The Opera model. A computer model for optimal energy retrofits in multi-family buildings
The Fortran code
Report LiTH-IKP-R-613

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Contents

Chapter 1

Preface

This document contains in its entirety the programming code used in the OPERA model, and closely related programs. Originally, it was assumed that the document was to be included in the tutorial to the model, published by the Swedish Counsil for Building Research, but due to high printing costs it was decided that the programming code was to be published by the institution itself.

The report is subsequently not aimed for reading, but instead it should be used as a detailed documentation of the OPERA model and as an appendix to the manual published by the Counsil. Please note that different versions of the code have been produced during the years but hpefully, the differencies from the original document is not too large.

Chapter 2

The Opera Fortran code

Unfortunately it has not been possible to find the precise code, Version 1.0, which was originally published in the printed report on paper. Instead, Version 1.03 can be found below. First the "main" code is presented and then the subroutines.

2.1 Appendix A. The main program

The following code has been found in the file ER8.FOR which was latest modified September 9, 1994.

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********THIS IS THE MAIN PROGRAMMING CODE, V 1.03, OF THE OPERA MODEL**
********DESIGNED BY STIG-INGE GUSTAFSSON, IKP/ENERGY SYSTEMS***********
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********UNAUTHORIZED USE IS PROHIBITED**********************************
        PROGRAM OPERA
        IMPLICIT REAL (A-Z)
        INTEGER ANN,ANO,ANS,ANV,X,Y,G,P,ROTMAT(10,20,10),AOP,
     +  ALGH,BOBBAN,KOLL,U,I,J,ORT,ROT,SPEC,SPEC1,SPEC2,P2,U1,ELSORT,
     +  BIROT,KOLL1,U2,U3,U4,U5,U6,J1,SPEC3,GRADTOP(12),U8,UTE3,PE3,
     +  HOPP,Y1,FONSN,FONSO,FONSS,FONSV,J2,U9,HOPP1,U10,PRI,UT7,UT8,
     +  UT10,LAN,CHECK,ST1,U11,DUR,HHOURS(12),LHOURS(12),FILKOLL,
     + READKOLL,WINBUFINF
        CHARACTER*30 VATYP,PANNA,OBJECT,VARIANT,NAME
        CHARACTER*85 TEXT
        COMMON SLANG1,LSLANG1,SLANG2,LSLANG2,UTE1,UTE2,NLP1,NLP2,PROC,
     +  LPROC,UTE3,TRANSENG,VENTEFG,TOTENE
        DIMENSION SUMBROT(5,10,10),NLA(4),IN(10),KO(10),WCOST(5:8),
     + AK(10),SUMP(5,10,10),SUMPA(10,10),A(8),TV2(12),TV12(12),
     +  BK(5),SVARET(10,10),MINSTA(10,10)
     +  ,PNUVEN(5,10,10),PNUVENA(10,10),INF(3:5),AKF(3:5)
     +  ,ANTF(5:8),MK(2:5),MINSTAF(5,10,10)
     +  ,ROTRES(10),RESGLAS(5),ROTGLAS(5,10,10),TOTNUVB(10)
     +  ,K(5:8,2:5),SPARMAT(15,10),KLIM(10,12),GRAD(12),ENEM(12),
     +  AFLANKO(10),AFLENE(10),ANFLKOST(10),AFLEFF(10),ENEFRAN(12),
     +  NEGMAT(15,10),NEGMATF(5,10,10),ENERES(12),GRATIS(12),SOL(4,12),
     +  ENEMROT(12),ENEROT(12),SOLROT(4,12),SHADE(3:5),ENERESB(12),
     +  RESUL(11),SOLTROT(4,12),FAST(3),EP(12),EPE(12),EPEF(12),SAK(12)
     +  ,RESPA(10),PANNK(10),SLANGAR(10),ENENUV(10),AVGIFT(10),ABONA(12)
     +  ,ISOLER(10),INEVIT(10),INSUL(10),NUFAKT(4),L(5),NL(7),ENEDEM(5)
**********OM U=1 FÅS UTSKRIFT PÅ SKÄRMEN.OM U=3 FÅS UTSKRIFT PÅ LI-PR.*******
**********OM U=0 FÅS INGEN UTSKRIFT ALLS************************************
**********DETSAMMA GÄLLER FÖR U1 OCH U2*************************************
**********U4=1 GER UTSKRIFT VID TÄTNING,U3=1 VID SUBRUTIN BIVAL**************
**********PRI=1 GER UTSKRIFT AV ENERGIBALANS FÖRSTA GÅNGEN, INNEBÄR ATT*****
**********U10 = U9 SE DÄR ENEBAL KALLAS ANDRA GÅNGEN************************
        DATA INSUL,RESUL(11)/11*0./
```

```
        DATA ST1,U11,CHECK,U,U1,U10,U2,UT7,UT8,UT10,U8/11*0/
        PRI=1
********HOPP=1 GER HOPP UR FÖRSTA BERÄKNINGSFALLET RAD C:A 216O*************
        DATA FONSN,FONSO,FONSS,FONSV,HOPP,HOPP1/6*0/
        VARIANT='BASE CASE'
WRITE(*,*)'OPERA FOR REPORT LiTH-IKP-R-613'
WRITE(*,*)'PROGRAMMED BY S.I. GUSTAFSSON'
WRITE(*,*)'VERSION NO. 1.03, 1994-09-09.'
WRITE(*,683)' TYPE THE NAME OF THE INPUT DATA FILE:'
READ(*,686)NAME
 685 CONTINUE
 15     FORMAT(' ',TR15,A)
 10     FORMAT(' ',TR15,2A)
 683    FORMAT(AÖ)
 686 FORMAT(A)
 687 FORMAT(2A)
WINBUFINF=32500
        OPEN(0,ERR=684,FILE='NUL',IOSTAT=FILKOLL)
c        OPEN(1,FILE='TERMINAL',PARITY='REMOVE')
        OPEN(1,ERR=684,FILE='USER',IOSTAT=FILKOLL,
     +  BLOCKSIZE=WINBUFINF)
        OPEN(2,ERR=684,FILE=NAME,
     + STATUS='OLD',IOSTAT=FILKOLL)
c         OPEN(3,FILE='LINE-PRINTER')
c         OPEN(4,FILE='BIV:DATA')
        OPEN(4,FILE='BIV.DAT',IOSTAT=FILKOLL)
C         OPEN(5,FILE='E2:TXT')
        OPEN(25,ERR=684,FILE='C:ÖOPERAÖE2.TXT',STATUS='OLD',
     +    IOSTAT=FILKOLL)
        DO 681 J=1,50
                READ(25,686,END=681,ERR=681,IOSTAT=READKOLL)TEXT
                WRITE(1,687)' ',TEXT
 681    CONTINUE
      IF(READKOLL.GT.0 .AND.READKOLL.NE.6405)THEN
WRITE(1,*)'READ OPEN ERROR. FINNS FILEN E2.TXT?'
STOP 'READ ERROR'
ENDIF
OPEN(7,FILE='C:ÖOPERAÖOPUT.TXT',ERR=684,IOSTAT=FILKOLL)
 684 CONTINUE
CLOSE(25)
IF(FILKOLL.GT.0)THEN
WRITE(1,*)'FILE OPEN ERROR'
WRITE(1,*)'WRITE THE CORRECT PATH AND BE SURE'
WRITE(1,*)'ALL FILES ARE PRESENT IN THE OPERA'
WRITE(1,*)'DIRECTORY'
CLOSE(1)
CLOSE(2)
CLOSE(3)
CLOSE(4)
CLOSE(5)
CLOSE(6)
STOP
ENDIF
        WRITE(1,*)'1'
        READ(2,*)LAN
        READ(2,*)AT,AG,AY,BA
        AI=AY
        READ(2,*)AN,ANN,AO,ANO,AS,ANS,AV,ANV
        READ(2,*)BKT,BKG,BKY
        READ(2,*)MK2
        KN=MK2
        KOS=MK2
        KS=MK2
        KV=MK2
        BK(5)=MK2
        WRITE(1,*)'2'
        READ(2,*)LT,LG,LY,LI,LF
        READ(2,*)OMS
READ(2,*)VATYP,EF,VGVAR,LVA
TV=0.
READ(2,*)(TV2(J),J=1,12,1)
DO 1126 J=1,12
     TV=TV+TV2(J)
 1126 CONTINUE
```

```
      READ(2,*)NLAT,NLAG,NLAY,NLAI
      READ(2,*)MK3
      KN3=MK3
      KO3=MK3
      KS3=MK3
      KV3=MK3
      READ(2,*)MK4
      KN4=MK4
      KO4=MK4
      KS4=MK4
      KV4=MK4
      READ(2,*)MK5
      KN5=MK5
      KO5=MK5
      KS5=MK5
      KV5=MK5
      READ(2,*)NLT,NLG,NLY,NLI,NLF
      IF(LAN.GE.1)THEN
             READ(2,*)OPTA,R,Q,SUBV
      ELSE
             READ(2,*)OPTA,R,Q
      ENDIF
      WRITE(1,*)'3'
      READ(2,*)INT,KOT,AKT
      READ(2,*)ING,KOG,AKG
      READ(2,*)INY,KOY,AKY
      READ(2,*)INI,KOI,AKI,HOJD,HYRA
      IF(LAN.EQ.1)READ(2,*)WLIM,LANUF
      READ(2,*)INTV,AKTV
      READ(2,*)INTR,AKTR
      READ(2,*)INFY,AKFY
      READ(2,*)INFE,AKFE
      WRITE(1,*)'4'
      READ(2,*)INPO,AKPO,VGVNO,NLPO,SLANGO,LSLANGO
      READ(2,*)INPE,AKPE,VGVNE,NLPE,SLANGE,LSLANGE
      READ(2,*)INPF,AKPF,VGVNF,NLPF,SLANGF,LSLANGF
      READ(2,*)INPV,AKPV,VGVNV,NLPV,SLANGV,LSLANGV
      READ(2,*)INPY,AKPY,VGVNY,NLPY,SLANGY,LSLANGY
      READ(2,*)INPU,AKPU,UTE1,UTE2,NLPU,SLANGU,LSLANGU,PROC,LPROC
      IF(LAN.EQ.1)READ(2,*)SUBO,SUBE,SUBVP
      WRITE(1,*)'5'
      READ(2,*)(KLIM(1,J),J=1,12,1)
      READ(2,*)(KLIM(2,J),J=1,12,1)
      READ(2,*)(KLIM(3,J),J=1,12,1)
      READ(2,*)AOP,KPO,OMDIFF,LITA
      READ(2,*)ALGH,TFIN,TIN,DUT1
      READ(2,*)ROR,LROR
      WRITE(1,*)'6'
      READ(2,*)INFL,AKFL,LFL,VGFLVP,TFUT
      IF(LAN.EQ.1)READ(2,*)SUBFR
      READ(2,*)OBJECT
      READ(2,*)ORT
      READ(2,*)U,U1,U2,U3,UT7,UT8,UT10,U11,ST1
      IF(U.EQ.3)OPEN(3,FILE='LPT2')
      U9=U
      READ(2,*)(GRATIS(J),J=1,12,1)
      READ(2,*)(SOL(1,J),J=1,12,1)
      READ(2,*)(SOL(2,J),J=1,12,1)
      READ(2,*)(SOL(3,J),J=1,12,1)
      READ(2,*)(SOL(4,J),J=1,12,1)
      READ(2,*)(SHADE(J),J=3,5,1)
      WRITE(1,*)'7'
      READ(2,*)EOL
      READ(2,*)EEL,HELP,LELP
      READ(2,*)EGAS,ANSGAS
      READ(2,*)EFJ,ANSL,(FAST(I),I=1,3,1),RV
      READ(2,*)(EP(J),J=1,12,1)
      READ(2,*)(ABONA(J),J=1,12)
      WRITE(1,*)'8'
      READ(2,*)(SAK(J),J=1,12)
      READ(2,*)(HHOURS(J),J=1,12)
      READ(2,*)(LHOURS(J),J=1,12)
      READ(2,*)FASTAVG,ABONAVG,EFFAVG
READ(2,*)(ENEDEM(J),J=1,5)
```

```
      EVPS=EEL
      CLOSE(2)
      WRITE(1,*)' '
      WRITE(1,*)'THE INPUT DATA FILE HAS BEEN READ WITHOUT PROBLEMS'
      IF(LAN.GE.1)WRITE(1,*)'SUBSIDY SYSTEM INCLUDED'
      IF(U.EQ.3)WRITE(*,*)'OPERA PRINTS THE OUTPUT ON THE PRINTER'
      IF(U11.EQ.0.AND.U.NE.3)U=0
 20   FORMAT(' ',A,G20.8)
      WRITE(U,59)
      WRITE(U,15)'************************************************'
      WRITE(U,10)'             OBJECT NAME: ',OBJECT
      WRITE(U,10)'================================================='
      WRITE(U,15)'    THE INPUT DATA BELOW SHOWS THE BASE CASE'
      WRITE(U,15)'************************************************'
*****   NU HAR ALLA INDATA LÄSTS IN**********************
*****   NU BÖRJAR RÄKNANDET*********************************
********R1 OCH R2 ÄR OLIKA RÄNTOR R1 FÖR BYGGKOST R2 FÖR ENERGIKOST
      WRITE(U,16)
 16   FORMAT('0')
      WRITE(U,25)'DATA ABOUT ECONOMY'
      WRITE(U,25)'=================='
 25   FORMAT(' ',TR5,A)
      WRITE(U,30)'REAL DISCOUNT RATE                ',R*100.,' %    '
      WRITE(U,30)'ANNUAL ENERGY PRICE ESCALATION    ',Q*100.,' %    '
      WRITE(U,30)'PROJECT LIFE                      ',OPTA,' YEARS  '
 30   FORMAT(' ',T15,A,F10.2,A)
 40   FORMAT(' ',T15,A,I10,A)
      R1=1+R
      R2=(1+Q)/(1+R)
      IF(ABS(R-Q).LT.0.01)THEN
              WRITE(*,*)'THIS VERSION OF THE PROGRAM CANNOT DEAL'
              WRITE(*,*)'WITH ALMOST EQUAL VALUES ON THE REAL'
              WRITE(*,*)'DISCOUNT RATE AND THE RATE OF ESCALATING'
              WRITE(*,*)'ENERGY PRICES. SET OTHER VALUES IN THE'
              WRITE(*,*)'INPUT DATA FILE. THE PROGRAM WILL NOW'
              WRITE(*,*)'TERMINATE'
              STOP
      ENDIF
*****   FÖRST SKALL NUVÄRDET FÖR DET BEF. HUSET BERÄKNAS***
      WRITE(U,16)
      WRITE(U,25)'DATA ABOUT BUILDING GEOMETRY'
      WRITE(U,25)'============================'
      A(1)=AT
      A(2)=AG
      A(3)=AY
      A(4)=AI
      A(5)=AN*ANN
      A(6)=AO*ANO
      A(7)=AS*ANS
      A(8)=AV*ANV
      ANTF(5)=ANN
      ANTF(6)=ANO
      ANTF(7)=ANS
      ANTF(8)=ANV
      WRITE(U,30)'AREA ATTIC FLOOR                  ',AT,' SQ.M   '
      WRITE(U,30)'     FLOOR                        ',AG,' SQ.M'
      WRITE(U,30)'     EXTERNAL WALL, WINDOWS EXCL. ',AY,' SQ.M'
      WRITE(U,30)'     APARTMENTS, TOTAL VALUE      ',BA,' SQ.M'
      WRITE(U,30)'     ONE WINDOW ORIEN. TO THE NORTH',AN,' SQ.M'
      WRITE(U,30)'                                EAST ',AO,' SQ.M'
      WRITE(U,30)'                                SOUTH',AS,' SQ.M'
      WRITE(U,30)'                                WEST ',AV,' SQ.M'
      WRITE(U,25)' '
      WRITE(U,40)'NUMBER OF WINDOWS TO THE      NORTH',ANN,' PCS '
      WRITE(U,40)'                                EAST ',ANO,' PCS'
      WRITE(U,40)'                                SOUTH',ANS,' PCS'
      WRITE(U,40)'                                WEST ',ANV,' PCS'
      WRITE(U,16)
      WRITE(U,25)'REMAINING LIFE OF THE BUILDING ENVELOPE'
      WRITE(U,25)'======================================='
      L(1)=LT
      L(2)=LG
      L(3)=LY
      L(4)=LI
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```
      L(5)=LF
      NL(1)=NLT
      NL(2)=NLG
      NL(3)=NLY
      NL(4)=NLI
      NL(5)=NLF
      WRITE(U,30)'ATTIC FLOOR                        ',LT,' YEARS'
      WRITE(U,30)'FLOOR                              ',LG,' YEARS'
      WRITE(U,30)'EXTERNAL WALL                      ',LY,' YEARS'
      WRITE(U,30)'INSIDE OF THE EXTERNAL WALL        ',LI,' YEARS'
      WRITE(U,30)'WINDOWS                            ',LF,' YEARS'
      WRITE(U,16)
      WRITE(U,25)'DURABILITY FOR NEW BUILDING ASSETS '
      WRITE(U,25)'==================================='
      WRITE(U,30)'ATTIC FLOOR                        ',NLT,' YEARS'
      WRITE(U,30)'FLOOR                              ',NLG,' YEARS'
      WRITE(U,30)'EXTERNAL WALL, FACADE              ',NLY,' YEARS'
      WRITE(U,30)'               INTERIOR            ',NLI,' YEARS'
      WRITE(U,30)'WINDOWS                            ',NLF,' YEARS'
      WRITE(U,16)
      WRITE(U,25)'COSTS FOR BUILDING ENVELOPE MEASURES'
      WRITE(U,25)'==================================== '
      WRITE(U,26)'                                 CONSTANT'
      WRITE(U,26)'                     C1          C2           C3'
      WRITE(U,26)'                     ----------------------------'
26    FORMAT(TR20,A)
      IN(1)=INT
      IN(2)=ING
      IN(3)=INY
      IN(4)=INI
      IN(5)=(INTV/AN)+AKTV
      IN(6)=(INTV/AO)+AKTV
      IN(7)=(INTV/AS)+AKTV
      IN(8)=(INTV/AV)+AKTV
      KO(1)=KOT*AT
      KO(2)=KOG*AG
      KO(3)=KOY*AY
      KO(4)=KOI*AI
      INF(3)=INTR
      INF(4)=INFY
      INF(5)=INFE
      AK(1)=AKT*AT
      AK(2)=AKG*AG
      AK(3)=AKY*AY
      AK(4)=AKI*AI
      AKF(3)=AKTR
      AKF(4)=AKFY
      AKF(5)=AKFE
      WRITE(U,50)'ATTIC FLOOR         ',INT,KOT,AKT
      WRITE(U,50)'FLOOR               ',ING,KOG,AKG
      WRITE(U,50)'EXTERNAL WALL       ',INY,KOY,AKY
      WRITE(U,50)'             , INS. ',INI,KOI,AKI
      WRITE(U,25)' '
50    FORMAT(' ',T15,A,F10.2,TR3,F10.2,TR3,F10.2)
60    FORMAT(' ',T15,A,F10.2,TR3,F10.2)
      WRITE(U,60)'WINDOWS, 2-GLAZED   ',INTV,AKTV
      WRITE(U,60)'         3-GLAZED   ',INTR,AKTR
      WRITE(U,60)'         3-GL + GAS.',INFY,AKFY
      WRITE(U,60)'         3-GL+GAS+LE',INFE,AKFE
      NLA(1)=NLAT
      NLA(2)=NLAG
      NLA(3)=NLAY
      NLA(4)=NLAI
      WRITE(U,16)
      WRITE(U,25)'THERMAL PARAMETERS'
      WRITE(U,25)'=================='
      WRITE(U,30)'EXISTING U-VALUE ATTIC FLOOR       ',BKT,' W/SQ.M,K'
      WRITE(U,30)'                 FLOOR             ',BKG,' W/SQ.M,K'
      WRITE(U,30)'                 EXTERNAL WALL     ',BKY,' W/SQ.M,K'
      WRITE(U,25)' '
      WRITE(U,30)'NEW U-VALUE WINDOWS, 2-GLAZED      ',MK2,' W/SQ.M,K'
      WRITE(U,30)'                     3-GLAZED      ',MK3,' W/SQ.M,K'
      WRITE(U,30)'                     3-GL.+GAS FILL',MK4,' W/SQ.M,K'
      WRITE(U,30)'                     3-GL+GAS+LOW E',MK5,' W/SQ.M,K'
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      WRITE(U,25)' '
      WRITE(U,30)'K-VALUE AT NEW ATTIC FLOOR         ',NLAT,' W/M,K'
      WRITE(U,30)'               FLOOR               ',NLAG,' W/M,K'
      WRITE(U,30)'               EXTERNAL WALL       ',NLAY,' W/M,K'
      WRITE(U,30)'                              ,INSIDE',NLAI,' W/M,K'
      MK(2)=MK2
      MK(3)=MK3
      MK(4)=MK4
      MK(5)=MK5
      BK(1)=BKT
      BK(2)=BKG
      BK(3)=BKY
      BK(4)=BKY
      K(5,2)=KN
      K(6,2)=KOS
      K(7,2)=KS
      K(8,2)=KV
      K(5,3)=KN3
      K(6,3)=KO3
      K(7,3)=KS3
      K(8,3)=KV3
      K(5,4)=KN4
      K(6,4)=KO4
      K(7,4)=KS4
      K(8,4)=KV4
      K(5,5)=KN5
      K(6,5)=KO5
      K(7,5)=KS5
      K(8,5)=KV5
      WRITE(U,16)
      WRITE(U,25)'MISCELLANEOUS'
      WRITE(U,25)'============='
      WRITE(U,30)'HEIGHT OF ONE APARTMENT            ',HOJD,' M'
      WRITE(U,30)'TENANTS RENT FOR THE APARTMENT     ',HYRA,' SEK/SQM,
     +YEAR'
      WRITE(U,30)'HOT WATER ENERGY DEMAND            ',TV,' KWH/YEAR'
      WRITE(U,6)'NUMBER OF APARTMENTS                  ',ALGH,'PCS'
      WRITE(U,30)'DESIRED INDOOR TEMPERATURE         ',TIN,' C'
      WRITE(U,30)'DIMENSIONING OUTDOOR TEMPERATURE   ',DUT1,' C'
      WRITE(U,16)
      WRITE(U,25)'EXISTING HEATING SYSTEM'
      WRITE(U,25)'======================='
      WRITE(U,31)'EXISTING BOILER TYPE                     ',VATYP
31    FORMAT(' ',T15,A,A)
51    FORMAT(' ',T5,2A)
      WRITE(U,3)'EFFICIENCY OR COP                  ',VGVAR
3     FORMAT(' ',T15,A,F10.2)
      WRITE(U,30)'INSTALLED THERMAL POWER            ',EF,' KW'
      WRITE(U,30)'REMAINING LIFE OF BOILER           ',LVA,' YEARS'
      WRITE(U,16)
      WRITE(U,25)'EXISTING SYSTEM FOR VENTILATION'
      WRITE(U,25)'==============================='
      WRITE(U,27)'TYPE                                  NATURAL'
      WRITE(U,30)'NUMBER OF AIR RENEWALS             ',OMS,' REN/HOUR'
      WRITE(U,16)
      WRITE(U,25)'INSTALLATION COSTS ETC, NEW HEATING EQUIPMENT'
      WRITE(U,25)'============================================='
      WRITE(U,25)' '
      WRITE(U,27)'                                CONSTANT'
      WRITE(U,27)'TYPE           C1        C2       C3        L1
     + L2        E'
      WRITE(U,27)'-----------------------------------------------------
     +-------------'
      WRITE(U,21)'OIL-BOILER  ',INPO,AKPO,SLANGO,NLPO,LSLANGO,VGVNO
21    FORMAT(' ',T15,A,6(F8.1,TR1))
27    FORMAT(' ',T15,A)
      WRITE(U,21)'EL.-BOILER  ',INPE,AKPE,SLANGE,NLPE,LSLANGE,VGVNE
      WRITE(U,21)'DISTR. HE.  ',INPF,AKPF,SLANGF,NLPF,LSLANGF,VGVNF
      WRITE(U,21)'HEAT P. 1   ',INPV,AKPV,SLANGV,NLPV,LSLANGV,VGVNV
      WRITE(U,21)'NAT. GAS    ',INPY,AKPY,SLANGY,NLPY,LSLANGY,VGVNY
      WRITE(U,2)'HEAT P. 2   ',INPU,AKPU,SLANGU,NLPU,LSLANGU
2     FORMAT(' ',T15,A,5(F8.1,TR1))
      WRITE(U,25)' '
      WRITE(U,3)'FIRST COP COEFFICIENT HEAT PUMP 2  ',UTE1
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      WRITE(U,3)'SECOND COP COEFFICIENT HEAT PUMP 2 ',UTE2
      WRITE(U,3)'REINVESTMENT RATE HEAT PUMP 2      ',PROC
      WRITE(U,30)'REINVESTMENT OCCURS EACH           ',LPROC,' YEARS'
      WRITE(U,16)
      WRITE(U,25)'WEATHERSTRIPPING'
      WRITE(U,25)'================'
      WRITE(U,6)'NUMBER OF ITEMS                       ',AOP,'PCS'
 6    FORMAT(' ',T15,A,I3,TR4,A)
      WRITE(U,30)'COST FOR EACH ITEM                 ',KPO,' SEK'
      WRITE(U,30)'REDUCTION OF VENT.  RENEWAL RATE   ',OMDIFF,' REN/H'
      WRITE(U,30)'REINVESTMENT EACH                  ',LITA,' YEARS'
      WRITE(U,16)
      WRITE(U,25)'EXHAUST AIR HEAT PUMP'
      WRITE(U,25)'====================='
      WRITE(U,30)'INLET AIR TEMPERATURE              ',TFIN,' C'
      WRITE(U,30)'OUTLET AIR TEMPERATURE             ',TFUT,' C'
      WRITE(U,30)'INSTALLATION COST C1               ',INFL,' SEK'
      WRITE(U,30)'                  C2               ',AKFL,' SEK/KW'
      WRITE(U,30)'REINVESTMENT EACH                  ',LFL,' YEARS'
      WRITE(U,3)'COEFFICIENT OF PERFORMANCE         ',VGFLVP
      WRITE(U,30)'PIPING INSTALLATION COST           ',ROR,' SEK/AP.'
      WRITE(U,16)
      WRITE(U,25)'FREE ENERGY GAINS FROM APPL., PERSONS AND THE SUN'
      WRITE(U,25)'================================================='
      WRITE(U,25)' '
      WRITE(U,27)'MONTH   APPL. AND                 SOLAR/SQ.M'
      WRITE(U,27)' NR     PERSONS     NORTH     EAST      SOUTH      W
     +EST'
      WRITE(U,27)'-------------------------------------------------
     +----'
      DO 1143 J=1,12
      WRITE(U,4)J,GRATIS(J),SOL(1,J),SOL(2,J),SOL(3,J),SOL(4,J)
 1143 CONTINUE
 4    FORMAT(' ',T16,I2,TR1,5(TR3,F7.1))
      WRITE(U,16)
      WRITE(U,25)'ENERGY RATES AND TARIFFS'
      WRITE(U,25)'========================'
      WRITE(U,30)'FIXED PRICE FOR OIL                ',EOL,' SEK/KWH'
      WRITE(U,30)'                ELECTRICITY        ',EEL,' SEK/KWH'
      WRITE(U,30)'                DISTRICT HEATING   ',EFJ,' SEK/KWH'
      WRITE(U,30)'                NATURAL GAS        ',EGAS,' SEK/KWH'
      WRITE(U,25)' '
      WRITE(U,30)'CONNECTION FEE, DISTRICT HEATING   ',ANSL,' SEK/KW'
      WRITE(U,30)'                NATURAL GAS        ',ANSGAS,' SEK/KW
     +'
      WRITE(U,25)' '
      WRITE(U,30)'FIXED FEE ELECTRICITY DEMAND RATE  ',FASTAVG,' SEK/Y
     +EAR'
      WRITE(U,30)'FIXED FEE 1 FOR DISTRICT HEATING   ',FAST(1),' SEK/Y
     +EAR'
      WRITE(U,30)'FIXED FEE 2 FOR DISTRICT HEATING   ',FAST(2),' SEK/Y
     +EAR'
      WRITE(U,30)'SUBSC FEE, ELECTRICITY DEMAND RATE ',ABONAVG,' SEK/K
     +W,YEAR'
      WRITE(U,25)' '
      WRITE(U,30)'POWER FEE FOR DISTRICT HEATING     ',FAST(3),' SEK/Y
     +EAR,KW'
      WRITE(U,30)'POWER FEE, ELECTRICITY DEMAND RATE ',EFFAVG,' SEK/YE
     +AR,KW'
      WRITE(U,3)'REDUCTION COEFFICIENT DISTRICT H.  ',RV
      WRITE(U,25)' '
      WRITE(U,27)'TIME-OF-USE RATES, TARIFF ELEMENTS'
      WRITE(U,25)' '
      WRITE(U,27)'LIMIT    SUBSCR.   MONTH   DISTR.  EL TIME ELEMENTS'
      WRITE(U,27)'AMPERE   FEE       NR      HEAT.     HIGH    LOW'
      WRITE(U,27)'-------------------------------------------------'
      DO 35 J=1,12
      WRITE(U,36)SAK(J),ABONA(J),J,EP(J),HHOURS(J),LHOURS(J)
 35   CONTINUE
********CHANGED FORMAT LINE NO 36 VERSION 1.01,910428**********
 36   FORMAT(' ',T15,F5.1,TR3,F7.1,TR5,I3,TR5,F4.3,TR6,I3,TR5,I3)
      WRITE(U,25)' '
      WRITE(U,27)'ENERGY PRICES:'
      WRITE(U,30)'FUSE RATE, HIGH PRICE              ',HELP,' SEK/KWH'
```

```
       WRITE(U,30)'           LOW PRICE              ',LELP,' SEK/KWH'
       WRITE(U,25)' '
       WRITE(U,30)'DEMAND RATE, ELEMENT NO 1         ',ENEDEM(1),' SEK
     +/KWH'
       WRITE(U,30)'                        2         ',ENEDEM(2),' SEK
     +/KWH'
       WRITE(U,30)'                        3         ',ENEDEM(3),' SEK
     +/KWH'
       WRITE(U,30)'                        4         ',ENEDEM(4),' SEK
     +/KWH'
       WRITE(U,30)'                        5         ',ENEDEM(5),' SEK
     +/KWH'
       WRITE(U,27)' '
       WRITE(U,25)'THIS IS THE END OF THE INPUT DATA FILE'
       WRITE(U,25)'**************************************************'
       WRITE(U,25)'**************************************************'
       OPTB=OPTA
       OPT=OPTA
       DUT=TIN-DUT1
       WRITE(U1,30)'STÖRSTA TEMP.DIFF MELLAN UTE OCH INNE  = ',DUT,' C'
       SPEC=0
********OM SPEC1=0 SÅ HAR MAN BEF FJÄRRVÄRME INNEBÄR ATT ANSLAVG = 0 KR***
       SUBP=0
       SPEC1=0
       SPEC2=0
       SPEC3=0
       P2=0
       SLANG=0.
       LSLANG=0.
       IF(U11.EQ.0.AND.U.NE.3)U=1
       CALL GRADTIM (KLIM,ORT,GRAD,GRADT,TIN)
       WRITE(U1,30)'THE NUMBER OF DEGREE HOURS EQUAL     ',GRADT,' C*H'
       CALL TARIFF(HELP,LELP,ENEDEM,HHOURS,LHOURS,EPE,EPEF)
       VGVA=VGVAR
       RESTP=0.
       WRITE(1,*)' '
       WRITE(1,*)'THE CALCULATIONS HAVE NOW STARTED'
       WRITE(1,*)'--------------------------------'
*              U=1
*              U1=1
*              U2=1
 59    FORMAT('1')
 5     CALL SKALROT (A,IN,NL,L,OPTB,R1,SUMBR)
*       IF(NUMMER.LT.35.AND.NUMMER.GT.25)THEN
*                U=1
*                U1=1
*                U2=1
*       ENDIF
       SLANG=0.
       LSLANG=0.
       WRITE(*,622)'THIS SESSION DEALS WITH ',VARIANT,NUMMER
 622   FORMAT(' ',A,A,F4.2)
       SUMBR1=SUMBR
*****  NU SKALL PANNANS OUNDVIKLIGA KOSTNADER BERÄKNAS*******
*       WRITE(*,*)'BEF VÄRMEANL ÄR',VATYP
 1212   IF (VATYP.EQ.'OIL-BOILER') THEN
         INP=INPO
         AKP=AKPO
         NLP=NLPO
         EPRIS=EOL
         EPRIS1=EOL
         NVGVA=VGVNO
         Y=1
         P2=1
         GOTO 690
       ELSEIF (VATYP.EQ.'ELFIX') THEN
         INP=INPE
         AKP=AKPE
         NLP=NLPE
         EPRIS=EEL
         EPRIS1=EEL
         NVGVA=VGVNE
         Y=3
         P2=3
```

```
          GOTO 690
        ELSEIF (VATYP.EQ.'DISFIX') THEN
          INP=INPF
          AKP=AKPF
          NLP=NLPF
          EPRIS=EFJ
          EPRIS1=EFJ
          NVGVA=VGVNF
**********DÅ DET ÄR BEF VÄRMESYSTEM SKA MAN EJ HA NÅGON ANS.AVG********
**********SPEC1=0 VILKET KOLLAS I SUBRUTIN TAXOR**********************
          SPEC1=0
          Y=4
          P2=4
*          WRITE(*,*)'NU ÄR JAG I BEF FJÄRRVÄRMEANL'
          GOTO 690
        ELSEIF (VATYP.EQ.'HPGROUND') THEN
          INP=INPV
          AKP=AKPV
          NLP=NLPV
          EPRIS=EVPS
          EPRIS1=EVPS
          NVGVA=VGVNV
          Y=5
          P2=5
          GOTO 690
        ELSEIF (VATYP.EQ.'NATGAS') THEN
          INP=INPY
          AKP=AKPY
          NLP=NLPY
          EPRIS=EGAS
          EPRIS1=EGAS
          NVGVA=VGVNY
          Y=6
          P2=6
          GOTO 690
        ELSEIF (VATYP.EQ.'DISDIFF')THEN
          INP=INPF
          AKP=AKPF
          NLP=NLPF
          EPRIS=EFJ
          EPRIS1=EFJ
          NVGVA=VGVNF
          SPEC1=0
          Y=7
          P2=7
          GOTO 690
        ELSEIF(VATYP.EQ.'ELDIFF')THEN
          INP=INPE
          AKP=AKPE
          NLP=NLPE
          EPRIS=EEL
          EPRIS1=EEL
          NVGVA=VGVNE
          Y=8
          P2=8
          GOTO 690
        ELSE
          WRITE(*,*)'THIS HEATING SYSTEM CAN NOT BE DEALT WITH!'
          WRITE(*,*)'CHECK THE SPELLING OF THE EXISTING HEATING'
          WRITE(*,*)'SYSTEM IN THE INPUT DATA FILE'
          WRITE(*,*)'OPERA WILL TERMINATE'
          STOP
        ENDIF
 690    IF(LVA.LT.0.1)LVA=0.001
        LIBP=LVA
        IF (SPEC.EQ.1)GOTO 1213
        EF1=EF
 695    CONTINUE
        IF(ROT.GE.10)THEN
                 IF(OPT.LT.1.)THEN
                      U2=1
                       U1=1
                       U=1
                       U3=1
```

```
                ENDIF
           SUMPAR=0.
           AAVG=0.
*********BIROT SÄTTS TILL 0 FÖR BIVALENT OCH INGEN ROTÅTGÄRD*********
           BIROT=0
********GÄRNA BIOPTIM MEN FÖRST EN ENERGIBALANS************************
           DO 19 J=1,12,1
             ENEM(J)=GRAD(J)*(TRANSEN+VENTEF)/1000.
 19        CONTINUE
           CALL ENEBAL(ENEM,GRATIS,SOL,A,TV2,ENERGIB,ENERGIB1,ENERESB,
     +     U3,GRADTOP)
*           TRANSENBI=((ENERGIB-TV)*2000./(CON1*CON3))-VENTEF
*           WRITE(U3,*)'TRANSENBI = ',TRANSENBI
                IF(LAN.EQ.1)THEN
                    EXTRA=SUBO
                    EXTRA1=SUBVP
                ENDIF
                IF(LAN.EQ.2)EXTRA=SUBV
           CALL BIOPTIM(CON1,CON2,EPRIS1,EPRIS2,INP1,AKP1,INP2,AKP2,
     +     NUSUMNA1,CON3,NUFAKT1,NUFAKT2,EFF,BIOPT,SUMPAR,NUVENBI,VGVN1,
     +     VGVN2,ENERGIB,ENERGIB1,TV,NLA(X),DUT,BYTE,BIROT,BEFK,AKT,
     +     SVARET,OPT,R1,EXTRA,EXTRA1,LAN)
           SUMPAR=SUMPAR+RESTP
           NUVENB=NUVENBI
           GOTO 696
         ENDIF
 700   CONTINUE
       SO=INP+(AKP*EF1)
       SUBP2=0.
       IF(LAN.EQ.2.AND.Y.GE.2)SUBP2=SO*SUBV
       IF(LAN.EQ.1.AND.Y.EQ.2)SUBP=SUBO
       IF(LAN.EQ.1.AND.Y.EQ.5)SUBP=SUBO
       IF(LAN.EQ.1.AND.Y.GT.2.AND.Y.NE.5)SUBP=SUBE
*       IF(LAN.EQ.1)U2=1
*       IF(LAN.EQ.1)U1=1
       IF(Y.GE.12)THEN
                U=1
                U1=1
                U2=1
        ELSE
                CONTINUE
        ENDIF
        S1=0.
        L1=LIBP
        L2=NLP
        CALL NUVARDE(SO,S1,L1,L2,OPT,R1)
        SUMPAR=S1+RESTP
        SO=SLANG*EF1
        SUBVSLA=0.
        IF(LAN.EQ.2.AND.Y.GE.2)SUBVSLA=SO*SUBV
        S1=0.
        L1=0.
        L2=LSLANG
        CALL NUVARDE(SO,S1,L1,L2,OPT,R1)
        SLANGR=S1
        SUMPAR = SUMPAR+SLANGR
        IF(LAN.EQ.1)SUMPAR=SUMPAR-SUBP
        IF(LAN.EQ.2)SUMPAR=SUMPAR-SUBP2-SUBVSLA
        WRITE(*,*)' '
        WRITE(*,*)'CONSIDERS HEATING SYSTEM NUMBER ',Y
        WRITE(*,*)'*******************************'
****    HÄR SKALL OUNDVIKLIG ROT PÅ VENT.ANL BERÄKNAS
****    DETTA DOCK EJ UTRETT ÄNNU.FORTSÄTTER DÄRFÖR
****    NU SKALL JAG RÄKNA UT KOSTNADEN FÖR ENERGIFÖRBRUKNINGEN
****    FÖRST DOCK NÖDVÄNDIG EFFEKT PÅ PANNAN
        TRANSEF=A(1)*BKT+A(2)*BKG+A(3)*BKY+(A(5)+A(6)+A(7)+A(8))*MK(2)
        WRITE(U2,*)'TRANSEF=',TRANSEF
        TRANSEN=A(1)*BKT+A(2)*BKG+A(3)*BKY+A(5)*KN+A(6)*KOS+A(7)*KS+
     +  A(8)*KV
        VENTEF=BA*OMS*.33*HOJD
        WRITE(U2,*)'VENTEF=',VENTEF
        TRANSENG=TRANSEN
        VENTEFG=VENTEF
        EFF=(TRANSEF+VENTEF)*DUT/1000
```

```
        NYEFF=EFF
        EXITRANS=TRANSEN+VENTEF
        TRAN1=TRANSEN
        VENT1=VENTEF
****    NÅGON EFFEKT FÖR TAPPVARMVATTENBER ANTAS INTE BEHÖVAS
        IF (EF1.GT.(EFF+.01*EFF)) THEN
           WRITE(1,27)'THE EXISTING BOILER IS TOO LARGE'
           WRITE(1,30)'OPERA WILL CHANGE THE SIZE TO ',EFF,' KW'
           EF1=EFF
           GOTO 700
******CHANGED FORMAT FROM 27 TO 30 1991 05 06*******
        ELSEIF (EF1.LT.(EFF-.01*EFF)) THEN
           WRITE(1,30)'THE EXISTING BOILER TOO SMALL. OPERA CHANGES THE
     +SIZE TO ',EFF,' KW'
           EF1=EFF
           GOTO 700
        ELSE
*          WRITE(*,*)'PANNAN LAGOM ÄNDRAR DOCK TILL BER EFFEKT'
           EF1=EFF
        ENDIF
******  HÄR SÄTTS ANL AVG.=AAVG=0 FÖR ATT DE ENKLARE FALLEN SKALL BLI RÄTT
        AAVG=0.
        AAVGR=0.
        AAVGRO=0.
        AAVGF=0.
        AAVGT=0.
        AAVGFL=0.
******  HÄR BERÄKNAS ENERGIÅTGÅNGEN I HUSET MED GRATISBIDR OCH SOL********
        IF(PRI.EQ.1)U10=U9
        DO 412 J=1,12,1
          ENEM(J)=GRAD(J)*((TRANSEF+VENTEF)/1000)
 412    CONTINUE
*        IF(Y.EQ.8)U10=1
        CALL ENEBAL(ENEM,GRATIS,SOL,A,TV2,ENERGI,ENERGI1,ENERES,U3,
     +  GRADTOP)
        IF(Y.EQ.1)DUR=1
        CALL TABELL2(GRAD,ENEM,GRATIS,SOL,A,TV2,ENERGI,ENERGI1,ENERES,
     +  U10,TRANSEF,VENTEF,DUR)
        DUR=0
        U10=0
        PRI=0
        GRADTPAN=(ENERGI-TV)*1000./(TRANSEF+VENTEF)
        GRADTOPT=ENERGI1*1000./(TRANSEF+VENTEF)
********HÄR SÄTTS FLAGGAN ROT = 0 DÅ DET EJ ÄR NÅGON ROTÅTGÄRD*****
        ROT=0
        CALL TAXOR(Y,EFF,ENERES,AAVG,EPRIS,ROT,SPEC1,EOL,EEL,EGAS,
     +  ANSGAS,EFJ,ANSL,FAST,RV,EP,ABONA,EPE,FASTAVG,ABONAVG,EFFAVG,
     +  EPEF,UT7,UT8,UT10)
        IF(Y.EQ.7)THEN
          WRITE(1,30)'NORMALIZED DIST HEATING PRICE = ',EPRIS,' SEK/KWH'
        ENDIF
        IF(Y.EQ.8)THEN
           WRITE(1,30)'NORMALIZED ELECTRICITY PRICE = ',EPRIS,' SEK/KWH'
        ENDIF
        NYENE=ENERGI
        KOSTBEN=EPRIS*ENERGI/VGVA
        KOSTNEN=EPRIS*ENERGI/NVGVA
        NUSUMB=(1-(R2**LIBP))*R2/(1-R2)
        IF(LIBP.LT.0.5)NUSUMB=0.
        NKOSTBEN=NUSUMB*KOSTBEN
        NUSUMNA=(1-(R2**(OPT-LIBP)))*R2/(1-R2)
        IF(LIBP.LT..5)NUSUMNA=(1-(R2**(OPT)))*R2/(1-R2)
        IF(Q.GT.0.)WRITE(U2,*)'NUSUMB,NUSUMNA= ',NUSUMB,NUSUMNA
        NKOSTNENA=KOSTNEN*NUSUMNA
        NKOSTNEN=NKOSTNENA*R2**LIBP
        NUVENB=NKOSTBEN+NKOSTNEN
        IF(LIBP.LT..5)NUVENB=KOSTNEN*NUSUMNA
        IF(LAN.EQ.1.AND.Y.EQ.5)THEN
                 ENEHP=NYENE-NYENE/VGVA
                 SUBHP=SUBVP*ENEHP
                 WRITE(U2,*)'SUBV PGA EBESP VP = ',SUBHP
                 SUMPAR=SUMPAR-SUBHP
        ENDIF
****    HÄR SKALL NUVÄRDENA SUMMERAS*****************************
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********HIT HOPPAR DET FRÅN LABEL 695 VID BIVALENT SYSTEM.SE OVAN*****
 696    CONTINUE
        WRITE(U1,*)'SUMBR1,SUMPAR,NUVENBAAVG=',SUMBR1,SUMPAR,NUVENB,AAVG
        TOTNUVB(Y)=SUMBR1+SUMPAR+NUVENB+AAVG
        WRITE(U1,*)'DET TOTALA NUVÄRDET BLEV',TOTNUVB(Y)
*        IF(Y.EQ.7)U2=0
        SPARMAT(1,Y)=TOTNUVB(Y)/1.E6
        ROTRES(Y)=TOTNUVB(Y)
*        WRITE(*,*)'KVOT FÖR PANNAN= ',ROTRES(Y)/TOTNUVB(Y)
****    HÄR KOMMER ROTÅTGÄRDERNA*************************
*********FÖRST MÅSTE JAG FIXA TILL RÄTT VÄRDE PÅ INVÄNDIG ISOLERING*******
        NUSUM1=(1-R1**(-OPT))/(R1-1)
        AK(4)=(AKI+NUSUM1*HYRA/HOJD)*AI
        WRITE(U2,*)'AK(4),NUSUM1= ',AK(4),NUSUM1
****    X AVSER OLIKA BYGGROTÅTGÄRDER.Y OLIKA VÄRMEANLÄGGNINGAR*****
****    I HÅLLER REDA PÅ INDEX I SPARMATRISEN.G PÅ ANTALET FÖNSTERRUTOR
        I=2
        G=3
*        IF(LAN.EQ.1)U2=1
*        IF(LAN.EQ.1)U1=1
 607    DO 300 X=1,8,1
                IF(LAN.EQ.1.AND.Y.GT.12)U2=1
                IF(G.GE.4.AND.X.LT.5)GOTO300
*                WRITE(U2,*)'NU RÄKNAS PÅ VANLIGT SÄTT'
*          IF(ROTMAT(3,4,5).EQ.1)STOP'NU SKEDDE DET'
          BYTE=A(X)
          A(X)=0.
          INVARDE=IN(X)
C     Calculates salvage value for building measure 1994 05 10, see 20 lines below
C          RESTVAR=BYTE*INVARDE
C          RESTVAR=L(X)*RESTVAR/NL(X)
*        IF(Y.EQ.9)THEN
*          U=1
*          U1=1
*          U2=1
*          U3=1
*        ENDIF
*        DO 292 J=1,10,1
*         WRITE(U2,*)A(J),IN(J),NL(J),L(J),OPTB,R1,SUMBR,SUMBR1
* 292    CONTINUE
          CALL SKALROT(A,IN,NL,L,OPTB,R1,SUMBR)
          SO=INVARDE*BYTE
          L1=0.
          L2=NL(X)
          S1=0.
          IF (X.GE.5) THEN
            IF(ANTF(X).LT.1.)THEN
              ROTMAT(G,X,Y)=0
*              WRITE(*,*)'HÄR FANNS DET INGA FÖNSTER'
              GOTO 540
            ENDIF
            SO=ANTF(X)*(INF(G)+AKF(G)*BYTE/ANTF(X))
            L2=NL(5)
                 IF(LAN.EQ.1)S2=LANUF
                 IF(LAN.EQ.2)S2=SO
          ENDIF
          CALL NUVARDE(SO,S1,L1,L2,OPT,R1)
        IF(LAN.GE.1.AND.X.LE.4) THEN
                 S1=S1-INVARDE*BYTE*SUBV
        ENDIF
        IF(LAN.EQ.1.AND.X.GT.4.AND.WLIM.GT.MK(G))THEN
                     S1=S1-S2*SUBV
                     WRITE(U2,*)'U-VALUE DURING DARKNESS = ',MK(G)
        ELSEIF(LAN.EQ.2.AND.X.GT.4)THEN
                 S1=S1-S2*SUBV
        ENDIF
C     Restvar added because of salvage value for building measures 1994 05 10, see 20 lines above
c         SUMBROT(G,X,Y)=SUMBR+S1+RESTVAR
          SUMBROT(G,X,Y)=SUMBR+S1
          IF(X.GE.5) GOTO 519
********NU SKALL DEN EGENTLIGA BYGGROTEN FIXAS TILL***************
****    NU SKALL PANNORNAS ANSKAFFNINGSKOSTNADER BERÄKNAS**********
****    FÖRST OM BYGGROTDELEN SAKNAS*****************************
        TRANSA=A(1)*BKT+A(2)*BKG+A(3)*BKY+(A(5)+A(6)+A(7)+A(8))*MK(2)
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        TRANSENA=A(1)*BKT+A(2)*BKG+A(3)*BKY+A(5)*KN+A(6)*KOS+A(7)*KS+
     +  A(8)*KV
        IF(X.EQ.4)THEN
        TRANSA=A(1)*BKT+A(2)*BKG+A(4)*BKY+(A(5)+A(6)+A(7)+A(8))*MK(2)
        TRANSENA=A(1)*BKT+A(2)*BKG+A(4)*BKY+A(5)*KN+A(6)*KOS+A(7)*KS+
     +  A(8)*KV
        ENDIF
        PEFF=EFF-(TRANSEF-TRANSA)*DUT/1000
        WRITE(U2,*)'TRANSA,TRANSENA,PEFF = ',TRANSA,TRANSENA,PEFF
        IF(ROT.GE.10)THEN
          SUMPAR=0.
          AAVG=0.
          WRITE(U2,*)'PEFF,TRANSENA,VENTEF= ',PEFF ,TRANSENA,VENTEF,BYTE
*********BIROT=1 FÖR HÄR SKALL MAN RÄKNA PÅ BIVALENT OCH ROTÅTGÄRD**********
          BEFK=(TRANSEF-TRANSA)/BYTE
          WRITE(U3,*)'BEFINTLIGT K-VÄRDE =',BEFK
          BIROT=1
          IF(X.GE.5)GOTO 519
********FÖRST EN ENERGIBALANS SEDAN BIOPTIM***************************
          DO 22 J=1,12,1
             ENEM(J)=GRAD(J)*(TRANSENA+VENTEF)/1000.
 22       CONTINUE
          CALL ENEBAL(ENEM,GRATIS,SOL,A,TV2,ENERGI,ENERGI1,
     +    ENERES,U3,GRADTOP)
          TRANSENG=TRANSENA
          CALL BIOPTIM(CON1,CON2,EPRIS1,EPRIS2,INP1,AKP1,INP2,AKP2,
     +    NUSUMNA1,CON3,NUFAKT1,NUFAKT2,PEFF,BIOPTP,SUMPAR,NUVENBI,VGVN1
     +    ,VGVN2,ENERGI,ENERGI1,TV,NLA(X),DUT,BYTE,BIROT,BEFK,AK(X),
     +    SVARET(X,Y),OPT,R1,EXTRA,EXTRA1,LAN)
***********OM OPTIMERING GAV ATT VP FÖR VÄRMEN = 0 TAS OLJEFALLET *****
***********FRAM HÄR*************************************************
          IF(SVARET(X,Y).GT.999..AND.SVARET(X,Y).LT.1001.)THEN
                SVARET(X,Y)=SVARET(X,2)
*                U3=1
          ENDIF
          WRITE(U3,*)'SVARET I HUVUDPROGRAM = ',SVARET(X,Y)
          TRANSENBB=TRANSENA+((NLA(X)*BEFK)/(NLA(X)+BEFK*SVARET(X,Y)))*
     +    BYTE
          TRANSENG=TRANSENBB
          WRITE(U3,*)'TRANSENBB = ',TRANSENBB
          DO 23 J=1,12,1
            ENEMROT(J)=GRAD(J)*(TRANSENBB+VENTEF)/1000.
 23       CONTINUE
          CALL ENEBAL(ENEMROT,GRATIS,SOL,A,TV2,ENERGIROT,ENERGIROT1,
     +    ENEROT,U3,GRADTOP)
          BIROT=0
          EFFC=(TRANSENBB+VENTEF)*DUT/1000.
          CALL BIOPTIM(CON1,CON2,EPRIS1,EPRIS2,INP1,AKP1,INP2,AKP2,
     +    NUSUMNA1,CON3,NUFAKT1,NUFAKT2,EFFC,BIOPT2,SUMPAR,NUVENBI,
     +    VGVN1,VGVN2,ENERGIROT,ENERGIROT1,TV,NLA(X),DUT,BYTE,BIROT,
     +    BEFK,AK(X),SVARET(X,Y),OPT,R1,EXTRA,EXTRA1,LAN)
          SUMP(G,X,Y)=SUMPAR+RESTP
          PNUVEN(G,X,Y)=NUVENBI
          WRITE(U3,*)',BIOPTP ÄR NU = ',BIOPTP
          WRITE(U2,*)'PANNORNA KOSTAR NU= ',SUMP(G,X,Y)
          WRITE(U2,*)'NUVÄRDET FÖR ENERGIN= ',PNUVEN(G,X,Y)
          WRITE(U2,*)SUMBROT(G,X,Y),KO(X),AK(X)
          MINSTA(X,Y)=SUMP(G,X,Y)+SUMBROT(G,X,Y)+KO(X)+PNUVEN(G,X,Y)+
     +    AK(X)*SVARET(X,Y)
          WRITE(U2,*)'MINSTA(X,Y) BLEV = ',MINSTA(X,Y)
          GOTO 1690
        ENDIF
        SO=INP+AKP*PEFF
        S1=0
        SUBVP3=0.
        IF(LAN.EQ.2.AND.Y.GE.2)SUBVP3=SO*SUBV
        L1=LIBP
        L2=NLP
        CALL NUVARDE (SO,S1,L1,L2,OPT,R1)
        IF(LAN.EQ.1)S1=S1-SUBP
        WRITE(U2,*)'SUBP = ',SUBP
        SUMP(G,X,Y)=S1+RESTP
        SO=SLANG*PEFF
        SUBSL=0.
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        IF(LAN.EQ.2.AND.Y.GE.2)SUBSL=SO*SUBV
        S1=0.
        L1=0.
        L2=LSLANG
        CALL NUVARDE (SO,S1,L1,L2,OPT,R1)
        SLANGB=S1
        WRITE(U1,*)'SLANGAR EXKL ROTDEL KOSTAR = ',SLANGB
        WRITE(U1,*)'SLANG,LSLANG',SLANG,LSLANG
        SUMP(G,X,Y)=SUMP(G,X,Y)+SLANGB
        IF(LAN.EQ.2)SUMP(G,X,Y)=SUMP(G,X,Y)-SUBVP3-SUBSL
        WRITE (U2,*)'DETTA ÄR SUMP',SUMP(G,X,Y)
******  NU KOMMER ENDAST ROTDELEN********************
****    NYA LAMBDAVÄRDEN TILL LÄMPLIGA REGISTER
        PEFFA=(TRANSEF-TRANSA)*DUT*NLA(X)*AKP/1000
        PEFF1=(TRANSEF-TRANSA)*DUT*NLA(X)/1000
        WRITE(U1,*)'PEFFA,AKP,TRANSEF,TRANSA,NLA(X)= ',PEFFA,AKP,TRANSEF
     +  ,TRANSA,NLA(X)
        SO=PEFFA
        S1=0.
        L1=LIBP
        L2=NLP
        CALL NUVARDE (SO,S1,L1,L2,OPT,R1)
        SUMPA(X,Y)=S1
        WRITE(U2,*)'DETTA ÄR PANNKOST FÖR ROTDELEN',SUMPA(X,Y)
        SO=SLANG*PEFF1
        S1=0.
        L1=0.
        L2=LSLANG
        CALL NUVARDE(SO,S1,L1,L2,OPT,R1)
        SLANGBA=S1
        WRITE(U1,*)'SLANGAR BARA FÖR ROTDEL KOSTAR = ',SLANGBA
        SUMPA(X,Y)=SUMPA(X,Y)+SLANGBA
        GOTO 520
******** HÄR KOMMER SPECIAL FÖR FÖNSTER*************************
******** BERÄKNAR KOSTNAD FÖR PANNORNA OM FÖNSTERROT*************
 519    PEFF=EFF-BYTE*DUT*(MK(2)-MK(G))/1000.
        IF (ROT.GE.10)THEN
          SUMPAR=0.
          AAVGF=0.
          BIROT=0
          TRANSENF=TRANSEN-BYTE*(K(X,2)-K(X,G))
          TRANSENG=TRANSENF
**********FÖRST EN ENERGIBALANS*****************************************
          DO 24 J=1,12,1
           ENEMROT(J)=GRAD(J)*(TRANSENF+VENTEF)/1000.
 24       CONTINUE
        A(X)=BYTE
        SHADE1=SHADE(G)
          IF(X.EQ.5)THEN
              DO 145 J1=1,12,1
                SOLROT(1,J1)=SOL(1,J1)-SHADE1*SOL(1,J1)
                SOLROT(2,J1)=SOL(2,J1)
                SOLROT(3,J1)=SOL(3,J1)
                SOLROT(4,J1)=SOL(4,J1)
 145          CONTINUE
            ELSEIF(X.EQ.6)THEN
              DO 146 J1=1,12,1
                SOLROT(1,J1)=SOL(1,J1)
                SOLROT(2,J1)=SOL(2,J1)-SHADE1*SOL(2,J1)
                SOLROT(3,J1)=SOL(3,J1)
                SOLROT(4,J1)=SOL(4,J1)
 146          CONTINUE
            ELSEIF(X.EQ.7)THEN
              DO 147 J1=1,12,1
                SOLROT(1,J1)=SOL(1,J1)
                SOLROT(2,J1)=SOL(2,J1)
                SOLROT(3,J1)=SOL(3,J1)-SHADE1*SOL(3,J1)
                SOLROT(4,J1)=SOL(4,J1)
 147          CONTINUE
            ELSEIF(X.EQ.8)THEN
              DO 148 J1=1,12,1
                SOLROT(1,J1)=SOL(1,J1)
                SOLROT(2,J1)=SOL(2,J1)
                SOLROT(3,J1)=SOL(3,J1)
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                SOLROT(4,J1)=SOL(4,J1)-SHADE1*SOL(4,J1)
 148          CONTINUE
          ENDIF
          CALL ENEBAL(ENEMROT,GRATIS,SOLROT,A,TV2,ENERGIROT,ENERGIROT1,
     +    ENEROT,U3,GRADTOP)
          CALL BIOPTIM(CON1,CON2,EPRIS1,EPRIS2,INP1,AKP1,INP2,AKP2,
     +    NUSUMNA1,CON3,NUFAKT1,NUFAKT2,PEFF,BIOPT2,SUMPAR,NUVENBI,
     +    VGVN1,VGVN2,ENERGIROT,ENERGIROT1,TV,NLA(X),DUT,BYTE,BIROT,
     +    BEFK,AK(X),SVARETA,OPT,R1,EXTRA,EXTRA1,LAN)
          SUMP(G,X,Y)=SUMPAR+RESTP
          WRITE(U3,*)'PANNOR BIVÅL. VID FÖNSTERROT KOSTAR',SUMP(G,X,Y)
          WRITE(U3,*)'PEFF,TRANSENF,BIOPT2 = ',PEFF,TRANSENF,BIOPT2
          PNUVEN(G,X,Y)=NUVENBI
          GOTO 539
        ENDIF
*        U=1
*        U1=1
*        U2=1
        SO=INP+AKP*PEFF
        SUBVF=0.
        IF(LAN.EQ.2.AND.Y.GE.2)SUBVF=SO*SUBV
        S1=0.
        L1=LIBP
        L2=NLP
        CALL NUVARDE (SO,S1,L1,L2,OPT,R1)
        SUMP(G,X,Y)=S1+RESTP
        SO=SLANG*PEFF
        SUBVFS=0.
        IF(LAN.EQ.2.AND.Y.GE.2)SUBVFS=SO*SUBV
        S1=0.
        L1=0.
        L2=LSLANG
        CALL NUVARDE(SO,S1,L1,L2,OPT,R1)
        SLANGB=S1
        WRITE(U1,*)'SLANGROT MED NYTT FÖNSTER KOSTAR = ',SLANGB
        SUMP(G,X,Y)=SUMP(G,X,Y)+SLANGB
        IF(LAN.EQ.1)SUMP(G,X,Y)=SUMP(G,X,Y)-SUBP
        IF(LAN.EQ.2)SUMP(G,X,Y)=SUMP(G,X,Y)-SUBVF-SUBVFS
        WRITE(U2,*)'PANNANS NUVÄRDE VID FÖNSTERROT BLEV',SUMP(G,X,Y)
********NU KOMMER ENERGITERMERNA**********************************
********FÖRST TAR VI BORT ROTDELEN*********************************
        IF (X.GE.5)GOTO 529
 520    TRANSENA=A(1)*BKT+A(2)*BKG+A(3)*BKY+A(5)*KN+A(6)*KOS+A(7)*KS+
     +  A(8)*KV
        IF(X.EQ.4)THEN
        TRANSENA=A(1)*BKT+A(2)*BKG+A(4)*BKY+A(5)*KN+A(6)*KOS+A(7)*KS+
     +  A(8)*KV
        ENDIF
*********HÄR MÅSTE UTREDAS OM DET BLIR LÅGSP.TAXA ELLER EFFEKTTAXA******
*********NÄR MAN GJORT ROTÅTGÄRDEN. KOLLAS I TAXOR**********************
        DO 2001 J=1,12,1
                ENEM(J)=GRAD(J)*(TRANSENA+VENTEF)/1000.
                WRITE(U2,*)'GRAD(J),ENEM(J) = ',GRAD(J),ENEM(J)
 2001   CONTINUE
        CALL ENEBAL(ENEM,GRATIS,SOL,A,TV2,EBLUFF1,EBLUFF2,ENERES,U3,
     +  GRADTOP)
        CALL TAXOR(Y,PEFF,ENERES,AAVG,EPRIS,ROT,SPEC1,EOL,EEL,EGAS,
     +  ANSGAS,EFJ,ANSL,FAST,RV,EP,ABONA,EPE,FASTAVG,ABONAVG,EFFAVG,
     +  EPEF,UT7,UT8,UT10)
        WRITE(U2,*)'TRANSM.FAKT EXKL ROTDEL = ',TRANSENA
        PEA=(TRANSEN-TRANSENA)*GRADTOPT/1000
        PEA1=PEA*NLA(X)/GRADTOPT
        WRITE(U2,*)'PEA RESP PEA1 = ',PEA,PEA1
        ROT=1
        IF (Y.NE.7.AND.Y.NE.8)GOTO 514
        DO 414 J=1,12,1
          ENEMROT(J)=GRAD(J)*PEA1*GRADTOP(J)
          WRITE(U2,*)'ENEMROT(J)',GRAD(J),GRADTOP(J),ENEMROT(J),J
 414    CONTINUE
        WRITE(U2,*)'DETTA ÄR EFFEKTEN PÅ ROTDELEN',PEFF1
        WRITE(U2,*)'DETTA ÄR ROTTERMEN PEA1 = ',PEA1
 514    CALL TAXOR(Y,PEFF1,ENEMROT,AAVGRO,EPRIS,ROT,SPEC1,EOL,EEL,EGAS,
     +  ANSGAS,EFJ,ANSL,FAST,RV,EP,ABONA,EPE,FASTAVG,ABONAVG,EFFAVG,
     +  EPEF,UT7,UT8,UT10)
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       ROT=0
       IF (Y.EQ.7) WRITE(U2,*)'EPRIS,AAVGRO= ',EPRIS,AAVGRO
       WRITE(U2,*)'ANSLUTNINGSAVGIFT FÖR ROTDEL= ',AAVGRO
       WRITE(U2,*)'ENERGIPRIS FÖR ROTDEL BLEV = ',EPRIS
       PKBENA=NUSUMB*PEA*EPRIS*NLA(X)/VGVA
       PKNENA=NUSUMNA*R2**LIBP*PEA*EPRIS*NLA(X)/NVGVA
       PNUVENA(X,Y)=PKBENA+PKNENA
       WRITE(U2,*)'NUVÄRDE ENERGI ROTTERM',PNUVENA(X,Y)
       GOTO 530
********HÄR KOMMER SPECIAL FÖR ENERGIKOSTN GENOM ROTFÖNSTREN*********
 529   WRITE(U2,*)'FÖRE FÖNSTERROT ÄR TRANSENF= ',TRANSENF
       WRITE(U2,*)'                      BYTE    = ',BYTE
       TRANSENF=TRANSEN-BYTE*(K(X,2)-K(X,G))
       WRITE(U2,*)'%%%%%%%%%%%%%%%%%FÖNSTER%%%%%%%%%%%%%%%%%%%%%%'
       WRITE(U2,*)'TRANSEN,TRANSENF,K(X,2),K(X,G)= ',TRANSEN,TRANSENF,
     +  K(X,2),K(X,G)
       DO 415 J=1,12,1
         ENEMROT(J)=GRAD(J)*(TRANSENF+VENTEF)/1000.
 415   CONTINUE
       A(X)=BYTE
       SHADE1=SHADE(G)
         IF(X.EQ.5)THEN
             DO 245 J1=1,12,1
               SOLROT(1,J1)=SOL(1,J1)-SHADE1*SOL(1,J1)
               SOLROT(2,J1)=SOL(2,J1)
               SOLROT(3,J1)=SOL(3,J1)
               SOLROT(4,J1)=SOL(4,J1)
 245         CONTINUE
           ELSEIF(X.EQ.6)THEN
             DO 246 J1=1,12,1
               SOLROT(1,J1)=SOL(1,J1)
               SOLROT(2,J1)=SOL(2,J1)-SHADE1*SOL(2,J1)
               SOLROT(3,J1)=SOL(3,J1)
               SOLROT(4,J1)=SOL(4,J1)
 246         CONTINUE
           ELSEIF(X.EQ.7)THEN
             DO 247 J1=1,12,1
               SOLROT(1,J1)=SOL(1,J1)
               SOLROT(2,J1)=SOL(2,J1)
               SOLROT(3,J1)=SOL(3,J1)-SHADE1*SOL(3,J1)
               SOLROT(4,J1)=SOL(4,J1)
 247         CONTINUE
           ELSEIF(X.EQ.8)THEN
             DO 248 J1=1,12,1
               SOLROT(1,J1)=SOL(1,J1)
               SOLROT(2,J1)=SOL(2,J1)
               SOLROT(3,J1)=SOL(3,J1)
               SOLROT(4,J1)=SOL(4,J1)-SHADE1*SOL(4,J1)
 248         CONTINUE
         ENDIF
*        IF(L(1).LT.10.)STOP
       CALL ENEBAL(ENEMROT,GRATIS,SOLROT,A,TV2,ENERGIROT,ENERGIROT1,
     +  ENEROT,U3,GRADTOP)
*         IF(G.EQ.3.AND.Y.EQ.3)U3=1
*                 IF(Y.EQ.3)CALL TABELL2(GRAD,ENEMROT,GRATIS,SOLROT,A,TV2,
*     +           ENERGIROT,ENERGIROT1,ENEROT,U3,TRANSENF,VENTEF,DUR)
 515      ROT=0
       CALL TAXOR(Y,PEFF,ENEROT,AAVGF,EPRIS,ROT,SPEC1,EOL,EEL,EGAS,
     +  ANSGAS,EFJ,ANSL,FAST,RV,EP,ABONA,EPE,FASTAVG,ABONAVG,EFFAVG,
     +  EPEF,UT7,UT8,UT10)
       WRITE(U2,*)'ANSLUTNINGSAVGIFT MED NYA FÖNSTER BLEV = ',AAVGF
       WRITE(U2,*)'ENERGIÅTGÅNG VID FÖNSTERROT BLEV = ',ENERGIROT
       PKBEN=NUSUMB*ENERGIROT*EPRIS/VGVA
       PKNEN=NUSUMNA*R2**LIBP*ENERGIROT*EPRIS/NVGVA
       PNUVEN(G,X,Y)=PKBEN+PKNEN
       WRITE(U2,*)'NUVÄRDET FÖR ENERGIN MED FÖNSTERROT=',PNUVEN(G,X,Y)
********NU HAR JAG ALLA DELAR I UTTRYCKET JAG SUMMERAR OCH DERIV.*****
       IF (X.GE.5) GOTO 539
 530   CONTINUE
       WRITE(U2,*)SUMBROT(G,X,Y),SUMP(G,X,Y),KO(X),PNUVEN(G,X,Y),AAVGR
       WRITE(U2,*)PNUVENA(X,Y),SUMPA(X,Y),AAVGRO
       KONST=SUMBROT(G,X,Y)+SUMP(G,X,Y)+KO(X)
       KONSTA=PNUVENA(X,Y)+SUMPA(X,Y)+AAVGRO
       SVARET(X,Y)=-NLA(X)/BK(X)+(KONSTA/(AK(X)*BK(X)))**.5
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        IF (SVARET(X,Y).LT.0.)WRITE(*,*)'VALUE NEGATIVE',
     +  X,Y,SVARET(X,Y)
        WRITE(U2,*)'ISOTJOCKLEK BLEV = ',SVARET(X,Y)
        WRITE(U2,*)BYTE,NLA(X),BK(X)
        TRANSENB=TRANSENA+BYTE*(NLA(X)*BK(X)/(NLA(X)+BK(X)
     +  *SVARET(X,Y)))
        WRITE(U2,*)'TRANSEN,TRANSENA,TRANSENB = ',TRANSEN,TRANSENA
        WRITE(U2,*)TRANSENB
        DO 243 J= 1,12,1
          ENEMROT(J)=GRAD(J)*(TRANSENB+VENTEF)/1000.
 243    CONTINUE
        A(X)=BYTE
        CALL ENEBAL(ENEMROT,GRATIS,SOL,A,TV2,ENERGIROT,ENERGIROT1,
     +  ENEROT,U3,GRADTOP)
        WRITE(U2,*)'ENERGI TOTALT INKL TV = ',ENERGIROT
        ENESPAR=ENERGI-ENERGIROT
        WRITE(U1,*)'MAN SPARAR I KWH = ',ENESPAR
        NEFF=(TRANSENB+VENTEF)*DUT/1000.
        ROT=0
        WRITE(U2,*)'NEFF = ',NEFF
        AAVGN=0.
        CALL TAXOR(Y,NEFF,ENEROT,AAVGN,EPRIS,ROT,SPEC1,EOL,EEL,EGAS,
     +  ANSGAS,EFJ,ANSL,FAST,RV,EP,ABONA,EPE,FASTAVG,ABONAVG,EFFAVG,
     +  EPEF,UT7,UT8,UT10)
        WRITE(U2,*)'NUSUMB,NUSUMNA = ',NUSUMB,NUSUMNA,EPRIS,NVGVA,LIBP
        WRITE(U2,*)'AAVGN = ',AAVGN
        PKBENR=NUSUMB*ENERGIROT*EPRIS/VGVA
        PKNENR=NUSUMNA*ENERGIROT*R2**LIBP*EPRIS/NVGVA
        WRITE(U2,*)PKBENR,PKNENR
        WRITE(U2,*)'R2,LIBP,EPRIS,NVGVA = ',R2,LIBP,EPRIS,NVGVA
        ENKOSROT=PKBENR+PKNENR
        WRITE(U2,*)'ENERGIKOSTNAD BLEV = ',ENKOSROT
        WRITE(U2,*)'SUMPA(X,Y),NLA(X),BK(X)',SUMPA(X,Y),NLA(X),BK(X)
        PANNKOROT=SUMPA(X,Y)/(NLA(X)+BK(X)*SVARET(X,Y))
        WRITE(U2,*)'PANNKOSTNAD FÖR ROTDEL BLEV = ',PANNKOROT
        WRITE(U2,*)'NYA PANNAN KOSTAR = ',SUMP(G,X,Y)+PANNKOROT
        IF(LAN.EQ.1.AND.Y.EQ.5)THEN
                 SUBVPI=SUBVP*(ENERGIROT-ENERGIROT/NVGVA)
                 SUMP(G,X,Y)=SUMP(G,X,Y)-SUBVPI
                 KONST=KONST-SUBVPI
                 WRITE(U2,*)'SUBVEN. VID VP OCH ISO BLEV = ',SUBVPI
                 WRITE(U2,*)'ENERGIROT = ',ENERGIROT
*                 U2=1
        ENDIF
        WRITE(U2,*)'KO(X),AK(X)= ',KO(X),AK(X)
        WRITE(U2,*)'ISOLERING KOSTAR = ',KO(X)+AK(X)*SVARET(X,Y)
        WRITE(U2,*)'KONST,AK(X) = ',KONST,AK(X)
        MINSTA(X,Y)=KONST+AK(X)*SVARET(X,Y)+ENKOSROT+PANNKOROT+AAVGN
        WRITE(U2,*)'TOTAL KOSTNAD MED ISO BLEV = ',MINSTA(X,Y)
*        MINSTA(X,Y)=KONST+(KONSTA/(NLA(X)+BK(X)*SVARET(X,Y)))+AK(X)*
*     +  SVARET(X,Y)
        WRITE(U2,*)'SVARET RESP MINSTA =',SVARET(X,Y),MINSTA(X,Y)
        WRITE(U2,*)'DET BEFINTLIGA NUVÄRDET = ',TOTNUVB(Y)
        NYAENE=ENERGIROT-TV
        WRITE(U2,*)'EFTER ROT BLEV ENERGIN EXKL TV = ',NYAENE
 1690   CONTINUE
        IF(ROT.GE.10)WRITE(U3,*)'MINSTA(X,Y)',MINSTA(X,Y),TOTNUVB(Y)
        IF(MINSTA(X,Y).GT.TOTNUVB(Y)) THEN
*                 IF(Y.EQ.5)U2=1
*                 IF(Y.GT.5)U2=0
          WRITE(U2,*)'DO NOT DO ANYTHING HERE'
          WRITE(U2,*)'G,X,Y, = ',G,X,Y
          ROTMAT(G,X,Y)=0
          WRITE(U2,*)'ROTMAT(G,X,Y)= ',ROTMAT(G,X,Y)
          IF(X.EQ.3)YTTER=0.
          IF(X.EQ.4)INNER=0.
          IF(G.EQ.3)NEGMAT(I,Y)=(TOTNUVB(Y)-MINSTA(X,Y))/1.E6
          IF (G.EQ.3) SPARMAT(I,Y)=0.
        ELSE
*          IF(Y.EQ.5)U2=1
          WRITE(U2,*)'ÅTGÄRDA OMEDELBART X,Y,G= ',X,Y,G
          ROTMAT(G,X,Y)=1
          ROTDIFF=TOTNUVB(Y)-MINSTA(X,Y)
          WRITE(U2,*)'ROTDIFF= ',ROTDIFF
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          IF(X.EQ.3)YTTER=ROTDIFF
          IF(G.EQ.3) SPARMAT(I,Y)=ROTDIFF/1.E6
          IF(G.GE.4)ROTDIFF=0.
*          IF(Y.EQ.8)THEN
*                 WRITE(*,*)X,Y,G,SVARET(X,Y)
*          ENDIF
          IF(X.EQ.4)THEN
                 INNER=ROTDIFF
                 IF(YTTER.GT.INNER)THEN
                          SPARMAT(I,Y)=0.
                          ROTMAT(G,X,Y)=0
                          ROTDIFF=0.
                          WRITE(U2,*)'YTTER,INNER = ',YTTER,INNER
                 ELSE
                          SPARMAT(I-1,Y)=0.
                          ROTMAT(G,X-1,Y)=0
                          IF(G.EQ.3) SPARMAT(I,Y)=ROTDIFF/1.E6
                          ROTMAT(G,X,Y)=1
                          ROTRES(Y)=ROTRES(Y)+YTTER
                          WRITE(U2,*)'ROTRES(Y) = ',ROTRES(Y)
                          WRITE(U2,*)'YTTER,INNER = ',YTTER,INNER
                 ENDIF
          ENDIF
          IF (G.GE.4)THEN
            ROTDIFF=0.
          ENDIF
          IF(X.LT.3)SPARMAT(I,Y)=ROTDIFF/1.E6
          ROTRES(Y)=ROTRES(Y)-ROTDIFF
          WRITE(U2,*)'ROTRES(Y) RESP ROTDIFF=',ROTRES(Y),ROTDIFF
          WRITE(U2,*)'I,Y,SPARMAT(I,Y)= ',I,Y,SPARMAT(I,Y)
          WRITE(U2,*)'I-1,Y,SPARMAT(I-1,Y) =',I-1,Y,SPARMAT(I-1,Y)
          WRITE(U2,*)'ROTMAT(G,X,Y)= ',ROTMAT(G,X,Y),G,X,Y
*          WRITE(*,*)'KVOT FÖR DENNA ROTÅTGÄRD= ',ROTRES(Y)/TOTNUVB(Y)
*          WRITE(*,*)'DETTA ÄR ROTÅTGÄRD NR  ',X,TOTNUVB(Y)
        ENDIF
        WRITE(U2,*)'EFTER ÄR SPARMAT(I,Y) = ',SPARMAT(I,Y),I,Y
        WRITE(U2,*)'EFTER ÄR ROTMAT(G,X,Y) = ',ROTMAT(G,X,Y),G,X
        WRITE(U2,*)'EFTER ÄR ROTRES(Y) = ',ROTRES(Y)
        WRITE(U2,*)'EFTER ÄR ROTMAT(G,X-1,Y) = ',ROTMAT(G,X-1,Y)
        GOTO 540
******* HÄR KOMMER SPECIAL FÖR FÖNSTER*************************
 539    CONTINUE
        IF(LAN.EQ.1.AND.Y.EQ.5)THEN
                 SUBVPF=SUBVP*(ENERGIROT-ENERGIROT/NVGVA)
                 SUMP(G,X,Y)=SUMP(G,X,Y)-SUBVPF
                 WRITE(U2,*)'SUBVEN. VID VP OCH FÖNSTER BLEV = ',SUBVPF
        ENDIF
         MINSTAF(G,X,Y)=SUMBROT(G,X,Y)+SUMP(G,X,Y)+PNUVEN(G,X,Y)+AAVGF
*         IF(ROT.GE.1)WRITE(*,*)'MINSTAF',MINSTAF(G,X,Y),TOTNUVB(Y)
        WRITE(U2,*)'NU EFTER 539 ÄR G,X,Y = ',G,X,Y
        WRITE(U2,*)'DET TOTALA NUVÄRDET BLEV',MINSTAF(G,X,Y)
        WRITE(U2,*)'DET BEF ÄR',TOTNUVB(Y)
        IF (MINSTAF(G,X,Y).GT.TOTNUVB(Y)) THEN
*          WRITE(*,*)'BYT EJ TILL',G,'-GLAS'
          ROTMAT(G,X,Y)=0
          NEGMATF(G,X,Y)=TOTNUVB(Y)-MINSTAF(G,X,Y)
        ELSE
         IF(G.EQ.3) THEN
            WRITE(U2,*)'BÄTTRE MED TRE- ÄN MED TVÅGLAS'
            WRITE(U2,*)'G,X,Y, = ',G,X,Y
            WRITE(U2,*)'SUMBROT SUMP = ',SUMBROT(G,X,Y),SUMP(G,X,Y)
            WRITE(U2,*)'PNUVEN AAVGF = ',PNUVEN(G,X,Y),AAVGF
            WRITE(U2,*)'MINSTAF,TOTNUVB = ',MINSTAF(G,X,Y),TOTNUVB(Y)
            ROTMAT(3,X,Y)=1
         ELSE
           IF(G.EQ.4)THEN
            IF (MINSTAF(4,X,Y).LT.MINSTAF(3,X,Y))THEN
*              WRITE(*,*)'BILLIGARE MED FYR- ÄN MED TREGLAS'
               ROTMAT(4,X,Y)=1
               ROTMAT(3,X,Y)=0
            ELSE
*              WRITE(*,*)'BILLIGARE MED TRE- ÄN MED FYRGLAS'
               ROTMAT(4,X,Y)=0
               ROTMAT(3,X,Y)=1
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           ENDIF
          ELSE
           IF(G.NE.5) STOP
             IF (MINSTAF(5,X,Y).LT.MINSTAF(3,X,Y)) THEN
               WRITE(*,*)'BILLIGARE MED FEMGLAS ÄN MED TREGLAS'
               WRITE(*,*)'HÄR KRÄVS MER ANALYSER I PROGRAMMET,STANNAR'
               STOP
             ELSE
               ROTMAT(5,X,Y)=0
               ROTMAT(3,X,Y)=1
             ENDIF
           ENDIF
         ENDIF
 538       ROTGLAS(G,X,Y)=TOTNUVB(Y)-MINSTAF(G,X,Y)
*          IF(G.GE. 4)WRITE(*,*)'TOTNUVB(Y),MINSTAF(G,X,Y),G,X,Y',TOTNUVB
*     +    (Y),MINSTAF(G,X,Y),G,X,Y
         RESGLAS(G)=RESGLAS(G)+ROTGLAS(G,X,Y)
*          WRITE(*,*)'RESGLAS(G),ROTGLAS=',RESGLAS(G),ROTGLAS(G,X,Y)
        ENDIF
********NU BYTER VI ROTÅTGÄRD**************************************
 540         A(X)=BYTE
        IF(I.LE.5)I=I+1
 300    CONTINUE
        G=G+1
        WRITE(U2,*)'G ÄR NU = ',G
        IF (G.GT.5) THEN
          IF(RESGLAS(3)+RESGLAS(4)+RESGLAS(5).LT.10.) THEN
            SPARMAT(6,Y)=0.
            SPARMAT(7,Y)=0.
            SPARMAT(8,Y)=0.
            GOTO 802
           ENDIF
          IF (RESGLAS(3).GT.RESGLAS(4).AND.RESGLAS(3).GT.RESGLAS(5))
     +  THEN
             ROTRES(Y)=ROTRES(Y)-RESGLAS(3)
*             WRITE(*,*)'TREGLASKVOT= ',ROTRES(Y)/TOTNUVB(Y)
            WRITE(U2,*)'RESGLAS(3),ROTRES(Y)= ',RESGLAS(3),ROTRES(Y)
            SPARMAT(6,Y)=RESGLAS(3)/1.E6
            SPARMAT(7,Y)=0.
            SPARMAT(8,Y)=0.
          ELSEIF (RESGLAS(4).GT.RESGLAS(5)) THEN
            ROTRES(Y)=ROTRES(Y)-RESGLAS(4)
*             WRITE(*,*)'FYRGLASKVOT= ',ROTRES(Y)/TOTNUVB(Y)
            WRITE(U2,*)'RESGLAS(4),ROTRES(Y)= ',RESGLAS(4),ROTRES(Y)
            SPARMAT(6,Y)=0.
            SPARMAT(7,Y)=RESGLAS(4)/1.E6
            SPARMAT(8,Y)=0.
          ELSE
            ROTRES(Y)=ROTRES(Y)-RESGLAS(5)
*             WRITE(*,*)'RESGLAS(5),ROTRES(Y)= ',RESGLAS(5),ROTRES(Y)
*             WRITE(*,*)'FEMGLASKVOT BLEV= ',ROTRES(Y)/TOTNUVB(Y)
            SPARMAT(6,Y)=0.
            SPARMAT(7,Y)=0.
            SPARMAT(8,Y)=RESGLAS(5)/1.E6
          ENDIF
*          WRITE(*,*)'ROTRES(Y)=',ROTRES(Y)
 802      RESGLAS(3)=0.
          RESGLAS(4)=0.
          RESGLAS(5)=0.
          GOTO 1000
        ELSE
          GOTO 607
        ENDIF
 1000   CONTINUE
        WRITE(U2,*)'ROTMAT(3,4,5)= ',ROTMAT(3,4,5)
********HÄR KOMMER TÄTNING AV FÖNSTER MM***********************
        WRITE(U4,*)'TTTTTTTTTTTTTTTTTTTTTTTTTTTTT'
*        WRITE(*,*)'ANTAL FÖNSTER DÖRRAR MM SOM SKALL TÄTAS=',AOP
*        WRITE(*,*)'KOSTNAD PER TÄTNING=',KPO
*        WRITE(*,*)'DIFFERENS I VENTILATIONSFLÖDE GENOM TÄTNINGEN
*     +  I OMS/H=',OMDIFF
*        WRITE(*,*)'LIVSLÄNGDEN PÅ TÄTNINGEN ANTAS VARA I ÅR=',LITA
        IF(OMS-OMDIFF.LT..49)THEN
           WRITE(*,*)'NU BLEV DET LÄGRE OMSÄTTNING ÄN .5 OMS/H.DETTA'
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          WRITE(*,*)'KAN SKAPA PROBLEM.RÄKNAR DOCK OM DET ÄR LÖNSAMT'
        ENDIF
        SO=AOP*KPO
        SUBVT=SUBV*SO
        S1=0.
        L1=0.
        L2=LITA
        CALL NUVARDE (SO,S1,L1,L2,OPT,R1)
        TATKOST=S1
        IF(LAN.EQ.2)TATKOST=TATKOST-SUBVT
        ATATKOST=TATKOST
*        WRITE(*,*)'NUVÄRDET AV TÄTNINGSKOSTNADEN BLEV = ',TATKOST
********HÄR KOMMER DET NYA NUVÄRDET PGA TÄTNINGEN*************
        PEFFT=(TRANSEF+VENTEF-OMDIFF*BA*.33*HOJD)*DUT/1000
        TRANSENT=TRANSEN+VENTEF-OMDIFF*BA*.33*HOJD
        WRITE(U4,*)'TRANSM FAKT VID TÄTNING = ',TRANSENT
        WRITE(U4,*)'TRANSEN,VENTEF,OMDIFF,BA',TRANSEN,VENTEF,OMDIFF,BA
        DO 282 J=1,12,1
          ENEMROT(J)=TRANSENT*GRAD(J)/1000.
 282    CONTINUE
        CALL ENEBAL(ENEMROT,GRATIS,SOL,A,TV2,TENERGI,ENERGIROT1,
     +  ENEROT,U4,GRADTOP)
        WRITE(U2,*)'PEFFT,TENERGI,ENERGI=',PEFFT,TENERGI,ENERGI
        IF(ROT.GE.10)THEN
          SUMPAR=0.
          AAVGT=0.
          BIROT=0
*          U4=1
          TRANSENG=TRANSEN
          VENTEFG=VENTEF-OMDIFF*BA*.33*HOJD
          WRITE(U4,*)'ENERGIROT VID TÄTNING,TOTENE = ',TENERGI,TOTENE
          WRITE(U4,*)'EFFEKT VID TÄTNING,ENERGIROT1= ',PEFFT,ENERGIROT1
          WRITE(U4,*)'TRANSEN,TRANSENT = ',TRANSEN,TRANSENT
          BYTE=-1.
          CALL BIOPTIM(CON1,CON2,EPRIS1,EPRIS2,INP1,AKP1,INP2,AKP2,
     +    NUSUMNA1,CON3,NUFAKT1,NUFAKT2,PEFFT,BIOPT2,SUMPAR,TNUVEN,
     +    VGVN1,VGVN2,TENERGI,ENERGIROT1,TV,NLA(X),DUT,BYTE,BIROT,BEFK,
     +    AKT,SVARETA,OPT,R1,EXTRA,EXTRA1,LAN)
          TSUMP=SUMPAR+RESTP
          WRITE(U4,*)'PANNKOST VID BIV TÄTNING= ',TSUMP
          WRITE(U4,*)'ENERGIKOSTNAD VID BIV.TÄTNING= ',TNUVEN
          WRITE(U4,*)'SUMBR1,TATKOST,AAVGT = ',SUMBR1,TATKOST,AAVGT
          GOTO 1691
        ENDIF
        SO=PEFFT*AKP+INP
        SUBVT=0.
        IF(LAN.EQ.2.AND.Y.GE.2)SUBVT=SO*SUBV
        S1=0.
        L1=LIBP
        L2=NLP
        CALL NUVARDE(SO,S1,L1,L2,OPT,R1)
        TSUMP=S1+RESTP
        SO=SLANG*PEFFT
        SUBVTS=0.
        IF(LAN.EQ.2.AND.Y.GE.2)SUBVTS=SO*SUBV
        L1=0.
        S1=0.
        L2=LSLANG
        CALL NUVARDE (SO,S1,L1,L2,OPT,R1)
        TSLANGB=S1
        WRITE(U1,*)'SLANGROT VID TÄTNING KOSTAR = ',TSLANGB
        TSUMP=TSUMP+TSLANGB
        IF(LAN.EQ.1)TSUMP=TSUMP-SUBP
        IF(LAN.EQ.2)TSUMP=TSUMP-SUBVT-SUBVTS
        WRITE(U2,*)'NUVÄRDET AV PANNOR MED TÄTNING  BLEV  ',TSUMP
        NVENTEF=VENTEF-OMDIFF*BA*.33*HOJD
        AAVGT=0.
        DO 416 J=1,12,1
          WRITE(U2,*)'ENERGIFÖRBR MÅNADSVIS MED TÄTNING = ',ENEROT(J)
 416    CONTINUE
 516    CALL TAXOR(Y,PEFFT,ENEROT,AAVGT,EPRIS,ROT,SPEC1,EOL,EEL,EGAS,
     +  ANSGAS,EFJ,ANSL,FAST,RV,EP,ABONA,EPE,FASTAVG,ABONAVG,EFFAVG,
     +  EPEF,UT7,UT8,UT10)
        WRITE(U4,*)'ENERGIPRIS VID TÄTNING= ',EPRIS
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        PKBEN=NUSUMB*TENERGI*EPRIS/VGVA
        PKNEN=NUSUMNA*R2**LIBP*TENERGI*EPRIS/NVGVA
        TNUVEN=PKBEN+PKNEN
        WRITE(U4,*)'NUVÄRDET FÖR ENERGIN MED TÄTNING BLEV =',TNUVEN
        IF(LAN.EQ.1.AND.Y.EQ.5)THEN
                SUBVPT=SUBVP*(TENERGI-TENERGI/NVGVA)
                TSUMP=TSUMP-SUBVPT
                WRITE(U4,*)'SUBSIDY WHEN HP AND CAULK. = ',SUBVPT
        ENDIF
********SUMMERING AV DELUTTRYCK FÖR TÄTNINGEN*******************
 1691   G=3
        MINSTAT=SUMBR1+TATKOST+TSUMP+TNUVEN+AAVGT
        WRITE(U4,*)'SUMBR1,AAVGT= ',SUMBR1,AAVGT
        WRITE(U4,*)'DET NYA TOT NUVÄRDET FÖR TÄTNING= ',MINSTAT
        WRITE(U4,*)'DET BEF HUSETS = ',TOTNUVB(Y)
*        WRITE(*,*)'TÄTNING OCH X = 9 ? ',X
        IF(ROT.GE.10)WRITE(U4,*)'MINSTAT,TOT.= ',MINSTAT,TOTNUVB(Y)
        IF (MINSTAT.GT.TOTNUVB(Y)) THEN
          WRITE(*,15)'NO WEATHERSTRIPPING'
          WRITE(*,15)'CAN THIS BE CORRECT ? CHECK INPUT DATA!!'
                 ATATKOST=0.
          ROTMAT(G,X,Y)=0
          SPARMAT(9,Y)=0.
*********HÄR SÄTTER JAG EN FLAGGA FÖR ATT VÄLJA RÄTT FLÖDE VID FRÅNLUFT-
*********VÄRMEPUMPEN NEDAN.DET KÄNSKE BLIR BILLIGARE ATT INTE TÄTA******
          BOBBAN=0
        ELSE
*          WRITE(*,15)'WEATHERSTRIPPING IS PROFITABLE'
          ROTMAT(G,X,Y)=1
          ROTDIFF=TOTNUVB(Y)-MINSTAT
          ROTRES(Y)=ROTRES(Y)-ROTDIFF
          BOBBAN=1
          WRITE(U2,*)'DECREASE IN LCC WITH WEATHERSTRIPPING = ',ROTDIFF
          SPARMAT(9,Y)=ROTDIFF/1.E6
*          WRITE(*,*)'KVOT FÖR TÄTNING BLEV =' ,ROTRES(Y)/TOTNUVB(Y)
        ENDIF
*********HÄR SKALL JAG KOLLA OM DET LÖNAR SIG MED FRÅNLUFT-*************
*********VÄRMEPUMP DELS TILL TAPPVARMVATTNET OCH DELS TILL *************
*********VÄRMESYSTEMET.EVENTUELL TÄTNING INVERKAR OCKSÅ*****************
        X=X+1
        IF(ROT.GE.10)BIROT=2
        IF (BOBBAN.EQ.1) THEN
          OMS1=OMS-OMDIFF
        ELSE
          OMS1=OMS
        ENDIF
*        IF(LAN.EQ.1.AND.Y.EQ.3)U5=1
*********HÄR FIXAR VI TILL EN FLAGGA FÖR BERÄKNING AV FULLT FLÖDE*****
*********FLAGGAN SÄTTS TILL 1 OM FRÅNLUFTVÄRMEPUMP VÄLJES NEDAN *******
        KOLL=0
*********HÄR EN FLAGGA FÖR RÄTT JÄMF OM FRLVP EJ VÄLJS NEDAN KOLL1 ÄR DÅ 1****
        KOLL1=0
201     FLODE=BA*HOJD*OMS1
        WRITE(U5,*)'DET TOTALA FRÅNLUFTFLÖDET I M3/H = ',FLODE
        TFDIFF=TFIN-TFUT
        WRITE(U5,*)'DETTA AVKYLES ANTAL GRADER C ',TFDIFF
        FLENE=.33*FLODE*TFDIFF*8760/1000
        WRITE(U5,*)'VÄRMET SOM FÅS UT ÄR I KWH/ÅR = ',FLENE
*********HÄR MÅSTE RÄTT ELPRIS HÄMTAS FRÅN TAXOR************************
        ELSORT=3
        IF(Y.EQ.8) ELSORT=Y
        DO 1250 J=1,12,1
        ENEFRAN(J)=GRAD(J)*((TRANSEN+VENTEF)/1000)+FLENE/(VGFLVP*12.)
     +  +TV/12.-FLENE/12.
 1250   CONTINUE
        ROT=2
        FLEFF=.33*FLODE*TFDIFF/1000.
        PEFF=EFF-FLEFF
**********HÄR KOLLAS OM VI TÄTAT.SE ÄVEN 20 RADER LÄNGRE NER***************
        IF(BOBBAN.EQ.1.AND.KOLL.NE.1)PEFF=PEFFT-FLEFF
        CALL TAXOR(ELSORT,PEFF,ENEFRAN,SKOJ,EPRISFVP,ROT,SPEC1,EOL,EEL,
     +  EGAS,ANSGAS,EFJ,ANSL,FAST,RV,EP,ABONA,EPE,FASTAVG,ABONAVG,EFFAVG
     +  ,EPEF,UT7,UT8,UT10)
        ROT=0
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        IF(BIROT.EQ.2)ROT=10
        WRITE(U2,*)'ELPRIS FÖR FR.L DRIFT= ',EPRISFVP
        FLKOST=FLENE*EPRISFVP/VGFLVP
        WRITE(U5,*)'KOSTNADEN FÖR FLVP-DRIFTEN I KR/ÅR = ',FLKOST
        R4=1/R2
        NFLKOST=FLKOST*(1-(R4**(-OPT)))/(R4-1)
        WRITE(U5,*)'DENNA NUVÄRDESBERÄKNAD BLEV I KR= ',NFLKOST
********HÄR KOMMER FRÅNL.VP ANLÄGGNINGSKOSTNADER******************
********FÖRST KOSTNADEN FÖR ATT FIXA TILL ALLA KANALER MM.VI GISSAR****
********PÅ ETT BELOPP PER LÄGENHET************************************
        SO=ROR*ALGH
        S1=0.
        L1=0.
        L2=LROR
        IF(LAN.EQ.2)SUBVROR=SO*SUBV
        CALL NUVARDE(SO,S1,L1,L2,OPT,R1)
        NROR=S1
        IF(LAN.EQ.2)NROR=NROR-SUBVROR
        WRITE(U5,*)'NUVÄRDET FÖR KANALER OCH RÖR BLEV= ',NROR
********HÄR KOMMER KOSTNADEN FÖR PUMPEN SJÄLV******************
        SO=INFL+AKFL*FLEFF
        SUBVFLA=0.
        IF(LAN.EQ.2)SUBVFLA=SO*SUBV
        S1=0.
        L1=0.
        L2=LFL
        CALL NUVARDE (SO,S1,L1,L2,OPT,R1)
        FLANKO=S1
        IF(LAN.EQ.1)THEN
                FLANKO=FLANKO-SUBFR
                WRITE(U5,*)'FLANKO SUBFR S1 = ',FLANKO,SUBFR,S1
        ENDIF
        IF(LAN.EQ.2)FLANKO=FLANKO-SUBVFLA
        WRITE(U5,*)'NUVÄRDET AV FLVP BLEV I KR = ',FLANKO
*********VI ANTAR ATT VI FÅR ETT EFFEKTTILLSKOTT PGA ATT PUMPEN********
*********PRIORITERAR VÄRMEN                                    ********
        WRITE(U5,*)'EFFEKTTILLSKOTT PGA FLVP I KW = ',FLEFF
********OM BOBBAN = 1 HAR VI TÄTAT.DÅ MÅSTE EN ANNAN EFFEKT ANVÄNDAS
********OM KOLL = 1 SKALL VI DOCK KOLLA MED FULLT FLÖDE OCH URSPR.EFF
        WRITE(U5,*)'PEFF,PEFFT,FLEFF= ',PEFF,PEFFT,FLEFF
        IF(BIROT.EQ.2)THEN
          U5=0
*          IF(UTE3.EQ.1)U5=1
*          IF(UTE3.EQ.1)U3=1
          SUMPAR=0.
          AAVGFL=0.
          PEFF1=PEFF+FLEFF
          WRITE(U5,*)'PEFF1 = ',PEFF1
          WRITE(U5,*)'CALCULATES ON BIV SYSTEM AND EXHAUST AIR HEAT P'
          DO 32 J=1,12,1
            ENEMROT(J)=GRAD(J)*(TRANSEN+NVENTEF)/1000.
 32       CONTINUE
          CALL ENEBAL(ENEMROT,GRATIS,SOL,A,TV2,ENERGIROTF,ENERGIROT1,
     +    ENEROT,U5,GRADTOP)
          WRITE(U5,*)'ENERGIROTF,ENERGIROT1 = ',ENERGIROTF,ENERGIROT1
          WRITE(U5,*)'TRANSEN,NVENTEF,FLENE = ',TRANSEN,NVENTEF,FLENE
          WRITE(U5,*)'EFF,PEFF,FLEFF,PEFFT = ',EFF,PEFF,FLEFF,PEFFT
          TRANSENG=TRANSEN
          VENTEFG=NVENTEF
          CALL BIOPTIM(CON1,CON2,EPRIS1,EPRIS2,INP1,AKP1,INP2,AKP2,
     +    NUSUMNA1,CON3,NUFAKT1,NUFAKT2,PEFF1,BIOPT2,SUMPAR,FLNUVEN,
     +    VGVN1,VGVN2,ENERGIROTF,ENERGIROT1,TV,FLENE,DUT,BYTE,BIROT,
     +    BEFK,AKT,SVARETA,OPT,R1,EXTRA,EXTRA1,LAN)
          FLSUMP=SUMPAR+RESTP
          WRITE(U3,*)'ENERGIN FRÅN FRÅNLVP BLEV= ',BYTE
          NFLKOST=BYTE*EPRISFVP*NUSUMNA1/VGFLVP
          WRITE(U3,*)'EPRISFVP,NFLKOST= ',EPRISFVP,NFLKOST
          WRITE(U3,*)'NUVÄRDE ENERGIÅTGÅNG FRÅN PANNOR= ',FLNUVEN
          GOTO 1692
        ENDIF
        SO=INP+AKP*PEFF
        SUBVFL2=0.
        IF(LAN.EQ.2.AND.Y.GE.2)SUBVFL2=SO*SUBV
        WRITE(U5,*)'EN PANNA VP = ',SO,PEFF,AKP,LIBP,NLP,RESTP,OPT,R1
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        S1=0
        L1=LIBP
        L2=NLP
        CALL NUVARDE(S0,S1,L1,L2,OPT,R1)
        FLSUMP=S1+RESTP
        S0=SLANG*PEFF
        SUBVF2S=0.
        IF(LAN.EQ.2.AND.Y.EQ.2)SUBVF2S=S0*SUBV
        S1=0.
        L1=0.
        L2=LSLANG
        CALL NUVARDE (S0,S1,L1,L2,OPT,R1)
        PSLANG=S1
        WRITE(U1,*)'SLANGROT VID FR.LUFTVP KOSTAR = ',PSLANG
        FLSUMP=FLSUMP+PSLANG
        IF(LAN.EQ.1)FLSUMP=FLSUMP-SUBP
        IF(LAN.EQ.2)FLSUMP=FLSUMP-SUBVFL2-SUBVF2S
        WRITE(U5,*)'NUVÄRDE VÄRMEANL MED FLVP INST BLEV I KR = ',FLSUMP
********HÄR SKA VI TA HÄNSYN TILL TAPPVARMVATTNET************************
        IF(TV.GT.FLENE)THEN
                FLENE1=0.
                TV1=TV-FLENE
 DO 1601 J=1,12
TV12(J)=TV2(J)-FLENE/12
 1601  CONTINUE
        ELSE
                FLENE1=FLENE-TV
                TV1=0.
 DO 1602 J=1,12
TV12(J)=0.
 1602  CONTINUE
        ENDIF
        WRITE(U5,*)'FLENE1 = ',FLENE1
        WRITE(U5,*)'TV1= ',TV1
        DO 257 J=1,12,1
          ENEMROT(J)=GRAD(J)*(TRANSEN+VENTEF)/1000.-FLENE1/12.
          IF(BOBBAN.EQ.1 .AND.KOLL.NE.1)THEN
            ENEMROT(J)=GRAD(J)*TRANSENT/1000.-FLENE1/12.
          ENDIF
 257    CONTINUE
        CALL ENEBAL(ENEMROT,GRATIS,SOL,A,TV12,ENERGIROT,ENERGIROT1,
     +  ENEROT,U5,GRADTOP)
        AAVGF=0.
 517    CALL TAXOR(Y,PEFF,ENEROT,AAVGFL,EPRIS,ROT,SPEC1,EOL,EEL,
     +  EGAS,ANSGAS,EFJ,ANSL,FAST,RV,EP,ABONA,EPE,FASTAVG,ABONAVG,EFFAVG
     +  ,EPEF,UT7,UT8,UT10)
        WRITE(U5,*)'ENERGIPRISET FÖR HUSET BLEV NU= ',EPRIS
        WRITE(U5,*)'ENERGIÅTGÅNG VID FRÅNL.VP I HUSET = ',ENERGIROT
        PKBEN=NUSUMB*ENERGIROT*EPRIS/VGVA
        PKNEN=NUSUMNA*R2**LIBP*ENERGIROT*EPRIS/NVGVA
        FLNUVEN=PKBEN+PKNEN
*        WRITE(*,*)NUSUMB,NUSUMNA,VGVA,NVGVA,R2,LIBP,PKBEN,PKNEN
        WRITE(U5,*)'NUVÄRDET FÖR ENERGIN BLEV I KR= ',FLNUVEN
********NU HAR VI ALLA KOSTNADER SUMMERAR DÄRFÖR**************
********VID HOPP TILL 1692 RÄKNAS PÅ BIVALENTA SYSTEM
 1692   CONTINUE
        IF(LAN.EQ.1.AND.Y.EQ.5)THEN
                SUBVPFL=SUBVP*(ENERGIROT-ENERGIROT/NVGVA)
                FLSUMP=FLSUMP-SUBVPFL
                WRITE(U5,*)'SUBSIDY WHEN HP AND CAULK. = ',SUBVPFL
        ENDIF
        FLMINSTA=FLNUVEN+SUMBR1+FLSUMP+FLANKO+NROR+NFLKOST+AAVGFL+
     +  ATATKOST
        IF(BIROT.EQ.2)WRITE(U3,*)FLNUVEN,SUMBR1,FLSUMP,FLANKO,NROR,
     +  NFLKOST,AAVGFL,ATATKOST,FLMINSTA
        WRITE(U5,*)FLNUVEN,SUMBR1,FLSUMP,FLANKO,NROR,NFLKOST,ATATKOST
        WRITE(U5,*)'AAVGFL=',AAVGFL
        WRITE(U5,*)'TATKOST= ',TATKOST
        WRITE(U5,*)'DET TOTALA NUVÄRDET FÖR HUSET MED FRÅNLUFTVÄRMEPUMP'
        WRITE(U5,*)'BLEV (FLMINSTA)= ',FLMINSTA
*********OM KOLL1=1 HAR JAG KOLLAT MED TÄTNING FÖRUT.DÅ LÖNADE DET SIG EJ MED*
*********FRÅNLUFTVP.NU KOLLAS OM DET LÖNAR SIG BÄTTRE MED FRVP UTAN TÄTNING***
        IF (KOLL1.EQ.1)THEN
          IF(FLMINSTA.LT.MINSTAT.AND.FLMINSTA.LT.TOTNUVB(Y))THEN
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            WRITE(*,15)'NO CAULKING BUT EXHAUST AIR HEATPUMP'
            WRITE(U5,*)'FLMINSTA,MINSTAT= ',FLMINSTA,MINSTAT
            ROTDIFF=TOTNUVB(Y)-FLMINSTA
            WRITE(U5,*)'ROTDIFF,FLVP= ',ROTDIFF
            ROTMAT(G,X-1,Y)=0
            SPARMAT(9,Y)=0.
            ROTRES(Y)=ROTRES(Y)+(TOTNUVB(Y)-MINSTAT)-ROTDIFF
            AFLEFF(Y)=FLEFF
            AFLENE(Y)=FLENE
            ANFLKOST(Y)=NFLKOST
            AFLANKO(Y)=FLANKO
                 ATATKOST=0.
            ROTMAT(G,X,Y)=1
            SPARMAT(10,Y)=ROTDIFF/1.E6
            KOLL1=0
            KOLL=0
            GOTO 419
          ELSE
            WRITE(U5,*)'HÄR VAR DET BÄST UTAN FRLVP OCH TÄTNING'
            ROTMAT(G,X,Y)=0
            SPARMAT(10,Y)=0.
            KOLL1=0
            KOLL=0
            GOTO 419
          ENDIF
        ENDIF
        MINSTAT1=MINSTAT
********OM INGEN TÄTNING KOLLAS MOT DET VANLIGA NUVÄRDET ELLER OM KOLL=1*******
        IF(ROTMAT(3,9,Y).EQ.0.OR.KOLL.EQ.1)MINSTAT1=TOTNUVB(Y)
        IF(BOBBAN.EQ.1)GOTO 693
        IF(ABS(MINSTAT1-TOTNUVB(Y)).LT.1..AND.KOLL.EQ.1)
     +  WRITE(*,*)'****SKUMT********'
 693    IF (FLMINSTA.GT.MINSTAT1) THEN
          WRITE(U5,*)'HÄR SKALL MAN INTE HA NÅGON FRÅNLUFTVÄRMEPUMP'
           IF(BIROT.EQ.2)WRITE(U3,*)'INGEN PUMP*************'
**********HÄR MÅSTE KOLLAS OM DET LÖNAR SIG MED FRLVP OM INGEN TÄTNING*******
          IF(KOLL1.EQ.1)GOTO 418
          KOLL=1
          OMS1=OMS
          KOLL1=1
          ATATKOST=0.
          IF(BIROT.EQ.2)NVENTEF=VENTEF
          GOTO 201
 418      ROTMAT(G,X,Y)=0
          SPARMAT(10,Y)=0.
        ELSE
           WRITE(U5,*)'INSTALLERA OMEDELBART FRÅNLUFTVÄRMEPUMP'
           IF (BOBBAN.EQ.0)THEN
             WRITE(U5,*)'HÄR LÖNADE DET SIG INTE ATT TÄTA FRÅN BÖRJAN'
            AFLEFF(Y)=FLEFF
            AFLENE(Y)=FLENE
            ANFLKOST(Y)=NFLKOST
            AFLANKO(Y)=FLANKO
             LFLMINSTA=FLMINSTA
             GOTO 202
           ENDIF
           IF (BOBBAN.EQ.1 .AND. KOLL.EQ.0)THEN
            WRITE(U5,*)'MÅSTE KOLLA OM DET LÖNAR SIG ATT INTE TÄTA'
            FLSPAR1=MINSTAT-FLMINSTA
            WRITE(U5,*)'MAN SPARADE MED FR.L.VP FRÅN TÄT= ',FLSPAR1
            WRITE(U5,*)'MAN SPARADE PÅ ATT TÄTA= ',TOTNUVB(Y)-MINSTAT
            AFLEFF(Y)=FLEFF
            AFLENE(Y)=FLENE
            ANFLKOST(Y)=NFLKOST
            AFLANKO(Y)=FLANKO
            KOLL=1
            OMS1=OMS
            FLMI1=FLMINSTA
            ATATKOST=0.
            GOTO 201
           ELSE
            IF(BOBBAN.EQ.1 .AND.KOLL .EQ.1) THEN
              FLSPAR2=TOTNUVB(Y)-FLMINSTA
              WRITE(U5,*)'SPARAR MED FR.L.VP.UTAN TÄT= ',FLSPAR2
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              IF(FLSPAR2.GT.(TOTNUVB(Y)-MINSTAT)+FLSPAR1) THEN
                ROTMAT(G,X-1,Y)=0
                SPARMAT(9,Y)=0.
                WRITE(U5,*)'HÄR LÖNADE DET SIG INTE ATT TÄTA.MAN TJÄNAR
     +',(TOTNUVB(Y)-MINSTAT)+FLSPAR1-FLSPAR2,' PÅ ATT INTE TÄTA'
                LFLMINSTA=FLMINSTA
                ROTRES(Y)=ROTRES(Y)+(TOTNUVB(Y)-MINSTAT)
                AFLEFF(Y)=FLEFF
                AFLANKO(Y)=FLANKO
                ANFLKOST(Y)=NFLKOST
                AFLENE(Y)=FLENE
**********KOLL=0 FÖR ATT DRA LFLMINSTA FRÅN RÄTT VÄRDE NEDAN*****
                KOLL=0
              ELSE
                WRITE(U5,*)'HÄR SKALL MAN BÅDE TÄTA OCH HA FRÅNL.VP'
                LFLMINSTA=FLMI1
              ENDIF
            ELSE
              WRITE(*,*)'HÄR SKALL JAG INTE VARA'
            ENDIF
           ENDIF
 202       ROTMAT(G,X,Y)=1
           ROTDIFF=MINSTAT1-LFLMINSTA
           IF(KOLL.EQ.1)ROTDIFF=MINSTAT-LFLMINSTA
           ROTRES(Y)=ROTRES(Y)-ROTDIFF
*           IF(UTE3.EQ.1)U5=1
           WRITE(U5,*)'MAN SPARADE PÅ ATT HA FRÅNLUFTVP = ',ROTDIFF
           SPARMAT(10,Y)=ROTDIFF/1.E6
*           WRITE(*,*)'FRÅNLUFTKVOT BLEV = ',ROTRES(Y)/TOTNUVB(Y)
         ENDIF
**********OM DEN BEF PANNAN EJ ÄR OLJA DVS Y>1 MÅSTE REGISTREN FIXAS TILL****
**********SÅ ATT DEN BEF ANL FÅR VÄRDEN MED INDEX Y=1**********************
 419     IF (Y.EQ.1) GOTO 110
         WRITE(U2,*)'RESTP VID 419 = ',RESTP
         IF(RESTP.GT.0.05)GOTO 110
         TOTNUVB(1)=TOTNUVB(P2)
         ROTRES(1)=ROTRES(P2)
         DO 108 I=1,15,1
         SPARMAT(I,1)=SPARMAT(I,P2)
         SVARET(I,1)=SVARET(I,P2)
         AFLEFF(1)=AFLEFF(P2)
         AFLENE(1)=AFLENE(P2)
         AFLANKO(1)=AFLANKO(P2)
         ANFLKOST(1)=ANFLKOST(P2)
         G=3
 107     ROTMAT(G,I,1)=ROTMAT(G,I,P2)
         SUMBROT(G,I,1)=SUMBROT(G,I,P2)
         G=G+1
         IF(G.GT.5) GOTO 108
         GOTO 107
 108     CONTINUE
 110     GOTO (111,112,113,114,115,116,117,118,119,120),Y
********NU KOMMER ROTÅTGÄRDER PÅ PANNORNA************************
********HÄR MÅSTE RESTVÄRDET PÅ DEN BEF PANNAN BERÄKNAS************
 111     RESTP=(INP+EF*AKP)*LVA/NLP
         SPEC1=1
         WRITE(U1,*)'RESTVÄRDET PÅ BEF PANNA ÄR',RESTP,INP,EF,AKP,LIBP
********FÖRST TAR VI OLJEROT
         Y=2
         INP=INPO
         AKP=AKPO
         VGVA=VGVNO
         NVGVA=VGVNO
         LIBP=0.
         NLP=NLPO
         EPRIS=EOL
         SLANG=SLANGO
         LSLANG=LSLANGO
         GOTO 700
********NU KOMMER ELROT*****************************************
 112     INP =INPE
         Y=3
         AKP=AKPE
         VGVA=VGVNE
```

```
        NVGVA=VGVNE
        LIBP=0.
        NLP=NLPE
        EPRIS=EEL
*        WRITE(*,*)'ELPRISET ÄR HÄR=  ',EPRIS
        SLANG=SLANGE
        LSLANG=LSLANGE
        GOTO 700
********NU KOMMER FJÄRRVÄRMEROT***********************************
 113    INP =INPF
        Y=4
        AKP=AKPF
        VGVA=VGVNF
        NVGVA=VGVNF
        NLP=NLPF
        LIBP=0.
        EPRIS=EFJ
        SLANG=SLANGF
        LSLANG=LSLANGF
        GOTO 700
********NU KOMMER VÄRMEPUMP SJÖ**********************************
 114    INP=INPV
        Y=5
        AKP=AKPV
        VGVA=VGVNV
        NVGVA=VGVNV
        LIBP=0.
        NLP=NLPV
        EPRIS=EVPS
*        WRITE(*,*)'ELPRISET VID SJÖV = ',EPRIS
*        WRITE(*,*)'VÄRDENA ÄR',INP,AKP,VGVA,NVGVA,NLP,EPRIS
        SLANG=SLANGV
        LSLANG=LSLANGV
        GOTO 700
********NU KOMMER YTJORDVÄRME**************************************
 115    Y=6
        INP=INPY
        AKP=AKPY
        VGVA=VGVNY
        NVGVA=VGVNY
        NLP=NLPY
        LIBP=0.
        EPRIS=EGAS
*        WRITE(*,*)'ELPRIS VID YTJV = ',EPRIS
        SLANG = SLANGY
        LSLANG=LSLANGY
        GOTO 700
**********HÄR KOMMER DIFFERENTIERAD FJÄRRVÄRMETAXA.SE TAXOR*****
 116    Y=7
        INP=INPF
        AKP=AKPF
        VGVA=VGVNF
        NLP=NLPF
        LIBP=0.
        L1=0.
        L2=NLPF
        NVGVA=VGVNF
        SLANG=SLANGF
        LSLANG=LSLANGF
        GOTO 700
**********HÄR KOMMER DIFFERENTIERAD ELTAXA.SE TAXOR**********************
 117    Y=8
        INP=INPE
        AKP=AKPE
        VGVA=VGVNE
        NVGVA=VGVNE
        NLP=NLPE
        LIBP=0.
        L1=0.
        L2=NLPE
        SLANG=SLANGE
        LSLANG=LSLANGE
        GOTO 700
**************BIVALENT HEATING SYSTEM CALCULATIONS, GR WATER - OIL BOILER***
```

```
 118    Y=9
        UTE3=0
*        U3=1
        WRITE(*,*)' '
        WRITE(*,*)'CONSIDERS HEATING SYSTEM NUMBER ',Y
        WRITE(*,*)'***********************************************'
***************FÖRST MÅSTE DEN OPTIMALA FÖRDELNINGEN MELLAN OLJEPANNA********
***************OCH VÄRMEPUMP BERÄKNAS FÖR DET BEFINTLIGA HUSET***************
***************FÖRDELNINGEN BERO AV KLIMATET SOM FUNKTION AV TIDEN***********
***************FUNKTIONEN BESTÄMS I SUBRUTINEN VARAKT************************
        CALL VARAKT(KLIM,ORT,CON1,CON2,CON3,TIN)
        WRITE(U3,*)'CON1,RESP CON2 OCH CON3',CON1,CON2,CON3
        L1=0.
        L2=NLPO
        SO=1.
        S1=0.
        CALL NUVARDE(SO,S1,L1,L2,OPT,R1)
        NUFAKT1=S1
        L1=0.
        L2=NLPV
        SO=1.
        S1=0.
        CALL NUVARDE(SO,S1,L1,L2,OPT,R1)
        NUFAKT2=S1
        WRITE(U3,*)'NUFAKT2 = ',NUFAKT2
***********RESULTATET BLIR EN ANDRAGRADARE TYP C1*P*P+C2*P+C3=KOSTNADEN********
***********SOM SKALL MINIMERAS .BERÄKNAR FÖRST C1.P=EFFEKT PÅ VÄRMEPUMP********
***********ROT SÄTTES TILL 10 FÖR ATT HÄMTA BÅDE OLJEPRIS OCH VÄRMEP.PRIS******
        INP1=INPO
        AKP1=AKPO
        INP2=INPV
        AKP2=AKPV
        VGVN1=VGVNO
        VGVN2=VGVNV
        SLANG1=SLANGO
        SLANG2=SLANGV
        LSLANG1=LSLANGO
        LSLANG2=LSLANGV
        ROT=10
        CALL TAXOR(Y,EFF,ENEM,EPRIS1,EPRIS2,ROT,SPEC1,EOL,EEL,
     +  EGAS,ANSGAS,EFJ,ANSL,FAST,RV,EP,ABONA,EPE,FASTAVG,ABONAVG,EFFAVG
     +  ,EPEF,UT7,UT8,UT10)
        WRITE(U3,*)'EPRIS1,EPRIS2,VGVN2= ',EPRIS1,EPRIS2,VGVN2
        NUSUMNA1=(1-(R2**OPT))*R2/(1-R2)
*        WRITE(*,*)'NUSUMNA1= ',NUSUMNA1
        GOTO 695
********HÄR SKALL DET IN BERÄKNINGAR FÖR BIVALENT OLJA UTELUFTVÄRMEPUMP******
 119    CONTINUE
        Y=10
        ROT=11
        WRITE(*,*)' '
        WRITE(*,*)'CONSIDERS HEATING SYSTEM NUMBER ', Y
        WRITE(*,*)'***************************************************'
        WRITE(U8,*)'VÄRDENA ÄR = ',INPU,AKPU,UTE1,UTE2,NLPU,SLANGU,
     +  LSLANGU
        SLANG1=SLANGO
        SLANG2=SLANGU
        LSLANG1=LSLANGO
        LSLANG2=LSLANGU
        INP2=INPU
        AKP2=AKPU
        NLP1=NLPO
        NLP2=NLPU
        WRITE(U8,*)'MERA VÄRDEN = ',EPRIS1,EPRIS2,CON1,CON2,CON3,INP1,
     +  AKP1,INP2,AKP2,NUSUMNA1,NLP1,NLP2,EFF,VGVN1,TRANSEN,VENTEF,TV,
     +  DUT,BYTE,BIROT,BEFK,AKT,OPT,R1
********HÄR SÄTTS UTE3 TILL 1 SOM SEDAN ANVÄNDS SOM FLAGGA I BIOPTIM****
********DÅ RÄKNAS PÅ UTELUFTVÄRMEPUMP**********************************
        UTE3=1
        GOTO 695
*******SLUTAR HÄR TILLS VIDARE************************
********HÄR SLUTAR ROTBERÄKNINGARNA.*******************************
********KOLLAR VILKA ÅTGÄRDER SOM BLEV BILLIGAST********************
*********OM RESTP = 0.HAR INGA ROTPANNOR TESTATS.DETTA SKER PÅ RAD 111********
```

```
 120    CONTINUE
        BIROT=0
        UTE3=0
        ROT=0
        U6=0
        WRITE(U6,*)'RESTVÄRDET PÅ PANNAN ÄR HÄR= ',RESTP
        IF(RESTP.LT..05)GOTO 111
        WRITE(U,*)' '
        WRITE(1,*)'CALCULATIONS PART 1 COMPLETED'
        WRITE(U,*)'----------------------------'
        WRITE(U,*)' '
       WRITE(U6,*)'NU SKALL RESULTATET ANALYSERAS'
        DO 109 Y=1,10,1
          WRITE(U6,*)'HÄR ÄR RESULTATET',ROTRES(Y),TOTNUVB(Y)
 109    CONTINUE
        P=1
        Y=2
 1117    IF (ROTRES(P).LT.ROTRES(Y))THEN
          Y=Y+1
          GOTO 1117
        ELSE
          IF (ROTRES(Y).LT.1.) THEN
            GOTO 1118
          ENDIF
          P=Y
          Y=Y+1
          GOTO 1117
        ENDIF
 1118   CONTINUE
        SUMBR10=SUMBR1
        NYEFF10=NYEFF
        EXIT10=EXITRANS
        NYENE10=NYENE
        GJ10=GJ
        ISOK10=ISOKOST
        OUNDV10=OUNDV
        RESTP10=RESTP
********HÄR KAN MAN SÄTTA P=NÅNTING FÖR ATT ANALYSERA OLIKA FALL****
********HÄR SKALL SAMTLIGA OPTIMALA ROTSTRATEGIER UNDERSÖKAS********
        DO 1256 PE3=1,10.,1
        P=PE3
*********RAD 1256 LIGGER PÅ RAD C:A 2120 I LÖPANDE RADNUMMER**************
 1260   CONTINUE
        WRITE(U2,*)'U9,HOPP1 = ',U9,HOPP1
*********IF U EQUALS U9 ALL HEATING SYSTEMS ARE SHOWN. IF U EQUALS 0
*********ONLY THE OPTIMAL ONE*****************************************
         U=0
*         U=U9
        IF(HOPP1.EQ.1)U=U9
*        IF(P.EQ.1)U6=U
        WRITE(U6,*)'MINSTA VÄRDET BLEV',ROTRES(P),P
********HÄR ANALYSERAS DETTA FALL*********************************
        WRITE(U6,*)'DEN OUNDV. ROTEN FÖR BEF HUS KOSTAR',SUMBR1
        OUNDV=SUMBR1
        GOTO (61,62,63,64,65,66,67,68,69,6900,1300),P
 61     PANNA=VATYP
        WRITE(U6,*)'DEN BEF ANL BILLIGAST. PANNA= ',VATYP
        SPEC=1
        SUBP=0
        GOTO 1212
 1213   L1=LVA
        L2=NLP
        VGVA=VGVAR
        RESTP=0.
        LIBP=LVA
        SPEC1=0
        ROT=0
        SLANG=SLANGO
        LSLANG=LSLANGO
        GOTO 70
 62     PANNA=' NEW OIL BOILER'
        SPEC1=1
        INP=INPO
        AKP=AKPO
```

```
      RESTP=RESTP10
      LIBP=0
      L1=0.
      L2=NLPO
      EPRIS=EOL
      NVGVA=VGVNO
      ROT=0
      SLANG=SLANGO
      LSLANG=LSLANGO
      SUBP=SUBO
      GOTO 70
 63   PANNA=' ELECTRICAL BOILER'
      INP=INPE
      LIBP=0.
      RESTP=RESTP10
      AKP=AKPE
      SPEC1=1
      L1=0.
      L2=NLPE
      EPRIS=EEL
      NVGVA=VGVNE
      ROT=0
      SLANG=SLANGE
      LSLANG=LSLANGE
      SUBP=SUBE
      GOTO 70
 64   PANNA=' DIST HEATING FIXED RATE'
      RESTP=RESTP10
      SPEC1=1
      INP=INPF
      LIBP=0.
      AKP=AKPF
      L1=0.
      L2=NLPF
      EPRIS=EFJ
      NVGVA=VGVNF
*      WRITE(*,*)'EFJ=,NVGVA= ',EPRIS,NVGVA
      ROT=0
      SLANG=SLANGF
      LSLANG=LSLANGF
      SUBP=SUBE
      GOTO 70
 65   PANNA=' GROUND W HEAT PUMP'
      RESTP=RESTP10
      INP=INPV
      AKP=AKPV
      SPEC1=1
      LIBP=0.
      L1=0.
      L2=NLPV
      EPRIS=EVPS
      NVGVA=VGVNV
      ROT=0
      SLANG=SLANGV
      LSLANG=LSLANGV
      SUBP=SUBO
      GOTO 70
 66   PANNA=' NATURAL GAS'
      INP=INPY
      LIBP=0.
      AKP=AKPY
      L1=0.
      RESTP=RESTP10
      L2=NLPY
      NVGVA=VGVNY
      EPRIS=EGAS
      ROT=0
      SLANG=SLANGY
      LSLANG=LSLANGY
      SPEC1=1
      SUBP=SUBE
      GOTO 70
 67   PANNA=' DISTR HEAT T-O-U'
      INP=INPF
```

```
      AKP=AKPF
      RESTP=RESTP10
      L1=0.
      LIBP=0.
      SPEC1=1
      L2=NLPF
      NVGVA=VGVNF
      ROT=0
      SLANG=SLANGF
      LSLANG=LSLANGF
      SUBP=SUBE
      GOTO 70
 68   CONTINUE
      PANNA=' ELECTRICAL BOILER T-O-U'
      INP=INPE
      LIBP=0.
      RESTP=RESTP10
      AKP=AKPE
      L1=0.
      L2=NLPE
      NVGVA=VGVNE
      ROT=0
      SLANG=SLANGE
      LSLANG=LSLANGE
      SPEC1=1
      SUBP=SUBE
      GOTO 70
 69   CONTINUE
*      WRITE(*,*)'ISOLER(1) VID SATS 69 = ',ISOLER(1)
      PANNA=' BIVALENT GROUND W HEAT PUMP'
      RESTP=RESTP10
      UTE3=0
      INP1=INPO
      INP2=INPV
      LIBP=0.
      AKP1=AKPO
      AKP2=AKPV
      SLANG1=SLANGO
      SLANG2=SLANGV
      LSLANG1=LSLANGO
      LSLANG2=LSLANGV
      L1=0.
      L2=NLPV
      SO=1.
      S1=0.
      CALL NUVARDE(SO,S1,L1,L2,OPT,R1)
      NUFAKT2=S1
      WRITE(U3,*)'NUFAKT2 = ',NUFAKT2
      ROT=10
      SUBP=SUBO
      GOTO 70
 6900 CONTINUE
      PANNA=' BIV. OUTSIDE AIR HEAT PUMP'
      RESTP=RESTP10
      LIBP=0.
      ROT=11
      UTE3=1
      SLANG1=SLANGO
      SLANG2=SLANGU
      LSLANG1=LSLANGO
      LSLANG2=LSLANGU
      INP2=INPU
      INP1=INPO
      AKP2=AKPU
      AKP1=AKPO
      NLP1=NLPO
      NLP2=NLPU
      SUBP=SUBO
      GOTO 70
 1300 WRITE(*,*)'SÅDAN PANNA FINNS EJ.STANNAR'
      STOP
70    CONTINUE
      DO 1407 J2=1,4,1
              DO 1408 J1=1,12,1
```

```
                      SOLROT(J2,J1)=SOL(J2,J1)
*                     WRITE(U6,*)'J2,J1,SOLROT = ',J2,J1,SOLROT(J2,J1)
1408            CONTINUE
1407    CONTINUE
        IF(U.EQ.3)WRITE(U,59)
        IF(U.EQ.1)WRITE(U,16)
        WRITE(U,*)'THE BEST HEATING SYSTEM IS THE ',PANNA
        WRITE(U,*)'======================================='
        ISOKOST=0.
*********NYENE AVSER ENERGI FRÅN PANNA************************
        GJ=NYENE*.0036
        WRITE(U,18)'LOAD   TRANS    ENERGY      RETROFIT    INEVITABLE'
        WRITE(U,18)'(KW)   (W/K)   (MWH/YEAR)  COST (KSEK)  COST (KSEK)'
 18     FORMAT(' ',T28,A)
        WRITE(U,17)'NO RETROFITS',NYEFF,EXITRANS,NYENE/1000.,
     +   ISOKOST/1000.,OUNDV/1000.
 17     FORMAT(' ',T3,A,T27,F5.1,TR2,F7.1,TR3,F7.1,TR4,F7.1,TR6,F7.1)
*********KOLLAR HÄR ROTMATRISEN FÖR ATT SE VAD SOM SKULLE GÖRAS*******
        G=3
        X=1
        TRANSEN1=TRANSEN
        VENTEF1=VENTEF
        BIROT=0
 71     IF (ROTMAT(G,X,P).EQ.0) THEN
          X=X+1
          IF (X.GT.10) THEN
            G=G+1
            IF (G.GT.5) THEN
              GOTO 72
            ENDIF
            X=1
            GOTO 71
          ENDIF
          GOTO 71
        ELSE
          IF (ROTMAT(G,X,P).NE.1) THEN
             WRITE(*,*)'HÄR FUNKADE DET EJ.MATRISEN TROLIGEN SLUT '
             X=X+1
             GOTO 71
          ENDIF
          IF (G.GT.3) THEN
            GOTO 73
          ENDIF
          IF(ROT.GE.10)WRITE(U3,*)'TRANSEN1,VENTEF1= ',TRANSEN1,VENTEF1
          WRITE(U6,*)'EXITRANS = ',EXITRANS
          WRITE(U6,*)'VI BÖRJAR MED NYEFF OCH EXITRANS= ',NYEFF,EXITRANS
          GOTO (81,82,83,84,85,86,87,88,89,891,90),X
 81       CONTINUE
*          WRITE(U,*)'HÄR ÄR X,P,G = ',X,P,G
          NYEFF=NYEFF-(BKT-(BKT*NLAT/(NLAT+BKT*SVARET(X,P))))*AT*DUT
     +    /1000
          EXITRANS=EXITRANS-(BKT-(BKT*NLAT/(NLAT+BKT*SVARET(X,P))))*AT
          TRANSEN1=TRANSEN1-(BKT-(BKT*NLAT/(NLAT+BKT*SVARET(X,P))))*AT
          ISOKOST=ISOKOST+AT*(KOT+(AKT*SVARET(X,P)))
          OUNDV=OUNDV+SUMBROT(3,1,P)-SUMBR1
          IF(P.GE.9)INSUL(1)=SVARET(X,P)
          DO 1110 J=1,12,1
                ENEM(J)=GRAD(J)*EXITRANS/1000.
 1110     CONTINUE
          CALL ENEBAL(ENEM,GRATIS,SOL,A,TV2,ENERG1,ENERG2,ENERES,U6,
     +    GRADTOP)
          GJ=ENERG1*0.0036
          WRITE(U,1)'ATTIC FLOOR INS.',SVARET(X,P),' M',NYEFF,EXITRANS,
     +          ENERG1/1000.,ISOKOST/1000.,OUNDV/1000.
 1      FORMAT(' ',T3,A,F3.2,A,T27,F5.1,TR2,F7.1,TR3,F7.1,TR4,F7.1,
     +  TR6,F7.1)
          X=X+1
          GOTO 71
 82       CONTINUE
          NYEFF=NYEFF-(BKG-(BKG*NLAG/(NLAG+BKG*SVARET(X,P))))*AG*DUT
     +    /1000
          EXITRANS=EXITRANS-(BKG-(BKG*NLAG/(NLAG+BKG*SVARET(X,P))))*AG
          TRANSEN1=TRANSEN1-(BKG-(BKG*NLAG/(NLAG+BKG*SVARET(X,P))))*AG
          ISOKOST=ISOKOST+AG*(KOG+(AKG*SVARET(X,P)))
```

```
          OUNDV=OUNDV+SUMBROT(3,2,P)-SUMBR1
          DO 1111 J=1,12,1
                 ENEM(J)=GRAD(J)*EXITRANS/1000.
 1111     CONTINUE
          CALL ENEBAL(ENEM,GRATIS,SOL,A,TV2,ENERG1,ENERG2,ENERES,U6,
     +    GRADTOP)
          GJ=ENERG1*0.0036
          WRITE(U,1)'FLOOR INS.',SVARET(X,P),' M',NYEFF,EXITRANS,
     +           ENERG1/1000.,ISOKOST/1000.,OUNDV/1000.
          IF(P.GE.9)INSUL(2)=SVARET(X,P)
          X=X+1
          GOTO 71
 83       CONTINUE
*          WRITE(U,*)'HÄR ÄR X,P,G = ',X,P,G
          NYEFF=NYEFF-(BKY-(BKY*NLAY/(NLAY+BKY*SVARET(X,P))))*AY*DUT/
     +    1000
          EXITRANS=EXITRANS-(BKY-(BKY*NLAY/(NLAY+BKY*SVARET(X,P))))*AY
          TRANSEN1=TRANSEN1-(BKY-(BKY*NLAY/(NLAY+BKY*SVARET(X,P))))*AY
          ISOKOST=ISOKOST+AY*(KOY+(AKY*SVARET(X,P)))
          OUNDV=OUNDV-SUMBR1+SUMBROT(3,3,P)
          DO 1112 J=1,12,1
                 ENEM(J)=GRAD(J)*EXITRANS/1000.
 1112     CONTINUE
          CALL ENEBAL(ENEM,GRATIS,SOL,A,TV2,ENERG1,ENERG2,ENERES,U6,
     +    GRADTOP)
*                  IF(P.EQ.3)U6=1
*                  IF(P.EQ.3)CALL TABELL2(GRAD,ENEM,GRATIS,SOL,A,TV2,
*     +            ENERG1,ENERG2,ENERES,U6,TRANSEN1,VENTEF1,DUR)
          GJ=ENERG1*0.0036
          IF(P.GE.9)INSUL(3)=SVARET(X,P)
          WRITE(U,1)'EXT. WALL INS. ',SVARET(X,P),' M',NYEFF,EXITRANS,
     +           ENERG1/1000.,ISOKOST/1000.,OUNDV/1000.
          X=X+1
          GOTO 71
 84       CONTINUE
          WRITE(U6,*)'ROTMAT(G,X,P) = ',ROTMAT(G,X,P)
          WRITE(U6,*)'BKY,NLAI,AI,DUT,KOI,AKI = ',BKY,NLAI,AI,DUT,KOI,
     +    AKI
          NYEFF=NYEFF-(BKY-(BKY*NLAI/(NLAI+BKY*SVARET(X,P))))*AI*DUT/
     +    1000.
          EXITRANS=EXITRANS-(BKY-(BKY*NLAI/(NLAI+BKY*SVARET(X,P))))*AI
          TRANSEN1=TRANSEN1-(BKY-(BKY*NLAI/(NLAI+BKY*SVARET(X,P))))*AI
          WRITE(U6,*)'NUSUM1,HYRA,HOJD = ',NUSUM1,HYRA,HOJD
          ISOKOST=ISOKOST+AI*(KOI+((AKI+NUSUM1*HYRA/HOJD)*SVARET(X,P)))
          OUNDV=OUNDV-SUMBR1+SUMBROT(3,4,P)
          DO 1113 J=1,12,1
                 ENEM(J)=GRAD(J)*EXITRANS/1000.
 1113     CONTINUE
          CALL ENEBAL(ENEM,GRATIS,SOL,A,TV2,ENERG1,ENERG2,ENERES,U6,
     +    GRADTOP)
          GJ=ENERG1*0.0036
          IF(P.GE.9)INSUL(4)=SVARET(X,P)
          WRITE(U,1)'INSIDE WALL INS.',SVARET(X,P),' M',NYEFF,EXITRANS,
     +           ENERG1/1000.,ISOKOST/1000.,OUNDV/1000.
          X=X+1
          GOTO 71
 85       CONTINUE
*          U6=1
          FONSN=1
          SHADE1=SHADE(3)
          SHAD=SHADE(3)
              DO 310 J1=1,12,1
                SOLROT(1,J1)=SOL(1,J1)-SHADE1*SOL(1,J1)
                SOLTROT(1,J1)=SOLROT(1,J1)
                SOLROT(2,J1)=SOL(2,J1)
                SOLROT(3,J1)=SOL(3,J1)
                SOLROT(4,J1)=SOL(4,J1)
 310          CONTINUE
          NYEFF=NYEFF-(MK2-MK3)*ANN*AN*DUT/1000
          EXITRANS=EXITRANS-(KN-KN3)*ANN*AN
          TRANSEN1=TRANSEN1-(KN-KN3)*ANN*AN
          ISOKOST=ISOKOST+ANN*(INTR+AN*AKTR)
          OUNDV=OUNDV+SUMBROT(3,5,P)-SUMBR1-ANN*(INTR+AN*AKTR)
          DO 1114 J=1,12,1
```

```
               ENEM(J)=GRAD(J)*EXITRANS/1000.
 1114     CONTINUE
          CALL ENEBAL(ENEM,GRATIS,SOLROT,A,TV2,ENERG1,ENERG2,ENERES,U6,
     +    GRADTOP)
          GJ=ENERG1*0.0036
                 IF(P.EQ.9)THEN
                      INSUL(5)=MK3
                      WCOST(5)=ANN*(INTR+AN*AKTR)
                 ENDIF
        WRITE(U,17)'TRIPLE-GL. WIN, NORTH',NYEFF,EXITRANS,
     +  ENERG1/1000.,ISOKOST/1000.,OUNDV/1000.
          X=X+1
          GOTO 71
 86       CONTINUE
*          U6=1
          SHADE1=SHADE(3)
          SHAD=SHADE(3)
          FONSO=1
              DO 311 J1=1,12,1
                SOLROT(1,J1)=SOL(1,J1)
                IF(FONSN.EQ.1)SOLROT(1,J1)=SOLTROT(1,J1)
                SOLROT(2,J1)=SOL(2,J1)-SHADE1*SOL(2,J1)
                SOLTROT(2,J1)=SOLROT(2,J1)
                SOLROT(3,J1)=SOL(3,J1)
                SOLROT(4,J1)=SOL(4,J1)
 311          CONTINUE
          NYEFF=NYEFF-(MK2-MK3)*ANO*AO*DUT/1000
          EXITRANS=EXITRANS-(KOS-KO3)*ANO*AO
          TRANSEN1=TRANSEN1-(KOS-KO3)*ANO*AO
          ISOKOST=ISOKOST+ANO*(INTR+AO*AKTR)
*          WRITE(*,*)'SUMBROT(3,6,P),SUMBR1 = ',SUMBROT(3,6,P),SUMBR1
          OUNDV=OUNDV+SUMBROT(3,6,P)-SUMBR1-ANO*(INTR+AO*AKTR)
          DO 1115 J=1,12,1
                 ENEM(J)=GRAD(J)*EXITRANS/1000.
 1115     CONTINUE
          CALL ENEBAL(ENEM,GRATIS,SOLROT,A,TV2,ENERG1,ENERG2,ENERES,U6,
     +    GRADTOP)
*                IF(P.EQ.3)CALL TABELL2(GRAD,ENEM,GRATIS,SOLROT,A,TV2,
*    +           ENERG1,ENERG2,ENERES,U6,TRANSEN1,VENTEF1,DUR)
          GJ=ENERG1*0.0036
                 IF(P.EQ.9)THEN
                      INSUL(6)=MK3
                      WCOST(6)=ANO*(INTR+AO*AKTR)
                 ENDIF
        WRITE(U,17)'TRIPLE-GL. WIN, EAST',NYEFF,EXITRANS,
     +  ENERG1/1000.,ISOKOST/1000.,OUNDV/1000.
          X=X+1
          GOTO 71
 87       CONTINUE
          FONSS=1
          SHADE1=SHADE(3)
          SHAD=SHADE(3)
              DO 312 J1=1,12,1
                SOLROT(1,J1)=SOL(1,J1)
                IF(FONSN.EQ.1)SOLROT(1,J1)=SOLTROT(1,J1)
                SOLROT(2,J1)=SOL(2,J1)
                IF(FONSO.EQ.1)SOLROT(2,J1)=SOLTROT(2,J1)
                SOLROT(3,J1)=SOL(3,J1)-SHADE1*SOL(3,J1)
                SOLTROT(3,J1)=SOLROT(3,J1)
                SOLROT(4,J1)=SOL(4,J1)
 312          CONTINUE
          NYEFF=NYEFF-(MK2-MK3)*ANS*AS*DUT/1000
          EXITRANS=EXITRANS-(KS-KS3)*ANS*AS
          TRANSEN1=TRANSEN1-(KS-KS3)*ANS*AS
          ISOKOST=ISOKOST+ANS*(INTR+AS*AKTR)
*          WRITE(*,*)'SUMBROT(3,7,P)=  ',SUMBROT(3,7,P)
          OUNDV=OUNDV+SUMBROT(3,7,P)-SUMBR1-ANS*(INTR+AS*AKTR)
          DO 1116 J=1,12,1
                 ENEM(J)=GRAD(J)*EXITRANS/1000.
 1116     CONTINUE
          CALL ENEBAL(ENEM,GRATIS,SOLROT,A,TV2,ENERG1,ENERG2,ENERES,U6,
     +    GRADTOP)
          GJ=ENERG1*0.0036
                 IF(P.EQ.9)THEN
```

```
                      INSUL(7)=MK3
                      WCOST(7)=ANS*(INTR+AS*AKTR)
                ENDIF
       WRITE(U,17)'TRIPLE-GL. WIN, SOUTH',NYEFF,EXITRANS,
     +  ENERG1/1000.,ISOKOST/1000.,OUNDV/1000.
          X=X+1
          GOTO 71
 88       CONTINUE
          SHADE1=SHADE(3)
          SHAD=SHADE(3)
          FONSV=1
              DO 313 J1=1,12,1
                SOLROT(1,J1)=SOL(1,J1)
                IF(FONSN.EQ.1)SOLROT(1,J1)=SOLTROT(1,J1)
                SOLROT(2,J1)=SOL(2,J1)
                IF(FONSO.EQ.1)SOLROT(2,J1)=SOLTROT(2,J1)
                SOLROT(3,J1)=SOL(3,J1)
                IF(FONSS.EQ.1)SOLROT(3,J1)=SOLTROT(3,J1)
                SOLROT(4,J1)=SOL(4,J1)-SHADE1*SOL(4,J1)
                SOLTROT(4,J1)=SOLROT(4,J1)
 313          CONTINUE
          NYEFF=NYEFF-(MK2-MK3)*ANV*AV*DUT/1000
          EXITRANS=EXITRANS-(KV-KV3)*ANV*AV
          TRANSEN1=TRANSEN1-(KV-KV3)*ANV*AV
          ISOKOST=ISOKOST+ANV*(INTR+AV*AKTR)
          OUNDV=OUNDV+SUMBROT(3,8,P)-SUMBR1-ANV*(INTR+AV*AKTR)
          DO 1127 J=1,12,1
                 ENEM(J)=GRAD(J)*EXITRANS/1000.
 1127     CONTINUE
          CALL ENEBAL(ENEM,GRATIS,SOLROT,A,TV2,ENERG1,ENERG2,ENERES,U6,
     +    GRADTOP)
*               IF(P.EQ.3)CALL TABELL2(GRAD,ENEM,GRATIS,SOLROT,A,TV,
*   +           ENERG1,ENERG2,ENERES,U6,TRANSEN1,VENTEF1,DUR)
          GJ=ENERG1*0.0036
                 IF(P.EQ.9)THEN
                       INSUL(8)=MK3
                       WCOST(8)=ANV*(INTR+AV*AKTR)
                 ENDIF
       WRITE(U,17)'TRIPLE-GL. WIN, WEST',NYEFF,EXITRANS,
     +  ENERG1/1000.,ISOKOST/1000.,OUNDV/1000.
          X=X+1
          GOTO 71
 89       CONTINUE
          NYEFF=NYEFF-OMDIFF*BA*HOJD*.33*DUT/1000
          EXITRANS=EXITRANS-OMDIFF*BA*HOJD*.33
          VENTEF1=VENTEF1-OMDIFF*BA*HOJD*.33
*          IF(ROT.EQ.10)WRITE(*,*)'VENTEF1= ',VENTEF1
          ISOKOST=ISOKOST+TATKOST
                 IF(P.EQ.9)THEN
                     INSUL(9)=OMDIFF*BA*HOJD*.33
                     WEACOST=TATKOST
                 ENDIF
          DO 1128 J=1,12,1
                 ENEM(J)=GRAD(J)*EXITRANS/1000.
 1128     CONTINUE
          CALL ENEBAL(ENEM,GRATIS,SOLROT,A,TV2,ENERG1,ENERG2,ENERES,U6,
     +    GRADTOP)
          GJ=ENERG1*0.0036
c Changed energi1 to energ1 in version 1.03
         WRITE(U,17)'WEATHERSTRIPPING',NYEFF,EXITRANS,
     +   ENERG1/1000.,ISOKOST/1000.,OUNDV/1000.
          X=X+1
          GOTO 71
 891      CONTINUE
          IF(ROT.GE.10)WRITE(U,*)'FRÅNLVP OCH BIV MYSKO############'
          WRITE(U,*)'INSTALLERA FRÅNLUFTVÄRMEPUMP'
          NYEFF=NYEFF-AFLEFF(P)
**********HÄR SÄTTS EN FLAGGA FÖR ATT RÄKNA MED RÄTT ENERGI OCH TV NEDAN******
          SPEC3=1
          ISOKOST=ISOKOST+NROR+ANFLKOST(P)+AFLANKO(P)
          WRITE(U,*)AFLEFF(P),AFLENE(P),AFLANKO(P),ANFLKOST(P),NROR
          X=X+1
          WRITE(U,*)'******',NYEFF,EXITRANS,ISOKOST,OUNDV
          WRITE(U,*)'OBS EXITRANS ÄNDRAS EJ HÄR!!'
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          GOTO 71
 90       WRITE(*,*)'INGA ROTÅTGÄRDER HÄR.X=11.STANNAR DÄRFÖR'
          STOP
********HÄR BEHANDLAS FYR- OCH FEMGLASFÖNSTER***********************
 73       IF(G.GT.4)GOTO 96
          GOTO (91,91,91,91,92,93,94,95,97),X
 91       X=X+1
          GOTO 71
 92       WRITE(U,*)'BYT TILL ENERGIGLASFÖNSTER ÅT NORR'
**********FONSN = 1 FÖR ATT RÄTT SOLROT SKA VÄLJAS NEDAN *************
          FONSN=1
          SHADE1=SHADE(4)
          SHAD=SHADE(4)
              DO 314 J1=1,12,1
                SOLROT(1,J1)=SOL(1,J1)-SHADE1*SOL(1,J1)
                SOLTROT(1,J1)=SOLROT(1,J1)
                SOLROT(2,J1)=SOL(2,J1)
                SOLROT(3,J1)=SOL(3,J1)
                SOLROT(4,J1)=SOL(4,J1)
 314          CONTINUE
          NYEFF=NYEFF-(MK2-MK4)*ANN*AN*DUT/1000.
          EXITRANS=EXITRANS-(KN-KN4)*ANN*AN
          TRANSEN1=TRANSEN1-(KN-KN4)*ANN*AN
          ISOKOST=ISOKOST+ANN*(INFY+AN*AKFY)
          OUNDV=OUNDV+SUMBROT(4,5,P)-SUMBR1-ANN*(INFY+AN*AKFY)
          DO 1119 J=1,12,1
                 ENEM(J)=GRAD(J)*EXITRANS/1000.
 1119     CONTINUE
          CALL ENEBAL(ENEM,GRATIS,SOLROT,A,TV2,ENERG1,ENERG2,ENERES,U6,
     +    GRADTOP)
          GJ=ENERG1*0.0036
          WRITE(U,*)'######',NYEFF,EXITRANS,ENERG1,GJ,ISOKOST,OUNDV
                 IF(P.EQ.9)THEN
                     INSUL(5)=MK4
                     WCOST(5)=ANN*(INFY+AN*AKFY)
                 ENDIF
          X=X+1
          GOTO 71
 93       WRITE(U,*)'BYT TILL ENERGIGLASFÖNSTER ÅT ÖSTER'
          FONSO=1
          SHADE1=SHADE(4)
          SHAD=SHADE(4)
              DO 315 J1=1,12,1
                SOLROT(1,J1)=SOL(1,J1)
                IF(FONSN.EQ.1)SOLROT(1,J1)=SOLTROT(1,J1)
                SOLROT(2,J1)=SOL(2,J1)-SHADE1*SOL(2,J1)
                SOLTROT(2,J1)=SOLROT(2,J1)
                SOLROT(3,J1)=SOL(3,J1)
                SOLROT(4,J1)=SOL(4,J1)
 315          CONTINUE
          NYEFF=NYEFF-(MK2-MK4)*ANO*AO*DUT/1000.
          EXITRANS=EXITRANS-(KOS-KO4)*ANO*AO
          TRANSEN1=TRANSEN1-(KOS-KO4)*ANO*AO
          ISOKOST=ISOKOST+ANO*(INFY+AKFY*AO)
          OUNDV=OUNDV+SUMBROT(4,6,P)-SUMBR1-ANO*(INFY+AO*AKFY)
          DO 1120 J=1,12,1
                 ENEM(J)=GRAD(J)*EXITRANS/1000.
 1120     CONTINUE
          CALL ENEBAL(ENEM,GRATIS,SOLROT,A,TV2,ENERG1,ENERG2,ENERES,U6,
     +    GRADTOP)
          GJ=ENERG1*0.0036
          WRITE(U,*)'######',NYEFF,EXITRANS,ENERG1,GJ,ISOKOST,OUNDV
                 IF(P.EQ.9)THEN
                     INSUL(6)=MK4
                     WCOST(6)=ANO*(INFY+AKFY*AO)
                 ENDIF
          X=X+1
          GOTO 71
 94       WRITE(U,*)'BYT TILL ENERGIGLASFÖNSTER ÅT SÖDER'
          SHADE1=SHADE(4)
          FONSS=1
              DO 316 J1=1,12,1
                SOLROT(1,J1)=SOL(1,J1)
                IF(FONSN.EQ.1)SOLROT(1,J1)=SOLTROT(1,J1)
```

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              SOLROT(2,J1)=SOL(2,J1)
              IF(FONSO.EQ.1)SOLROT(2,J1)=SOLTROT(2,J1)
              SOLROT(3,J1)=SOL(3,J1)-SHADE1*SOL(3,J1)
              SOLTROT(3,J1)=SOLROT(3,J1)
              SOLROT(4,J1)=SOL(4,J1)
316          CONTINUE
         NYEFF=NYEFF-(MK2-MK4)*ANS*AS*DUT/1000.
         EXITRANS=EXITRANS-(KS-KS4)*ANS*AS
         TRANSEN1=TRANSEN1-(KS-KS4)*ANS*AS
         ISOKOST=ISOKOST+ANS*(INFY+AS*AKFY)
         OUNDV=OUNDV+SUMBROT(4,7,P)-SUMBR1-ANS*(INFY+AS*AKFY)
         DO 1121 J=1,12,1
                ENEM(J)=GRAD(J)*EXITRANS/1000.
1121     CONTINUE
         CALL ENEBAL(ENEM,GRATIS,SOLROT,A,TV2,ENERG1,ENERG2,ENERES,U6,
     +   GRADTOP)
         GJ=ENERG1*0.0036
         WRITE(U,*)'######',NYEFF,EXITRANS,ENERG1,GJ,ISOKOST,OUNDV
                IF(P.EQ.9)THEN
                INSUL(7)=MK4
                WCOST(7)=ANS*(INFY+AS*AKFY)
                ENDIF
         X=X+1
         GOTO 71
95       WRITE(U,*)'BYT TILL ENERGIGLASFÖNSTER MOT VÄSTER'
         SHADE1=SHADE(4)
         SHAD=SHADE(4)
         FONSV=1
             DO 317 J1=1,12,1
               SOLROT(1,J1)=SOL(1,J1)
               IF(FONSN.EQ.1)SOLROT(1,J1)=SOLTROT(1,J1)
               SOLROT(2,J1)=SOL(2,J1)
               IF(FONSO.EQ.1)SOLROT(2,J1)=SOLTROT(2,J1)
               SOLROT(3,J1)=SOL(3,J1)
               IF(FONSS.EQ.1)SOLROT(3,J1)=SOLTROT(3,J1)
               SOLROT(4,J1)=SOL(4,J1)-SHADE1*SOL(4,J1)
               SOLTROT(4,J1)=SOLROT(4,J1)
317          CONTINUE
         NYEFF=NYEFF-(MK2-MK4)*ANV*AV*DUT/1000.
         EXITRANS=EXITRANS-(KV-KV4)*ANV*AV
         TRANSEN1=TRANSEN1-(KV-KV4)*ANV*AV
         ISOKOST=ISOKOST+ANV*(INFY+AV*AKFY)
         OUNDV=OUNDV+SUMBROT(4,8,P)-SUMBR1-ANV*(INFY+AKFY*AV)
         DO 1122 J=1,12,1
                ENEM(J)=GRAD(J)*EXITRANS/1000.
1122     CONTINUE
         CALL ENEBAL(ENEM,GRATIS,SOLROT,A,TV2,ENERG1,ENERG2,ENERES,U6,
     +   GRADTOP)
         GJ=ENERG1*0.0036
         WRITE(U,*)'######',NYEFF,EXITRANS,ENERG1,GJ,ISOKOST,OUNDV
                IF(P.EQ.9)THEN
                    INSUL(8)=MK(4)
                    WCOST(8)=ANV*(INFY+AKFY*AV)
                ENDIF
         X=X+1
         GOTO 71
96       GOTO(959,959,959,959,960,960,960,960,97)X
959      X=X+1
         GOTO 71
960      WRITE(*,*)'HÄR SKALL DET IN  ENERGIGLASFÖNSTER+GASFYLLNING
     +   KLARAR EJ DETTA ÄN.FORTSÄTTER DOCK ÄNDÅ ##################'
         WRITE(*,*)'DETTA ÄR G,X,P',G,X,P
         X=X+1
         GOTO 71
97       WRITE(*,*)'HÄR SKALL DET INTE HAMNA.STANNAR DÄRFÖR'
         STOP
        ENDIF
72      CONTINUE
*        IF(LAN.EQ.2)U6=1
        WRITE(U6,*)'HAR NU RÄKNAT PÅ BILLIGASTE ROTFALL.
     +  RESULTATET BLEV FÖLJANDE:'
        WRITE(U6,*)'ISOLERINGS+TÄT.-KOSTNADEN BLEV',ISOKOST
*********OM BIVALENT PANNA HOPPAR VI TILL BIOPT*******************
*        WRITE(*,*)'ISOLER(1) VID RAD 2250 = ',ISOLER(1)
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        IF(ROT.GE.10)THEN
          SUMPAR=0.
          AAVG1=0.
          BIROT=0
**********HÄR KAN X VARA STÖRRE ÄN 10 VILKET GER FEL I VISSA VERSIONER***
          X=10
          NLA(X)=0.
          BYTE=0.
*          WRITE(*,*)'ISOLER(1) FÖRE DO-LOOP = ',ISOLER(1)
*          WRITE(*,*)'X ÄR HÄR = ',X
          DO 34 J=1,12,1
            ENEM(J)=GRAD(J)*(TRANSEN1+VENTEF1)/1000.
            IF (SPEC3.EQ.1)ENEM(J)=GRAD(J)*(TRANSEN1+VENTEF1)/1000.-
     +      AFLENE(P)/12.
 34       CONTINUE
*          WRITE(*,*)'FÖRE ENEBAL RAD 2263 ISOLER(1)= ',ISOLER(1)
          CALL ENEBAL(ENEM,GRATIS,SOLROT,A,TV2,ENERGID,ENERGID1,ENERES,
     +    U6,GRADTOP)
          TRANSENG=TRANSEN1
          VENTEFG=VENTEF1
          WRITE(U6,*)'TRANSENG, VENTEFG BLEV = ',TRANSENG,VENTEFG
*          UTE3=2
        CALL TAXOR(P,NYEFF,ENERES,EPRIS1,EPRIS2,ROT,SPEC1,EOL,EEL,
     +  EGAS,ANSGAS,EFJ,ANSL,FAST,RV,EP,ABONA,EPE,FASTAVG,ABONAVG,EFFAVG
     +  ,EPEF,UT7,UT8,UT10)
          WRITE(U1,*)'EPRIS1, EPRIS2 = ',EPRIS1,EPRIS2
*          WRITE(*,*)'ISOLER(1) FÖRE BIOPTIM = ',ISOLER(1)
          CALL BIOPTIM(CON1,CON2,EPRIS1,EPRIS2,INP1,AKP1,INP2,AKP2,
     +    NUSUMNA1,CON3,NUFAKT1,NUFAKT2,NYEFF,BIOPT2,NYPA,NYNUVEN,
     +    VGVN1,VGVN2,ENERGID,ENERGID1,TV,NLA(X),DUT,BYTE,BIROT,BEFK,
     +    AK(X),SVARETA,OPT,R1,EXTRA,EXTRA1,LAN)
*          WRITE(*,*)'ISOLER(1) EFTER BIOPTIM = ',ISOLER(1)
          U3=0
          WRITE(*,*)' '
          WRITE(U3,*)'NUVÄRDE ENERGI BLEV = ',NYNUVEN
          WRITE(U3,*)'NYA PANNOR KOSTAR INKL SLANGAR = ',NYPA
          WRITE(U,9)'THERMAL SIZE OF HEAT PUMP  = ',BIOPT2,' KW'
          WRITE(U,9)'THERMAL SIZE OF OIL-BOILER = ',NYEFF-BIOPT2,' KW'
 9             FORMAT(' ',T3,A,F5.1,A)
          WRITE(*,*)' '
*          WRITE(*,*)'ISOLER(1) VID BIVALENT = ',ISOLER(1)
********HÄR SKA SLANGKOSTNAD BERÄKNAS FÖR ATT FÅ RÄTT VÄRDE I TABELL****
                S1=0.
                SO=SLANG1*(NYEFF-BIOPT2)
                L1=0.
                L2=LSLANG1
                CALL NUVARDE(SO,S1,L1,L2,OPT,R1)
                WRITE(U3,*)'SLANGKOSTNAD FÖR BIV.OLJEPANNA = ',S1
                NYSLANG=S1
                S1=0
                SO=SLANG2*BIOPT2
                L1=0.
                L2=LSLANG2
                CALL NUVARDE(SO,S1,L1,L2,OPT,R1)
                WRITE(U3,*)'SLANGAR FÖR VÄRMEPUMP KOSTAR = ',S1
                NYSLANG=NYSLANG+S1
                WRITE(U3,*)'TOTAL SLANGKOSTNAD BLEV = ',NYSLANG
                IF(SPEC.EQ.1)NYSLANG=0.
                GOTO 1695
        ENDIF
        S1=0.
        SO=INP+NYEFF*AKP
        SUBVPB=0.
        IF(LAN.EQ.2.AND.P.GE.2)SUBVPB=SO*SUBV
        WRITE(U6,*)'INP,NYEFF,AKP,SO,L1,L2,OPT,R1=',INP,NYEFF,AKP,SO,L1,
     +  L2,OPT,R1
        CALL NUVARDE (SO,S1,L1,L2,OPT,R1)
        NYPA=S1
        WRITE(U6,*)'RESTKOSTNADEN PÅ DEN BEFINTLIGA PANNAN=',RESTP
        SO=SLANG*NYEFF
        SUBVSB=0.
        IF(LAN.EQ.2.AND.Y.GE.2)SUBVSB=SO*SUBV
        S1=0.
        L1=0.
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        L2=LSLANG
        CALL NUVARDE (S0,S1,L1,L2,OPT,R1)
        NYSLANG=S1
        IF(SPEC.EQ.1)NYSLANG=0.
        WRITE(U6,*)'SLANGKOSTNAD MED TOTALROT BLEV = ',NYSLANG
        NYPA=NYPA+NYSLANG
        IF(LAN.EQ.1)NYPA=NYPA-SUBP
        IF(LAN.EQ.2)NYPA=NYPA-SUBVPB-SUBVSB
        WRITE(U6,*)'NYA PANNKOSTNADEN BLEV',NYPA
        NUSUMB=(1.-(R2**LIBP))*R2/(1.-R2)
        NUSUMNA=(1.-(R2**(OPT-LIBP)))*R2/(1-R2)
*        WRITE(*,*)'LIBP,NUSUMB,NUSUMNA=',LIBP,NUSUMB,NUSUMNA
        IF(P.EQ.1)THEN
          SPEC2=1
          P=P2
        ENDIF
        IF(SPEC3.EQ.1)THEN
*                U5=1
*                U6=1
                WRITE(U5,*)' ***** HÄR BLIR DET FRÅNLUFTV.P.**** '
                IF(TV.GT.AFLENE(P))THEN
                        AFLENE1=0.
                        TV1=TV-AFLENE(P)
                ELSE
                        TV1=0.
                        AFLENE1=AFLENE(P)-TV
                ENDIF
        WRITE(U5,*)'TV1 RESP AFLENE1 = ',TV1,AFLENE1
        ENDIF
        DO 636 J=1,12,1
          ENEM(J)=GRAD(J)*EXITRANS/1000.
        IF(SPEC3.EQ.1)ENEM(J)=GRAD(J)*EXITRANS/1000.-AFLENE1/12.
 636    CONTINUE
        IF(SPEC3.NE.1)THEN
TV1=TV
DO 1847 J=1,12
TV12(J)=TV2(J)
 1847 CONTINUE
ENDIF
C U6=7 GER UTSKRIFT AV ENERGIBALANS TILL FILEN OPUT.TXT, 931122
C SE ÄVEN NÅGRA RADER LÄNGRE NER DÄR U6 SÄTTS TILL 0
CALL ENEBAL(ENEM,GRATIS,SOLROT,A,TV12,ENERGI2,ENERGI1,ENERES,U6,
     +  GRADTOP)
U6=7
WRITE(U6,*)'ENERGIBALANS FÖR SYSTEM NR ',P
CALL TABELL2(GRAD,ENEM,GRATIS,SOLROT,A,TV12,ENERGI1,ENERGI2,
     + ENERES,U6,TRANSEN1,VENTEF1,DUR)
U6=0
 518    CALL TAXOR(P,NYEFF,ENERES,AAVG,EPRIS,ROT,SPEC1,EOL,EEL,
     +  EGAS,ANSGAS,EFJ,ANSL,FAST,RV,EP,ABONA,EPE,FASTAVG,ABONAVG,EFFAVG
     +  ,EPEF,UT7,UT8,UT10)
        WRITE(U6,*)'P,NYEFF,ENERGI2,AAVG,EPRIS,ROT',P,NYEFF,ENERGI2,
     +  AAVG,EPRIS,ROT
        NPKBEN=NUSUMB*ENERGI2*EPRIS/VGVA
        NPKNEN=NUSUMNA*R2**LIBP*ENERGI2*EPRIS/NVGVA
        NYNUVEN=NPKBEN+NPKNEN
        WRITE(U6,*)'NPKBEN,NPKNEN=  ',NPKBEN,NPKNEN
        WRITE(U6,*)'NUVÄRDET FÖR NYA ENERGIN BLEV',NYNUVEN
********SUMMERAR KOSTNADERNA FÖR BILLIGASTE FALLET****************
        AAVG1=0.
        IF(SPEC2.EQ.1)P=1
        SPEC2=0
        P2=0
        SPEC=0
        IF(LAN.EQ.1.AND.P.EQ.5)THEN
                ENERHP=ENERGI2/NVGVA
                SUBVHP=SUBVP*(ENERGI2-ENERHP)
                NYPA=NYPA-SUBVHP
        ENDIF
        IF(P.EQ.7.OR.P.EQ.4.OR.P.EQ.6)AAVG1=AAVG
 1695   CONTINUE
        BILLNUV=RESTP+OUNDV+NYPA+NYNUVEN+ISOKOST+AAVG1
        RESUL(PE3)=BILLNUV
        EXNYP=NYPA-NYSLANG
```

```
        WRITE(U,*)' '
        WRITE(U,*)'DIFFERENT PARTS OF THE LCC IN SEK:'
        WRITE(U,*)'---------------------------------'
        WRITE(U,8)'SALVATION VALUE EXISTING BOILER   = ',RESTP
        WRITE(U,8)'INEVITABLE BUILDING RETROFIT COST = ',OUNDV
        WRITE(U,8)'NEW BOILERS COST, PIPING EXCLUDED = ',EXNYP
        WRITE(U,8)'PIPING COST                       = ',NYSLANG
        WRITE(U,8)'ENERGY COST                       = ',NYNUVEN
        WRITE(U,8)'BUILDING RETROFIT COST            = ',ISOKOST
        WRITE(U,8)'CONNECTION FEE                    = ',AAVG1
        WRITE(U,7)'-----------'
        WRITE(U,8)'THE LOWEST COMBINATION LCC        = ',BILLNUV
        WRITE(U,8)'INCREMENTAL LCC                   = ',ROTRES(P)
        WRITE(U,7)'-----------'
 8      FORMAT(' ',T3,A,F8.0)
 7      FORMAT(' ',T37,A)
********HÄR SÄTTS VÄRDEN IN SOM SEDAN ANVÄNDS I TABELLEN*************
        RESPA(PE3)=RESTP
        PANNK(PE3)=NYPA-NYSLANG
        SLANGAR(PE3)=NYSLANG
        ENENUV(PE3)=NYNUVEN
        AVGIFT(PE3)=AAVG1
        ISOLER(PE3)=ISOKOST
*        WRITE(*,*)'ISOLER(1) FÖRE = ',ISOLER(1)
*        WRITE(*,*)'PE3 = ',PE3,'  ISOLER(PE3)= ',ISOLER(PE3)
*        WRITE(*,*)'ISOLER(1) = ',ISOLER(1)
        INEVIT(PE3)=OUNDV
        DIFF=ROTRES(P)-BILLNUV
        WRITE(U,8)'DIFFERENCE BETWEEN INC. AND COMB.   ',DIFF
        ROT=0
        BIROT=0
        SPEC3=0
        FONSN=0
        FONSO=0
        FONSS=0
        FONSV=0
        SUMBR1=SUMBR10
        NYEFF=NYEFF10
        EXITRANS=EXIT10
        GJ=GJ10
        NYENE=NYENE10
        ISOKOST=ISOK10
        OUNDV=OUNDV10
        IF(HOPP.EQ.1)GOTO 1261
        IF(HOPP.EQ.2)GOTO 1262
        S0=1.
        S1=0.
        L1=0.
        L2=LSLANG1
        CALL NUVARDE(S0,S1,L1,L2,OPT,R1)
        NUFAKT(3)=S1
        S0=1.
        S1=0.
        L1=0.
        L2=LSLANG2
        CALL NUVARDE(S0,S1,L1,L2,OPT,R1)
        NUFAKT(4)=S1
        NUFAKT(1)=NUFAKT1
        NUFAKT(2)=NUFAKT2
        IF(P.EQ.9.AND.CHECK.EQ.0)THEN
          WRITE(4,*)EPRIS1,HELP,LELP,(ABONA(J),J=1,12),(SAK(J),J=1,12)
          WRITE(4,*)INP1,AKP1,INP2,AKP2,NUSUMNA1,(NUFAKT(J),J=1,4)
          WRITE(4,*)EFF,BIOPT2,VGVN1,VGVN2,TV,(NLA(J),J=1,4),DUT
          WRITE(4,*)(A(J),J=1,8),(BK(J),J=1,5)
          WRITE(4,*)(KO(J),J=1,4),(AK(J),J=1,4),(WCOST(J),J=5,8)
          WRITE(4,*)(INSUL(J),J=1,10),OPT,R1,WEACOST
          WRITE(4,*)(GRAD(J),J=1,12)
          WRITE(4,*)TRAN1,VENT1,(GRATIS(J),J=1,12)
          WRITE(4,*)((SOL(I,J),I=1,4),J=1,12),SHAD
          WRITE(4,*)SLANG1,SLANG2,INEVIT(9),RESTP
                 CHECK=1
                 CLOSE(4)
        ENDIF
*       IF(P.EQ.9)CALL BIVAL(EPRIS1,ABONA,INP1,AKP1,INP2,AKP2,
```

```
*     +  NUSUMNA1,NUFAKT,EFF,BIOPT2,SUMPAR,NUVENBI,VGVN1,VGVN2,
*     +  TV,NLA,DUT,A,BK,IN,KO,AK,WCOST,INSUL,OPT,R1,FASTAVG,ABONAVG,
*     +  EFFAVG,NYEFF,GRAD,TRAN1,VENT1,GRATIS,SOL,SHAD)
 1256   CONTINUE
        DO 1257 Y1=1,10,1
                WRITE(U1,*)'RESUL(',Y1,') = ',RESUL(Y1)
                WRITE(U1,*)'RESPA(',Y1,') = ',RESPA(Y1)
                WRITE(U1,*)'PANNK(',Y1,') = ',PANNK(Y1)
                WRITE(U1,*)'SLANGAR(',Y1,') = ',SLANGAR(Y1)
                WRITE(U1,*)'ENENUV(',Y1,') = ',ENENUV(Y1)
                WRITE(U1,*)'AVGIFT(',Y1,') = ',AVGIFT(Y1)
                WRITE(U1,*)'ISOLER(',Y1,') = ',ISOLER(Y1)
                WRITE(U1,*)'INEVIT(',Y1,') = ',INEVIT(Y1)
 1257   CONTINUE
        PE3=1
        Y1=2
 1258   IF(RESUL(PE3).LT.RESUL(Y1))THEN
                Y1=Y1+1
                GOTO 1258
        ELSE
                IF(RESUL(Y1).LT.1.)GOTO 1259
                PE3=Y1
                Y1=Y1+1
                GOTO 1258
        ENDIF
 1259   CONTINUE
        WRITE(U,*)'LÄGSTA RESULTAT BLEV= ',RESUL(PE3)
WRITE(7,*)'OPTIMALT SYSTEM HAR NUMMER = ',PE3
        P=PE3
*        U6=1
*        U=1
        HOPP=1
        HOPP1=1
        GOTO 1260
 1261   CONTINUE
*        IF(SVARET(3,7).LT..05)HOPP=2
*********HÄR KAN MAN PRÖVA ATT ÄNDRA ISOLERTJOCKLEK OCH SE OM NÅT HÄNDER***
*        WRITE(*,*)'SVARET(3,6) = ',SVARET(3,6)
*        ROTMAT(3,3,6)=1
*        READ(1,*)VARDE
*        IF (VARDE.GT.1.)STOP'NU SKA DET STANNA NATURLIGT'
*        SVARET(3,6)=VARDE
*        WRITE(*,*)'HOPP= ',HOPP
*        U9=3
*        SVARET(3,7)=.12
*        GOTO 1260
 1262   CONTINUE
        HOPP=0
        IF(VARIANT.EQ.'OPTIMERINGSTID =') GOTO 600
        IF (VARIANT.EQ.'REAL KALKYLRÄNTA =')GOTO 600
        IF (VARIANT.EQ.'ENERGIPRISHÖJNINGAR I % =')GOTO 600
        IF (VARIANT.EQ.'ANTALET GRADTIMMAR = ')STOP'NU ÄR DET SLUT'
        VARIANT='BASE CASE'
        NUMMER=1.
 600    CONTINUE
        WRITE(U2,*)'FÖRE TABELL1 ÄR U, U9 = ',U,U9
        IF(U.EQ.3)WRITE(U,59)
        WRITE(1,*)' '
        WRITE(1,*)'CALCULATIONS PART 2 COMPLETED'
        WRITE(1,*)'----------------------------'
        IF(U.EQ.1)WRITE(U,16)
        CALL TABELL1(U,SPARMAT,ROTRES,VARIANT,NUMMER,RESUL,RESPA,
     +  PANNK,SLANGAR,ENENUV,AVGIFT,ISOLER,INEVIT)
*        IF(U9.EQ.3)STOP' UTSKRIFT SNART KLAR'
        IF(ST1.EQ.1)THEN
CLOSE(UNIT=1,STATUS='KEEP')
CLOSE(6)
STOP' ST1=1 STOPS HERE'
ENDIF
        IF(U.EQ.0)HOPP1=0
        IF (OPT.LE.10.) GOTO 601
        IF (VARIANT.EQ.'REAL KALKYLRÄNTA =') GOTO 601
        IF (VARIANT.EQ.'ENERGIPRISHÖJNINGAR I % =')GOTO 602
        IF(VARIANT.EQ.'ANTALET GRADTIMMAR = ')GOTO 605
```

```
********HÄR SKALL PRÖVAS OLIKA OPTIMERINGSTIDER**************************
        OPT=OPT-10.
        OPTB=OPT
        RESTP=0.
        VGVA=VGVAR
        VARIANT='OPTIMERINGSTID ='
        NUMMER =OPT
        Y=1
*        DO 1002 I=1,7,1
*        WRITE(*,*)A(I),IN(I),NL(I),L(I),OPTB,R1,SUMBR
* 1002   CONTINUE
        GOTO 5
 601    OPT=OPTA
        OPTB=OPTA
*        WRITE(*,*)'NU BLEV OPT.TIDEN ÅTERIGEN=',OPTA
*************HÄR PRÖVAR VI MED OLIKA RÄNTOR************************
        IF(R3.GT..07) GOTO 602
        IF (VARIANT.EQ.'OPTIMERINGSTID =') R3=.01
        R3=R3+.02
        R1=1+R3
        R2=(1+Q)/(1+R3)
        RESTP=0.
        VGVA=VGVAR
        VARIANT='REAL KALKYLRÄNTA ='
        NUMMER=R3
        Q1=Q
        Y=1
        GOTO 5
 602    R1=1+R
        R2=(1+Q)/(1+R)
*        WRITE(*,*)'NU BLEV R1=',R1
**************HÄR SKALL VI KOLLA STIGANDE ENERGIPRIS(= Q ÖKAR)**********
 603    IF(Q1.GT..025)GOTO 604
        Q1=Q1+.01
        R2=(1+Q1)/(1+R)
        RESTP=0.
        VGVA=VGVAR
        VARIANT='ENERGIPRISHÖJNINGAR I % ='
        NUMMER=Q1
        Y=1
        GOTO 5
 604    Q=0.
        R2=(1+Q)/(1+R)
*        WRITE(*,*)'NU ÄR ÅTERIGEN R2=',R2
**********HÄR SKALL VI KOLLA ÄNDRAT KLIMAT**********************
 605    IF (GRADT.GT.140000.)GOTO 606
        IF(VARIANT.EQ.'ENERGIPRISHÖJNINGAR I % =')GRADT =30000.
        GRADT=GRADT+20000.
        VARIANT='ANTALET GRADTIMMAR = '
        NUMMER=GRADT
        RESTP=0.
        VGVA=VGVAR
        Y=1
        GOTO 5
 606    GRADT=105241.
************HÄR KAN VI TESTA NÅGOT ANNAT**********************
        WRITE(*,*)'STANNAR HÄR SÅ LÄNGE'
CLOSE(6)
        STOP
        END
```

2.2 Appendix B. The subroutines as found in the file TR8.FOR

```
        SUBROUTINE NUVARDE(S0,S1,L1,L2,OPT,R1)
            REAL S0,S1,L1,L2,OPT,R1
        IF(S0.LT.0.05)GOTO 500
        IF(L2.LT.0.05)GOTO 500
        IF(L1.GE.OPT)THEN
          S1=0.
```

```
          GOTO 500
        ENDIF
 100    S1=S1+S0*R1**(-L1)
*        WRITE(*,*)'S0,S1,L1,L2,OPT,R1=',S0,S1,L1,L2,OPT,R1
        L1=L1+L2
        IF(L1.GT.OPT) THEN
          GOTO 400
        ELSE
          GOTO 100
        ENDIF
 400    S1=S1-(((L1-OPT)/L2)*S0)*R1**(-OPT)
*        WRITE(*,*)'MEN NU ÄR S1 = ',S1
 500    RETURN
        END
*****************************************************************
        SUBROUTINE SKALROT (A,IN,NL,L,OPTB,R1,SUMBR)
        REAL A(8),IN(10),NL(7),L(5),L1,L2,OPTB,R1,SUMBR,S0,S1
        INTEGER Z,U
        SUMBR=0.
        U=0
        DO 250 Z=1,8,1
          WRITE(U,*)'Z,A,IN,NL,L = ',Z,A(Z),IN(Z),NL(Z),L(Z)
          S0=A(Z)*IN(Z)
          S1=0.
          IF(Z.GT.5)THEN
            L1=L(5)
            L2=NL(5)
            GOTO 260
          ENDIF
          L1=L(Z)
          L2=NL(Z)
 260      OPT=OPTB
          CALL NUVARDE (S0,S1,L1,L2,OPT,R1)
        WRITE(U,*)'DETTA ÄR S1 OCH Z  ',S1,Z
          SUMBR=SUMBR+S1
 250    CONTINUE
        RETURN
        END
******************SUBRUTIN TABELL1**********************************
        SUBROUTINE TABELL1 (U,SPARMAT,ROTRES,VARIANT,NUMMER,RESUL,
     +  RESPA,PANNK,SLANGAR,ENENUV,AVGIFT,ISOLER,INEVIT)
        REAL SPARMAT(15,10),ROTRES(10),NUMMER,RESUL(10),RESPA(10),
     +  PANNK(10),SLANGAR(10),ENENUV(10),AVGIFT(10),ISOLER(10),
     +  INEVIT(10)
        INTEGER U,Y
        CHARACTER*25 VARIANT
*********OM U=1 FÅS UTSKRIFT PÅ SKÄRMEN OM U=3 FÅS UTSKRIFT PÅ PRINTER
*********KAN STYRAS FRÅN HUVUDPROG MEN MAN FÅR MYCKET ANNAT DÅ*******
        WRITE(U,1001)'***  LCC TABLE FOR  ',VARIANT,NUMMER,'  ***'
        WRITE(U,1007)'     VALUES IN MSEK'
        WRITE(U,1007)'=========================================='
 59     FORMAT('1')
 1001   FORMAT('',T25,2A,F5.2,A)
        WRITE(U,1002)' EXIS.  NEW  ELE.  DIST. GR.W  NAT.  TOU   TOU   B
     +IV.  BIV.O.'
 1002   FORMAT(' ',T19,A)
        WRITE(U,1004)' SYST.  OIL  HEAT  HEAT  HEAT  GAS   DIST  ELEC. G
     +R.HP AIR HP'
 1004   FORMAT(' ',T19,A)
        WRITE(U,*)' ----------------------------------------------------
     +------------------------'
        WRITE(U,1006)'NO BUILD. RETR.',(SPARMAT(1,Y),Y=1,10)
 1006   FORMAT(' ',TR1,A,TR1,10(F5.2,TR1))
        WRITE(U,*)' SAVINGS:'
        WRITE(U,1006)'ATTIC FL. INS  ',(SPARMAT(2,Y),Y=1,10)
        WRITE(U,1006)'FLOOR INS.     ',(SPARMAT(3,Y),Y=1,10)
        WRITE(U,1006)'EXT. WALL INS. ',(SPARMAT(4,Y),Y=1,10)
        WRITE(U,1006)'INS. WALL INS. ',(SPARMAT(5,Y),Y=1,10)
        WRITE(U,1006)'TRIPLE-GLAZING ',(SPARMAT(6,Y),Y=1,10)
        WRITE(U,1006)'TRIPLE-GL. L.E.',(SPARMAT(7,Y),Y=1,10)
        WRITE(U,1006)'TR.-GL. L.E. G.',(SPARMAT(8,Y),Y=1,10)
        WRITE(U,1006)'WEATHERSTRIP.  ',(SPARMAT(9,Y),Y=1,10)
        WRITE(U,1006)'EXH. AIR H. P. ',(SPARMAT(10,Y),Y=1,10)
        WRITE(U,1008)'----------------------------------------------
```

```
     +-------------------------'
 1008   FORMAT(TR2,A)
        WRITE(U,1006)'SUM. OF RETRO. ',(ROTRES(Y)/1.E6,Y=1,10)
        WRITE(U,1006)'SUM. OF COMB.  ',(RESUL(Y)/1.E6,Y=1,10)
        WRITE(U,1008)'-----------------------------------------------
     +-------------------------'
        WRITE(U,*)'DISTRIBUTION:'
        WRITE(U,1006)'SAL. OLD BOILER',(RESPA(Y)/1.E6,Y=1,10)
        WRITE(U,1006)'NEW BOIL. COST ',(PANNK(Y)/1.E6,Y=1,10)
        WRITE(U,1006)'PIPING COST    ',(SLANGAR(Y)/1.E6,Y=1,10)
        WRITE(U,1006)'ENERGY COST    ',(ENENUV(Y)/1.E6,Y=1,10)
        WRITE(U,1006)'CONNECTION FEE ',(AVGIFT(Y)/1.E6,Y=1,10)
        WRITE(U,1006)'BUIL. RETROF. C',(ISOLER(Y)/1.E6,Y=1,10)
        WRITE(U,1006)'INEVITABLE COST',(INEVIT(Y)/1.E6,Y=1,10)
        WRITE(U,1008)'==============================================
     +==========================='
 1007   FORMAT(' ',T25,A)
        WRITE(U,59)
        U=0
        RETURN
        END
**************************************************************************
        SUBROUTINE TAXOR(Y,EFF,ENEM,AAVG,EPRIS,ROT,SPEC1,EOL,EEL,EGAS,
     +  ANSGAS,EFJ,ANSL,FAST,R,EP,ABONA,EPE,FASTAVG,ABONAVG,EFFAVG,
     +  EPEF,U7,U8,U10)
        IMPLICIT REAL (A-Z)
        INTEGER Y,J,ROT,SPEC1,U7,U8,TYP,KONTROLL,U10
        DIMENSION FAST(3),ENEM(12),EP(12),EPE(12),EPEF(12),ABONA(12)
********* OM ROT= 10 SÅ RÄKNAR JAG PÅ BIVALENTA SYSTEM TVÅ ENERGIPRIS******
********* ÅKER DÅ TILLBAKA DET ENA I AAVG**********************************
        IF(ROT.GE.10) THEN
          AAVG=EOL
          EPRIS=EEL
          RETURN
        ENDIF
        GOTO(21,21,23,24,23,26,27,28,29,30),Y
 21     EPRIS=EOL
        RETURN
 23     CONTINUE
*********HÄR SKALL DET IN RIKTIGA ELTAXOR. OM DIFF ELTAXA SE UNDER 28 NEDAN****
        EPRIS=EEL
        RETURN
 24     EPRIS=EFJ
        AAVG=0.
*********HÄR KOLLAS OM DET BEF VÄRMESYST ÄR FJ.V.I SÅ FALL AAVG=0.
        IF(SPEC1.EQ.1)AAVG=ANSL*EFF
        RETURN
*********HÄR SKALL DET IN RIKTIGA TAXOR************************
*********BÖRJAR MED FJÄRRVÄRMEN I MALMÖ SOM JAG KAN BÄST********
 26     EPRIS=EGAS
        AAVG=ANSGAS*EFF
*        U10=1
        WRITE(U10,*)'NU ÄR DET NATURGAS I TAXOR'
        WRITE(U10,*)'ENERGIPRIS NATURGAS = ',EPRIS
        WRITE(U10,*)'ANSLUTNINGSAVGIFT = ',AAVG
        RETURN
 27     CONTINUE
******  BÖRJAR MED ANSLUTNINGSAVGIFTEN*******************
        WRITE(U7,*)'EFFEKTEN ÄR ',EFF
        AAVG=0.
        IF(SPEC1.EQ.1)AAVG=ANSL*EFF
        WRITE(U7,*)'ANSLUTNINGSAVGIFTEN BLEV ',AAVG
******  HÄR KOMMER DEN FASTA AVGIFTEN**********************
******  FÖRST BERÄKNAS DEBITERINGSEFFEKTEN*****************
        EFOR=ENEM(1)+ENEM(2)
        WRITE(U7,*)'ENEM(1),ENEM(2)',ENEM(1),ENEM(2)
        WRITE(U7,*)'ENERGIN I JANUARI+FEBRUARI BLEV  ',EFOR
        DEEF=EFOR/(31*24.+((3*28.+29.)/4.)*24.)
        WRITE(U7,*)'ROT = ',ROT
        WRITE(U7,*)'DEBITERINGSEFFEKTEN BLEV= ',DEEF
        IF(ROT.EQ.1)GOTO 36
******HÄR GÖRS ETT HOPP FÖR ATT FÅ IN NY TAXA FRÅN APRIL 86********
*        IF(DEEF.LT.25.01)THEN
*          FASTAV=FAST(1)+FAST(2)*DEEF
```

```
*          EXTRA=FAST(2)
*          GOTO 41
*        ELSEIF (DEEF.LT.100.01)THEN
*          FASTAV=FAST(3)+FAST(4)*DEEF
*          EXTRA=FAST(4)
*          GOTO 41
*        ELSEIF (DEEF.LT.800.01)THEN
*          FASTAV=FAST(5)+FAST(6)*DEEF
*          EXTRA=FAST(6)
*          GOTO 41
*        ELSE
*          FASTAV=FAST(7)+FAST(8)*DEEF
*          EXTRA=FAST(8)
*        ENDIF
********HÄR KOMMER NYA TAXAN************************************
        IF (DEEF.LT.801.) THEN
          FASTAV=FAST(1)+(FAST(3)*DEEF*R)
          EXTRA=FAST(3)*DEEF*R
        ELSE
          FASTAV=FAST(2)+(FAST(3)*DEEF*R)
          EXTRA=FAST(3)*DEEF*R
        ENDIF
* 41     CONTINUE
        WRITE(U7,*)'DEN FASTA AVGIFTEN BLEV =',FASTAV
        WRITE(U7,*)'FAST(2),FAST(3),R = ',FAST(2),FAST(3),R
        FASTAV1=FASTAV
        GOTO 37
 36     FASTAV1=DEEF*FAST(3)*R
        WRITE(U7,*)'DEN FASTA AVGIFTEN VID ROT BLEV = ',FASTAV1
********NU KOMMER INDEXUPPRÄKNING OCH MULT.MED R-VÄRDE*******************
* 37     FASTAV1=R*FASTAV*(INDEX-145.)/145
* 37     FASTAV1=R*FASTAV
        WRITE(U7,*)'DEN FASTA AVGIFTEN MED INDEX OCH R-JUST=',FASTAV1
********NU KOMMER ENERGIAVGIFTEN**********************
 37     CONTINUE
        SUMENK=0.
        ENER=0.
        DO 100 J=1,12,1
          SUMENK=SUMENK+EP(J)*ENEM(J)
          WRITE(U7,*)'SUMENK,EP(J),ENEM(J)= ',SUMENK,EP(J),ENEM(J)
          ENER=ENER+ENEM(J)
          WRITE(U7,*)'ENER= ',ENER
 100    CONTINUE
        EPRIS=(FASTAV1+SUMENK)/ENER
        WRITE(U7,*)'MEDELPRIS MED DIFF FJ.V.TAXA BLEV',EPRIS
        WRITE(U7,*)'ENDAST RÖRLIGA KOSTNADEN MEDEL = ',SUMENK/ENER
        WRITE(U7,*)'FASTAV1 = ',FASTAV1
*        U7=0
        RETURN
 28     CONTINUE
*********HÄR SKALL DET IN EN DIFFERENTIERAD ELTAXA TYP MALMÖ**************
        U8=0
        WRITE(U8,*)'NU ÄR JAG I DIFFERENTIERAD ELTAXA'
*********HÄR KOMMER DET SENARE IN EN ENGÅNGSAVGIFT VIG LÅGSPÄNNINGSTAXA******
*********TILLS VIDARE BORTSES FRÅN DENNA. AAVG= 0.**********************
        WRITE(U8,*)'EFFEKTEN ÄR = ',EFF
        IF(ROT.EQ.1)THEN
                ABON1=ABON2*EFF
                WRITE(U8,*)'NU BLEV ABON1 = ',ABON1
                IF(TYP.EQ.0)GOTO 200
                IF(TYP.EQ.1)GOTO 350
        ENDIF
        ABON=0.
        AAVG=0.
*********VI ANTAR 380 VOLT SPÄNNING SAMT COS FI = 1
        SAKRING=EFF*1000./(380.*SQRT(3.))
        WRITE(U8,*)'SÄKRINGSSTORLEK BLEV = ',SAKRING,' AMPERE'
********ENLIGT TAXAN SKA DET VARA 250 I ST. FÖR 300**************
        IF(SAKRING.GT.250.)GOTO 300
        WRITE(U8,*)'LÅGSPÄNNINGSTAXA'
********HÄR SÄTTER JAG EN FLAGGA FÖR ATT KOMMA IHÅG OM LÅGSP.TAXA
        TYP=0
*********OM KONTROLL = 1 HAR JAG FÖRUT RÄKNAT MED EFFEKTTAXA*********
        IF(KONTROLL.EQ.1) THEN
```

```
                WRITE(*,*)'&&&&&&&&&& HÄR BLIR DET PROBLEM &&&&&&&'
                WRITE(*,*)'EFFEKTTARIFF FÖRST SEDAN SÄKRINGSTARIFF'
                WRITE(*,*)'PROGRAMMET RÄKNAR FEL PÅ DIFF ELTAXOR'
        ENDIF
        KONTROLL=0
        IF(SAKRING.GT.200.)THEN
          ABON=ABONA(12)
          GOTO 200
        ELSEIF (SAKRING.GT.160.)THEN
          ABON=ABONA(11)
          GOTO 200
        ELSEIF(SAKRING.GT.125.)THEN
          ABON=ABONA(10)
          GOTO 200
        ELSEIF(SAKRING.GT.100.)THEN
          ABON=ABONA(9)
          GOTO 200
        ELSEIF(SAKRING.GT.80.)THEN
          ABON=ABONA(8)
          GOTO 200
        ELSEIF(SAKRING.GT.63.)THEN
          ABON=ABONA(7)
          GOTO 200
        ELSEIF(SAKRING.GT.50.)THEN
                ABON=ABONA(6)
                GOTO 200
        ELSEIF(SAKRING.GT.35.)THEN
                ABON=ABONA(5)
                GOTO 200
        ELSEIF(SAKRING.GT.25.)THEN
                ABON=ABONA(4)
                GOTO 200
ELSEIF(SAKRING.GT.20.)THEN
ABON=ABONA(3)
GOTO 200
ELSEIF(SAKRING.GT.16.)THEN
ABON=ABONA(2)
GOTO 200
ELSEIF(SAKRING.GT.0.)THEN
ABON=ABONA(1)
GOTO 200
        ELSE
  WRITE(*,*)'THE VALUE FOR SAKRING IS NOT APPLICABLE'
  WRITE(*,*)'THE VALUE IS = ',SAKRING
          WRITE(*,*)'HÄR KAN MAN VÄLJA EN ANNAN TARIFF.STANNAR'
          STOP
        ENDIF
 200    CONTINUE
        WRITE(U8,*)'DEN ÅRLIGA ABONNEMANGSAVGIFTEN BLEV = ',ABON,' KR'
        IF(ROT.EQ.0)ABON2=ABON/EFF
        WRITE(U8,*)'NU KOMMER ENERGIKOSTNADEN'
        SUMENK=0.
        ENER=0.
        DO 230 J=1,12,1
          SUMENK=SUMENK+EPE(J)*ENEM(J)
          WRITE(U8,*)'SUMENK,EPE(J),ENEM(J)= ',SUMENK,EPE(J),ENEM(J)
          ENER=ENER+ENEM(J)
          WRITE(U8,*)'ENERGIFÖRBRUKNING= ',ENER
 230    CONTINUE
        WRITE(U8,*)'SUMENK,ENER,ABON',SUMENK,ENER,ABON
        EPRIS=(ABON+SUMENK)/ENER
        WRITE(U8,*)'MEDELPRIS MED DIFF ELTAXA BLEV',EPRIS
        ROTPRIS=(SUMENK+ABON1)/ENER
        WRITE(U8,*)'ENDAST RÖRLIGA KOSTNADEN MED BLEV',SUMENK/ENER
        IF(ROT.EQ.1)EPRIS=ROTPRIS
        RETURN
 300    CONTINUE
        WRITE(U8,*)'HÄR BLIR DET FÖR BÖVELEN EFFEKTTAXA.'
********HÄR KOMMER NU EFFEKTTAXA ENLIGT 1986 ÅRS EFFEKTTARIFF***************
        KONTROLL=1
        TYP=1
        IF(EFF.GT.500.)GOTO 310
 350    CONTINUE
        WRITE(U8,*)'EFFEKTEN = ',EFF
```

```
      FASTAV=FASTAVG
      ABON=ABONAVG*EFF
      EFFA=EFFAVG*EFF
      EFFAR=FASTAV+ABON+EFFA
      WRITE(U8,*)'TOTAL ÅRLIG AVGIFT EXKL ENERGI = ',EFFAR
      IF(ROT.EQ.0)EFFAR2=EFFAR/EFF
      IF(ROT.EQ.1)EFFAR1=EFFAR2*EFF
********HÄR KOMMER ENERGIN*********************************************
      SUMENK=0.
      ENER=0.
      DO 330 J=1,12,1
      SUMENK=SUMENK+EPEF(J)*ENEM(J)
      WRITE(U8,*)'SUMENK,EPEF(J),ENEM(J) = ',SUMENK,EPEF(J),ENEM(J)
      ENER=ENER+ENEM(J)
      WRITE(U8,*)'ENERGIFÖRBRUKNING = ',ENER
 330  CONTINUE
      EPRIS=(EFFAR+SUMENK)/ENER
      WRITE(U8,*)'MEDELPRIS MED EFFEKTTAXA BLEV = ',EPRIS
      ROTPRIS=(EFFAR1+SUMENK)/ENER
      WRITE(U8,*)'ROTPRISET BLEV = ',ROTPRIS
      IF(ROT.EQ.1)EPRIS=ROTPRIS
      RETURN
 29   WRITE(*,*)'HÄR SKALL DET INTE KUNNA HAMNA SATS 29 I TAXOR'
      STOP
 30   WRITE(*,*)'HÄR SKALL DET INTE VARA.SATS 30 I TAXOR'
 310  WRITE(*,*)'HÄR BLIR DET HÖGSPÄNNINGSTAXA.STANNAR DOCK EJ.'
      WRITE(*,*)'KÖR MED EFFEKTTAXA I STÄLLET.'
      GOTO 350
      END
************************************************************************
      SUBROUTINE GRADTIM (KLIM,ORT,GRAD,GRADT,TIN)
      REAL KLIM(10,12),GRAD(12),GRADT,TIN
      INTEGER J,ORT
      GRADT=0.
      DO 50 J=1,12,1
        IF (J.EQ.1.OR.J.EQ.3 .OR.J.EQ.5.OR.J.EQ.7.OR.J.EQ.8.OR.J.EQ.
     +    10.OR.J.EQ.12)TIM=31.*24.
        IF(J.EQ.2)TIM=(3*28.+29.)*24./4.
        IF(J.EQ.4.OR.J.EQ.6.OR.J.EQ.9.OR.J.EQ.11)TIM=30.*24
        GRAD(J)=(TIN-KLIM(ORT,J))*TIM
        GRADT=GRADT+GRAD(J)
 50   CONTINUE
      RETURN
      END
************************************************************************
      SUBROUTINE VARAKT(KLIM,ORT,CON1,CON2,CON3,TIN)
      REAL TEMP(12),CON1,CON2,KLIM(10,12),TEMPA(12),TAU(12),TIM,TID,
     +  CON3,TIN
      INTEGER J,I,ORT,K,U9
      U9=0
      DO 10 J=1,12,1
        TEMP(J)=TIN-KLIM(ORT,J)
        WRITE(U9,*)'TEMP(J)= ',TEMP(J)
 10   CONTINUE
      K=2
      I=1
      TID=0.
 20   IF (TEMP(I).LT.TEMP(K)) THEN
*        WRITE(*,*)'TEMP(I),TEMP(K)=',TEMP(I),TEMP(K)
        I=K
        K=K+1
        IF(K.EQ.13)GOTO 30
        GOTO 20
      ELSE
        K=K+1
        IF(K.EQ.13) GOTO 30
        GOTO 20
      ENDIF
 30   TEMPA(I)=TEMP(I)
*       WRITE(*,*)'TEMP(I) BLIR 0.I= ',I
      TEMP(I)=0.
      IF(I.EQ.1.OR.I.EQ.3.OR.I.EQ.5.OR.I.EQ.7.OR.I.EQ.8.OR.I.EQ.10.
     +  OR.I.EQ.12)TIM=31.*24.
      IF(I.EQ.2)TIM=(3.*28.+29.)*24./4.
```

```
        IF(I.EQ.4.OR.I.EQ.6.OR.I.EQ.9.OR.I.EQ.11)TIM=30.*24.
*        WRITE(*,*)'TIM BLEV =',TIM
        TID=TID+TIM
        TAU(I)=TID-TIM/2
*        WRITE(*,*)'TAU(I),I=',TAU(I),I
        I=1
        K=2
 60     IF(ABS(TEMP(I)-TEMP(K)).LT..5)THEN
          I=I+1
          K=K+1
          IF(K.EQ.13)GOTO 40
          GOTO 60
        ENDIF
        GOTO 20
 40     SUMXY=0.
        SUMX=0.
        SUMY=0.
        SUMXX=0.
        DO 50 J=1,12,1
*         WRITE(*,*)TEMPA(J),TAU(J)
         SUMXY=SUMXY+TEMPA(J)*TAU(J)
         SUMX=SUMX+TAU(J)
         SUMY=SUMY+TEMPA(J)
         SUMXX=SUMXX+TAU(J)**2
*         WRITE(*,*)'SUMX,SUMY,SUMXY,SUMXX',SUMX,SUMY,SUMXY,SUMXX
 50     CONTINUE
        CON2=(12*SUMXY-SUMX*SUMY)/(12*SUMXX-SUMX**2)
        CON1=(SUMY/12)-CON2*(SUMX/12)
*        WRITE(*,*)'CON1 RESP CON2= ',CON1,CON2
        CON3=-CON1/CON2
*        WRITE(*,*)'CON3= ',CON3
        RETURN
        END
************************************************************************
        SUBROUTINE BIOPTIM(CON1,CON2,EPRIS1,EPRIS2,INP1,AKP1,INP2,
     +  AKP2,NUSUMNA1,CON3,NUFAKT1,NUFAKT2,EFF,BIOPT2,SUMPAR,NUVENBI,
     +  VGVN1,VGVN2,ENERGI,ENERGI1,TV,NLA,DUT,BYTE,BIROT,BEFK,AKT,
     +  SVARET,OPT,R1,EXTRA,EXTRA1,LAN)
        IMPLICIT REAL (A-Z)
        INTEGER BIROT,NUM,U3,U8,UTE3,LAN
        COMMON SLANG1,LSLANG1,SLANG2,LSLANG2,UTE1,UTE2,NLP1,NLP2,PROC,
     +  LPROC,UTE3,TRANSENG,VENTEFG,TOTENE
********OM VARIABELN U3=1 FÅS ALLA VÄRDEN PÅ SKÄRMEN*******************
*        IF(OPT.LT.1)U3=1
*         IF(LAN.EQ.1)U3=1
         U3=0
*********OM BIROT = 2 RÄKNAS PÅ FRÅNLUFTVÄRMEPUMP**********************
*********OM UTE3 = 1 RÄKNAS PÅ UTELUFTVÄRMEPUMP************************
*        IF(BIROT.EQ.2)U3=1
*         IF(UTE3.EQ.1)U3=1
*        IF(UTE3.EQ.2)U3=1
        WRITE(U3,*)'ENERGI,ENERGI1,CON2',ENERGI,ENERGI1,CON2
        WRITE(U3,*)'EPRIS1,VGVN1,EPRIS2',EPRIS1,VGVN1,EPRIS2
        WRITE(U3,*)'VGVN2,NUSUMNA1,TV',VGVN2,NUSUMNA1,TV
        WRITE(U3,*)'TRANSENG,VENTEFG,TOTENE = ',TRANSENG,VENTEFG,TOTENE
        WRITE(U3,*)'EFF,BIOPT2 = ',EFF,BIOPT2
        WRITE(U3,*)'CON1,CON3 = ',CON1,CON3
        WRITE(U3,*)'INP1,AKP1,INP2,AKP2 = ',INP1,AKP1,INP2,AKP2
        WRITE(U3,*)'NUFAKT1,NUFAKT2 = ',NUFAKT1,NUFAKT2
*********HÄR SKA JAG FÖRST FIXA TILL VARAKTIGHETSDIAGRAMMET*****************
        SOM=TOTENE-ENERGI1
        OVR=TOTENE-SOM-(ENERGI-TV)
        IF(SOM.LT.0.05)WRITE(*,*)'GRATISBIDRAG LITET, RÄTT?'
        IF(OVR.LT.0.05)WRITE(*,*)'GRATISBIDRAG LITET, RÄTT?'
        FAKT1=NUSUMNA1*EPRIS1/VGVN1
        FAKT2=NUSUMNA1*EPRIS2/VGVN2
        WRITE(U3,*)'SOM,OVR,FAKT1,FAKT2 = ',SOM,OVR,FAKT1,FAKT2
        WRITE(U3,*)'UTE1,UTE2,UTE3 = ',UTE1,UTE2,UTE3
        SUM=0.001*(TRANSENG+VENTEFG)
        TAU1=CON3-SQRT(SOM*2.*CON3/(SUM*CON1))
        IF(SOM.LT.1.)TAU1=CON3
        WRITE(U3,*)'NLA,DUT,BYTE,TAU1,SUM= ',NLA,DUT,BYTE,TAU1,SUM
        IF(SOM.GT.1.)THEN
              PSOM=SOM*2./(CON3-TAU1)
```

```
            POVR=OVR/TAU1
          ELSE
            PSOM=0.
            POVR=OVR/TAU1
          ENDIF
          IF(SOM.LT.1..AND.OVR.GT.1)THEN
             WRITE(U3,*)'SOM < 1, OVR > 1, SPECIALBERÄKNING '
             UTTR=((CON3*SUM*CON1/2.)-OVR)/(CON1*SUM/(2.*CON3))
             TAU1=SQRT(UTTR)
             POVR=OVR/((CON3+TAU1)/2.)
             SOM=POVR*(CON3-TAU1)/2.
             OVR=OVR-SOM
          ENDIF
          WRITE(U3,*)'PSOM,POVR,SOM,OVR= ',PSOM,POVR,SOM,OVR
          WRITE(U3,*)'SLANG1,LSLANG1,SLANG2,LSLANG2 =',SLANG1,LSLANG1,
     +    SLANG2,LSLANG2
          SO=1.
          S1=0.
          L1=0.
          L2=LSLANG1
          CALL NUVARDE(SO,S1,L1,L2,OPT,R1)
          NUFAKT3=S1
          SO=1.
          S1=0.
          L1=0.
          L2=LSLANG2
          CALL NUVARDE(SO,S1,L1,L2,OPT,R1)
          NUFAKT4=S1
          C11=-AKP1*NUFAKT1-SLANG1*NUFAKT3
          IF(UTE3.EQ.1)THEN
            U8=0
            C11=0.
            FIO=(-CON1+UTE1)/UTE2
            FI1=UTE1/UTE2
            VGVN4=(FIO+FI1)/2.
            FI2=FIO+TAU1*(FI1-FIO)/CON3
            VGVN3=(FIO+FI2)/2.
            FAKT2=EPRIS2*NUSUMNA1/((FI2+FIO)/2.)
            WRITE(U3,*)'FIO,FI1,FI2,FAKT2 = ',FIO,FI1,FI2,FAKT2
            WRITE(U3,*)'VGVN3,VGVN4 = ',VGVN3,VGVN4
********BÖRJAR MED KOSTNAD FÖR OLJEPANNAN*********************************
            SUMPAR1=(INP1+AKP1*EFF)*NUFAKT1
            WRITE(U8,*)'INP1,AKP1,EFF,NUFAKT1 = ',INP1,AKP1,EFF,NUFAKT1
            WRITE(U8,*)'SLANG1,LSLANG1,SLANG2,LSLANG2 =',SLANG1,LSLANG1,
     +      SLANG2,LSLANG2
            SO=1.
            S1=0.
            L1=0.
            L2=LSLANG1
            CALL NUVARDE(SO,S1,L1,L2,OPT,R1)
            NUFAKT3=S1
            SO=1.
            S1=0.
            L1=0.
            L2=LSLANG2
            CALL NUVARDE(SO,S1,L1,L2,OPT,R1)
            NUFAKT4=S1
            SUMPAR1=SUMPAR1+SLANG1*EFF*NUFAKT3
            WRITE(U8,*)'OLJEPANNAN KOSTAR, NUVÄRDE = ',SUMPAR1
********SEDAN KOMMER VÄRMEPUMPEN*****************************************
            SO=1.
            S1=0.
            L1=0.
            L2=NLP2
             CALL NUVARDE(SO,S1,L1,L2,OPT,R1)
            NUFAKT21=S1
            WRITE(U8,*)'NUFAKT21 = ',NUFAKT21
            WRITE(U8,*)'PROC,LPROC= ',PROC,LPROC
            SO=PROC
            S1=0.
            L1=LPROC
            L2=NLP2
            CALL NUVARDE(SO,S1,L1,L2,OPT,R1)
            NUFAKT22=S1
```

```
          WRITE(U8,*)'NUFAKT22 = ',NUFAKT22
          NUFAKT2=NUFAKT21+NUFAKT22
          WRITE(U8,*)'NUFAKT2 = ',NUFAKT2
         WRITE(U8,*)'INP2,AKP2 = ',INP2,AKP2
          WRITE(U8,*)'EPRIS2,UTE2,NUSUMNA1,CON2 = ',EPRIS2,UTE2,NUSUMNA1
     +    ,CON2
          SUMPAR21=INP2*NUFAKT2
          SUMPAR22=AKP2*NUFAKT2+SLANG2*NUFAKT4
          WRITE(U8,*)'SUMPAR21,22 = ',SUMPAR21,SUMPAR22
        ENDIF
        WRITE(U3,*)'KONSTANTEN C11,NUFAKT3,4= ',C11,NUFAKT3,NUFAKT4
        C12=AKP2*NUFAKT2+SLANG2*NUFAKT4
        IF(UTE3.EQ.1)C12=SUMPAR22
        C13=(-1)/(SUM*CON2)
        WRITE(U3,*)'POVR,SUM,CON1,CON2,TAU1=',POVR,SUM,CON1,CON2,TAU1
        C14=((-(POVR/SUM)+CON1)/CON2)+TAU1
        C15=(C14+((-C13)*(PSOM-POVR)))/(-2.)
        IF(PSOM.LE.POVR)C15=0.
        C16=(TAU1+C15)*FAKT2
        WRITE(U3,*)'C12,C13,C14,C15,C16= ',C12,C13,C14,C15,C16
        C171=POVR/(CON2*SUM)+CON3
        C17=((((CON1*SUM-POVR)*(-C13))-C171)/2.)*FAKT1
        C1=C11+C12+C16+C17
        WRITE(U3,*)'C171,C17,C1= ',C171,C17,C1
        C21=(-FAKT2)*C13/2.
        C22=FAKT1*C13/2.
        C2=C21+C22
        IF(LAN.EQ.1) THEN
                 WRITE(U3,*)'SUBVENT PGA E.BESP = ',EXTRA1
                 C18=(C171-C171/VGVN2)*EXTRA1
                 C1=C1-C18
                 C23=(C13/2-C13/(2*VGVN2))*EXTRA1
                 C2=C2-C23
        ENDIF
        WRITE(U3,*)'C21,C22,C2,C18,C23,C1= ',C21,C22,C2,C18,C23,C1
        BIOPTA=-C1/(2.*C2)
        WRITE(U3,*)'VÄRDET BIOPTA BLEV= ',BIOPTA
        IF(BIOPTA.LT.0.)THEN
                 WRITE(*,*)'NEGATIV VÄRMEPUMP FUNKAR EJ#####'
                 WRITE(*,*)'SÄTTER EFFEKT = 0. = OLJEELDNING'
                 BIOPTA=0.
                 GOTO 397
        ENDIF
        TAU2=-((-(BIOPTA+POVR)/SUM)+CON1)/CON2
        WRITE(U3,*)'TAU2 = ',TAU2
********HÄR KOMMER TAPPVARMVATTNET IN.LÄGGS TILL BIOPT2*************
        BIOPT2=BIOPTA+TV/CON3
        WRITE(U3,*)'VÄRMEPUMPEN SKALL HA EFFEKTEN= ',BIOPT2
        FVPEFF=0.
        ENEFVP=0.
        IF(BIROT.EQ.2)THEN
********OM BIROT=2 HAR MAN EN FRÅNLUFTVP SOM ROTÅTGÄRD**************
********DÅ MÅSTE DENNA ENERGI TAS BORT FRÅN OLJEPANNEENERGIN***************
********ENERGIN LIGGER I NLA************************************
        WRITE(U3,*)'FRÅNLUFTENERGI= ',NLA
*********KOLLAR  VARAKTIGHETSDIAGRAMMET**************************
          NYEFFL=NLA/8760.+BIOPTA+POVR
          TEMPFL=NYEFFL/SUM
          WRITE(U3,*)'TRANSENG,VENTEFG,TEMPFL= ',TRANSENG,VENTEFG,TEMPFL
          TAU3=(-TEMPFL+CON1)/(-CON2)
          WRITE(U3,*)'TAU3 BLEV NU,SUM= ',TAU3,SUM
          TAU4=((-(BIOPTA+POVR)/SUM)+CON1)/(-CON2)
          WRITE(U3,*)'TAU4= ',TAU4
          ENEFVP=(NLA/8760.)*(TAU3+((TAU4-TAU3)/2))
          IF(BIOPTA+POVR.LT.PSOM) THEN
            ENEFVP=(NLA/8760.)*TAU1
            WRITE(*,*)'VÄRMEPUMP FÖR LITEN FÖR ATT TEORIN SKALL GÄLLA'
            WRITE(U3,*)'ENEFVP I BIOPTIM = ',ENEFVP
          ENDIF
          WRITE(U3,*)'AV VÄRMEN1 TAS SÅLEDES KWH= ',ENEFVP
          FVPEFF=NLA/8760.
        ENDIF
        BIOPT1=EFF-BIOPTA-FVPEFF
        IF(UTE3.EQ.1)BIOPT1=EFF-FVPEFF
```

```
      WRITE(U3,*)'OLJEPANNAN SÅLEDES EFFEKTEN= ',BIOPT1
      WRITE(U3,*)INP1,AKP1,BIOPT1,NUFAKT1
      WRITE(U3,*)INP2,AKP2,BIOPT2,NUFAKT2
      WRITE(U3,*)SLANG1,NUFAKT3,SLANG2,NUFAKT4
*********HÄR BERÄKNAS KOSTNADEN FÖR VÄRMESYSTEMEN*****************
      SUMPAR=((INP1+AKP1*BIOPT1)*NUFAKT1)+(INP2+AKP2*BIOPT2)*
     +  NUFAKT2+SLANG1*BIOPT1*NUFAKT3+SLANG2*BIOPT2*NUFAKT4
      IF(LAN.EQ.1)THEN
               SUMPAR=SUMPAR-EXTRA
      ENDIF
      IF(LAN.EQ.2)THEN
               SUBVP21=EXTRA*(INP1+AKP1*BIOPT1)
               SUBVP22=EXTRA*(INP2+AKP2*BIOPT2)
               SUBVP23=EXTRA*(SLANG1*BIOPT1)
               SUBVP24=EXTRA*(SLANG2*BIOPT2)
               SUMPAR=SUMPAR-SUBVP21-SUBVP22-SUBVP23-SUBVP24
      ENDIF
      WRITE(U3,*)'PANNORNA KOSTAR= ',SUMPAR
*********FÖRST ENERGI FRÅN VÄRMEPUMP*********************************
      C18=(PSOM-POVR)*C15/2.
      ENV21=TAU1*BIOPTA-(BIOPTA**2.)*C13/2.+C15*BIOPTA-C18
      P3=POVR+BIOPTA
      IF(P3.LT.PSOM)THEN
        WRITE(*,*)'HÄR BLEV VP.EFF LÄGRE ÄN PSOM !!!!!!!!!! '
        ENV21=TAU1*BIOPTA
      ENDIF
********HÄR KOMMER VARMVATTNET*********************************
      ENV2=ENV21+TV
      WRITE(U3,*)'ENERGIN FRÅN VP I KWH/ÅR,ENV21 = ',ENV2,ENV21
      NUVEN2=ENV2*NUSUMNA1*EPRIS2/VGVN2
      NUVEN21=ENV21*NUSUMNA1*EPRIS2/VGVN2
      IF(UTE3.EQ.1)THEN
        NUVEN21=ENV21*EPRIS2*NUSUMNA1/VGVN3
        NUVEN22=TV*EPRIS2*NUSUMNA1/VGVN4
        NUVEN2=NUVEN21+NUVEN22
        WRITE(U3,*)'NUVEN21,22 = ',NUVEN21,NUVEN22
      ENDIF
      WRITE(U3,*)'NUVÄRDET FÖR ENERGIN FRÅN VP = ',NUVEN2
      IF(LAN.EQ.1)THEN
               SUBVEN=(ENV2-ENV2/VGVN2)*EXTRA1
               WRITE(U3,*)'SUBVEN FÖR ESPAR = ',SUBVEN
      ELSE
               SUBVEN=0.
      ENDIF
*********HÄR KOMMER ENERGI FRÅN ANLÄGGNING NR 1**************
      C19=(CON1*SUM-POVR)*C171/2.
      ENV111=(C13/2.)*BIOPTA**2.+C17*BIOPTA/FAKT1+C19
      IF(P3.LT.PSOM)THEN
        ENV1111=(PSOM-P3)*TAU1
        ENV1112=TAU1*(SUM*CON1-P3)/2.
        ENV111=ENV1111+ENV1112
      ENDIF
      ENV11=ENV111-ENEFVP
      WRITE(U3,*)'C18,C19 = ',C18,C19
      WRITE(U3,*)'ENERGI FRÅN OLJEPANNAN BLEV= ',ENV11
      WRITE(U3,*)'TOTALA ENERGIN ÄR= ',ENV11+ENV21+TV+ENEFVP
      ENERGA=CON1*SUM*CON3/2.-OVR-SOM+TV
      WRITE(U3,*)'JÄMFÖR MED ENERGA = ',ENERGA
      IF(ABS(ENV11+ENV21+TV+ENEFVP-ENERGA).GT.1000.)WRITE(*,*)'EDIF##'
      NUVEN1=FAKT1*ENV11
      WRITE(U3,*)'NUVÄRDET FÖR ENERGIN FRÅN OLJAN BLEV= ',NUVEN1
      NUVENBI=NUVEN2+NUVEN1-SUBVEN
      WRITE(U3,*)'TOTALT NUVÄRDE FÖR ENERGIN= ',NUVENBI
      EPRISBI=NUVENBI/(NUSUMNA1*(ENV11+ENV21+TV))
      WRITE(U3,*)'ENERGIPRIS MED BIVALENT DRIFT BLEV= ',EPRISBI
      IF(BIROT.EQ.2)BYTE=ENEFVP
      IF(BIROT.NE.1)RETURN
      GOTO 398
 397  WRITE(U8,*)'VÄRMEPUMPENS EFFEKT ÄR 0 KW. OLJEPANNA TILL VÄRMEN!'
      WRITE(U8,*)'VÄRMEPUMP TILL TAPPVARMVATTEN'
      WRITE(U8,*)'OLJEPANNAN KOSTAR + SLANGAR = ',SUMPAR1
      SUMPAR22=AKP2*NUFAKT2*TV/CON3+SLANG2*NUFAKT4*TV/CON3
      SUMPAR2=SUMPAR21+SUMPAR22
      SUMPAR=SUMPAR1+SUMPAR2
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        WRITE(U8,*)'VÄRMEPUMP KOSTAR + SLANGAR = ',SUMPAR2
        WRITE(U8,*)'TOTALT FÖR VÄRMESYSTEM FÅS = ',SUMPAR
        IF(UTE3.EQ.1)NUVEN2=TV*NUSUMNA1*EPRIS2*2./(FIO+FI1)
        IF(UTE3.EQ.0)NUVEN2=TV*FAKT2
        NUVEN1=(ENERGI-TV)*FAKT1
        WRITE(U8,*)'NUVEN1, NUVEN2 = ',NUVEN1,NUVEN2
        NUVENBI=NUVEN1+NUVEN2
        EPRISBI=NUVENBI/(NUSUMNA1*ENERGI)
        WRITE(U8,*)'NUVENBI, EPRISBI = ',NUVENBI,EPRISBI
        BIOPT2=TV/CON3
        IF(BIROT.EQ.2)THEN
*                U8=1
                ENEFVP=(NLA/8760.)*TAU1
                BIOPT1=EFF-(NLA/8760)
                SUMPAR1=(INP1+AKP1*BIOPT1)*NUFAKT1
                EN11=ENERGI-TV-ENEFVP
                WRITE(U8,*)'EN11,ENEFVP,SUMPAR1 = ',EN11,ENEFVP,SUMPAR1
                SUMPAR=SUMPAR1+SUMPAR2
                NUVEN1=EN11*FAKT1
                NUVENBI=NUVEN2+NUVEN1
                WRITE(U8,*)'NUVENBI,NUVEN1 = ',NUVENBI,NUVEN1
                WRITE(U8,*)'SUMPAR = ',SUMPAR
        ENDIF
        IF(BIROT.NE.1)RETURN
*********HÄR KOMMER ISOLERING MED ENDAST OLJEPANNA. OPTIMAL TJOCKLEK**
*********BERÄKNAD TIDIGARE*********************************************
        SVARET=1000.
*********RÄTT VÄRDE LETAS UPP I HUVUDPROGRAMMET***********************
        RETURN
*********OM BIROT = 1 SÅ ÄR DET EN ROTÅTGÄRD .GER BÖKIGARE OPTIMERING********
 398    WRITE(U3,*)'$$$$$$$VÄLKOMMEN TILL ISO.OPTIMERING$$$$$$$$$$$$$'
        WRITE(U3,*)'NYA TRANSENG UTAN ROTDEL = ',TRANSENG
*********HÄR SÄTTES POVR = 0.001 OCH OVR = 0.001 DÅ GRATISBIDRAGET***********
*********SKALL VÄRDERAS UNDER ELDNINGSSÄSONGEN VID ISO.OPTIMERING************
        POVR=0.001
        OVR=0.001
*********BÖRJAR MED KOSTNAD FÖR OLJEPANNAN**********************************
        C31=BEFK*NLA*BYTE*.001
        C32=C31*DUT*NUFAKT1*AKP1
        C33=C31*DUT*NUFAKT3*SLANG1
        C34=C32+C33
        IF(UTE3.EQ.1)THEN
          C11=0.
          WRITE(U3,*)'OLJEPANNAN KOSTAR SUMPAR1 = ',SUMPAR1
        ENDIF
        WRITE(U3,*)'C31,C32,C33,C34 = ',C31,C32,C33,C34
********HÄR KOMMER ENERGIN FRÅN VÄRMEPUMPEN*********************************
        C41=-NLA*POVR*.5/CON2
        C42=-(PSOM-POVR)*NLA*.5/CON2
        C4=C42-C41
        WRITE(U3,*)'C41,C42,C4= ',C41,C42,C4
        C5=TAU1+(-TAU1+CON3)/2
        WRITE(U3,*)'C5= ',C5
        C6=-NLA*.5/CON2
        WRITE(U3,*)'C6= ',C6
        C7=-BEFK*.5/CON2
        C81=-BEFK*POVR*.5/CON2
        C82=-(PSOM-POVR)*BEFK*.5/CON2
        C8=C82-C81
        WRITE(U3,*)'C7,C81,C82,C8= ',C7,C81,C82,C8
        C9=-(PSOM-POVR)*POVR*NLA*.5/CON2
        C10=-(PSOM-POVR)*BEFK*POVR*.5/CON2
        NA2=BEFK*SUM
        NA1=SUM*NLA+.001*BEFK*NLA*BYTE
        WRITE(U3,*)'C9,C10,NA1,NA2 = ',C9,C10,NA1,NA2
*********HÄR KOMMER TERMER FÖR OLJEENERGIN*******************************
        O1=(CON1*SUM*CON3/2.)-SOM-OVR
        O2=C31*CON1*CON3/2.
        WRITE(U3,*)'O1,O2 = ',O1,O2
*********HÄR KOMMER TERMER FÖR DEN TOTALA KOSTNADEN**********************
        T1=C34+O2*FAKT1
        T2=-(C11+C12)+C5*(FAKT1-FAKT2)
        T3=C6*(FAKT1-FAKT2)
        T4=C7*(FAKT1-FAKT2)
```

```
        T5=C4*(FAKT1-FAKT2)
        T6=C8*(FAKT1-FAKT2)
        T7=C9*(FAKT1-FAKT2)
        T8=C10*(FAKT1-FAKT2)
        WRITE(U3,*)'T1-T4 = ',T1,T2,T3,T4
        WRITE(U3,*)'T5-T8 = ',T5,T6,T7,T8
        IF(LAN.EQ.1)THEN
                SUFA=((VGVN2-1.)/VGVN2)*EXTRA1
                T2=T2+SUFA*C5
                T3=T3+SUFA*C6
                T4=T4+SUFA*C7
                T5=T5+SUFA*C4
                T6=T6+SUFA*C8
                T7=T7+SUFA*C9
                T8=T8+SUFA*C10
                WRITE(U3,*)'VID SUBVENTION FÅS:'
                WRITE(U3,*)'T1-T4 = ',T1,T2,T3,T4
                WRITE(U3,*)'T5-T8 = ',T5,T6,T7,T8
        ENDIF
********THE DERIVATIVE CONCERNING THE HEAT PUMP POWER***************
        T91=T2*NA1+T5
        T92=T2*NA2+T6
        T93=2.*T3
        T94=2.*T4
        WRITE(U3,*)'T91-T94 = ',T91,T92,T93,T94
********HÄR STARTAR NU LETANDET EFTER OPTIMUM*****************************
********FÖRST RÄKNAR JAG UT DERIVATAN M.A.P.PETVÅ************************
        SVARET=0.
        DIFF=.1
        TECKEN1=-1.
        TECKEN2=+1.
        NUM=0
 102    PETVA=(T91+T92*SVARET)/(T93+T94*SVARET)
        NUM=NUM+1
*        WRITE(*,*)'NUM = ',NUM
        IF(NUM.GT.500)THEN
          WRITE(*,*)'KONVERGERAR EJ TILLRÄCKLIGT.NOLL = ',NOLL
          WRITE(*,*)'STANNAR DOCK EJ UTAN HOPPAR UR HÄR'
          GOTO 101
        ENDIF
        WRITE(U3,*)'PETVA= ',PETVA
        WRITE(U3,*)'SVARET= ',SVARET
        TECKEN3=TECKEN1*TECKEN2
*        WRITE(U3,*)'TECKEN3= ',TECKEN3
********DETTA SÄTTES IN I UTTRYCKET DÄR DER.M.A.P.SVARET=0.
        D1=T1*BEFK/((NLA+BEFK*SVARET)**2.)
        NA3=(NA1+NA2*SVARET)**2.
        D2=T3*NA2*PETVA**2./NA3
        D3=T4*NA1*PETVA**2./NA3
        D4=T5*NA2*PETVA/NA3
        WRITE(U3,*)'D1-D4,NA3 = ',D1,D2,D3,D4,NA3
        D5=T6*NA1*PETVA/NA3
        D6=T7*NA2/NA3
        D7=T8*NA1/NA3
        NOLL=-D1-D2+D3+D4-D5+D6-D7+AKT
        WRITE(U3,*)'D5-D7,NOLL,AKT = ',D5,D6,D7,NOLL,AKT
        IF(ABS(NOLL).LT.5.)THEN
          WRITE(U3,*)'SVARET RESP PETVA= ',SVARET,PETVA
          GOTO 101
        ELSE
          IF(NOLL.LT.-5.)THEN
            IF(TECKEN3.GT.0.)THEN
              DIFF=-.1*DIFF
              SVARET=SVARET+DIFF
              TECKEN2=-1*TECKEN2
              GOTO 102
            ELSE
              SVARET=SVARET+DIFF
              GOTO 102
            ENDIF
          ELSE
            IF(TECKEN3.LT.0.)THEN
              DIFF=-.1*DIFF
              SVARET=SVARET+DIFF
```

```
              TECKEN2=-1.*TECKEN2
              GOTO 102
            ELSE
              SVARET=SVARET+DIFF
              GOTO 102
            ENDIF
          ENDIF
        ENDIF
 101    CONTINUE
        WRITE(U3,*)'OPTIMERING KLAR.ANL 2 SKALL HA EFF.= ',PETVA
        IF(PETVA+POVR.LT.PSOM)THEN
         WRITE(*,*)'HÄR BLIR VÄRMEPUMPENS EFFEKT FÖR LITEN'
         WRITE(*,*)'TEORIN GÄLLER EJ. RÄKNAR PÅ I ALLA FALL!!!!!!!'
        ENDIF
        IF(PETVA.LT.0)WRITE(*,*)'VP MINDRE ÄN 0 KW. FUNKAR EJ#####'
        WRITE(U3,*)'ISOLERINGEN SKALL HA TJOCKLEK= ',SVARET
        RETURN
        END
*************************************************************************
        SUBROUTINE ENEBAL(ENEM,GRATIS,SOL,A,TV2,ENERGI,ENERGI1,ENERES,U,
     +  GRADTOP)
        REAL ENEM(12),GRATIS(12),SOL(4,12),ENERGI,ENERGI1,ENERES(12),
     +  ENEM1(12),SOLA(12),A(8),SOLSUM,TV2(12),TOTENE
        INTEGER J,GRADTOP(12),U
        COMMON SLANG1,LSLANG1,SLANG2,LSLANG2,UTE1,UTE2,NLP1,NLP2,PROC,
     +  LPROC,UTE3,TRANSENG,VENTEFG,TOTENE
        WRITE(U,*)'NU ÄR JAG I ENEBAL'
        TOTENE=0.
        ENERGI=0.
        ENERGI1=0.
        SOLSUM=0.
        DO 10 J=1,12
          SOLA(J)=SOL(1,J)*A(5)+SOL(2,J)*A(6)+SOL(3,J)*A(7)+SOL(4,J)*
     +    A(8)
          WRITE(U,*)'SOL(1,J).....',SOL(1,J),SOL(2,J),SOL(3,J),SOL(4,J)
          WRITE(U,*)'SOLA,A = ',SOLA(J),A(5),A(6),A(7),A(8)
          SOLSUM = SOLSUM+SOLA(J)
          WRITE(U,*)'SOLSUM = ',SOLSUM
          ENEM1(J)=ENEM(J)
          WRITE(U,*)'ENEM(J) = ',ENEM(J)
          ENERES(J)=ENEM(J)-GRATIS(J)-SOLA(J)
          WRITE(U,*)'ENERES,J = ',ENERES(J),J
          GRADTOP(J)=1
          IF(ENERES(J).LT.0.1)ENERES(J) = 0.
          IF(ENERES(J).LT.0.1)ENEM1(J)=0.
          IF(ENERES(J).LT.0.1)GRADTOP(J)=0
          ENERES(J)=ENERES(J)+TV2(J)
          WRITE(U,*)'ENERES(J)+TV2(J) = ',ENERES(J)
          ENERGI =ENERGI+ENERES(J)
          ENERGI1=ENERGI1+ENEM1(J)
          TOTENE=TOTENE+ENEM(J)
          WRITE(U,*)'TOTENE = ',TOTENE
          WRITE(U,*)'ENERGI1 = ',ENERGI1
          WRITE(U,*)'GRADTOP = ',GRADTOP(J)
 10     CONTINUE
        RETURN
        END
*************************************************************************
        SUBROUTINE TABELL2(GRAD,ENEM,GRATIS,SOL,A,TV2,ENERGI,ENERGI1,
     +  ENERES,U,TRANSEF,VENTEF,DUR)
        REAL GRAD(12),ENEM(12),GRATIS(12),SOL(4,12),ENERGI,ENERGI1,
     +  ENERES(12),SOLA(12),A(8),SOLSUM,TV2(12),ENEMTOT,TRANSEF,VENTEF,
     + ENE1RES(12),ENEM1(12),GRADT,GRAT,UTGRAT(12),SUMUT,TV3
        INTEGER U,J,DUR
C        IF(DUR.EQ.1)OPEN(6,FILE='DUR:DATA')
        IF(DUR.EQ.1)OPEN(6,FILE='DUR.DAT')
        SOLSUM=0.
        ENEMTOT=0.
        GRADT=0.
        GRAT=0.
        SUMUT=0.
TV3=0.
        WRITE(U,59)
        WRITE(U,10)'ENERGY BALANCE'
```

```
      WRITE(U,10)'==============='
 10   FORMAT(' ',T30,A)
 11   FORMAT(' ',T5,9(A,TR2))
 59   FORMAT('1')
      WRITE(U,*)' '
      WRITE(U,*)' '
      WRITE(U,11)'MONTH  DEG.-  ENERGY-   HOT -   FREE    SOLAR  UTILI
     +Z. FROM    INSUL.'
      WRITE(U,11)'NO     HOURS  TRANSM    WATER   ENERGY  HEAT   FREE
     +   BOILER  OPTIM.'
      WRITE(U,*)'-----------------------------------------------------
     +--------------------'
      DO 1 J=1,12
            SOLA(J)=SOL(1,J)*A(5)+SOL(2,J)*A(6)+SOL(3,J)*A(7)+
     +      SOL(4,J)*A(8)
            ENEMTOT=ENEMTOT+ENEM(J)
            SOLSUM=SOLSUM+SOLA(J)
            GRADT=GRADT+GRAD(J)
            GRAT=GRAT+GRATIS(J)
            UTGRAT(J)=SOLA(J)+GRATIS(J)
            ENEM1(J)=ENEM(J)
            IF((ENERES(J)-TV2(J)).LT.5.)THEN
                     ENEM1(J)=0.
                   UTGRAT(J)=UTGRAT(J)+(ENEM(J)-GRATIS(J)-SOLA(J))
            ENDIF
            SUMUT=SUMUT+UTGRAT(J)
            ENE1RES(J)=ENEM1(J)
            WRITE(U,12)J,GRAD(J),ENEM(J),TV2(J),GRATIS(J),SOLA(J),
     +      UTGRAT(J),ENERES(J),ENE1RES(J)
 TV3=TV3+TV2(J)
            IF(DUR.EQ.1)THEN
               WRITE(6,*)ENEM(J),GRATIS(J),SOLA(J),ENERES(J),TV2(J)
            ENDIF
 1    CONTINUE
 12   FORMAT(' ',T5,I2,TR5,8(F6.0,TR2))
      WRITE(U,*)'-----------------------------------------------------
     +-----------------'
      WRITE(U,13)'TOTAL',GRADT,ENEMTOT,TV3,GRAT,SOLSUM,SUMUT,ENERGI,
     +  ENERGI1
 13   FORMAT(' ',A,T11,8(F7.0,TR1))
      WRITE(U,*)' '
      WRITE(U,*)' '
      WRITE(U,15)'TRANSMISSION COEFFICIENT = ',TRANSEF,' W/K'
      WRITE(U,15)'VENTILATION COEFFICIENT  = ',VENTEF,' W/K'
 15   FORMAT(' ',TR15,A,F8.2,A)
      CLOSE(6)
*      IF(U.EQ.1)STOP
      RETURN
      END
*****************************************************************
      SUBROUTINE TARIFF(HELP,LELP,ENEDEM,HHOURS,LHOURS,EPE,EPEF)
*******THIS IS A SUBROUTINE FOR MAKING REAL TARIFFS USABLE FOR OPERA****

      REAL HELP,LELP,ENEDEM(5),EPE(12),EPEF(12),ELPD1,ELPD2
      INTEGER HHOURS(12),LHOURS(12),I,MON,U

      U=0
      DO 10 I=1,12
            MON=HHOURS(I)+LHOURS(I)
            ELP1=LELP
            ELPD1=ENEDEM(1)
            ELPD2=ENEDEM(2)
            IF(I.GE.5.AND.I.LE.8)THEN
                     ELPD1=ENEDEM(4)
                     ELPD2=ENEDEM(5)
            ENDIF
            IF(I.EQ.4.OR.I.EQ.9.OR.I.EQ.10)THEN
                     ELPD1=ENEDEM(2)
                     ELPD2=ENEDEM(3)
            ENDIF
            IF(I.LE.3.OR.I.GE.11)ELP1=HELP
            EPE(I)=(HHOURS(I)*ELP1+LHOURS(I)*LELP)/MON
            EPEF(I)=(HHOURS(I)*ELPD1+LHOURS(I)*ELPD2)/MON
            WRITE(U,*)'EPE(I),I EPEF(I)= ',EPE(I),I,EPEF(I)
```

```
10      CONTINUE
        RETURN
        END
```

Chapter 3

Appendix C. Transfer program for the Swedish former subsidy system, sub.c

```
/*This is a program for transferring OPERA input files due
to the Swedish subsidy system, retrofit loans
Version 1.01 1990 10 10*/


#include "stdio.h"
#include "math.h"

float sys(float r),prew();
void minkva(float lam,float uexi, float in,float ko,float ak,float red
,float b[2],float tik);
void readval(int to);
void revekt(float vekt[10],int ant,int spec);
void insul();
void boilval();
extern FILE *fo;

FILE *fi,*fp;

void main()


{

float  r,wlim,subw,subwi,buiar,area[4],
pro,in,ko,ak,lam,uexi,bk[4],vekt[10],nla[4],red,tik,
b[2],subo,subp,subhp,suboi,subel,subhpu,exhp,exhpu,opt;


register int i=0,to;
```

```
int ant,spec,lansys=2,fl=0,fil;



if((fi=fopen("house.dat","r"))==NULL)
{
cprintf("The input file HOUSE.DAT cannot be found\n");
exit(0);
}
cprintf("The file named HOUSE.DAT has been opened and will be processed\n\n");
if((fp=fopen("sub.dat","w"))==NULL)
{
cprintf("The output file SUB.DAT cannot be opened");
exit(0);
}
spec=0 ;
fscanf(fi,"%d",&fil);
if(fil!=0)
{
printf("This is not a valid OPERA file\n");
exit(0);
}
if(lansys!=1&&lansys!=2){cprintf("Subsidize system unknown\n");exit(0);}
if(lansys==1)fprintf(fp,"1\n");
if(lansys==2)fprintf(fp,"2\n");
ant=4;
revekt(area,ant,spec);
buiar=area[3];
to=2;
readval(to);
ant=3;
revekt(bk,ant,spec);
bk[3]=bk[2];
to=6;
readval(to);
ant=4;
revekt(nla,ant,spec);
to=5;
readval(to);
ant=3;
revekt(vekt,ant,spec);
opt=vekt[0];
r=vekt[1];
fflush(fp);
pro=1.-sys(r);
cprintf("\nSubsidize rate became = % f\n",pro);
fprintf(fp,"%5.3f\n",pro);
fscanf(fo,"%f",&tik);
for(i=0;i<4;i++)
```

```
{
ant=3;
spec=1;/* Changes the printout on file SUB.DAT */
revekt(vekt,ant,spec);
in=vekt[0];
ko=vekt[1];
ak=vekt[2];
lam=nla[i];
uexi=bk[i];
red=pro;
switch(lansys)
{
case 1: minkva(lam,uexi,in,ko,ak,red,b,tik);break;
case 2: insul(in,ko,ak,red,b); break;
default:printf("Subsidize system unknown\n");exit(0);
}
fprintf(fp,"%3.2f,%3.2f,%3.2f",in,b[0],b[1]);
if(i<3) fprintf(fp,"\n");
if(i>=3) fprintf(fp,",");
}

to=1            ;
readval(to);
if(lansys==1)
{
fscanf(fo,"%f,%f",&subw,&wlim);
subwi=tik*subw*buiar;
fprintf(fp,"%3.2f,%3.2f\n",wlim,subwi);
to=10;
readval(to);
fscanf(fo,"%f",&subp);
fscanf(fo,"%f,%f",&subo,&subhp);
subel=subp*buiar*tik*pro;
suboi=(subp*buiar+subo)*tik*pro;
subhpu=subhp*tik*pro;
fprintf(fp,"%3.2f,%3.2f,%3.2f\n",suboi,subel,subhpu);
to=7;
readval(to);
fscanf(fo,"%f",&exhp);
exhpu=exhp*tik*buiar*pro;
fprintf(fp,"%3.2f\n",exhpu);
to=18;
readval(to);
}
else
{
to=4;
readval(to);
for(i=1;i<=5;i++)
{
```

```
ant=6;
revekt(vekt,ant,spec);
boilval(vekt,opt,red,r,fl,b);
fprintf(fp,"%8.1f,%7.1f,%4.2f,%4.1f,%7.1f,%4.1f\n",
vekt[0]*b[0],vekt[1]*b[0],vekt[2],vekt[3],vekt[4]*b[1],
vekt[5]);
}
fflush(fp);
ant=9;
revekt(vekt,ant,spec);
fl=1;
boilval(vekt,opt,red,r,fl,b);
fprintf(fp,"%8.1f,%7.1f,%6.2f,%6.2f,%4.1f,%7.1f,%4.1f,%4.2f,%4.1f",
vekt[0]*b[0],vekt[1]*b[0],vekt[2],vekt[3],vekt[4],vekt[5]*b[1],
vekt[6],vekt[7],vekt[8]);    /* Outside air heat pump */
readval(7);
revekt(vekt,5,spec);
boilval(vekt,opt,red,r,fl,b);
fprintf(fp,"%7.1f,%7.1f,%4.1f,%4.1f,%4.1f",vekt[0]*b[0],
vekt[1]*b[0],vekt[2],vekt[3],vekt[4]);
readval(21);                /* Text and to the end of house.dat */
}
close(fo);
close(fi);
close(fp);
}


void readval(int to)

{

char varde;
register int i=0;


do
{
varde=getc(fi);
if(varde==10)i++;
putc(varde,fp);
}
while(varde!=EOF && i<to);
fflush(fp);
return;
}

void revekt(float vekt[10],int ant,int spec)

{
```

```
register int i;
int inte;

for(i=0;i<ant;i++)
{
if(spec==2)
{
fscanf(fi,"%d,",&inte);
fprintf(fp,"%3d,",inte);
spec=1;
i++;
}
fscanf(fi,"%f,",&vekt[i]);
if(spec==0)fprintf(fp,"%3.2f,",vekt[i]);
}
return;
}


/*This is a function calculating insulation retrofits subsidies with the
  system 1989 10 31. The old system is in minkva.c */

  void insul(in,ko,ak,red,b)

  float in,ko,ak,red,b[2];

  {
  register int i;
  float xy=0.,x=0.,y=0.,x2=0.,valu[10],t=0.;

  for(i=0;i<10;i++)
{
valu[i]=(in+ko+ak*t)*(1-red);
xy+=t*valu[i];
x+=t;
y+=valu[i];
x2+=t*t;
t+=0.05;
}
  b[1]=(i*xy-x*y)/(i*x2-x*x);
  b[0]=y/i-b[1]*x/i;
  return;
  }


  /* This is a function calculating boiler values when the new
     subsidy system is to be simulated */

  void  boilval(vekt,opt,red,r,fl,b)
```

```
  float vekt[10],opt,red,r,b[2];
  int fl;

  {

  float boill,pipel,precoe,first=0;

  if(fl==0){
  boill=vekt[3];
  pipel=vekt[5];
  }
  else{
boill=vekt[4];
pipel=vekt[6];
}

  precoe=prew(first,boill,opt,r);
  b[0]=(-red+precoe)/precoe;
  precoe=prew(first,pipel,opt,r);
  b[1]=(-red+precoe)/precoe;
  return;
  }

  /* This is a function for calculating the present worth */



  float prew(life1,life2,opt,r)


  float life1,life2,opt,r;


  {
  float pw=0.;

  while(life1<=opt){
pw+=(pow((1.+r),-life1));
life1+=life2;
}
  pw-=((life1-opt)/life2)*pow((1+r),-opt);
  return pw;
  }


/* This is a function for present worth calculations of the Swedish
   subsidy system */
```

```
#include "math.h"
#include "stdio.h"

FILE *fo;

float sys(float r)

{
int amtid,botam,egtid,bosam,stat;

float ran,annu,kost=190000.,boslan,botlan,garran1,pay3=0.,fix2=0.,
      eglan,bosran,botran,egran,pres2=0.,subeg,subrat,subeg1,
      garran,fip,ambos,infl,ranta,amort,
      lanf,inter,garta,pay,kostlan,garta1,pay1[50],fix[50],
      pres[50],pay2=0.,fix1=0.,pres1=0.,okn,lan;

register int i,j;


if((fo=fopen("loan.dat","r"))==NULL)
{
printf("Could not find the input data file loan.dat\n");
exit(0);
}
stat=fscanf(fo,"%d,%d,%d",&bosam,&botam,&egtid);
stat+=fscanf(fo,"%f,%f,%f",&boslan,&botlan,&eglan);
stat+=fscanf(fo,"%f,%f,%f,%f,%f",&bosran,&botran,&egran,&garran,&okn);
stat+=fscanf(fo,"%f,%f",&ambos,&infl);
close(fo);
garran1=garran;

for(j=0;j<3;j++)
{
if(j==0)
{

printf("\n\n                THE RESIDENCE LOAN\n");
amtid=bosam;
annu=ambos;
lan=boslan;
ran=bosran;
}
else if(j==1&&j!=2&&j)
{
printf("\f\n\n                  THE BASE PART LOAN\n");
amtid=botam;
annu=ambos;
lan=botlan;
```

```
ran=botran;
}
else
{
printf("\f\n\n                ORDINARY LOANS\n");
amtid=egtid;
annu=egran;
lan=eglan;
ran=egran;
garran=ran+.01;
}
printf("               ====================================\n");
printf("\n");
printf(" Year    FIP    Interest   Amorti-    Warr     To      Next    Real\n");
printf(" Numb           cost       zation     cost     pay     year    int.\n");
printf("-------------------------------------------------------------------\n");


fip=kost*annu*lan/(1-pow((1+annu),-amtid));
/*printf(" FIP for the residence loan is = %7.1f\n",fipbos);*/
lanf=lan*kost;
kostlan=lanf;


for(i=1;i<=(amtid);i++)
{
ranta=kostlan*annu;
inter=kostlan*ran;
garta=lanf*garran;
garta1=garta;
garran+=okn;
amort=fip-ranta;
if(garta>inter)garta1=inter;
pay=amort+garta1;
pay1[i]=pay;
fix[i]=pay*pow((1+infl),-i);
pres[i]=fix[i]*pow((1+r),-i);
kostlan-=amort;
printf(" %2d   %7.0f  %7.0f    %7.0f %7.0f  %7.0f   %7.0f %7.0f\n",
i,fip,ranta,amort,garta,pay,kostlan,inter);
}
garran=garran1;

printf("\f\n\nTransfer calculations\n");
printf("-----------------------\n");
printf("\n\nYear    To pay   Fixed prices     Present worth\n");
printf("-------------------------------------------------\n");


for(i=1;i<=amtid;i++)
```

```
{
printf(" %2d    %7.0f    %7.0f        %7.0f\n",i,pay1[i],fix[i],pres[i]);
pay2+=pay1[i];
fix1+=fix[i];
pres1+=pres[i];
}

printf("\nSum of payments is     =%8.0f\n",pay2);
printf("Sum of fixed prices is    = %8.0f\n",fix1);
printf("Sum of present worths is  = %8.0f\n",pres1);
pay3+=pay2;
fix2+=fix1;
pres2+=pres1;
if(j==0)subrat=pres1/lanf;
pay2=0.;
fix1=0.;
pres1=0;
}
printf("\nTotal payment, running prices, for all the loans = %8.0f\n",pay3);
printf("Total payment, fixed prices, for all the loans    = %8.0f\n",fix2);
printf("Total payment, present worth, for all the loans   = %8.0f\n",pres2);
return(pres2/kost);
}
```

Chapter 4

Appendix D. Program for solar radiation through windows, sola.c from 1992-04-08

```
/*This program calculates the solar radiation
  through windows*/


#include "stdio.h"
#include <math.h>
#include <process.h>
#define PI 3.14159265
#define DAG 15

float direct();
float *transm();
float summan1=0.;


void main()


{
float varde[30],fakt1,fakt2,fakt3,ha,rm,mansum[3][12],
mansu1[3][12],typer[2][12],resultat[12];
static int forsta=1,sista=0,dagtyp=0;
/*static int dagar[12] = {1,1,1,1,1,1,1,1,1,1,1,1};*/
static int dagar[12] = {31,28,31,30,31,30,31,31,30,31,30,31};
static float rco[12]={1.0315,1.0235,1.0103,0.9913,0.9757,0.968,0.968,
      0.9757,0.9898,1.0087,1.0238,1.0318};
register int manad,i;
FILE *in;

printf("        THIS IS THE OUTPUT FROM THE SORAD PROGRAM CALCULATING SOLAR \n");
printf("                        RADIATION THROUGH WINDOWS\n");
printf("        ============================================================\n\n");
printf("\nThis solar program is financed by the Helgo Zettervall foundation administrated\n");
printf("by The Swedish National Board of Public Building. The input data are located\n");
printf("at a separate file called SUNI.DAT.\n\n");
printf("The program is designed by Stig-Inge Gustafsson, PhD in Energy Systems at the\n");
printf("Institute of Technology in Linköping, Sweden. Tel int+46 13 281156, Fax: 281788,\n");
printf("and is written in the language C. The source could be found in the file SOLA.C\n");
printf("which can be looked at by use of an editor.\n\n");
printf("The day no 15 is shown in the output but this could be changed in the DEFINE\n");
```

```
printf("statement in the code.\n\n");
printf("The calculations are elaborated for clear, half-clear and overcast days.\n");
printf("A special manual for the program could be found in -The OPERA model- by \n");
printf("Stig-Inge Gustafsson.\n\n");


if((in = fopen("SUN.DAT","r")) != NULL)
{
register int i=0;
while(fscanf(in,"%f",&varde[i]) != EOF)
{
/*printf("Detta är värdet =  %5.2f\n",varde[i]);*/
i++;
}
fclose(in);
ha=0.;
rm=0.2;
for(dagtyp=0;dagtyp<=2;dagtyp++)
{
       /*Här kommer värden för olika dagtyper*/
       switch(dagtyp)
       {
       case 0:
       /*Här sätts faktorer för en helklar dag*/
       fakt1=0.9;
       fakt2=0.2;
       fakt3=0.04;
printf("                ==================CLEAR DAYS================\n");
printf("\n");
break;
       case 1:
       /*Här sätts faktorer för en halvklar dag*/
       fakt1=0.52;
       fakt2=0.38;
fakt3=0.032;
printf("\n\n");
printf("                ==================HALF-CLEAR DAYS================\n");
printf("\n");
break;
       case 2:
       /*Här kommer värden för en mulen dag*/
       fakt1=0.1;
       fakt2=0.35;
fakt3=0.016;
printf("\f");
printf("                ====================OVERCAST DAYS================\n");
printf("\n");
       break;
       }
       /*printf("fakt1=%6.4f fakt2=%6.4f fakt3=%6.4f\n",fakt1,fakt2,
       fakt3);*/
       /*Här skall man se till att rätt antal dagar används*/
       for(manad=0;manad<=11;manad++)
       {
       /*printf("manad = %3d dagar =%3d\n",manad,dagar[manad]);*/
       sista+=dagar[manad];
       /*printf("Första = %3d, Sista = %3d \n",forsta,sista);*/
mansum[dagtyp][manad]=direct(varde[0],varde[1],
varde[2],forsta,sista,fakt1,fakt2,fakt3,ha,rm,
rco[manad]);
mansu1[dagtyp][manad]=summan1;
       /*printf("Den totala solstrålningen i månad %2d blev = %5.2f\n",manad+1,mansum[dagtyp][manad]);*/
/*printf("The total radiation through a window month %2d became:  %6.2f\n",manad+1,summan1);*/
       /*printf("Efter funk är forsta = %3d sista = %3d\n",
       forsta,sista);*/
       forsta=sista+1;
       summan1=0.;
       }
       forsta=1;
       sista=0;
       }
       }
       else
       {
```

```
printf("Could not find the input data file!!");
exit(0);
}
printf("\n\n");
/*printf("Nu har programmet kommit till slutet\n");*/
printf("     SOLAR RADIATION IN kWh/SQ.M. AT THE OUTSIDE AND THE INSIDE OF THE WINDOW \n");
printf("     ---------------------------------------------------------------------------\n");
printf("Month        Clear days          Half-clear days          Overcast days\n");
printf("  nr      Outside   Inside      Outside   Inside          Outside   Inside\n");
for(manad=0;manad<=11;manad++)
printf(" %3d %6.1f %6.1f %6.1f %6.1f %6.1f %6.1f %6.1f\n",
manad+1,mansum[0][manad]/1000.,mansu1[0][manad]/1000.,mansum[1][manad]/1000.,
mansu1[1][manad]/1000.,mansum[2][manad]/1000.,mansu1[2][manad]/1000.);

/* Här ska nu tas hänsyn till tvåglasfönster samt antal klara, halvklara
samt mulna dagar*/
i=3;
for(dagtyp=0;dagtyp<=1;dagtyp++)
{
for(manad=0;manad<=11;manad++)
{
typer[dagtyp][manad]=varde[i];
/*printf("Antalet typdagar = %4.1f\n",typer[dagtyp][manad]);*/
i++;
}
}
printf("\n\n");
printf("            SOLAR ENERGY THROUGH A TWO PANE WINDOW\n");
printf("       ================================================\n");
printf("The normal of the window directed %5.1f degrees clockwise from the south\n",varde[1]);
printf("                Month             Energy \n");
printf("                 no               kWh/sq.m\n");
for(manad=0;manad<=11;manad++)
{
resultat[manad]=0.9*((mansu1[0][manad]*typer[0][manad])+(mansu1[1][manad]*(dagar[manad]-
typer[0][manad]-typer[1][manad]))
+(mansu1[2][manad]*typer[1][manad]))/dagar[manad];
printf("                %3d               %6.2f   \n",manad+1,resultat[manad]/1000.);
}
printf("The program has now come to its end\f");
}



/* Här kommer en funktion för att beräkna den direkta solinstrålningen*/


float direct(lat,azyta,b,forsta,sista,fakt1,fakt2,fakt3,ha,rm,rc)
float lat,azyta,b,fakt1,fakt2,fakt3,ha,rm,rc;
int forsta,sista;

{
float dekl,timv,c1,c2,hojdv,azim,idn,latr,timvun,tupp,tner,azim1;
float azimd,hojdvd,sumidn,sumidn1,azytar,irad,igrad,brad;
float idn1,azres,azimpos,idirh,idiffh,threl,rikt,absor,absco,trans;
float cv,itotal,itoth,idiffb,idiffm,idn2,summan,iehim,iemark,idn3=0.;
float *pektrans,*pekm,itot=0.;
float midn3=0.,himdiff,absorhim,transhim,absorm,transma,markdiff;
float totstral=0.;
double uttr;
int koll,flagga;
register int kl1,dagnr;
unsigned int kl;

/*Här sätts absorbtionscoefficienten till 0.07*/
absco=0.07;
/*printf("Latituden blev = %5.2f grader N\n",lat);*/
/*printf("Ytans azimut = %5.2f grader räknat från söder och medurs.\n",azyta);*/
/*printf("Ytans lutning mot horisontalplanet = %5.2f grader \n",b);*/

latr=lat*2.*PI/360.;/* Latituden ska vara i radianer */
summan=0.;
summan1=0.;
/*printf("I början av direkt är summan1= %6.2f\n",summan1);*/
```

```
/*printf("                      midn3= %6.2f\n",midn3);*/
pekm=&midn3;
/*printf("                         idn3= %6.2f\n",idn3);*/

/*Här börjar beräkningarna för varje månad*/

for(dagnr=forsta;dagnr<=sista;dagnr++)
      {
      c2=0.017214*(dagnr-2.8749);
      c1=c2+0.0334*sin(c2)+1.78128;
      dekl=asin(-0.3979*sin(c1));

      /* Först måste beräknas när solen går upp och ner*/
      if(dagnr==DAG)
       {
printf("                    CALCULATIONS FOR DAY NO %3d\n",dagnr);
printf("\n");
/*printf("              Tidsperiod = från dag nr %4d till %4d \n",forsta,sista);*/
printf("                ==========================================\n");
       }
      timvun=acos(-(sin(latr)*sin(dekl)/(cos(latr)*cos(dekl))));
      tupp=12.-timvun*360./(2.*PI*15.);
      tner=12.+timvun*360./(2.*PI*15.);
      /*printf(" Timvinkel vid solnedgång i radianer = %5.2f\n",timvun);*/
      /*printf(" Solen går upp kl %5.2f  och går ner kl %5.2f\n",tupp,tner);*/
      kl=(int)tupp;
      kl1=(int)tner;
      /*printf(" Heltalsdelen av soluppgången = %5d \n",kl); */
      kl++;
      if(dagnr==DAG)
       {
printf("True  Eleva- Solar   Solar    Beta  Solar    Diffuse  Diffuse  Total    Total\n");
printf("solar tion   azimuth radia.   angle radia.   radia.   radia.   radia.   radia.\n");
printf("time  angle  angle   IDN             IDN1     sky      ground   outside  inside\n");
printf("[ h ] [deg]  [ deg ] [W/sq.m] [deg] [W/sq.m] [W/sq.m] [W/sq.m] [W/sq.m] [W/sq.m]\n");
printf("-------------------------------------------------------------------------------\n");
}
      sumidn=0.;
      itotal=0.;
      sumidn1=0.;
      koll=2;
      while(kl<=kl1)
       {
       /*printf(" Nu är klockan = %5d \n",kl);*/
timv=(kl-12.)*15.*2.*PI/360.; /* Timvinkel i radianer */
       hojdv=asin(sin(latr)*sin(dekl)+cos(latr)*cos(dekl)*cos(timv));
       azim=asin(cos(dekl)*sin(timv)/cos(hojdv));
       uttr=(sin(dekl)*cos(latr)-cos(dekl)*sin(latr)*cos(timv))/cos(hojdv);
       if(uttr<=-1.) uttr=-0.999999;
       azim1=acos(uttr);
       /*printf(" Azimuten beräknad på enkla sättet blev = %6.4f radianer. \n" ,azim);*/
       /*printf(" Detta är latr,c2,c1,dekl = %5.2f , %5.2f , %5.2f , %5.2f
       \n",latr,c2,c1,dekl);*/
       /*printf(" Detta är timv,höjdv,azim = %5.2f , %5.2f , %5.2f\n",timv,hoj dv,azim);*/
       if(hojdv>=0.001)
idn=fakt1*rc*991.64*exp(-0.09143/sin(hojdv));
       else
       idn=0.;
       idn2=idn;
       /*printf("Direkt strålning mot normalen = %7.2f \n",idn);*/
       /* Här ska jag ta hänsyn till hur ytan lutar.*/
       brad=b*2.*PI/360.;
       azytar=azyta*2.*PI/360.;
       azres=azim-azytar;
       azimd=azim*360./(2.*PI);
       if(azimd<=0.)
       {
       azimpos=360.+azimd;
       /*printf("azimpos = %7.4f grader\n",azimpos);*/
       if(azimpos>=azyta+90.)
       {
       if(azimpos>=azyta+270.)
       {
       /*printf("Framsidan.Bidrag.\n");*/
```

```
       flagga=1;
       }
       else
       {
       /*printf("Baksidan.Inget bidrag\n");*/
       idn=0.;
       azres=(azimpos-azyta)*2.*PI/360.;
       }
       }
       else
       {
       /*printf("Nu lyser solen på framsidan. Bidrag.\n");*/
       flagga=1;
       }
       }
       else
       {
       if(azimd<=(azyta-90.))
       {
       /*printf("Här lyser solen på baksidan. Inget bidrag.\n");*/
       idn=0.;
       azres=azytar-azim;
       }
       else
       {
       /*printf("Här blir det bidrag. \n");*/
       flagga=1;
       }
       }
       irad=acos(sin(hojdv)*cos(brad)+cos(hojdv)*sin(brad)*cos(azres));
       igrad=irad*360./(2.*PI);
       /*printf(" irad = %7.4f , igrad = %7.4f \n",irad,igrad);*/
       /*printf(" Här i funktionen direkt( ) blev idn = %5.2f\n",idn);*/
idn1=idn*cos(irad);
       /*Här kommer direkt strålning mot horisontell yta.*/
       idirh=fakt1*idn2*sin(hojdv);
       /*printf("Dir strålning mot horisontell yta = %7.2f W/kv.m\n",idirh);*/
       idiffh=(fakt2*sin(hojdv)+fakt3)*idn2;
       /*printf("Diff strål mot horisontell yta = %7.2f W/kv.m\n",idiffh);*/
       /*Threlkelds faktor*/
       /*printf("solazimut-ytazimut i radianer = %5.3f\n",azres);*/
       cv=cos(hojdv)*cos(azres);
       threl=0.55+0.437*cv+0.313*cv*cv;
       /*printf("cv = %7.3f threl = %7.3f \n",cv,threl);*/
       if(threl<=0.45) threl=0.45;
idiffb=(1+fakt1*(2.*threl-1.)*sin(brad)*sin(brad))*0.5*(cos(ha)+cos(brad))*idiffh;
/*printf("Diffus strålning mot lutande yta är = %7.2f \n",idiffb);*/
       itoth=idirh+idiffh;
       idiffm=rm*0.5*(2.-cos(ha)-cos(brad))*itoth;
       /*printf("Strålning reflekterad från marken = %7.2f \n",idiffm);*/
/*Total strålning blir direkt+diffus+mark */
       itotal=idn1+idiffb+idiffm;
/*printf("Total strålning blev = %7.2f W/kv.m \n",itotal);*/
       hojdvd=hojdv*360./(2.*PI);
       /*Här ska beräknas strålningen genom ett fönster*/
       /*Först ny vinkel Se medd. 146 sid 8*/
       iehim=59.68-0.1388*b+0.001497*b*b;
       iemark=90.-0.5788*b+0.002693*b*b;
       /*printf("Vinkeln = %5.2f iehim=%5.2f iemark= %5.2f \n"
       ,b,iehim,iemark);*/
       /*Här kommer transmissionsberäkning. Se B&I sid 162 */
       /*Först beräknas för direkt instrålning*/
       if(flagga==1)
       {
       /*printf("Här lyser det på framsidan. Alltså direkt strålning\n");*/
       rikt=igrad;
pektrans=transm(rikt,absco);
       trans=*pektrans;
       absor=*(pektrans+1);
       /*printf("trans = %6.2f  absor = %6.2f \n",trans,absor);*/
       idn3=idn1*trans+0.3*idn1*absor;/*Se medd. 146 sid 9*/
       /*printf("idn= %6.2f idn1 = %6.2f idn3 = %6.2f\n",idn,idn1,idn3);*/
       }
/* Här skall diffusa strålningen in genom fönstret*/
```

```
/* Först tar jag himmelsstrålning */
rikt=iehim;
pektrans=transm(rikt,absco);
transhim=*pektrans;
absorhim=*(pektrans+1);
/*printf("Transmissionsfaktor vid himmelsstrålning blev = %6.2f\n",transhim);*/
/*printf("Absorbtionsfaktor vid him.stråln. = %6.2f\n",absorhim);*/
/* Här kommer markreflekterad strålning*/
rikt=iemark;
pektrans=transm(rikt,absco);
transma=*pektrans;
absorm=*(pektrans+1);
himdiff=idiffb*(transhim+0.3*absorhim);
/*printf("Den resulterande him.stråln. blev = %6.2f\n",himdiff);*/
markdiff=idiffm*(transma+0.3*absorm);
/*printf("Transma = %6.2f Absorm = %6.2f\n",transma,absorm);*/
/*printf("Den resulterande markstrålningen blev = %6.2f\n",markdiff);*/
/* Här kommer total strålning som transmitterats genom fönstret*/
totstral=himdiff+markdiff+idn3;
/*printf("Total strålning genom fönstret blev = %6.2f\n",totstral);*/
       if(dagnr==DAG)
{
printf(" %2d   %4.1f  %6.1f  %6.1f  %6.1f  %6.1f   %5.1f     %5.1f    %5.1f    %5.1f\n",
kl,hojdvd,azimd,idn,igrad,idn1,idiffb,idiffm,itotal,totstral);
}
/*printf("  koll = %2d \n",koll);*/
       if(koll == 2)
       {
       sumidn=-(tupp-kl)*itotal/2.;
       /*printf("tupp,kl,idn = %5.2f %5d %5.2f \n",tupp,kl,idn);*/
        /*printf("sumidn = %5.2f \n",sumidn);*/
       koll = 1;
       }
       sumidn+=itotal;
       kl++;
       flagga=0;
       /*printf("idn3 = %6.2f midn3 = %6.2f\n",idn3,midn3);*/
/*printf("*pekm = %6.2f\n",*pekm);*/
       midn3+=totstral;
/*printf("Nu efter summan är idn3= %6.2f\n",idn3);*/
/*printf("Omväg via pekare ger efter summan = %6.2f\n",*pekm);*/
/*printf("Adressen är nu = %6d\n",&midn3);*/
       /*printf("midn3 efter summan = %6.2f\n",midn3);*/
       idn3=0.;
totstral=0.;
itot+=itotal;
}
      sumidn+=-(tner-kl)*itotal/2.;
      /*printf("tner = %4.2f kl = %3d \n",tner,kl);*/
      /*printf("Bidrag på slutet blir %7.4f \n",-(tner-kl)*idn1/2.);*/
      sumidn1=sumidn;
      summan+=sumidn1;
      /*printf("Före summering är summan1 = %6.2f och midn3= %6.2f\n",summan1,midn3);*/
      summan1+=midn3;

      if(dagnr==DAG)
{
printf("--------------------------------------------------------------------------------\n");
printf("\n");
printf("The sum of the total outside radiation day no. %3d equals %4.1f Wh/sq.m.\n",dagnr,itot);
printf("The sum of the total inside radiation day no.  %3d equals %4.1f Wh/sq.m.\n",dagnr,midn3);
/*printf("Dag nr %3d är summan = %7.2f W/kv.m\n",dagnr,summan);*/
/*printf("Dag nr %3d är midn3 = %7.2f W/kv.m\n",dagnr,midn3);    */
/*printf("Dag nr %3d är summan1 = %7.2f W/kv.m\n",dagnr,summan1); */
}
      sumidn1=0.;
      midn3=0.;
      itot=0.;
      }
/*printf("summan1 = %6.2f\n",summan1);*/
return(summan);
}
```

```
	/*Här kommer en funktion för att beräkna transmission och
	  absorbtion i glasrutan*/

	float *transm(rikt,absco)

	float rikt,absco;

	{

	float *pektrans;
	float riktrad,bryti=1.52,taljpar,namnpar,taljvin,namnvin,riktpar,riktvin;
	float faktor,alfpar,alfvin,r1par,r1vin,alf1vin,alf1par,atot,ttot,sum1;
	float sum2,sum3,tpar,tvin,refpar,refvin,reftot,apar,avin;
	double roten;

	/*printf("Riktning resp abs.coeff blev %6.2f %6.4f \n",rikt,absco);*/
	/*Här ska först reflektionsfaktorerna beräknas. Par = parallell
	och vin = vinkelrät, se 1:47 och 1:48 i B&I */
	/*Om rikt är större än 90 grader blir det fel. Minska med 180 grader*/
	if(rikt>=90.) rikt = 180.-rikt;
	riktrad=rikt*2.*PI/360.;
	roten=sqrt(bryti*bryti-sin(riktrad)*sin(riktrad));
	/*printf("rikt = %6.2f riktrad = %6.4f roten = %6.4f \n",rikt,riktrad,roten);*/
	taljpar=bryti*bryti*cos(riktrad)-roten;
	namnpar=bryti*bryti*cos(riktrad)+roten;
	riktpar=(taljpar/namnpar)*(taljpar/namnpar);
	taljvin=cos(riktrad)-roten;
	namnvin=cos(riktrad)+roten;
	riktvin=(taljvin/namnvin)*(taljvin/namnvin);
	/*printf("riktpar = %6.4f riktvin = %6.4f \n",riktpar,riktvin);*/

	/*Här kommer formel 3:8 i B&I */
	faktor=1.-(exp(-absco*bryti/roten));
	alfpar=(1.-riktpar)*faktor;
	alfvin=(1.-riktvin)*faktor;
	/*printf("faktor= %6.4f alfpar = %6.4f alfvin = %6.4f \n",faktor,alfpar,alfvin);*/

	/*Här kommer formel 3:9 i B&I */
	r1par=1.-riktpar;
	r1vin=1.-riktvin;
	alf1par=1.-alfpar;
	alf1vin=1.-alfvin;

	refpar=riktpar+(riktpar*(r1par*r1par*alf1par*alf1par)/(1.-riktpar*riktpar*alf1par*alf1par));
	refvin=riktvin+(riktvin*(r1vin*r1vin*alf1vin*alf1vin)/(1.-riktvin*riktvin*alf1vin*alf1vin));
	reftot=(refpar+refvin)/2.;
	/*printf("refpar = %6.4f refvin = %6.4f reftot = %6.4f\n",refpar,refvin,reftot);*/

	/*Här kommer formel 3:10 i B&I*/
	apar=(alfpar*r1par*(1.+riktpar*alf1par))/(1.-riktpar*riktpar*alf1par*alf1par);
	avin=(alfvin*r1vin*(1.+riktvin*alf1vin))/(1.-riktvin*riktvin*alf1vin*alf1vin);
	atot=(apar+avin)/2.;
	/*printf("apar =%6.4f avin = %6.4f atot = %6.4f \n",apar,avin,atot);*/

	/*Här kommer formel 3:11 i B&I */
	tpar=(1.-riktpar)*(1.-riktpar)*alf1par/(1.-riktpar*riktpar*alf1par*alf1par);
	tvin=(1.-riktvin)*(1.-riktvin)*alf1vin/(1.-riktvin*riktvin*alf1vin*alf1vin);
	ttot=(tpar+tvin)/2.;
	/*printf("tpar = %6.4f tvin = %6.4f ttot = %6.4f\n",tpar,tvin,ttot);*/

	/*Här ska summorna kollas*/
	sum1=refpar+apar+tpar;
	sum2=refvin+avin+tvin;
	sum3=reftot+atot+ttot;
	/*printf("sum1 = %4.2f sum2 = %4.2f sum3 = %4.2f\n",sum1,sum2,sum3);*/
	if(sum1>1.05||sum1<.95||sum2>1.05||sum2<.95||sum3>1.05||sum3<.95)
	 printf("Här blev det fel i transmissionsberäkningen\n");

	pektrans=&ttot;
	*(pektrans+1)=atot;
	return(pektrans);
}
```

Chapter 5

Appendix E. Program for bivalent system optimization, P1.FOR from November 24, 1992

```
        PROGRAM BIVAL

********THIS IS A FORTRAN PROGRAM CALCULATING THE OPTIMAL DISTRIBUTION*
********BETWEEN AN OIL-BOILER, A HEAT PUMP AND ONE INSULATION MEASURE**
********IN DISCRETE STEPS. NOTE NO REAL OPTIMIZATION IS MADE**********
********THE PROGRAM HAS BEEN FINANCED BY THE FOUNDATION OF ELNA****
********BENGTSSON AND THE SWEDISH COUNSIL FOR BUILDING RESEARCH*******
********VERSION 1.0  1990 06 01**************************************
********VERSION 1.01 1990 10 09**************************************

        IMPLICIT REAL(A-Z)
        INTEGER I,U,X,J,FLAG,X1,K,U1,F
        DIMENSION INS(10),FUSE(12),UEXI(5),NH(4),A(8),
     +  DEGH(12),ELHOURS(12),HOURS(12),FREEA(12),SUN(5:8,12),SUNNY(12),
     +  PREFAC(4),C2(4),WCOST(5:8),C3(4),AFUSE(12),POW(12),
     +  POWS(12)
        COMMON SLANG1,LSLANG1,SLANG2,LSLANG2,UTE1,UTE2,NLP1,NLP2,PROC,
     +  LPROC,UTE3,TRANSENG,VENTEFG,TOTENE

        OPEN(2,FILE='BIV.DAT')
OPEN(0,FILE='NUL')
OPEN(1,FILE='CON')
READ(2,*)OILP,ELLOW,ELHIGH,(FUSE(J),J=1,12),(AFUSE(J),J=1,12)
        READ(2,*)INP1,AKP1,INP2,AKP2,PREOCC,(PREFAC(J),J=1,4)
        READ(2,*)ELOAD,HPLOAD,EFFIO,EFFIHP,HW,(NH(J),J=1,4),DUT
        READ(2,*)(A(J),J=1,8),(UEXI(J),J=1,5)
```

```
        READ(2,*)(C2(J),J=1,4),(C3(J),J=1,4),(WCOST(J),J=5,8)
        READ(2,*)(INS(J),J=1,10),OPT,R1,WEACOST
        READ(2,*)(DEGH(J),J=1,12)
        READ(2,*)TRAN1,VENT1,(FREEA(J),J=1,12)
        READ(2,*)((SUN(I,J),I=5,8),J=1,12),SHAD
        READ(2,*)SLANG1,SLANG2,INEVIT,SALVAGE
        CLOSE(2)

        DATA ELHOURS/392.,358.,376.,720.,744.,720.,744.,744.,720.,744.,
     +  368.,408./
        DATA HOURS/744.,678.,744.,720.,744.,720.,744.,744.,720.,744.,
     +  720.,744./
        DATA F,K,X1,FLAG1/4*0/
        TOTLOW=1.E+15
U=0
U1=1
        STEP=0.01
WRITE(*,*)'THIS IS VERSION 1.01 OF THE BIVAL PROGRAM'
WRITE(*,*)'BE SURE THAT YOU HAVE A VALID INPUT DATA FILE'
WRITE(*,*)'WHICH IS CALLED BIV.DAT AND IS GENERATED BY'
WRITE(*,*)'USE OF THE OPERA MODEL'
 9      CONTINUE
        J=0
        STEG=1.
        NTRA=TRAN1
        NVEN=VENT1
        ANHOUR=0.
        LOWCOST=1.E+15
        INSCOST=0.
        DO 4 I=1,12
                 ANHOUR=ANHOUR+HOURS(I)
                 SUNNY(I)=0.
 4      CONTINUE
        K=K+1
        HWL=HW/ANHOUR
        DO 1 X=1,10
        IF(INS(X).GT.0.01)THEN
           IF(X.LE.4)THEN
               DTI=A(X)*(UEXI(X)-UEXI(X)*NH(X)/(NH(X)+UEXI(X)*INS(X)))
                 IF(X1.GT.0)STOP'TOO MANY INS. MEASURES'
                 X1=X
                 INSCOST=INSCOST+C2(X)+C3(X)*INS(X)
                 F=1
           ELSEIF(X.LE.8)THEN
                 DTI=A(X)*(UEXI(5)-INS(X))
                 INSCOST=INSCOST+WCOST(X)
                 DO 3 I=1,12
                         SUNNY(I)=SUNNY(I)+A(X)*(SUN(X,I)-SHAD*SUN(X,I))
 3               CONTINUE
           ELSEIF(X.LE.9)THEN
```

```
            DCA=INS(9)
            INSCOST=INSCOST+WEACOST
         ELSEIF(X.GE.10)THEN
            WRITE(*,*)'CANNOT DO TWO HEAT PUMPS. STOPS HERE'
            STOP
         ENDIF
            WRITE(U,*)'NTRA, DTI,NVEN,DCA= ',NTRA,DTI,NVEN,DCA
         NVEN=NVEN-DCA
         NTRA=NTRA-DTI
            DTI=0.
            DCA=0.
      ENDIF
1     CONTINUE
      SUM=0.001*(NTRA+NVEN)
      NLOAD=SUM*DUT
5     CONTINUE
      J=J+1
      WRITE(U,*)'HEAT PUMP LOAD IS NOW = ',HPLOAD
      OBC=(INP1+(NLOAD-HPLOAD)*AKP1)*PREFAC(1)
      HPC=(INP2+HPLOAD*AKP2)*PREFAC(2)
      PIPE1=(NLOAD-HPLOAD)*SLANG1*PREFAC(3)
      PIPE2=HPLOAD*SLANG2*PREFAC(4)

      EQUIPC=OBC+HPC+PIPE1+PIPE2
      WRITE(U,*)'HEATING EQUIPMENT COST WILL BE: ',EQUIPC

      NFUSE=1000.*(HPLOAD/EFFIHP)/(380.0*SQRT(3.))
      IF(NFUSE.GT.AFUSE(12))STOP'DEMAND TARIFF'
      IF(NFUSE.LE.AFUSE(12).AND.NFUSE.GT.AFUSE(11))SUBFEE=FUSE(12)
      IF(NFUSE.LE.AFUSE(11).AND.NFUSE.GT.AFUSE(10))SUBFEE=FUSE(11)
      IF(NFUSE.LE.AFUSE(10).AND.NFUSE.GT.AFUSE(9))SUBFEE=FUSE(10)
      IF(NFUSE.LE.AFUSE(9).AND.NFUSE.GT.AFUSE(8))SUBFEE=FUSE(9)
      IF(NFUSE.LE.AFUSE(8).AND.NFUSE.GT.AFUSE(7))SUBFEE=FUSE(8)
      IF(NFUSE.LE.AFUSE(7).AND.NFUSE.GT.AFUSE(6))SUBFEE=FUSE(7)
      IF(NFUSE.LE.AFUSE(6).AND.NFUSE.GT.AFUSE(5))SUBFEE=FUSE(6)
      IF(NFUSE.LE.AFUSE(5).AND.NFUSE.GT.AFUSE(4))SUBFEE=FUSE(5)
      IF(NFUSE.LE.AFUSE(4).AND.NFUSE.GT.AFUSE(3))SUBFEE=FUSE(4)
      IF(NFUSE.LE.AFUSE(3).AND.NFUSE.GT.AFUSE(2))SUBFEE=FUSE(3)
      IF(NFUSE.LE.AFUSE(2).AND.NFUSE.GT.AFUSE(1))SUBFEE=FUSE(2)
      IF(NFUSE.LE.AFUSE(1))SUBFEE=FUSE(1)
      WRITE(U,*)'SUBSCRIPTION FEE BECAME = ',SUBFEE
      ELCOST=0.
      OCOST=0.

      DO 2 I=1,12
            ELHEAT=HPLOAD*HOURS(I)
            MONEN=SUM*DEGH(I)+HWL*HOURS(I)
            POW(I)=MONEN/HOURS(I)
            FREE=FREEA(I)+SUNNY(I)
            POWS(I)=POW(I)-FREE/HOURS(I)
```

```
                IF(FREE.GE.(MONEN-HWL*HOURS(I)))THEN
                    IF(HPLOAD.LT.HWL)THEN
                        ELCOST=ELCOST+HPLOAD*ELHOURS(I)*ELLOW/EFFIHP
                        IF((OILP/EFFIO).LT.(ELHIGH/EFFIHP))THEN
                                ELCOST=ELCOST+0.
                                OCOST=OCOST+(HOURS(I)-ELHOURS(I))*
     +                          HPLOAD*OILP/EFFIO
                        ELSE
                               ELCOST=ELCOST+(HOURS(I)-ELHOURS(I))
     +                         *HPLOAD* ELHIGH/EFFIHP
                        ENDIF
                        OCOST=OCOST+(HWL-HPLOAD)*HOURS(I)*OILP/EFFIO
                        GOTO 6
                     ENDIF
                        MONEN=HWL*HOURS(I)
                        ELCOST=ELCOST+ELHOURS(I)*HWL*ELLOW/EFFIHP
                        IF((HOURS(I)-ELHOURS(I)).GT.0.)THEN
                          IF((OILP/EFFIO).LT.(ELHIGH/EFFIHP))THEN
                                ELCOST=ELCOST+0.
                                OCOST=OCOST+(HOURS(I)-ELHOURS(I))*
     +                          HWL*OILP/EFFIO
                          ELSE
                           ELCOST=ELCOST+(HOURS(I)-ELHOURS(I))*HWL*
     +                           ELHIGH/EFFIHP
                          ENDIF
                        ENDIF
                        IF((MONEN-ELHEAT).GT.0.)THEN
                        OCOST=OCOST+(MONEN-ELHEAT)*OILP/EFFIO
                        ENDIF
                        OCOST=OCOST+0.
 6                      WRITE(U,*)'OUTSIDE HEATING SEASON'
                ELSEIF(ELHEAT.LE.(MONEN-FREE))THEN
                        WRITE(U,*)'OIL AND ELECTRICITY '
                        ELCOST=ELCOST+ELHOURS(I)*HPLOAD*ELLOW/EFFIHP
                        IF((OILP/EFFIO).LT.(ELHIGH/EFFIHP))THEN
                                ELCOST=ELCOST+0.
                                OCOST=OCOST+((HOURS(I)-ELHOURS(I))*
     +                                HPLOAD*OILP/EFFIO)
                        ELSE
                                ELCOST=ELCOST+(HOURS(I)-ELHOURS(I))
     +                                 *HPLOAD* ELHIGH/EFFIHP
                        ENDIF
                        OCOST=OCOST+(MONEN-ELHEAT-FREE)*OILP/EFFIO
                ELSE
                     ELCOST=ELCOST+ELHOURS(I)*((MONEN-FREE)/HOURS(I))*
     +                  ELLOW/EFFIHP
                        IF((OILP/EFFIO).LT.(ELHIGH/EFFIHP))THEN
                                ELCOST=ELCOST+0.
                                OCOST=OCOST+((HOURS(I)-ELHOURS(I))*
     +                          ((MONEN-FREE)/HOURS(I))*OILP/EFFIO)
```

```
                        ELSE
                                ELCOST=ELCOST+(HOURS(I)-ELHOURS(I))*
     +                          ((MONEN-FREE)/HOURS(I))*ELHIGH/EFFIHP
                        ENDIF
                        OCOST=OCOST+0.
                        WRITE(U,*)'ONLY ELECTRICITY'
                ENDIF
 2      CONTINUE
        WRITE(U,*)'OIL COST, ELECTRICITY COST = ',OCOST,ELCOST
        TOTCOST=EQUIPC+(OCOST+ELCOST+SUBFEE)*PREOCC+INSCOST+INEVIT+
     +  SALVAGE
        WRITE(U,*)'J,TOT,LOWCOST,INS(3) = ',J,TOTCOST,LOWCOST,INS(3)
        IF(ABS(TOTCOST-LOWCOST).LT.100..OR.J.GT.100)GOTO 7
        IF(TOTCOST.LT.LOWCOST)THEN
                LOWCOST=TOTCOST
                HPLOAD=HPLOAD+STEG
                GOTO 5
        ELSE
                STEG=-STEG
                IF(FLAG.EQ.1)THEN
                        STEG=STEG/10.
                        FLAG=0
                ELSE
                        FLAG=1
                ENDIF
                HPLOAD=HPLOAD+STEG
                LOWCOST=TOTCOST
                GOTO 5
        ENDIF
 7      CONTINUE
        WRITE(U,*)'J,TOTCOST,HPLOAD,INS(X1)= ',J,TOTCOST,HPLOAD,INS(X1)
        IF(F.EQ.0)THEN
WRITE(*,*)'NO INSULATION OPTIMIZATION'
INS(X1)=0.
GOTO 8
ENDIF
        IF(ABS(TOTCOST-TOTLOW).LT.100..OR.K.GT.50)GOTO 8
        WRITE(U,*)'THIS IS THE INSULATION OPTIMIZATION ROUTINE, K =',K
        WRITE(U,*)'TOTCOST,TOTLOW,TOTTOT= ',TOTCOST,TOTLOW,TOTTOT
        IF(TOTCOST.LT.TOTLOW)THEN
                TOTLOW=TOTCOST
 INS(X1)=INS(X1)+STEP
                X1=0
                GOTO 9
        ELSE
                STEP=-STEP
                IF(FLAG1.EQ.1)THEN
                        STEP=STEP/10.
                        FLAG1=0
                ELSE
```

```
                        FLAG1=1
                ENDIF
                INS(X1)=INS(X1)+STEP
                X1=0
                TOTLOW=TOTCOST
                GOTO 9
        ENDIF
 8      CONTINUE
        WRITE(U1,*)'THE OPTIMIZATION HAS TERMINATED'
        WRITE(U1,*)'THE HEAT PUMP SIZE BECAME          = ',HPLOAD
        WRITE(U1,*)'THE INSULATION THICKNESS BECAME    = ',INS(X1)
        WRITE(U1,*)'THE LOWEST PRESENT W. COST BECAME  =',TOTCOST
        WRITE(U1,*)'CONSISTING OF THE:'
        WRITE(U1,*)'EQUIPMENT COST          = ',EQUIPC
        WRITE(U1,*)'ANNUAL SUBSCRIPTION FEE = ',SUBFEE
        WRITE(U1,*)'ANNUAL COST FOR OIL     = ',OCOST
        WRITE(U1,*)'ANNUAL COST FOR EL.     = ',ELCOST
        WRITE(U1,*)'INSULATION COST         = ',INSCOST
        WRITE(U1,*)'INEVITABLE COST         = ',INEVIT
        WRITE(U1,*)'BOILER SALVAGE COST     = ',SALVAGE
END
```

Chapter 6

Appendix F. Duration graph program, graph.c from March 20, 1990

```
/*This program will show duration graphs emmanated from OPERA*/

#include <graphics.h>
#include <stdio.h>


static int hours[12]={744,678,744,720,744,720,744,744,720,744,720,744};


void main()



{
float enem[12],free[12],sun[12],eres[12],hv[12],load[12],mload=0.,sload[12],
sum=10.;
int gd=0,gm,i,x1,x2,y1,y2,x3,y3,x4,y4,ho,no[12],j=0,flag=0,k=0,scale=1000.,
hy1,hy2,fy1,fy2,sy1,sy2,ey1,ey2,side,side1,po[10];
char tim[5],kw[3],month[2];
FILE *fi;

if((fi=fopen("dur.dat","r"))==NULL){
printf("The file dur.dat cannot be found\n");
exit(0);
}
for(i=0;i<12;i++){
fscanf(fi,"%f%f%f%f%f",&enem[i],&free[i],&sun[i],&eres[i],&hv[i]);
load[i]=(enem[i]+hv[i])/hours[i];
sload[i]=load[i];
}
fclose(fi);
while(sum>1.)
{
sum=0.;
for(i=0;i<12;i++)
{
if(sload[i]>(mload+0.1)){
if(flag==1)sload[k]=load[k];
flag=1;
mload=sload[i];
no[j]=i;
k=i;
sload[i]=0.;
}
sum+=sload[i];
```

```
if(flag==1)sum+=1.;
}

mload=0.;
flag=0;
j++;
}
if(load[no[0]]>8000.){
printf("Load too large for graphics. > 8000. kW\n");
printf("Set higher values in the C-code\n");
exit(0);
}
if(load[no[0]]<800.)scale=100;
if(load[no[0]]<80.)scale=10;
if(load[no[0]]<8.)scale=1;

initgraph(&gd,&gm,"");
if(gd<0)printf("Negative value returned see C-manual\n");
moveto(400,20);
switch(gd){
case 9:outtext("VGA-system found");
moveto(400,35);
break;
default:printf("Graphics system not identified\n");exit(0);
}
switch(gm){
case 2:outtext("Resolution 640*480 pixels");break;
default:printf("Could not detect a resolution value\n");exit(0);
}
setbkcolor(0);
setlinestyle(0,0,3);
setcolor(14);
line(80,30,80,440);
line(80,440,550,440);
for(i=0;i<10;i++){
x1=80+i*50;
x2=x1;
y3=440-i*50;
y4=y3;
line(x1,440,x2,445);
line(75,y3,80,y4);
moveto(80+i*50,460);
settextjustify(1,1);
itoa(i*1000,tim,10);
outtext(tim);
moveto(60,440-i*50);
itoa(i*scale,kw,10);
outtext(kw);

}
moveto(590,460);
outtext("[ hours ]");
moveto(580,440);
outtext("Time");
moveto(120,30);
outtext("[ kW ]");
moveto(120,10);
outtext("Thermal");
moveto(120,20);
outtext("load");
setcolor(4);
setlinestyle(0,0,3);
x1=83;
for(i=0;i<12;i++){
x2=hours[i]*50./1000.;
y1=440-load[no[i]]*50./10.;
y2=440-load[(no[i+1])]*50./10.;
setcolor(1);
hy1=440-(hv[no[i]]/hours[no[i]])*50./10.;
        hy2=440-(hv[(no[i+1])]/hours[(no[i+1])])*50./10.;
fy1=y1+(free[no[i]]/hours[no[i]])*50./10.;
        fy2=y2+(free[(no[i+1])]/hours[(no[i+1])])*50./10.;
        if(fy1>hy1)fy1=hy1;
if(fy2>hy2)fy2=hy2;
```

```
po[0]=x1;po[1]=fy1;po[2]=x1+x2;po[3]=fy1;po[4]=x1+x2;po[5]=y1+3;
po[6]=x1;po[7]=y1+3;po[8]=x1;po[9]=fy1;
setcolor(10);
setfillstyle(1,10);
fillpoly(5,po);
sy1=fy1+(sun[no[i]]/hours[no[i]])*50./10.;
        sy2=fy2+(sun[no[i+1]]/hours[no[i+1]])*50./10.;
        if(sy1>hy1)sy1=hy1-3;
        if(sy2>hy2)sy2=hy2-3;
po[1]=fy1;po[3]=fy1;po[5]=sy1;
po[7]=sy1;po[9]=fy1;
setcolor(2);
setfillstyle(1,2);
fillpoly(5,po);
ey1=440-(eres[no[i]]/hours[no[i]])*50./10.;
ey2=440-(eres[no[i+1]]/hours[no[i+1]])*50./10.;
po[1]=ey1;po[3]=ey1;po[5]=hy1;po[7]=hy1;po[9]=ey1;
setfillstyle(1,9);
setcolor(9);
fillpoly(5,po);
po[1]=hy1;po[3]=hy1;po[5]=440-3;po[7]=440-3;po[9]=hy1;
setcolor(1);
setfillstyle(1,1);
fillpoly(5,po);
setcolor(4);
        line(x1,y1,x1+x2,y1);
        line(x1+x2,y1,x1+x2,440-load[(no[i+1])]*50./10.);
x1+=hours[i]*50./1000.;
moveto((x1-x2/2),y1-7);
itoa(no[i]+1,month,10);
        setcolor(4);
outtext(month);
        setcolor(4);
        }
moveto(200,430);
setcolor(15);
outtext("Hot water energy");
setcolor(15);
moveto(200,hy1-20);
outtext("Space heating energy");
moveto(490,95);
settextjustify(0,0);
outtext("Free energy");
moveto(490,123);
outtext("Solar energy");
po[0]=450;po[1]=110;po[2]=480;po[3]=110;po[4]=480;po[5]=130;po[6]=450;
po[7]=130;po[8]=450;po[9]=110;
setcolor(2);
setfillstyle(1,2);
fillpoly(5,po);
po[0]=450;po[1]=80;po[2]=480;po[3]=80;po[4]=480;po[5]=100;po[6]=450;
po[7]=100;po[8]=450;po[9]=80;
setcolor(10);
setfillstyle(1,10);
fillpoly(5,po);
}
```