINGS AND MOBILE HOME	,
	6	30HMISCELLANEOUS WOOD PRODUCTS	,
	7	30HHOUSEHOLD FURNITURE	,
	8	30HOFFICE FURNITURE	,
	9	30HPUBLIC BLDG., RELATED FURNITUR	,
135	A	30HPARTITIONS AND FIXTURES	/
		DATA (APP(IA),IA=121,180,3) /30HMISC. FURNITURE AND FIXTURES	,
	2	30HPULPMILLS	,
	3	30HPAPERMILLS, EXC. BUILDING PAPE	,
	4	30HPAPERBOARD MILLS	,
140	5	30HMISC. CONVERTED PAPER PRODUCTS	,
	6	30HPAPERBOARD CONTAINERS AND BOXE	,
	7	30HBUILDING PAPER AND BOARD MILLS	,
	8	30HNEWSPAPERS	,
	9	30HPERIODICALS	,
145	A	30HBOOKS	,
	1	30HMISCELLANEOUS PUBLISHING	,
	2	30HCOMMERCIAL PRINTING	,
	3	30HMANIFOLD BUSINESS FORMS	,
	4	30HGREETING CARD PUBLISHING	,
150	5	30HBLANKBOOKS AND BOOKBINDING	,
	6	30HPRINTING TRADE SERVICES	,
	7	30HINDUSTRIAL INORGANIC CHEMICALS	,
	8	30HPLASTICS MATERIALS, SYNTHETICS	,
	9	30HDRUGS	,
155	A	30HSOAP, CLEANERS, TOILET GOODS	/
		DATA (APP(IA),IA=181,240,3) /30HPAINTS AND ALLIED PRODUCTS	,
	2	30HINDUSTRIAL ORGANIC CHEMICALS	,
	3	30HAGRICULTURAL CHEMICALS	,
	4	30HMISCELLANEOUS CHEMICAL PRODUCT	,

160	5	30HPETROLEUM REFINING	,
	6	30HPAVING AND ROOFING MATERIALS	,
	7	30HMISC. PETROLEUM, COAL PRODUCTS,	
	8	30HTIRES AND INNER TUBES	,
	9	30HRUBBER AND PLASTICS FOOTWEAR	,
165	A	30HRUBBER, PLASTICS HOSE, BELTING,	
	1	30HFABRICATED RUBBER PRODUCTS, NE,	
	2	30HMISCELLANEOUS PLASTICS PRODUCT,	
	3	30HLEATHER TANNING AND FINISHING	,
	4	30HBOOT, SHOE CUT STOCK, FINDINGS,	
170	5	30HFOOTWEAR, EXCEPT RUBBER	,
	6	30HLEATHER GLOVES AND MITTENS	,
	7	30HLUGGAGE	,
	8	30HWOMEN>S HANDBAGS AND PURSES	,
	9	30HFLAT GLASS	,
175	A	30HGLASS, PRESSED OR BLOWN	/
		DATA (APP(IA),IA=241,300,3) /30HPRODUCTS OF PURCHASED GLASS	,
	2	30HCEMENT, HYDRAULIC	,
	3	30HSTRUCTURAL CLAY PRODUCTS	,
	4	30HPOTTERY AND RELATED PRODUCTS	,
180	5	30HCONCRETE, GYPSUM, PLASTER PROD,	
	6	30HCUT STONE AND STONE PRODUCTS	,
	7	30HMISC. NONMETALLIC MINERAL PROD,	
	8	30HBLAST FURNACE, BASIC STEEL PRO,	
	9	30HIRON AND STEEL FOUNDRIES	,
185	A	30HPRIMARY NONFERROUS METALS	,
	1	30HSECONDARY NONFERROUS METALS	,
	2	30HNONFERROUS ROLLING AND DRAWING,	
	3	30HNONFERROUS FOUNDRIES	,
	4	30HMISC. PRIMARY METAL PRODUCTS	,
190	5	30HMETAL CANS, SHIPPING CONTAINER,	
	6	30HCUTLERY, HANDTOOLS AND HARDWAR,	
	7	30HPLUMBING, HEATING, EXCEPT ELEC,	
	8	30HFABRICATED STRUC. METAL PRODS	,
	9	30HSCREW MACHINE PROD., BOLTS, ET,	
195	A	30HMETAL FORGINGS AND STAMPINGS	/
		DATA (APP(IA),IA=301,360,3) /30HMETAL SERVICES, NEC	,
	2	30HORDNANCE AND ACCESSORIES, NEC	,
	3	30HMISC. FABRICATED METAL PRODUCT,	
	4	30HENGINES AND TURBINES	,
200	5	30HFARM AND GARDEN MACHINERY	,
	6	30HCONSTRUCTION, RELATED MACHINER,	
	7	30HMETALWORKING MACHINERY	,
	8	30HSPECIAL INDUSTRY MACHINERY	,
	9	30HGENERAL INDUSTRIAL MACHINERY	,
205	A	30HOFFICE AND COMPUTING MACHINES	,
	1	30HREFRIGERATION AND SERVICE MACH,	
	2	30HMISC. MACHINERY, EXC. ELEC	,
	3	30HELECTRIC DISTRIBUTING EQUIPMEN,	
	4	30HELECTRICAL INDUSTRIAL APPARATU,	
210	5	30HHOUSEHOLD APPLIANCES	,
	6	30HELEC. LIGHTING, WIRING EQUIP	,
	7	30HRADIO, TV RECEIVING EQUIPMENT	,

PROGRAM SAMRGP

76/76

OPT=2

FTN 4.6+428B

07/10/78 14.02.36*

	8	30HCOMMUNICATION EQUIPMENT	
215	9	30HELECTRONIC COMPONENTS, ACCESS ,	
	A	30HMISC. ELEC. EQUIPMENT, SUPPLIE/	
		DATA (APP(IA),IA=361,420,3) /30HMOTOR VEHICLES AND EQUIPMENT ,	
	2	30HAIRCRAFT AND PARTS	
	3	30HSHIP, BOAT BUILDING, REPAIRING,	
	4	30HRAILROAD EQUIPMENT	
220	5	30HMOTORCYCLES, BICYCLES, PARTS ,	
	6	30HGUIDED MISSILES, SPACE VEHICLE,	
	7	30HTRANSPORTATION EQUIPMENT, NEC ,	
	8	30HENGINEERING, SCIENTIFIC INSTRU,	
	9	30HMEASURING, CONTROLLING DEVICES,	
225	A	30HOPTICAL INSTRUMENTS AND LENSES,	
	1	30HMEDICAL INSTRUMENTS, SUPPLIES ,	
	2	30HOPHTHALMIC GOODS	
	3	30HPHOTOGRAPHIC EQUIP., SUPPLIES ,	
	4	30HWATCHES, CLOCKS, AND WATCHCASE,	
230	5	30HJEWELRY, SILVER AND PLATED WAR,	
	6	30HMUSICAL INSTRUMENTS	
	7	30HTOYS AND SPORTING GOODS	
	8	30HPENS, OFFICE AND ART GOODS	
	9	30HCOSTUME JEWELRY AND NOTIONS	
235	A	30HMISCELLANEOUS MANUFACTURES /	
	C		
	C	LOC IS TABLE CONTAINING NAMES FOR 50 STATES.	
	C		
		DATA (LOC(ILOC),ILOC=1,36,1)	
240	1/20	HALABAMA ,	20HALASKA ,
	2	20HARIZONA ,	20HARKANSAS ,
	3	20HCALIFORNIA ,	20HCOLORADO ,
	4	20HCONNECTICUT ,	20HDELAWARE ,
	5	20HFLORIDA ,	20HGEORGIA ,
245	6	20HHAWAII ,	20HIDAHO ,
	7	20HILLINOIS ,	20HINDIANA ,
	8	20HIOWA ,	20HKANSAS ,
	9	20HKENTUCKY ,	20HLOUISIANA ,
	A	20HMAINE ,	20HMARYLAND ,
250	B	20HMASSACHUSETTS ,	20HMICHIGAN ,
	C	20HMINNESOTA ,	20HMISSISSIPPI ,
	D	20HMISSOURI ,	20HMONTANA ,
	E	20HNEBRASKA ,	20HNEVADA ,
	F	20HNEW HAMPSHIRE ,	20HNEW JERSEY ,
255	G	20HNEW MEXICO ,	20HNEW YORK ,
	H	20HNORTH CAROLINA ,	20HNORTH DAKOTA ,
	I	20HOHIO ,	20HOKLAHOMA /
		DATA (LOC(ILOC),ILOC=37,50,1)	
260	1/20	HOREGON ,	20HPENNSYLVANIA ,
	2	20HRHODE ISLAND ,	20HSOUTH CAROLINA ,
	3	20HSOUTH DAKOTA ,	20HTENNESSEE ,
	4	20HTEXAS ,	20HUTAH ,
	5	20HVERMONT ,	20HVIRGINIA ,
	6	20HWASHINGTON ,	20HWEST VIRGINIA ,
265	7	20HWISCONSIN ,	20HWYOMING /

```

C
C      LNULO IS LAST VALUE OF NILO (LOW VALUE OF RANGE OF LOCATIONS
C      OF INTEREST)
C
270      DATA LNULO/0/
C
C      TITLE IS 30 CHARACTER TITLE THAT APPEARS AT START OF PRINTOUT
C
C      DATA TITLE / 10HBASELINE T, 10HEST CASE , 10H /
275      NAMELIST /IN/ SORT,NILO,NIHI,NJLO,NJHI,ECRLO,ECRHI,YEAR,TITLE
C
C      * * * * *
C
C      PROGRAM STARTS HERE.
280      * * * * *
C
C      NREC = 140
C      10 CONTINUE
285      C
C      READ NAMELIST INPUTS.
C
C      READ (5,IN)
C
290      C      IF EOF READ, TERMINATE EXECUTION, OTHERWISE PRINT BACK
C      NAMELIST VALUES.
C
C      IF (EOF(5)) 450,20
C      20 CONTINUE
295      CALL HEADING(TITLE)
C      WRITE (6,30) SORT, NILO, NIHI, NJLO, NJHI, ECRLO, ECRHI
C      * ,YEAR
C      30 FORMAT(/* SORT =*,A10,/* NILO = *,I10,/* NIHI = *,I10,/*
300      1 * NJLO = *,I10,/* NJHI = *,I10,/* ECRLO = *,F10.2,/*
C      2 * ECRHI = *,F10.2,/* YEAR = *,A10)
C
C      ZERO OUT FUEL DISPLACEMENT ARRAYS.
C
C
305      C      SAFDEI IS THE AMOUNT OF FUEL DISPLACED FOR ELECTRICAL
C      ENERGY FOR 50 STATES.
C      SAFDEJ IS THE AMOUNT OF FUEL DISPLACED FOR ELECTRICAL
C      ENERGY FOR 140 APPLICATIONS.
C      SAFDTI IS THE AMOUNT OF FUEL DISPLACED FOR THERMAL ENERGY
C      FOR 50 STATES.
310      C      SAFDTJ IS THE AMOUNT OF FUEL DISPLACED FOR THERMAL ENERGY
C      FOR 140 APPLICATIONS.
C      SFDEI IS THE AMOUNT OF FUEL DISPLACED FOR ELECTRICAL
C      ENERGY FOR 50 STATES AND 6 TYPES OF FUELS.
C      SFDEJ IS THE AMOUNT OF FUEL DISPLACED FOR ELECTRICAL
315      C      ENERGY FOR 140 APPLICATIONS AND FOR 6 TYPES OF FUELS.
C      SFDTI IS THE AMOUNT OF FUEL DISPLACED FOR THERMAL ENERGY
C      FOR 50 STATES AND FOR 6 TYPES OF FUELS.
C      SFD TJ IS THE AMOUNT OF FUEL DISPLACED FOR THERMAL ENERGY

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```

      C      FOR 140 APPLICATIONS AND FOR 6 TYPES OF FUELS.
320      C
      DO 60 I=1,140
      SAFDEJ(I)=0.
      SAFDTJ(I)=0.
      DO 50 J=1,6
325      SFDEJ(I,J)=0.
      SFDTJ(I,J)=0.
      50 CONTINUE
      60 CONTINUE
      DO 80 I=1,50
330      SAFDEI(I)=0.
      SAFDTI(I)=0.
      DO 70 J=1,6
      SFDEI(I,J)=0.
      SFDTI(I,J)=0.
335      70 CONTINUE
      80 CONTINUE
      C
      C      POSITION SAM DATA BASE TAPE AT FILE CORRESPONDING TO YEAR
      C      OF INTEREST.
340      C
      DO 90 I=1,7
      IT=I
      IF (YEAR .EQ. TIM(I)) GO TO 110
      90 CONTINUE
      WRITE (6,100)
345      100 FORMAT (* ILLEGAL VALUE OF INPUT VARIABLE YEAR*)
      GO TO 10
      110 CONTINUE
      IF (IT-NFILE) 120,170,130
350      120 REWIND 1
      NFILE=0
      GO TO 110
      130 CONTINUE
      IF (IT .EQ. (NFILE+1)) GO TO 150
355      NFILE=NFILE+1
      140 CONTINUE
      READ (1)
      IF (EOF(1)) 110,140
      C
      C      READ ENTIRE SAM DATA BASE FOR CURRENT TIME PERIOD
      C
      150 CONTINUE
      NFILE=NFILE+1
      160 CONTINUE
365      READ (1) I, J, ECR(J,I), FD(J,I), TFDT(J,I), TFDE(J,I),
      1 (AFDT(J,I,K),K=1,4),(AFDE(J,I,K),K=1,6),R(J,I)
      IF (EOF(1)) 170,160
      170 CONTINUE
      C
      C      IF FIRST CASE THEN ALWAYS PRINT SUMMARY REPORTS
      C

```

```

      IF (LNIL0 .EQ. 0) GO TO 180
375      C      IF SAME YEAR AND SAME LOCATIONS, INDUSTRIES, AND ECR VALUES
      C      AS LAST CASE, THEN BRANCH AROUND THE SUMMARY REPORT
      C      PROCESSING AND PRINTOUT.
      C
380      C      IF (LIT .EQ. IT .A. LNIL0 .EQ. NIL0 .A. LNIHI .EQ. NIHI
      C      *      .A. LNJLO .EQ. NJLO .A. LNJHI .EQ. NJHI
      C      *      .A. PECRLO .EQ. ECRLO .A. PECRHI .EQ. ECRHI) GO TO 240
      C
      C      PERFORM PROCESSING FOR SUMMARY REPORTS AND PRINT THEM OUT.
      C
180      C      CONTINUE
385      C
      C      SUM ALL STATES IN RANGE OF INTEREST
      C
      DO 230 I=NIL0,NIHI
390      C      SUM ALL INDUSTRIES IN RANGE OF INTEREST
      C
      DO 230 J=NJLO,NJHI
395      C      ECR MUST BE IN WINDOW OF INTEREST
      C
      IF (ECR(J,I) .EQ. 0) GO TO 230
      IF (ECR(J,I) .LT. ECRLO .O. ECR(J,I) .GT. ECRHI) GO TO 230
400      C      WRITE OUTPUTS FOR APPLICATION J, LOCATION I.
      C      THIS OUTPUT TAPE IS USED BY THE MARKET PENETRATION MODEL.
      C
      WRITE (2) I,J,ECR(J,I),FD(J,I),TFDT(J,I),TFDE(J,I),
      1      (AFDT(J,I,K),K=1,4),(AFDE(J,I,K),K=1,6),R(J,I)
      TAFDE=TAFDT=0.
405      DO 190 K=1,6
      TAFDE=TAFDE+AFDE(J,I,K)
      190      CONTINUE
      DO 200 K=1,4
      TAFDT=TAFDT+AFDT(J,I,K)
410      200      CONTINUE
      C
      C      ACCUMULATE AMOUNT OF FUEL DISPLACED FOR THERMAL ENERGY
      C      BY APPLICATION
      C
415      C      SAFDTJ(J) = SAFDTJ(J)+TAFDT
      C
      C      ACCUMULATE AMOUNT OF FUEL DISPLACED FOR ELECTRIC ENERGY
      C      BY APPLICATION
      C
420      C      SAFDEJ(J) = SAFDEJ(J)+TAFDE
      C
      C      ACCUMULATE AMOUNT OF FUEL DISPLACED FOR THERMAL ENERGY
      C      BY LOCATION
      C

```

```

425      SAFDTI(I) = SAFDTI(I)+TAFDT                                01520
      C                                                                01530
      C      ACCUMULATE AMOUNT OF FUEL DISPLACED FOR ELECTRIC ENERGY
      C      BY LOCATION
      C
430      SAFDEI(I) = SAFDEI(I)+TAFDE                                01560
      C
      C      DO 210 NF=1,4
      C
      C      ACCUMULATE AMOUNT OF FUEL DISPLACED FOR THERMAL ENERGY FOR
435      EACH FUEL TYPE BY APPLICATION
      C
      C      SFDTJ(J,NF) = SFDTJ(J,NF)+AFDT(J,I,NF)
      C
      C      ACCUMULATE AMOUNT OF FUEL DISPLACED FOR THERMAL ENERGY FOR
440      EACH FUEL TYPE BY LOCATION
      C
      C      SFDTI(I,NF) = SFDTI(I,NF)+AFDT(J,I,NF)
      C      210 CONTINUE
      C      DO 220 NF=1,6
445      C
      C      ACCUMULATE AMOUNT OF FUEL DISPLACED FOR ELECTRIC ENERGY FOR
      C      EACH FUEL TYPE BY APPLICATION
      C
      C      SFDEJ(J,NF) = SFDEJ(J,NF)+AFDE(J,I,NF)
450      C
      C      ACCUMULATE AMOUNT OF FUEL DISPLACED FOR ELECTRIC ENERGY FOR
      C      EACH FUEL TYPE BY LOCATION
      C
      C      SFDEI(I,NF) = SFDEI(I,NF)+AFDE(J,I,NF)
455      C      220 CONTINUE
      C      230 CONTINUE
      C
      C      CALL SUBROUTINE PRNTOUT TO PRINT OUT THERMAL AND ELECTRIC
      C      DISPLACEMENT SUMMARIES BY LOCATION AND BY APPLICATION.
460      C
      C      CALL PRNTOUT (IT)
      C      ENDFILE 2
      C      240 CONTINUE
      C      WRITE (6,245) SORT,TIM(IT),NILO,NIHI,NJLO,NJHI,ECRLO,ECRHI
465      C      245 FORMAT(*1*,*APPLICATIONS WITHIN STATES SORTED BY *,A8,
      C      *      * FOR YEAR *,A4,*,*/ ,
      C      *      1X,*STATES*,I3,* TO*,I3,*, APPLICATIONS*,I4,* TO*,I4,
      C      *      *, AND ECR VALUES*,F10.3,* TO*,F10.3)
      C      IF (SORT.NE.STATE) GO TO 340
470      C
      C      SORT BY STATE
      C
      C      LOOP ON STATE
      C
475      C      NUM=0
      C      DO 330 NI=NILO, NIHI
      C      CALL LEMPT(NREC, FEMPT, SUCC)

```

```

C
C      INITIALIZE
480  C
C      FFULL=0
C      LFULL=0
C
C      LOOP ON APPLICATION
485  C
C      DO 270 NJ=NJLO, NJHI
C
C      ECR MUST BE IN WINDOW OF INTEREST
C
490  C      IF (ECR(NJ,NI) .EQ. 0.) GO TO 270
C      IF (ECR(NJ,NI) .LT. ECRLO) GO TO 270
C      IF (ECR(NJ,NI) .GT. ECRHI) GO TO 270
C
C      FILE ENTITY IN SET
495  C
C      I = LCREAT(FEMPT, SUCC)
C      IF (I.EQ.0) GO TO 250
C
C      DATA IS ARRANGED IN ASCENDING ORDER BY ECR
500  C
C      RANK(I) = ECR(NJ,NI)
C      TENT(I) = NJ
C      CALL LFILER(I, FFULL, LFULL, PRED, SUCC, RANK)
C      GO TO 270
505  250 CONTINUE
C      WRITE (6,260)
C      260 FORMAT(* LCREAT RETURNS WITH I=0*)
C      STOP
C      270 CONTINUE
510  C
C      REMOVE ENTITY FROM SET
C
C      280 CONTINUE
C      I = FFULL
515  C      IF (I.EQ.0) GO TO 330
C      J = TENT(I)
C      CALL LREMV(I, FFULL, LFULL, PRED, SUCC)
C      CALL LDEST(I, FEMPT, SUCC)
C      SAFD(1) = AFDT(J,NI,1) + AFDE(J,NI,1)
520  C      SAFD(2) = AFDT(J,NI,2) + AFDE(J,NI,2)
C      SAFD(3) = AFDT(J,NI,3) + AFDE(J,NI,3)
C      SAFD(4) = AFDE(J,NI,4)
C      SAFD(5) = AFDE(J,NI,5)
C      SAFD(6) = AFDT(J,NI,4) + AFDE(J,NI,6)
525  C      TAFDE=0.
C      TAFDT=0.
C      DO 290 K=1,6
C      TAFDE=TAFDE+AFDE(J,NI,K)
C      290 CONTINUE
530  C      DO 300 K=1,4

```

```

TAFDT=TAFDT+AFDT(J,NI,K)
300 CONTINUE
TAFD = TAFDT+TAFDE
C
535 C PRINT STATE SORTED ECRIS AND ASSOCIATED MARKETING PARAMETERS.
C
WRITE (6,310) LOC(NI), (APP(K,J),K=1,3), ECR(J,NI), FD(J,NI),
1 R(J,NI),TFDT(J,NI),TAFDT,(AFDT(J,NI,K),K=1,4),TFDE(J,NI),
2 TAFDE,(AFDE(J,NI,K),K=1,6),TAFD,SAFD
540 310 FORMAT (// * LOCATION = *,2A10,17X,*APPLICATION = *,3A10,
1 /11X,*FUEL DISP*,15X,*FUEL DISPLACED*,
2 /7X,*ECR*,2X,*PER CENT*,5X,*R*,5X,*PER CENT BTU NATL GAS*,
3 6X,* OIL COAL NUCLEAR HYDROELEC OTHER*,
4 /F10.2,F10.2,F6.2,* THERM*,F7.2,1X,4(1PE9.2,1X),20X,E9.2,/26X,
545 5 * ELECT*,0PF7.2,
6 1X,7(1PE9.2,1X),/26X,* TOTAL*,8X,7(E9.2,1X))
NUM=NUM+1
IF (MOD(NUM,7) .EQ. 0) WRITE (6,320)
550 320 FORMAT (1H1)
GO TO 280
330 CONTINUE
GO TO 440
340 CONTINUE
IF (SORT.NE.INDUSTRY) GO TO 420
555 C
C SORT BY INDUSTRY
C
C LOOP ON INDUSTRY
C
560 NUM=0
DO 410 NJ=NJLO, NJHI
CALL LEMPT(NREC, FEMPT, SUCC)
C
C INITIALIZE
565 C
C FFULL=0
C LFULL=0
C
C LOOP ON STATE
570 C
C DO 360 NI=NILO, NIHI
C
C ECR MUST BE IN WINDOW OF INTEREST
C
575 IF (ECR(NJ,NI) .EQ. 0.) GO TO 360
IF (ECR(NJ,NI) .LT. ECRLO) GO TO 360
IF (ECR(NJ,NI) .GT. ECRHI) GO TO 360
C
C FILE ENTITY IN SET
580 C
C I = LCREAT(FEMPT, SUCC)
IF (I.EQ.0) GO TO 350
C

```

```

      C      DATA IS RANKED IN ASCENDING ORDER BY ECR
585      C
      RANK(I) = ECR(NJ,NI)
      TENT(I) = NI
      CALL LFILER(I, FFULL, LFULL, PRED, SUCC, RANK)
      GO TO 360
590      350 CONTINUE
      WRITE (6,260)
      STOP
      360 CONTINUE
595      C      REMOVE ENTITY FROM SET
      C
      C
      370 CONTINUE
      J = FFULL
      IF (J.EQ.0) GO TO 410
      I = TENT(J)
600      CALL LREMV(J, FFULL, LFULL, PRED, SUCC)
      CALL LDEST(J, FEMPT, SUCC)
      SAFD(1) = AFDT(NJ,I,1) + AFDE(NJ,I,1)
      SAFD(2) = AFDT(NJ,I,2) + AFDE(NJ,I,2)
605      SAFD(3) = AFDT(NJ,I,3) + AFDE(NJ,I,3)
      SAFD(4) = AFDE(NJ,I,4)
      SAFD(5) = AFDE(NJ,I,5)
      SAFD(6) = AFDT(NJ,I,4) + AFDE(NJ,I,6)
      TAFDE=TAFDT=0.
610      DO 380 K=1,4
      TAFDT=TAFDT+AFDT(NJ,I,K)
      380 CONTINUE
      DO 390 K=1,6
      TAFDE=TAFDE+AFDE(NJ,I,K)
615      390 CONTINUE
      TAFD = TAFDT+TAFDE
      C
      C      PRINT INDUSTRY SORTED ECR'S AND OTHER MARKETING PARAMETERS.
      C
620      WRITE (6,400) (APP(K,NJ),K=1,3), LOC(I), ECR(NJ,I), FD(NJ,I),
      1 R(NJ,I),TFDT(NJ,I),TAFDT,(AFDT(NJ,I,K),K=1,4),TFDE(NJ,I),
      2 TAFDE,(AFDE(NJ,I,K),K=1,6),TAFD,SAFD
      400 FORMAT (//** APPLICATION = *,3A10,4X,*LOCATION = *,2A10,
      1 /11X,*FUEL DISP*,15X,*FUEL DISPLACED*,
625      2 /7X,*ECR*,2X,*PER CENT*,5X,*R*,5X,*PER CENT      BTU NATL GAS*,
      3 6X,* OIL      COAL      NUCLEAR HYDROELEC      OTHER*,
      4 /F10.2,F10.2,F6.2,* THERM*,F7.2,1X,4(1PE9.2,1X),20X,E9.2,/26X,
      5 * ELECT*,0PF7.2,
630      6 1X,7(1PE9.2,1X),/26X,* TOTAL*,8X,7(E9.2,1X))
      NUM=NUM+1
      IF (MOD(NUM,7) .EQ. 0) WRITE (6,320)
      GO TO 370
      410 CONTINUE
      GO TO 440
635      420 CONTINUE
      WRITE (6,430)

```

```
      430 FORMAT(* ILLEGAL VALUE OF INPUT VARIABLE SORT*)
      440 CONTINUE
640      C
          C      LOOP FOR NEXT CASE
          C
          C
          C      LNILO IS VALUE OF NILO FOR LAST CASE
645      C      LNILO = NILO
          C
          C      LNIHI IS VALUE OF NIHI FOR LAST CASE
          C      LNIHI = NIHI
650      C
          C      LNJLO IS VALUE OF NJLO FOR LAST CASE
          C      LNJLO = NJLO
655      C
          C      LNJHI IS VALUE OF NJHI FOR LAST CASE
          C      LNJHI = NJHI
          C
          C      PECRLO IS VALUE OF ECRLO FOR LAST CASE
660      C      PECRLO = ECRLO
          C
          C      PECRHI IS VALUE OF ECRHI FOR LAST CASE
665      C      PECRHI = ECRHI
          C
          C      LIT IS VALUE OF IT (RELATIVE YEAR VALUE) FOR LAST CASE
          C      LIT = IT
670      GO TO 10
          450 CONTINUE
          STOP
          END
```

FUNCTION LCREAT

76/76 OPT=2

FTN 4.6+4285

07/10/78 14.02.36\$

```

1      FUNCTION LCREAT(FEMPT,SUCC)
      C
      C      CREATES A RECORD BY UNLINKING THE FIRST RECORD FROM A SET OF
      C      EMPTY RECORDS AND RETURNING ITS SUBSCRIPT.  PARAMETERS -
5      C      FEMPT = SUBSCRIPT OF FIRST EMPTY RECORD IN SET (0
      C      INDICATES NO EMPTY RECORDS)
      C      SUCC(I) = SUBSCRIPT OF SUCCESSOR OF ITH RECORD (0
      C      INDICATES NO SUCCESSOR - LAST RECORD)
      C      LCREAT = FEMPT = 0 INDICATES NO EMPTY RECORDS.
10     C
      C      INTEGER FEMPT,SUCC(1)
      C
      C      RETURN SUBSCRIPT OF FIRST EMPTY RECORD IN SET.
      C
15     C      LCREAT = FEMPT
      C      I = FEMPT
      C
      C      IF EMPTY RECORDS IN SET, SET SUBSCRIPT OF FIRST EMPTY RECORD
      C      IN SET = SUBSCRIPT OF SUCCESSOR RECORD.
20     C
      C      IF (I .NE. 0) FEMPT = SUCC(I)
      C      RETURN
      C      END

```


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SUBROUTINE LDEST

76/76 OPT=2

FTN 4.6+4288

07/10/78 14.02.36\$

1		SUBROUTINE LDEST(I,FEMPT,SUCC)
	C	
	C	DESTROYS A RECORD BY LINKING IT TO A SET OF EMPTY RECORDS
	C	BEFORE THE FIRST RECORD IN THE SET. PARAMETERS -
5	C	I = SUBSCRIPT OF RECORD TO BE DESTROYED
	C	FEMPT = SUBSCRIPT OF FIRST EMPTY RECORD IN SET (0
	C	INDICATES NO EMPTY RECORDS)
	C	SUCC(I) = SUBSCRIPT OF SUCCESSOR OF ITH RECORD (0
	C	INDICATES NO SUCCESSOR - LAST RECORD)
10	C	
	C	INTEGER FEMPT,SUCC(1)
	C	
	C	LINK RECORD TO SET OF EMPTY RECORDS BEFORE FIRST RECORD IN
15	C	SET, AND SET SUBSCRIPT OF FIRST EMPTY RECORD IN SET =
	C	SUBSCRIPT OF RECORD.
	C	
		SUCC(I) = FEMPT
		FEMPT = I
		RETURN
20		END

```

1      SUBROUTINE LFILER(I,FFULL,LFULL,PRED,SUCC,ATTR)
      C
      C      FILES A RECORD IN A SET RANKED ON A SPECIFIED ATTRIBUTE BY
      C      LINKING THE RECORD INTO THE SET OF FULL RECORDS SO THAT THE
5      C      ATTRIBUTE VALUES REMAIN IN ASCENDING NUMERICAL ORDER.
      C      PARAMETERS -
      C      I = SUBSCRIPT OF RECORD TO BE FILED IN SET
      C      FFULL = SUBSCRIPT OF FIRST FULL RECORD IN SET (0
      C      INDICATES NO FULL RECORDS)
10     C      LFULL = SUBSCRIPT OF LAST FULL RECORD IN SET (0 INDICATES
      C      NO FULL RECORDS)
      C      PRED(I) = SUBSCRIPT OF PREDECESSOR TO ITH FULL RECORD
      C      (0 INDICATES NO PREDECESSOR - FIRST RECORD)
      C      SUCC(I) = SUBSCRIPT OF SUCCESSOR OF ITH RECORD (0
15     C      INDICATES NO SUCCESSOR - LAST RECORD)
      C      ATTR(I) = RANKING ATTRIBUTE OF ITH RECORD
      C
      C      INTEGER FFULL,PRED(1),SUCC(1),ATTR(1)
20     C      IF NO FULL RECORDS, SET SUBSCRIPTS OF PREDECESSOR AND
      C      SUCCESSOR RECORDS = 0, AND SET SUBSCRIPTS OF FIRST AND LAST
      C      FULL RECORDS IN SET = SUBSCRIPT OF RECORD.
      C
      C      J = FFULL
25     C      IF (J .NE. 0) GO TO 10
      C      PRED(I) = 0
      C      SUCC(I) = 0
      C      FFULL = I
      C      LFULL = I
30     C      RETURN
      C
      C      FIND FIRST ATTRIBUTE VALUE .GT. ATTRIBUTE OF RECORD TO BE
      C      FILED IN SET.
35     C      10 IF (ATTR(J) .GT. ATTR(I)) GO TO 20
      C      J = SUCC(J)
      C      IF (J .NE. 0) GO TO 10
      C
      C      IF ATTRIBUTE OF RECORD TO BE FILED IN SET .GT. ALL ATTRIBUTE
40     C      VALUES, LINK RECORD TO SET OF FULL RECORDS FOLLOWING LAST
      C      RECORD IN SET, AND SET SUBSCRIPT OF LAST FULL RECORD IN SET =
      C      SUBSCRIPT OF RECORD.
      C
      C      SUCC(LFULL) = I
45     C      PRED(I) = LFULL
      C      SUCC(I) = 0
      C      LFULL = I
      C      RETURN
      C
50     C      IF ATTRIBUTE OF RECORD TO BE FILED IN SET .LT. ALL ATTRIBUTE
      C      VALUES, LINK RECORD TO SET OF FULL RECORDS BEFORE FIRST
      C      RECORD IN SET, AND SET SUBSCRIPT OF FIRST FULL RECORD IN SET
      C      = SUBSCRIPT OF RECORD.

```

SUBROUTINE LFILER 76/76 OPT=2

FTN 4.6+4285

07/10/78 14.02.36\$

```
      C
55      20 IF (J .NE. FFULL) GO TO 30
          PRED(I) = 0
          SUCC(I) = FFULL
          PRED(FFULL) = I
          FFULL = I
60      RETURN
      C
      C      OTHERWISE, LINK RECORD TO SET OF FULL RECORDS SO ATTRIBUTE
      C      VALUES REMAIN IN ASCENDING NUMERICAL ORDER.
      C
65      30 IP = PRED(J)
          SUCC(IP) = I
          PRED(I) = IP
          SUCC(I) = J
          PRED(J) = I
70      RETURN
      END
```

SUBROUTINE LREMV

76/76 OPT=2

FTN 4.6+428B

07/10/78 14.02.36\$

```

1      SUBROUTINE LREMV(I,FFULL,LFULL,PRED,SUCC)
      C
      C      REMOVES A SPECIFIED RECORD FROM A SET OF FULL RECORDS BY
      C      UNLINKING THE RECORD FROM THE SET.  PARAMETERS -
5      C      I = SUBSCRIPT OF RECORD TO BE REMOVED
      C      FFULL = SUBSCRIPT OF FIRST FULL RECORD IN SET (0
      C      INDICATES NO FULL RECORDS)
      C      LFULL = SUBSCRIPT OF LAST FULL RECORD IN SET (0 INDICATES
      C      NO FULL RECORDS)
10     C      PRED(I) = SUBSCRIPT OF PREDECESSOR TO ITH FULL RECORD
      C      (0 INDICATES NO PREDECESSOR - FIRST RECORD)
      C      SUCC(I) = SUBSCRIPT OF SUCCESSOR OF ITH RECORD (0
      C      INDICATES NO SUCCESSOR - LAST RECORD)
      C
15     C      INTEGER FFULL,PRED(1),SUCC(1)
      C
      C      UNLINK RECORD FROM SET OF FULL RECORDS.
      C
      C      IP = PRED(I)
      C      IS = SUCC(I)
20     C
      C      IF NO PREDECESSOR RECORD, SET SUBSCRIPT OF FIRST FULL RECORD
      C      IN SET = SUBSCRIPT OF SUCCESSOR RECORD.
      C
25     C      IF (IP .NE. 0) GO TO 10
      C      FFULL = IS
      C      GO TO 20
      C
      C      IF PREDECESSOR RECORD, LINK TO SUCCESSOR RECORD.
30     C
      C      10 SUCC(IP) = IS
      C
      C      IF NO SUCCESSOR RECORD, SET SUBSCRIPT OF LAST FULL RECORD IN
      C      SET = SUBSCRIPT OF PREDECESSOR RECORD.
35     C
      C      20 IF (IS .NE. 0) GO TO 30
      C      LFULL = IP
      C      RETURN
40     C
      C      IF SUCCESSOR RECORD, LINK TO PREDECESSOR RECORD.
      C
      C      30 PRED(IS) = IP
      C      RETURN
      C      END

```

SYMBOLIC REFERENCE MAP (R=3)

```

1      SUBROUTINE PRNTOUT (IT)
      C
      C      PRNTOUT WRITES SUMMARY REPORTS FOR FUEL DISPLACED BY THERMAL
      C      ENERGY, ELECTRIC ENERGY, AND BOTH FOR EACH STATE AND EACH
5      C      INDUSTRY.
      C
      INTEGER FP, APPCODE                                00190
      LOGICAL DBG
      DOUBLE LOC, FUEL
10     DIMENSION SSFDTI(4), SSFDEI(6), SFDI(6), SSFDI(6)
      DIMENSION SSFDTJ(4), SSFDEJ(6), SFDJ(6), SSFDJ(6)
      COMMON /OUTPUT/
      *   APP(3,140), ECRLO, ECRHI, LOC(50), NILO, NIHI, NJLO, NJHI
      *   ,SAFDEI(50), SAFDEJ(140), SAFDTI(50), SAFDTJ(140)
15     *   ,SFDEI(50,6), SFDEJ(140,6), SFDTI(50,6), SFDTJ(140,6)
      *   ,TIM(7)
      C
      C      PRINT OUT SUMMATION OF AMOUNT OF FUEL DISPLACED
      C      BY THERMAL ENERGY AND ELECTRIC ENERGY FOR ALL LOCATIONS
      C
20     WRITE (6,10) TIM(IT), NILO, NIHI, NJLO, NJHI, ECRLO, ECRHI
      10 FORMAT(*1*,13X,*AMOUNT OF THERMAL ENERGY DISPLACED (IN BTU S) *,
      *   *BY LOCATION FOR YEAR *,A4,* ,*/
      *   14X,*STATES*,I3,* TO*,I3,* , APPLICATIONS*,I4,* TO*,I4,
25     *   *, AND ECR VALUES*,F10.3,* TO*,F10.3,
      *   ///2X,*LOCATION*,18X,*TOTAL*,3X,
      *   *NATL GAS      OIL      COAL      OTHER*)
      SSAFDTI = 0
      DO 20 K=1,4
30     SSFDTI(K) = 0
      20 CONTINUE
      DO 50 I=1,50
      WRITE (6,30) LOC(I), SAFDTI(I), (SFDTI(I,K),K=1,4)
35     30 FORMAT (2X,2A10,5E11.4)
      SSAFDTI = SSAFDTI+SAFDTI(I)
      DO 40 K=1,4
      SSFDTI(K) = SSFDTI(K)+SFDTI(I,K)
40     40 CONTINUE
      50 CONTINUE
      WRITE (6,60) SSAFDTI, (SSFDTI(K),K=1,4)
      60 FORMAT(/2X,*TOTAL*,15X,5E11.4)
      WRITE (6,70) TIM(IT), NILO, NIHI, NJLO, NJHI, ECRLO, ECRHI
      70 FORMAT(*1*,13X,*AMOUNT OF ELECTRIC ENERGY DISPLACED (IN BTU S) *
      *   *BY LOCATION FOR YEAR *,A4,* ,*/
      *   14X,*STATES*,I3,* TO*,I3,* , APPLICATIONS*,I4,* TO*,I4,
45     *   *, AND ECR VALUES*,F10.3,* TO*,F10.3,
      *   ///2X,*LOCATION*,18X,*TOTAL*,3X,
      *   *NATL GAS      OIL      COAL      NUCLEAR  HYDROELEC      *
      *   *OTHER*)
50     SSAFDEI = 0
      DO 80 K=1,6
      SSFDEI(K) = 0
      80 CONTINUE

```

```

      DO 110 I=1,50
55      WRITE (6,90) LOC(I), SAFDEI(I), (SFDEI(I,K),K=1,6)
      90 FORMAT (2X,2A10,7E11.4)
      SSAFDEI = SSAFDEI+SAFDEI(I)
      DO 100 K=1,6
      SSFDEI(K) = SSFDEI(K)+SFDEI(I,K)
60      100 CONTINUE
      110 CONTINUE
      WRITE (6,120) SSAFDEI,(SSFDEI(K),K=1,6)
      120 FORMAT(2X,*TOTAL*,15X,7E11.4)
      C
65      C      PRINT SUMMATION OF AMOUNT OF FUEL DISPLACED FOR THERMAL AND
      C      ELECTRIC ENERGY COMBINED FOR ALL LOCATIONS
      C
      WRITE (6,130) TIM(IT),NILO,NIHI,NJLO,NJHI,ECRLO,ECRHI
      130 FORMAT(*1*,13X,*AMOUNT OF THERMAL AND ELECTRIC ENERGY DISPLACED *
70      *      *(IN BTU S) *,
      *      *BY LOCATION FOR YEAR *,A4,* */,
      *      14X,*STATES*,I3,* TO*,I3,*, APPLICATIONS*,I4,* TO*,I4,
      *      *, AND ECR VALUES*,F10.3,* TO*,F10.3,
      *      ///2X,*LOCATION*,18X,*TOTAL*,3X,
75      *      *NATL GAS      OIL      COAL      NUCLEAR  HYDROELEC      *
      *      *OTHER*)
      SSAFDI = 0
      DO 140 K=1,6
      SSFDI(K) = 0
80      140 CONTINUE
      DO 170 I=1,50
      SAFDI = SAFDI(I)+SAFDEI(I)
      DO 150 K=1,3
      SFDI(K) = SFDI(I,K)+SFDEI(I,K)
85      150 CONTINUE
      SFDI(4) = SFDEI(I,4)
      SFDI(5) = SFDEI(I,5)
      SFDI(6) = SFDI(I,4)+SFDEI(I,6)
      WRITE (6,90) LOC(I), SAFDI, (SFDI(K),K=1,6)
90      SSAFDI = SSAFDI+SAFDI
      DO 160 K=1,6
      SSFDI(K) = SSFDI(K)+SFDI(K)
      160 CONTINUE
      170 CONTINUE
95      WRITE (6,120) SSAFDI,(SSFDI(K),K=1,6)
      C
      C      PRINT OUT SUMMATION OF AMOUNT OF FUEL DISPLACED
      C      BY THERMAL ENERGY AND ELECTRIC ENERGY FOR ALL APPLICATIONS
      C
100      SSAFDI = 0
      DO 180 K=1,4
      SSFDI(K) = 0
      180 CONTINUE
      DO 230 I=1,140,50
105      WRITE (6,190) TIM(IT),NILO,NIHI,NJLO,NJHI,ECRLO,ECRHI
      190 FORMAT(*1*,13X,*AMOUNT OF THERMAL ENERGY DISPLACED (IN BTU S) *,

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```

      *      *BY APPLICATION FOR YEAR *,A4,*,*/,
      *      14X,*STATES*,I3,* TO*,I3,*, APPLICATIONS*,I4,* TO*,I4,
      *      *, AND ECR VALUES*,F10.3,* TO*,F10.3,
110      *      ///2X,*APPLICATION*,25X,*TOTAL*,3X,
      *      *NATL GAS      OIL      COAL      OTHER*)
      DO 220 M=1,50
      J = L+M-1
      IF (J.GT.140) GO TO 230
115      WRITE (6,200) (APP(K,J),K=1,3), SAFDTJ(J), (SFDTJ(J,K),K=1,4)
      200 FORMAT (2X,3A10,5E11.4)
      SSAFDTJ = SSAFDTJ+SAFDTJ(J)
      DO 210 K=1,4
      SSFDTJ(K) = SSFDTJ(K)+SFDTJ(J,K)
120      210 CONTINUE
      220 CONTINUE
      230 CONTINUE
      WRITE (6,240) SSAFDTJ, (SSFDTJ(K),K=1,4)
      240 FORMAT (/2X,*TOTAL*,25X,5E11.4)
125      SSAFDEJ = 0
      DO 250 K=1,6
      SSFDEJ(K) = 0
      250 CONTINUE
      DO 300 L=1,140,50
130      WRITE (6,260) TIM(IT),NILO,NIHI,NJLO,NJHI,ECRLO,ECRHI
      260 FORMAT(*1*,13X,*AMOUNT OF ELECTRIC ENERGY DISPLACED (IN BTU S) *,
      *      *BY APPLICATION FOR YEAR *,A4,*,*/,
      *      14X,*STATES*,I3,* TO*,I3,*, APPLICATIONS*,I4,* TO*,I4,
      *      *, AND ECR VALUES*,F10.3,* TO*,F10.3,
135      *      ///2X,*APPLICATION*,25X,*TOTAL*,3X,
      *      *NATL GAS      OIL      COAL      NUCLEAR      HYDROELEC      *
      *      *OTHER*)
      DO 290 M=1,50
      J = L+M-1
140      IF (J.GT.140) GO TO 300
      WRITE (6,270) (APP(K,J),K=1,3), SAFDEJ(J), (SFDEJ(J,K),K=1,6)
      270 FORMAT (2X,3A10,7E11.4)
      SSAFDEJ = SSAFDEJ+SAFDEJ(J)
      DO 280 K=1,6
      SSFDEJ(K) = SSFDEJ(K)+SFDEJ(J,K)
145      280 CONTINUE
      290 CONTINUE
      300 CONTINUE
      WRITE (6,310) SSAFDEJ, (SSFDEJ(K),K=1,6)
150      310 FORMAT (/2X,*TOTAL*,25X,7E11.4)
      C
      C      PRINT SUMMATION OF AMOUNT OF FUEL DISPLACED FOR THERMAL AND
      C      ELECTRIC ENERGY COMBINED FOR ALL APPLICATIONS.
      C
155      SSAFDJ = 0
      DO 320 K=1,6
      SSFDJ(K) = 0
      320 CONTINUE
      DO 370 L=1,140,50

```


SUBROUTINE PRNTOUT

76/76

OPT=2

FTN 4.6+4280

07/10/78 14.02.369

```

160      WRITE (6,330) TIM(IT),NILO,NITH,NJLO,NJHI,ECRLO,ECRHI
      330 FORMAT(*1*,13X,*AMOUNT OF THERMAL AND ELECTRIC ENERGY DISPLACED *
      *      *(IN BTU S) *,
      *      *BY APPLICATION FOR YEAR *,A4,*,*/,
      *      14X,*STATES*,I3,* TO*,I3,* APPLICATIONS*,I4,* TO*,I4,
165      *      *, AND ECR VALUES*,F10.3,* TO*,F10.3,
      *      ///2X,*APPLICATION*,25X,*TOTAL*,3X,
      *      *NATL GAS      OIL      COAL      NUCLEAR  HYDROELEG      *
      *      *OTHER*)
      DO 360 M=1,50
170      J = L+M-1
      IF (J.GT.140) GO TO 370
      SAFDJ = SAFDTJ(J)+SAFDEJ(J)
      DO 340 K=1,3
      SFDJ(K) = SFDJTJ(J,K)+SFDEJ(J,K)
175      340 CONTINUE
      SFDJ(4) = SFDEJ(J,4)
      SFDJ(5) = SFDEJ(J,5)
      SFDJ(6) = SFDJTJ(J,4)+SFDEJ(J,6)
      WRITE(6,270) (APP(K,J),K=1,3), SAFDJ, (SFDJ(K),K=1,6)
180      SSAFDJ = SSAFDJ+SAFDJ
      DO 350 K=1,6
      SSFDJ(K) = SSFDJ(K)+SFDJ(K)
      350 CONTINUE
      360 CONTINUE
185      370 CONTINUE
      WRITE(6,310) SSAFDJ, (SSFDJ(K),K=1,6)
      RETURN
      END

```

02780

02790

SUBROUTINE HEADING 76/76 OPT=2

FTN 4.6+42bd

07/10/78 14.02.36\$

1 SUBROUTINE HEADING (TITLE)

C
C
C
C

HEADING SKIPS TO NEW PAGE AND PRINTS TITLE, DATE,
AND TIME

5

DIMENSION TITLE(3)
CALL DATE(TODAY)
CALL TIME(NOW)
WRITE (6,10) TITLE, NOW, TODAY

10

10 FORMAT (1H1,29X,3A10,12X,A6,4X,A10)
RETURN
END

Appendix C - Preprocessor Programs

The preprocessor programs consist of programs that compile the simulation results of ideal and non-ideal STES applications. In addition, these programs process Survey of Manufacturers census data and a Sherman H. Clark Associates-developed data base of energy prices and energy demands by state, industry and various future time periods. A description of each preprocessor program follows.

1. FRACTION NATIONAL INDUSTRIAL DEMAND (FNID)

1.1 FNID Description

The purpose of FNID is to compute fractions of national industrial demand AIS(i,s) by industry (i = 1 to 140) and state (s = 1 to 50), such that AIS(i,1) + AIS(i,2) + ... + AIS(i,50) = 1 for each industry i. This program extracts industrial demand DMD(i,s) for each industry i in each state s from the 1974 Survey of Manufacturers data tape. Then it computes the fraction of national industrial demand as follows:

$$\text{AIS}(i,s) = \frac{\text{DMD}(i,s)}{\sum_{\text{all states}} \text{DMD}(i,s)} \quad (\text{C-1})$$

Industries in Washington, D.C. were summed into the Maryland data. There were five industries whose demand summed over all states was zero. For these industries (SIC codes 213, 302, 315, 316, and 375), the fractional demands for the corresponding two digit SIC codes (21, 30, 31, and 37) were substituted. This program is written in PL/I for the IBM 370 computer.

1.2 FNID Input

Input consists of the 1974 Survey of Manufacturers data tape received from the U.S. Department of Commerce, Bureau of the Census in Washington, D.C. The industrial demands were extracted from Table 2 under the heading "Purchased Fuels and Electric Energy, Kilowatt Hour Equivalent".

1.3 FNID Output

Output consists of a tape containing state code, industry code, and fraction national industrial demand. These values are also printed out.

2. CALCULATION OF FUTURE ENERGY DEMAND (CED)

2.1 CED Description

The purpose of CED is to compute energy demand $EMI(i,s,y)$ for each three digit SIC industry ($i = 1$ to 140) in each state ($s = 1$ to 50) for seven time periods in increments of five years ($y = 1985, 1990, \dots, 2015$). The input to the program is provided by program FNID and by Sherman H. Clark Associates. Program FNID furnished the fractions of national industrial demand $AIS(i,s)$ for industry i in state s for 1974. Sherman H. Clark Associates provided forecasts of state industrial energy demand totals $SMI(s,y)$ for state s and national industrial energy demand $NMI(i,y)$ for industry i for time period y . Using this information, CED calculates energy demand such that:

$$EMI(i,s,y) = AIS(i,s) * NMI(i,y) \quad (C-2)$$

Then an iterative technique is used to modify the EMI values so that energy demand summed over each state agrees with SMI values within a one percent tolerance. In other words, industrial energy demands are modified for future years through an iterative process to reflect Sherman H. Clark Associates' forecast of (a) national change in individual industry demand and (b) individual state industrial demand growth (see Reference 2 pp. VI-11 and VI-12). State totals were scaled to offset state/industry accounting differences.

2.2 CED Input

Sherman H. Clark Associates provided industrial energy demand forecasts by state and by industry for seven time periods (1985, 1990, ..., 2015). Sample demand forecasts for Maryland and Washington, D.C., are shown in Table C-1. Since SAM dealt with industrial applications, only the industrial energy demand forecasts were used from this table. Sample demand forecasts for some three digit SIC industries are shown in Table C-2.

Table C-1. Energy Demand in Maryland and Washington, D.C.
(Trillions of Btu), 1974-2015

	1974	1975	1985	1990	1995	2000	2005	2010	2015
Residential									
Natural gas	85.1	84.4	108.0	115.0	122.0	122.0	122.0	122.0	122.0
Electricity	34.2	35.9	60.0	76.0	92.5	109.5	126.5	146.0	168.5
Light oil	87.3	87.4	98.0	97.0	95.5	100.5	105.5	108.0	107.5
Other	15.4	22.2	16.0	16.0	16.0	16.0	16.0	16.0	16.0
Total	222.0	229.9	282.0	304.0	326.0	348.0	370.0	392.0	414.0
Commercial									
Natural gas	44.2	38.4	60.0	67.0	74.0	74.0	71.0	70.0	72.0
Electricity	34.9	36.9	60.0	76.0	92.5	109.5	126.5	146.0	168.5
Light oil	1.7	1.2	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Heavy oil	11.2	7.1	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Coal	0.7	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Other	1.4	1.5	1.5	1.5	1.5	1.5	6.0	7.0	3.5
Total	94.1	85.6	125.0	148.0	171.5	188.5	207.0	226.5	247.5
Industrial									
Natural gas	59.0	44.3	17.0	16.0	12.0	6.0	--	--	--
Electricity	41.1	39.4	73.0	87.5	102.0	116.5	131.0	146.0	161.0
Light oil	8.6	9.0	--	--	--	--	--	--	--
Heavy oil	69.2	42.5	150.0	150.0	150.0	150.0	150.0	150.0	150.0
Coal	23.4	14.9	36.5	43.0	52.5	64.0	75.5	75.5	80.5
Other	8.3	8.2	8.5	8.5	8.5	8.5	8.5	8.5	8.5
Total	209.6	158.3	285.0	305.0	325.0	345.0	365.0	380.0	400.0
Power plants									
Natural gas	13.8	0.5	--	--	--	--	--	--	--
Light oil	16.5	11.5	15.0	15.0	15.0	15.0	15.0	15.0	15.0
Heavy oil	184.3	119.1	108.5	92.4	78.1	63.8	49.4	35.1	20.8
Coal	112.3	99.2	235.5	317.9	401.7	487.1	537.7	592.6	651.2
Nuclear	--	43.9	163.2	245.6	329.4	414.8	528.7	653.4	793.0
Hydroelectric	19.7	23.1	26.0	27.0	27.0	27.0	27.0	27.0	27.0
Other	--	--	--	--	--	--	--	--	--
Total	346.6	297.3	548.2	697.9	851.2	1,007.7	1,157.8	1,323.1	1,507.0

Sources: Historical--
Projected--SHCA.

Table C-2. Estimated Energy Consumption by Manufacturing Industry
(Trillions of Btu)
1967-2015

SIC Code and Manufacturing Industry	Historical			Projected						
	1967	1971	1974	1985	1990	1995	2000	2005	2010	2015
20 Food and kindred products	894.8	1,025.7	958.8	1,166.9	1,265.9	1,364.5	1,464.1	1,565.7	1,667.5	1,768.7
201 Meat products	110.2	134.1	115.0	132.6	140.6	148.4	156.1	163.8	171.4	178.9
202 Dairy products	124.6	114.0	100.3	100.0	100.5	101.0	101.5	102.0	102.5	103.0
203 Preserved fruits and vegetables	114.0	126.6	128.3	177.5	200.1	222.5	244.0	265.0	285.1	304.2
204 Grain mill products	129.0	145.7	149.1	203.5	226.8	248.8	267.4	290.8	315.0	339.4
205 Bakery products	55.6	64.5	54.6	54.0	54.5	55.0	55.5	56.0	56.5	57.0
206 Sugar, confectionery products	128.9	154.2	151.5	191.5	213.2	236.8	261.2	287.0	313.5	340.4
207 Fats and oils	96.3	116.0	104.4	127.0	137.8	148.6	159.4	170.4	181.5	192.6
208 Beverages	99.4	118.7	105.1	123.8	132.5	141.1	153.5	162.4	171.1	179.7
209 Misc. foods, kindred products	36.8	51.9	50.5	57.0	59.9	62.7	65.4	68.2	70.9	73.4
21 Tobacco products	19.4	18.6	20.1	20.9	21.2	21.5	21.8	22.1	22.4	22.7
211 Cigarettes	11.4	10.2	13.0	13.9	14.2	14.4	14.7	14.9	15.2	15.4
212 Cigars	2.2	1.0	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9
213 Chewing and smoking tobacco		1.0	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9
214 Tobacco stemming and redrying	5.8	6.4	5.1	5.2	5.2	5.3	5.4	5.4	5.4	5.5
22 Textile mill products	315.3	363.4	322.7	388.0	419.2	453.0	486.6	521.1	555.7	590.2
221 Weaving mills, cotton	58.3	48.4	34.8	39.4	41.5	43.6	45.7	47.8	49.9	52.0
222 Weaving mills, manmade fiber	32.6	50.5	48.4	58.5	63.4	68.6	73.8	79.2	84.6	90.0
223 Weaving, finishing mills, wool	21.3	12.3	6.8	7.8	8.2	8.6	9.1	9.5	9.9	10.4
224 Narrow fabric mills	5.3	4.8	3.8	4.3	4.5	4.8	5.0	5.2	5.4	5.6
225 Knitting mills	41.3	59.4	55.6	67.2	72.8	78.7	84.7	90.9	96.9	102.9
226 Textile finishing, except wool	82.2	86.3	74.3	89.0	96.4	104.1	111.7	119.6	127.5	135.4
227 Floor covering mills	18.9	32.8	30.0	36.5	39.6	42.9	46.2	49.7	53.2	56.6
228 Yarn and thread mills	28.4	38.9	41.3	51.2	55.6	60.9	65.9	71.1	76.3	81.6
229 Misc. textile goods	27.0	30.0	27.6	34.2	37.4	40.9	44.5	48.2	52.0	55.7
23 Apparel, other textile products	47.4	67.2	68.2	82.1	88.6	95.7	102.8	110.1	117.4	124.7
231 Men's & boys' suits & coats	4.5	5.8	6.8	8.0	8.6	9.2	9.8	10.4	11.0	11.6
232 Men's & boys' furnishings	9.4	14.7	14.0	16.7	17.9	19.2	20.6	21.9	23.3	24.6
233 Women's & misses' outerwear	13.8	16.4	17.7	21.4	23.2	25.1	27.0	29.0	31.0	32.9
234 Women's, children's undergarments	3.0	3.4	3.4	4.0	4.2	4.5	4.8	5.1	5.4	5.7
235 Hats, caps, and millinery	1.1	0.7	1.4	1.6	1.7	1.8	1.9	2.0	2.1	2.2
236 Children's outerwear	1.9	2.4	2.4	2.8	2.9	3.1	3.3	3.4	3.6	3.8
237 Fur goods	0.5	0.3	0.4	0.5	0.5	0.5	0.6	0.6	0.6	0.6
238 Misc. apparel and accessories	2.0	2.7	2.7	3.3	3.6	3.9	4.2	4.5	4.8	5.1
239 Misc. fabricated textile products	11.2	20.8	19.4	23.9	26.0	28.4	30.7	33.2	35.6	38.1
24 Lumber and wood products	187.7	233.4	274.0	379.3	429.1	485.5	541.3	597.7	650.2	700.1
241 Logging camps, log contractors	46.5	46.1	57.0	79.8	90.0	101.5	112.8	123.7	133.7	143.3
242 Sawmills and planing	67.8	88.4	94.5	127.6	142.9	160.0	176.7	193.5	209.0	223.7
243 Millwork, plywood structure members	33.1	47.4	53.9	72.8	81.5	91.2	100.8	110.4	119.2	127.6
244 Wood containers	2.4	3.1	5.1	7.3	8.4	9.1	9.9	10.6	11.3	11.9
245 Wood building & mobile homes	--	--	8.9	16.5	21.3	27.5	34.5	42.5	50.3	58.5
249 Misc. wood products	37.9	48.4	54.6	75.4	85.2	96.2	106.6	117.0	126.7	135.5

Program FNID provided an input tape containing state code, industry code, and fraction national industrial demand.

2.3 CED Output

Energy demand forecasts $EMI(i,s,y)$ in trillion Btu's for each three digit SIC industry i in each state s for seven time periods y are output on a tape which is read by SAMDGP. See Section 2.2.1 (Tape 3 Input) for a description of the data format and ordering on this tape. See Figure 2-3 for sample data on this tape.

3. POLYNOMIAL FITS OF STES SIMULATION RESULTS

A polynomial curve fit program was written to compute the coefficients for a second degree curve fit through the data points of simulation results of ideal and non-ideal industrial applications for the following relationships:

- o Equivalent Cost Ratio (ECR) vs Average Daily Direct Insolation (I)
- o Fuel Displacement Percentage (FD) vs I
- o T/E Ratio of Displaced Energy (R) vs I

Tables 2-4, 2-5, and 2-6 give the coefficients A, B, and C in the equation:

$$Y = A + BI + CI^2 \quad (C-3)$$

where I is the average daily direct insolation and Y is one of the above mentioned parameters of ECR, FD or R. These polynomial coefficients were obtained for eight T/E demand ratios and three phasing patterns as shown in the tables. The above coefficients were obtained from the STES simulation results of four geographic locations involving Los Angeles, CA; Columbia, MO; Albuquerque, NM; and Blue Hill, MA. These coefficients were used to find the appropriate STES simulation parameters in SAMDGP for any one of the 50 state locations by using their corresponding values of average daily direct insolation and a given industry's phasing pattern and T/E demand ratio. If a given industry falls in between the two polynomials of consecutive T/E demand ratios, linear interpolation is used for the appropriate STES simulation parameters.

3.1 Polynomial Fit Input

Input consists of I and STES simulation results of ECR, FD, and R for the four geographic locations listed above.

3.2 Polynomial Fit Output

Output consists of coefficients for a second degree curve through the input data points for ECR, FD, and R versus I. See Tables 2-4, 2-5, and 2-6. These coefficients were keypunched onto cards which were inserted into SAMDGP in DATA statements.

4. CALCULATION OF LEVELIZED ELECTRIC AND FUEL COSTS (LEAFC)

Levelized electric costs for future time spans of n years are computed in increments of five years ($t = 1985, 1990, \dots, 2015$) for each state using the following:

$$LV_t = PV_t \frac{k}{1 - (1+k)^{-n}} \text{ for } k \neq 0$$

(C-5)

$$LV_t = \frac{PV_t}{n} \text{ for } k = 0$$

where

LV_t = levelized cost of one kWh electric power in mills/kWh for years t to $t+n$

PV_t = present value in mills for next n years supply of one kWh/year

$$= \sum_{j=t}^{t+(n-1)} C_j (1+k)^{t-j-1}$$

C_j = composite electric energy price in year j

n = STES lifetime (nominally 30 years)

k = discount rate, given as input parameter

Similarly, levelized cost of 10^6 Btu's of thermal energy in dollars/ 10^6 Btu's were obtained in increments of five years for each state where the composite thermal energy price C_j for year j was computed as follows:

$$C_j = x_j^O f_j^O + x_j^{NG} f_j^{NG} + x_j^C f_j^C + x_j^X f_j^X$$

(C-6)

where

$$1 = f_j^O + f_j^{NG} + f_j^C + f_j^X$$

The f values are the fractions of thermal energy produced from oil, natural gas, coal and other energy, respectively in year j, and the x values are the prices of the fuels indicated by the superscript for year j. The thermal energy prices of fuels for each year from 1985 to 2015 were computed using interpolation on Sherman H. Clark-furnished price data for each state (See Table C-3). Fuel mix fractions for thermal and electric energy by fuel type were calculated on a state basis for seven time periods (1985, 1990, ..., 2015) using Sherman H. Clark-furnished demand data (See Table C-1).

Table C-3. Energy Prices in Maryland and Washington D. C.
(In Original Units and Cents per Million Btu)
1974-2015

	Original Units*									Cents per Million Btu								
	1974	1975	1985	1990	1995	2000	2005	2010	2015	1974	1975	1985	1990	1995	2000	2005	2010	2015
Residential																		
Natural gas	171	233	390	501	586	625	617	603	606	167c	227c	300c	489c	572c	610c	602c	593c	591c
Electricity	3.58	3.95	4.30	4.60	5.00	5.40	5.70	6.20	6.70	1049	1157	1260	1348	1465	1582	1670	1817	1963
Light fuel oil	35.8	36.0	56.6	62.9	70.0	76.9	77.1	77.5	77.7	257	258	406	452	502	552	553	556	558
Commercial																		
Natural gas	149	206	364	479	568	610	606	602	604	145	201	355	467	554	595	591	587	589
Electricity	3.59	3.85	4.40	4.70	5.10	5.50	5.80	6.30	6.80	1052	1128	1289	1377	1494	1612	1699	1856	1992
Light fuel oil	29.9	32.9	53.0	59.3	66.4	73.3	73.6	73.9	74.2	215	236	380	426	477	526	528	531	533
Heavy fuel oil	11.83	12.52	21.65	24.30	27.30	30.30	30.40	30.50	30.60	194	205	355	398	448	497	498	500	502
Coal	33.96	38.77	48.11	54.81	62.44	71.01	79.54	89.67	101.75	146	159	201	230	262	298	335	378	429
Industrial																		
Natural gas	118	137	295	412	503	548	548	547	554	115	134	288	402	491	535	535	534	540
Electricity	2.34	2.67	3.10	3.60	4.10	4.70	5.20	5.80	6.50	686	782	908	1055	1201	1377	1524	1699	1904
Light fuel oil	25.9	29.9	49.4	55.7	62.9	69.8	70.0	70.4	70.6	193	216	355	400	452	501	502	505	507
Heavy fuel oil	11.53	12.22	21.35	24.00	27.00	30.00	30.10	30.20	30.30	183	194	339	381	428	476	478	479	481
Coal	31.96	36.77	42.77	48.72	55.50	63.12	70.70	79.70	90.44	137	151	179	204	235	265	298	336	382
Power plants																		
Natural gas	60	102	--	--	--	--	--	--	--	59	100	--	--	--	--	--	--	--
Light fuel oil	26.9	29.9	49.2	55.5	62.6	69.5	69.8	70.1	70.4	193	216	353	398	449	499	501	503	505
Heavy fuel oil	10.83	11.52	20.70	23.35	26.35	29.35	29.45	29.55	29.65	172	187	329	371	418	466	468	469	471
Coal	26.96	31.77	35.64	40.60	46.25	52.60	58.92	66.42	75.37	116	130	149	170	194	221	248	280	318
Nuclear	--	0.22	0.39	0.45	0.54	0.66	0.82	1.01	1.26	--	22	39	45	54	66	82	101	126

* Natural gas--cents per thousand cubic feet; electricity--cents per kWh; light fuel oil--cents per gallon; heavy fuel oil--dollars per barrel; coal--dollars per ton; and nuclear--cents per kWh.

Sources: Historical--
Projected--SHCA.

+ All prices are stated in 1977 constant dollars except for 1974 and 1975 which are stated in actual dollars.

4.1 LEAFC Input

Sherman H. Clark Associates developed fuel and electric energy prices for each of the fifty states in five-year time increments from 1985 to 2015. (See Table C-3.) LEAFC uses the fuel and electric prices given for industrial applications in cents per million Btu's in 1977 dollars. Sherman H. Clark Associates also developed fuel and electric energy demands for each of the fifty states in five-year time increments from 1985 to 2015. (See Table C-1.) LEAFC uses the industrial applications data (except electricity) to compute fuel mix fractions for thermal energy. The program uses power plant data to compute fuel mix fractions for electric energy.

4.2 LEAFC Output

LEAFC generates an output tape (Tape 3) containing the following data for each state and for seven time periods: fuel mix fractions for thermal and electric energy; composite thermal energy prices and composite electric energy prices; levelized costs for electric energy and thermal energy. Only the fuel mix fractions which appear at the start of the tape are read by SAMDGP. See Section 2.2.2 (Tape 4 Input) for a description of the data format on this tape. See Figure 2-4 for sample data on this tape. This tape is also input to Market Penetration Model Program.

LEAFC also punches cards containing levelized costs for electric energy and thermal energy for each state for seven time periods. These cards are part of the tape 5 input stream for SAMDGP (See Section 2.2.3).