THE DOE–2 USER NEWS

DOE-2: A COMPUTER PROGRAM FOR BUILDING ENERGY SIMULATION

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☞ ☞ HANDS ON ☜ ☜

☞ Inflate Before Ordering!!

Before you order DOE-2 documentation, check the back cover of this USER NEWS for new prices. Every January, the National Technical Information Service "adjusts" their prices (*Upward!*).

☞ Directory of Services

DOE-2 has generated program-related software and consulting services that are listed on the inside back page of this newsletter.

This work was supported by the Assistant Secretary for Conservation and Renewable Energy, Office of Buildings and Community Systems, Buildings Division, of the U. S. Department of Energy, under Contract No. DE-AC03-76SF00098.

☞ Time To Make Travel Plans

Oct 24-28 — *Twelfth World Energy Engineering Congress*

to be held in Atlanta, Georgia.
Sponsor: Association of Energy Engineers and the Alliance to Save Energy. Contact: Association of Energy Engineers, 4025 Pleasantdale Road #420, Atlanta, GA 30340. Phone: (404) 447-5083.

* * * * *

Feb 11-14, 1990 — *Winter meeting of ASHRAE*

to be held in Atlanta, Georgia.
Contact: ASHRAE, 1791 Tullie Circle N.E., Atlanta, GA 30329. Phone: (404) 636-8400.

* * * * *

March 19-21 — *Energy Technology Conference and Exposition*

to be held in Washington, D.C.
Sponsors: Government Institutes
Contact: ETC, Government Institutes, 966 Hungerford Drive #24, Rockville, MD 20850-1714. Phone: (301) 251-9250.

* * * * *

June 24-27 — *Summer Meeting of ASHRAE*

to be held in Minneapolis, Minnesota. Contact: ASHRAE, 1791 Tullie Circle N.E., Atlanta, GA 30329. Phone: (404) 636-8400.

* * * * *

Aug 26-Sep 1 — *ACEEE Sixth Summer Study*

to be held at the Asilomar facility in Pacific Grove, California. Sponsor: American Council for an Energy Efficient Economy. Contact: ACEEE 1990 Summer Study, Bldg 90H, Lawrence Berkeley Laboratory, Berkeley, CA 94720. Phone: (415) 486-7478.

PROCESSING NONSTANDARD WEATHER DATA FOR DOE-2

by

Fred Buhl
Simulation Research Group

The DOE-2 weather processor is capable of processing raw weather data in a variety of formats into a DOE-2 compatible form. Quite frequently, however, users obtain weather data in a format that is unknown to the weather processor. The user then has two alternatives: convert the data into a known format; or process the raw weather data directly by filling in the empty subroutine OTHER in the DOE-2 weather processor.

Use of the subroutine OTHER

OTHER is a typical weather data processing subroutine in the DOE-2 weather processor — it just doesn't contain any code! But like the other such routines (TRYDCD, TMYDCD, etc.) it is called once every 24 hours by subroutine PACKER, and its use can be triggered by the weather processor input. Putting OTHER in the first 5 columns of the 3rd record of the PACK input sequence informs the weather packer that subroutine OTHER will be used for reading in and processing the raw data. It is up to the user to then supply the code in OTHER that will do this.

Basically, the arrays in the common block /RAWDAT/ must be filled for each call to OTHER. The arrays are dimensioned 24, and are all integers. They are

IDRY, IWET and IDEW	drybulb, wetbulb, and dewpoint temperatures in degrees Fahrenheit, rounded to the nearest whole degree.
IPRESS	atmospheric pressure in inches of Hg times 100 (so 29.92 will be 2992, etc.)
IWNDSP	wind speed, in knots (!) (nearest whole knot).
ICLAMT	cloud amount (sky cover), 0 - 10; 0 = no clouds, 10 = totally cloudy.
ISOL, IDN	total solar on a horizontal surface and direct normal (beam) solar radiation, both in Btu/sqft-hr, nearest whole unit.
IWNDIR	wind direction in compass points (0 - 15). 0 is north, 15 is NNW.
ICLTY, ICLTY1	DOE-2 cloud type - ICLTY takes the values 0, 1, and 2. ICLTY1 is unused. Type 0 is the most transparent cloud category. It contains TRY types 8 and 9 (cirrus and cirrostratus or cirrocumulus). Type 1 is the most opaque. It contains TRY type 2 (stratus or fractus stratus). Type 2 is of intermediate transparency. It contains all other types of clouds, and is a good

default if no cloud type information is available.

IRN, ISN — the rain and snow flags. Set to 1 if raining or snowing, 0 otherwise. IRN and ISN are never used, but it is nice to set them anyway. When printed out along with the other weather variables with the LIST option of the weather processor, they can help explain some otherwise odd looking weather or solar data.

Frequently the raw data will include drybulb and relative humidity, instead of drybulb, wetbulb, and dewpoint as required by the weather processor. The user should use the procedure given in 1989 ASHRAE Fundamentals, page 6.14, situation number 3. A slightly different procedure is used in the example OTHER subroutine at the end of this article.

In the case of solar data, the weather processor needs total horizontal and direct normal. The data is often in the form of direct and diffuse on a horizontal surface. The cosine of the solar zenith angle (or the sine of the solar altitude) must then be calculated in order to obtain the direct normal from the direct horizontal. This calculation involves knowing the solar declination angle and the equation of time, and is complicated by the fact that the cosine of the zenith angle must usually be averaged over a one hour time bin, since the solar data point is usually the average over 1 hour of a number of data points taken at less than 1 hour intervals. In this case it is best to simply follow the procedure shown in the example subroutine. As in the example, it is usually necessary to do a limit check on the resulting direct normal, particularly at sunrise and sunset, where the data is frequently bad.

Sometimes only total horizontal solar data is available. A model must then be employed to obtain the direct radiation from the total. We recommend the model of Erbs, Klein, and Duffie, described in Solar Energy, volume 28, page 293 (1982).

Converting the data to TRY format

The alternative to creating an OTHER subroutine is to convert the raw data to a standard format known to the DOE-2 weather processor. The easiest format to use is TRY which is described in the DOE-2 Reference Manual, volume 2, page VIII.26.

Only the fields listed below need be filled! ↓

day	total sky cover
dew point temperature	type of lowest cloud layer
dry bulb temperature	wet bulb temperature
month	wind direction
station number	wind speed
station pressure	year
weather (not strictly necessary)	

The major deficiency of the TRY format is that it hasn't included solar data. In DOE-2.1D, however, the weather processor has been altered to look for solar data in TRY records:

> columns 57-59 total horizontal radiation in Btu/sqft-hr;
>
> columns 61-63 direct normal radiation in Btu/sqft-hr.

The user must specify SOLAR rather than NORMAL in the third record of the PACK input sequence for this to work.

Example OTHER subroutine

Here are the UPDATE mods to the DOE-2.1D weather processor to create an example OTHER subroutine.

```
*/ This adds code to OTHER to process data from a German
*/ TRY file; this format has no resemblance to a US TRY file.
*IDENT GERTRY
*I OTHER.5
*CALL /LOCALD/
*CALL /CONST/
*CALL /TIMES/
*CALL /MONTHC/
*I OTHER.14
      DIMENSION DEABC(5)
C               DAY OF YEAR
      IDOY = BEFORE(IMNTH) + IDAY
C               GET SUN PARAMETERS.  DEABC(1) IS THE SOLAR
C               DECLINATION ANGLE IN RADIANS; DEABC(2) IS
C               THE EQUATION OF TIME IN HOURS.
      CALL SUNPRM(IDOY,DEABC)
C               SOLAR CONSTANT
      SOLCON = 436.8*(1.+0.33*COS(DTOR*360.*FLOAT(IDOY)/365.))
C               LOOP OVER HOURS IN THE DAY
      DO 1000 IH=1,24
C               READ IN WEATHER DATA
C               SKYCOV - sky cover in eighths (0.0 - 1.0)
C               IWINDR - wind direction in degrees; north = 0
C               WNDSPD - wind speed in m/s
C               PRESMB - pressure in millibars
C               TDRY   - dry bulb temperature in deg C.
C               RELH   - relative humidity (0.0 - 1.0)
C               IDIRH  - direct solar on a horiz surface in w/m**2
C               IDIFFH - diffuse solar on a horiz surface in w/m**2
----+----1----+----2----+----3----+----4----+----5----+----6----+----7
```

```
      READ (INWTH,9001) IVR,ID,IM,IHR,SKYCOV,IWINDR,WNDSPD,WSVECT,
     1 IWTHR,DEP,PRESMB,TDRY,RELH,IDIRH,IDIFFH,ILLUMH,IRH,IATMRH
 9001 FORMAT(I1,3I2,1X,F4.2,1X,I3,2(1X,F4.1),1X,I2,1X,F4.1,1X,F6.1,
     1 1X,F5.1,1X,F4.2,1X,I4,1X,I4,1X,I7,1X,I4,1X,I4)
C               CONVERT DRYBULB FROM CENTIGRADE TO FAHRENHEIT
      TDRYF = 1.8*TDRY + 32.
C               CALCULATE WETBULB AND DEWPOINT
C               SATURATED VAPOR PRESSURE
      PS = PPWVMS(TDRYF)
C               PARTIAL PRESSURE
      PW = RELH*PS
C               CONVERT PRESSURE FROM MILLIBARS TO INCHES OF HG
      PRESHG = .02953*PRESMB
C               HUMIDITY RATIO
      HUMRAT = 0.622*PW/(PRESHG-PW)
C               SPECIFIC ENTHALPY
      ENTH = 0.24*TDRYF + (1061.+0.444*TDRYF)*HUMRAT
      TWETF = WBF(ENTH,PRESHG)
      Y = LOG(PW)
      IF (PW .LE. 0.1836) THEN
          TDEWF = 71.98 + 24.873*Y + 0.8927*Y*Y
      ELSE
          TDEWF = 79.047 + 30.579*Y + 1.8893*Y*Y
      END IF
C               CONVERT WINDSPEED FROM M/S TO KNOTS
      WSKNOT = 1.9438*WNDSPD
      SOLHOR = 0.
      SOLDRN = 0.
C               SET UPPER AND LOWER HOUR ANGLE BIN EDGES
C               FOR SOLAR ZENITH ANGLE CALCULATION.
C               HOUR ANGLE IN UNITS OF HOURS.
      UL = FLOAT(IH) - 12. + FLOAT(NTZ) + DEABC(2) - STALON/PIOV12
      BL = UL -1.
C               SUNRISE AND SUNSET HOUR ANGLES
      SSHA = ACOS(-TAN(STALAT)*TAN(DEABC(1)))/PIOV12
      SRHA = -SSHA
C               SKIP IF SUN DOWN
      IF ((UL .LE. SRHA) .OR. (BL .GE. SSHA)) GO TO 300
C               RESET BIN EDGES AT SUNRISE OR SUNSET
      IF (SRHA .GT. BL)  BL = SRHA
      IF (SSHA .LT. UL)  UL = SSHA
      IF ((UL-BL) .LT. .02)  GO TO 300
----+----1----+----2----+----3----+----4----+----5----+----6----+----7
```

```
C               TOTAL HORIZONTAL SOLAR; CONVERT FROM W/M**2 TO
C               BTU/(FT**2)(HR)
              SOLHOR = .31721*FLOAT(IDIRH+IDIFFH)
C               GET THE AVERAGE OF THE COSINE OF THE SOLAR
C               ZENITH ANGLE FOR THE 1 HOUR TIME BIN
              A = SIN(DEABC(1))*SIN(STALAT)
              B = COS(DEABC(1))*COS(STALAT)
              COSZIN = A*(UL-BL) + B*(SIN(PIOV12*UL)-SIN(PIOV12*BL))/PIOV12
              COSZAV = COSZIN/(UL-BL)
C               GET DIRECT NORMAL SOLAR
              SOLDRN = .31721*FLOAT(IDIRH)/COSZAV
C               PUT LIMITS ON THE SUNRISE AND SUNSET BEAM RADIATION
              CALL MAXDIR(COSZAV,SOLCON,DIRMAX)
              SOLDRN = AMIN1(SOLDRN,DIRMAX)
  300 CONTINUE
C               FILL THE DATA ARRAYS
        IDRY(IH) = IROUND(TDRYF)
        IWET(IH) = MIN0(IDRY(IH),IROUND(TWETF))
        IDEW(IH) = MIN0(IWET(IH),IROUND(TDEWF))
        IPRESS(IH) = IROUND(100.*PRESHG)
        IWNDSP(IH) = IROUND(WSKNOT)
        IWNDIR(IH) = IROUND(.0444444*FLOAT(IWINDR))
        IF (IWNDIR(IH) .EQ. 16) IWNDIR(IH) = 0
        ICLAMT(IH) = IROUND(10.*SKYCOV)
        ISOL(IH) = IROUND(SOLHOR)
        IDN(IH) = IROUND(SOLDRN)
        ICLTY(IH) = 2
        ICLTY1(IH) = 2
        IRN(IH) = 0
        ISN(IH) = 0
 1000 CONTINUE
----+----1----+----2----+----3----+----4----+----5----+----6----+----7
```

A Method to Quickly Analyze DOE-2 Outputs

by

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Introduction

A project involving the DOE-2 program may sometimes require analysis of many pages of output. Additionally, the parametric studies portion of the same project may require that this analysis be done repetitively. Such a task is far from uncommon for someone using DOE-2. Unless the right tools are used, the repetitive extraction and plotting of the hundreds of numbers dispersed throughout the DOE-2 output becomes a time consuming, mind-numbing task. The method described herein makes the analysis process of a DOE-2 run quick and (almost) painless!

The following article is broken down as follows: First, the different steps involved in the method are described. Second, an example is shown, giving the specific details related to each step. Most of the basics of the computer programs used in this method are explained; however, the casual DOE-2 user should not expect to gain immediate expertise solely as a result of this article. Please feel free to contact me at LBL if you have questions, comments, or suggestions.

Method Description

The following method uses three software tools. They are:

1) **Awk**[1], a powerful file-processing programming language that is available for the MS-DOS and UNIX operating systems. Awk is designed to make many common information and retrieval text manipulation tasks easy to state and perform.

2) **Versaterm**[2], a communication program, available on the Macintosh Personal Computer.

3) **Cricket Graph**[3], a scientific graphing program, available on the Macintosh Personal Computer.

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1 **Awk** is part of the utility package contained in the Unix operating system. It is also available for MS/DOS and OS/2 through Mortice Kern Systems, Inc., 35 King Street North, Waterloo, Ontario, Canada N2J 2W9 – Phone: (800) 265-2797.

2 **Versaterm 4.0** is available from Synergy Software, 2457 Perkiomen Avenue, Reading, PA 19606 – Phone: (215) 779-0522.

3 **Cricket Graph** is available from Cricket Software, 40 Valley Stream Parkway, Malvern, PA 19355, – Phone: (215) 889-0267.

As shown in Fig. 1, Awk acts as a filter; it removes headers and comments from the DOE-2 output and creates and formats a file that contains only the data to be analyzed. Versaterm is used to transfer the file created by Awk from UNIX to the Macintosh. Cricket Graph is the platform from which data transformation, simple regression analysis and plotting can be performed easily and quickly. In addition to its user friendliness, Cricket Graph has excellent page layout capabilities and allows the printing of more than one resizable graph on a page with excellent output produced on a laser printer.

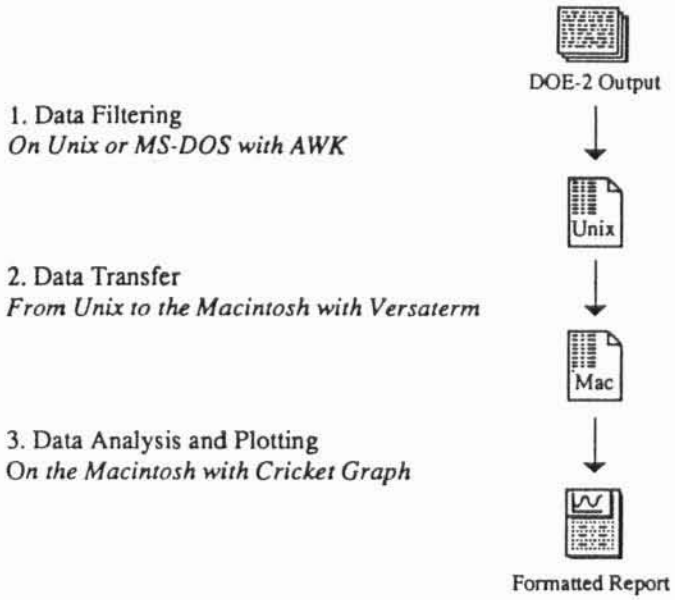

Figure 1: Description of the Method

Step–By–Step Example

Figure 2 shows a portion of DOE-2 output that will be used to demonstrate the method. The study consists of looking at the variations of the maximum daily cooling coil power for a typical office building. Printed are the daily minimum, maximum, integrated, and averaged values for the wet bulb temperature, dry bulb temperature, solar gains, and building cooling loads. (The analysis covers the time period June 1 to October 15, but only the last few days of October are shown in Fig. 2.)

Step One The first step in the method is to use Awk. Awk scans the DOE-2 output file and to each record that matches a certain pattern, it applies a set of procedures. Patterns and procedures are specified in an Awk script. The procedures can be simple calculations, conditional *if*s or print statements that apply to fields of a record. Within a file each record is defined by the record separator (RS) and fields within each record are defined by the field separator (FS). By default, RS is a carriage return and FS is any number of spaces; they do not need to be changed for the analysis of a DOE-2 output. In the Awk language,

$0 is the variable that contains the record,

$$i$ is the variable that contains the ith field within the record.

The bottom of Fig. 2 shows $1 through $8 for the DOE-2 output used in this example.

To run an Awk script on the UNIX system, type the command

awk -f AwkScriptName FileName

Where "AwkScriptName" is the name of the file that contains the Awk script and "FileName" is the name of the file to which the Awk script is to be applied.

1 EPRI THERMAL ENERGY STORAGE PROJECT, VARIABLE AIR VOLUME SYSTEM

CUSTOM WEIGHTING FACTORS

REPORT4 = HOURLY-REPORT

	GLOBAL WET BULB TEMP F ——(7)	GLOBAL DRY BULB TEMP F ——(8)	GLOBAL STD AIR ENTH BTU/LB ——(12)	RZ1 ZONE TEMP F ——(6)	RZ5 ZONE TEMP F ——(6)	BLD-SYS RETN AIR TEMP F ——(4)	BLD-SYS TOT CLG COIL POWER BTU/HR ——(6)
0 DAILY SUMMARY (OCT 13)							
MN	57.0	59.0	24.50	71.2	70 .1	.0	0.
MX	62.0	68.0	28.00	71.7	71.2	.0	0.
SM	1440.0	1506.0	639.50	1713.3	1694.0	.0	0.
AV	60.0	62.8	26.65	71.4	70.6	.0	0.
0 DAILY SUMMARY (OCT 14)							
MN	43.0	46.0	16.50	70 .5	68.3	.0	0.
MX	59.0	62.0	26.00	73.7	73.0	73.8	104939.
SM	1183.0	1290.0	482.00	1733.2	1709.5	810.1	1094719.
AV	49.3	53.8	20.08	72.2	71.2	33.8	45613.
0 DAILY SUMMARY (OCT 15)							
MN	33.0	37.0	12.00	70.1	66.7	.0	0.
MX	45.0	55.0	17.50	73.7	73.0	73.7	102049.
SM	955.0	1115.0	361.50	1730.4	1694.7	809.3	1033394.
AV	39.8	46.5	15.06	72.1	70.6	33.7	43058.
0 MONTHLY SUMMARY (OCT)							
MN	33.0	36.0	12.00	70.1	66.7	.0	0.
MX	65.0	78.0	30.00	75.9	78.0	76.5	186596.
SM	18392.0	21116.0	7698.50	26290.5	26080.6	8973.8	14205990.
AV	51.1	58.7	21.38	73.0	72.4	24.9	39461.
0 YEARLY SUMMARY							
MN	33.0	36.0	12.00	70.1	66.7	.0	0.
MX	78.0	99.0	42.0	85.1	88.5	81.8	464624.
SM	202712.0	231156.0	93045.50	253994.5	253947.8	81400.5	252804000.
$1	**$2**	**$3**	**$4**	**$5**	**$6**	**$7**	**$8**

AWK Fields for the last line

Figure 2: Example DOE-2 Output

```
BEGIN {
printf "%5s \t %5s \t %6s \n","Date","MaxDb","MaxClg" > "Project"
printf "%5s \t %5s \t %6s \n","      ","Deg F","Btu/hr" > "Project"
OFS="^I"
        }
$2=="YEARLY" {getline;getline;getline}
$2=="MONTHLY" {getline;getline;getline}
$2=="DAILY" {date=$4$5}
$1=="MX" {print date,$3,$8 > "Project"}
END {print "Job Done!"}
```

Figure 3: Example Awk Script

In the example, the Awk script, Fig. 3, is used to extract daily maximum temperature and daily maximum cooling coil power from the DOE-2 output shown in Fig. 2. The BEGIN and END parts of the script will only be executed once. The BEGIN command was used to open a new file called "Project", to write the three column labels separated by tabs, and to set the output field separator (OFS) to a tab character (ctrl-I). Thus, "Project" will have the typical Macintosh text format: columns separated by tabs and lines by returns; and Cricket Graph will be able to read it. At the end of the file, END is used to send a message on screen and will print "Job Done!".

Between the BEGIN and END statements, four procedures will be applied to each new line according to whether one of the fields of that line matches a specified pattern. The first three patterns are used to ascertain if the new line corresponds to yearly, monthly or daily summaries. If it is a yearly or a monthly summary, Awk skips three lines so that the last procedure won't be applied on the maximum value line that would immediately follow. If it is a daily summary, the date is stored under the variable "date", concatenation of the fourth and the fifth field in that line: date=$4$5 where $4="(OCT" and $5="13)". The fourth pattern is used to check if the new line corresponds to a maximum value line beginning with MX. In that case, the variable date, the drybulb temperature ($3) and the cooling coil power ($8) are written to the file "Project". If none of the the fields in the line match the four patterns, Awk scans a new line. Figure 4 shows the file created by the Awk script.

Date	MaxDb Deg F	MaxCl Btu/hr
—	—	—
—	—	—
(OCT2)	75.0	142573.
(OCT3)	58.0	109119.
(OCT4)	66.0	121451.
(OCT5)	78.0	0.
(OCT6)	77.0	0.
(OCT7)	77.0	186596.
(OCT8)	68.0	157105.
(OCT9)	71.0	163790.
(OCT10)	56.0	106564.
(OCT11)	66.0	112100.
(OCT12)	67.0	0.
(OCT13)	68.0	0.
(OCT14)	62.0	104939.
(OCT15)	55.0	102049.

Figure 4: The file that results from applying the Awk script (Fig. 3) to the DOE-2.1C output (Fig. 2)

Step Two The second step in the method is to transfer the file created by the Awk script from UNIX to the Macintosh. Although this can be accomplished in many ways, Macintosh's Versaterm 3.0 was used because it replicates a VT-100 terminal. Once connected to UNIX, use the Kermit file transfer protocol by typing "kermit" and issuing the command: "send Project". On the Macintosh, the transfer mode is set to "Text Kermit" in the File menu and "Receive File" is selected in the same File menu.

When file transfer is complete, new commands may be issued or the user may quit Kermit, logout of UNIX, and exit to the Macintosh finder. File transfer is straightforward and plotting data using Cricket Graph is even simpler.

Step Three Cricket Graph 1.1 is similar to Excel or 1-2-3 on the IBM; however, the worksheet portion of the program is less powerful than in the other two programs. It has fewer operations and it is column-oriented as opposed to cell-oriented. This means two cells cannot be added without adding the corresponding columns. It also means that an entire column must always be plotted against another. Despite these limitations, it has an intuitive user interface and excellent graphic capabilities. A format can be saved that contains axis labels, font type, graph type, etc., and used on different data files. Titles, labels, legends, arrows, and borders can be easily changed. The output on a laser printer is excellent and more than one resizable graph can be printed on a page. To plot the file that was transferred in **Step Two**, choose "Open" in the File menu, move to the folder where "Project" was saved and select the option "Show all TEXT" files; finally, click on "Open".

Choose "Scatter" in the Graph menu and select MaxDb (maximum drybulb temperature) as the horizontal (X) axis and MaxClg (maximum cooling coil power) as the vertical (Y) axis. Finally, click on "New Plot". Figure 5 shows the final plot with labels and title as printed on an Apple LaserWriter.

Conclusion

For simplicity, the example contains only three variables; however, a Cricket Graph worksheet can handle 64 variables of 2700 values. With a macro program such as Tempo-II or Auto Mac III, one keystroke on a Macintosh would be enough to run the Awk script, transfer the file, plot, and print the data. This would be a big help for parametric studies. The most difficult step in the method described above is to achieve proficiency with the Awk language in order to be able to change the script according to changes in the variables. However, once Awk is learned, the method takes less than half an hour to have plots printed -- and changes can be made in minutes. Although the method described herein uses a Macintosh, there is no reason why it could not be used on an IBM with similar software packages. Use of this method allowed us to save an incredible amount of time in terms of analysis of DOE-2 results. Studies with DOE-2 that would have been lengthy and *painful* a few years ago, can now be done quickly and easily.

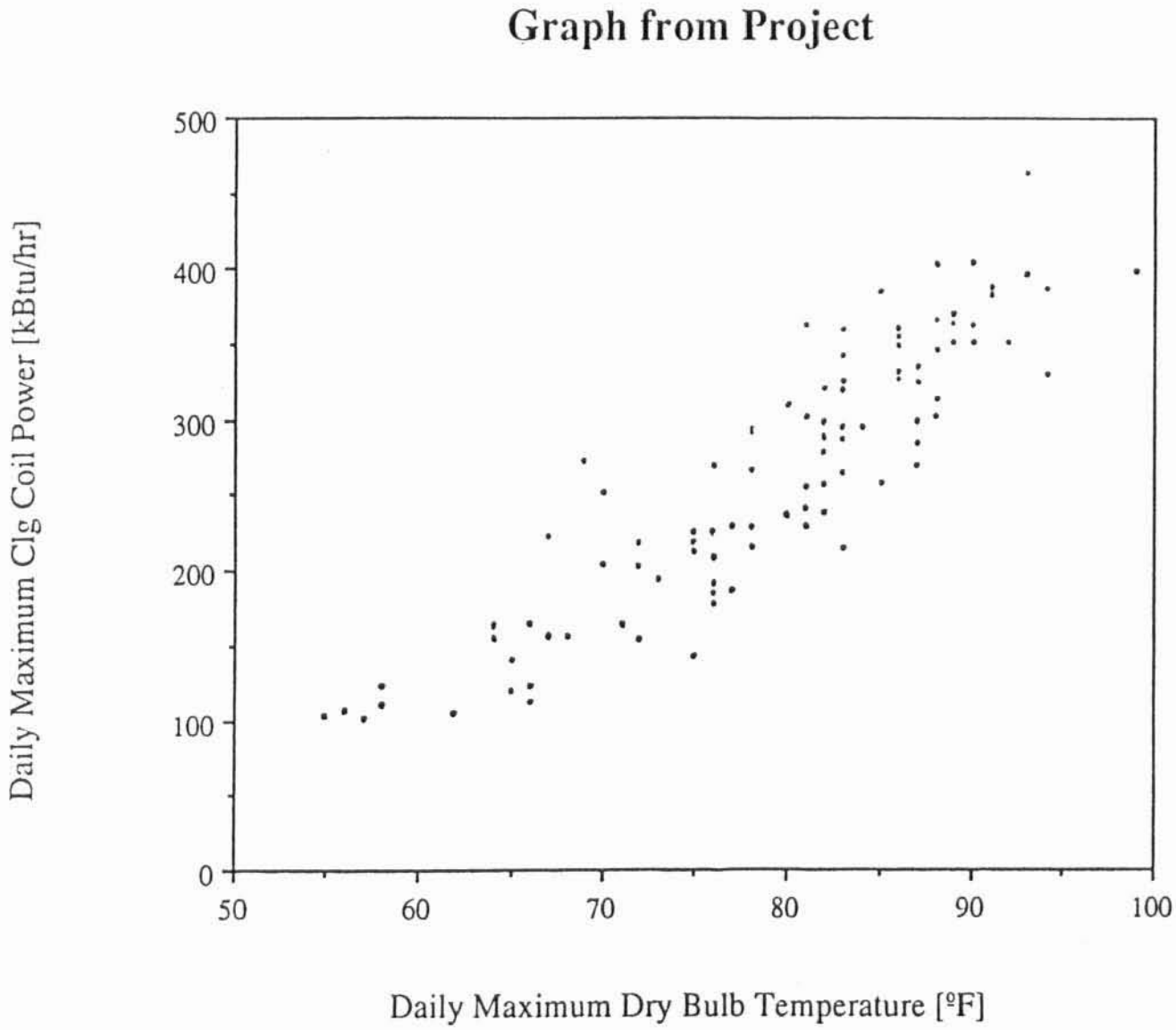

Figure 5: Cricket Graph Plot as printed on an Apple LaserWriter

• • • • DOE-2 TRAINING SESSIONS • • • •

The Washington State Energy Office is sponsoring training sessions for the DOE-2 program. Instructors from Energy Simulation Specialists in Tempe, AZ, will provide the following 2-day training sessions:

LOCATION	DATES
Renton, WA	October 16, 17
Olympia, WA	October 18, 19
Missoula, MT	October 23, 24
Boise, ID	October 26, 27
Tualatin, OR	October 30, 31
Eugene, OR	November 1, 2
Richland, WA	November 6, 7
Spokane, WA	November 8, 9

The registration fee is $35.00 and the number of participants is limited to 50 per location. The training is co-sponsored by Oregon Energy Extension, Idaho Department of Water Resources, and the Montana Department of Natural Resources; and is partially funded by Bonneville Power Administration.

For more information or to register, contact

Linda White
Washington State Energy Office
809 Legion Way S.E.
Olympia, WA 98504-1211
* * * * *
Phone: (206) 586-5066

■ ■ ■ ■ DOE-2 DIRECTORY ■ ■ ■ ■

Program Related Software and Services

■■VIDEO■■

DOE-2 Video and Manual
Karen George, Program Development
Joint Center for Energy Management
University of Colorado at Boulder
Campus Box 428
Boulder, CO 80309-0428

■■SOFTWARE■■

DOE-2.1C for Micros (MICRO-DOE2)
Gene Tsai, Suite #230
Acrosoft International
9745 East Hampden Avenue
Denver, CO 80231
Phone: (303) 368-9225

■■ UTILITY PROGRAMS ■■

Pre- and Post-Processor Software
James Trowbridge
Trowbridge Software Engineering
4884-D Sunset Terrace
Fair Oaks, CA 95628
Phone: (916) 962-3001

Graphs from DOE-2
Ernie Jessup
E. Jessup & Associates
4977 Canoga Avenue
Woodland Hills, CA 91364
Phone: (818) 884-3997

■■ CONSULTANTS ■■

Consulting Engineers
Craig Cattelino
Burns & McDonnell Engineers
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