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TOWARDS IMPROVING ELECTRICITY GENERATION IN NIGERIA: A CONCEPTUAL APPROACH

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ABSTRACT

Energy is the fundamental resource, it gives the ability to transform, transport and manufacture any and all goods and it is vital to the development of any economy. In Nigeria, electricity is one of the oldest energy forms available for daily activities. It is also, unfortunately, grossly inadequate to meet the demands of an ever increasing population. This is largely due to inadequate planning. Efficient energy management necessitates the development and utilization of an energy plan to ensure a balance between demand and supply with any economy. Energy analysis is defined as a particular set of procedures for evaluating the total energy requirements for the supply of a service or project.

Energy analysis is an important exercise in the overall energy systems planning and management. Its relevance? To generate forecasts of future energy consumption (demand)/supply patterns. Three main methods are used in energy analysis to determine energy requirements. They are process analysis, statistical analysis, and input, output analysis.

This article examines the problems of Nigeria's electricity system and based on electricity generation and consumption data, presents a conceptual approach aimed at enhancing electricity generation in the country. Based on a statistical method of forecasting; the moving average and semi average, time series techniques, data obtained was used to develop a program in Fortran 77. The program proved effective useful in forecasting electricity generation and consumption scenarios in the nation.

Keywords: Electricity, Forecasting, Nigeria.

INTRODUCTION

In Nigeria, electricity is generated primarily by the National Electric Power Authority (NEPA), a government organization that coordinates eight power stations, with a combined generating capacity in excess of 500mw across the nation. Yet this generated capacity has been inadequate compared to demand, which keeps rising.

National Electric Power Authority (NEPA): Problems

One of NEPA's problems is that it does not take into account the fact that projects requiring electricity supply are being planned, and executed on a continual basis by various sectors of the economy. It assumes that already existing facilities are adequate for the additional structures, business and industries being established; with the consequence that existing supply is always less than demand.

Technical and non-technical losses are also another of NEPA's problems said Fawibe (1997) Technical losses occur during power transmission over long distances due to the configuration of the distribution network, whilst non-technical looses are the result of illegal connections by illegal consumers. These problems have lead to a situation where about 80% of NEPA injection substation are either fully loaded or overloaded.

NEPA has been unable to meet demand because it has neither been able to add much to its transmission network or develop new power stations due to financial constraints. She also has several old plants, which have proved difficult to maintain in operational condition due to the difficulty of obtaining spares, as the plants are virtually obsolete .Two examples are Afam and Delta commisioned in 1965 and 1966 respectively.

In Nigeria, electricity is cheap. The tariff charged for electricity is far below the cost of production. The weighted average tariff NEPA charges customers is about N2 per Kwh whereas the cost of production is about N7 per Kwh. Therefore, about N5 per Kwh is subsidy. This does not help the organisation (which is owed massive amounts of money by customers) in its revenue generation efforts!

Electricity Generation and Supply In Nigeria

According to Osakwe (1979), NEPA was born in 1970. Then, it had a generating capacity of 804.7mw and a total generation of 1,547MKw/h and a consumption of 1,272.8MKw/hr. Since then, NEPA's growth in terms of installed capacity and generation has remained virtually static. Since 1986, no new 330Kv transmission line or

132Kv transmission line has been constructed. Until recently, the last Hydro power plant (Shiroro) was constructed in 1989. Nigeria has only been able to increase its installed capacity with the addition of 276mw from Afam power station after 12years (Olowo, 2002).

Obviously, we have failed to replan continually! South Africa has a total installed capacity of 31,000mw and a total maximum demand of 23,000mw. This implies that a surplus capacity of about 8,000mw exists (Fawibe, 1997). This surplus capacity is more than the total installed capacity of Nigeria, which stands at 4,548.6mw (Osamgbi, 2001).

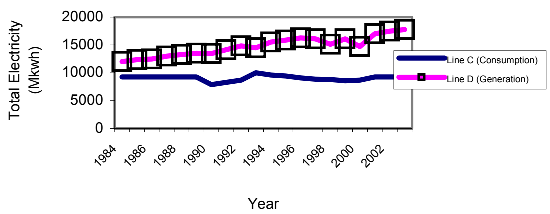
Table 1: Total Electricity Supply (Generation) and Demand (Consumption) in Nigeria

NEPA operates 5 thermal power stations, Egbin, Sapele. Afam, Delta, Ijora and three hydro power stations, Shiroro, Jebba and Kanji. Although conflicting figures exists about the additional power generated from each of these power stations with their recent rehabilitations, the additional power generated was expected to add about 2000mw of electricity to the already existing 2000mw, with the private operators, EPP Enron, and EPP Abuja contributing about 300mw and 30mw respectively. (Osambgi, 2001;Olowo, 2002). In-spite of NEPA's efforts to ensure reliable power supply as shown by generation trends (Table 1, fig 1) there is still inadequate electricity supply.

Table1: Total electricity generation and consumption trends

Year	Supply (MKwh)	Demand (MKwh)
1989	13500	9250
1990	13875	7870.5
1991	14000	8292
1992	14500	8699
1993	14875	9998.3
1994	15000	9593.9
1995	15250	9435.9
1996	15500	9051.8
1997	16000	8843.7
1998	16250	8792.4
1999	16500	8576.3
2000	16875	8688.3

Fig. 1: Total Electricity Generation (Supply) and Consumption (Demand) in Nigeria



Most current supply models place a great deal of emphasis or weighing on system reliability. The number of most often used to describe reliability is loss of load expectation (LOLE). This gives !the estimated number of days per year that power supply will not meet the power demand. A typical LOLE is 24 hours in every ten years(Fawibe, 1997). In Nigeria, LOLE is almost everyday.

This inadequacy of power supply is due mainly to technical losses and non-technical losses. Technical losses are losses, which occur during transmission and distribution and account for 3% of the total power generated. Non-technical loses due to illegal connections are much more than the amount of power consumed by registered customers. Thus these non-technical losses far exceed the difference between the amount of power generated and the sum total of the power consumed by NEPA's customers are technical losses. Although non-technical losses are not accounted for and are not reflected in the statistics released by NEPA, their effect is felt as evidence by power outages as a result of overload, which occurs whenever demand exceeds supply.

If they were accounted for and Nigeria's available capacity remained constant as they have, over the years, then the nation should have an electricity demand and supply situation similar to that shown in Figure 2**.**

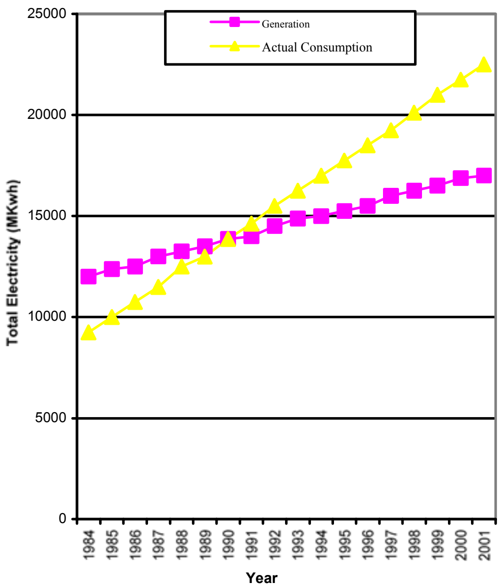


Fig. 2: Actual Electricity Generation and Consumption in Nigeria

This situation clearly, does not conform to the law of supply and demand. As can be seen from Fig 2.0, both consumption and supply have linear trends. The point (W) where consumption levels with supply is characterized by power outages and system collapses.

In Nigeria, it is difficult to determine from data when the first system collapses occurred. This is because electricity consumption figures do not reflect technical and non-technical losses but we do know that they exist!

Enhancing Electricity Generation and Supply

In order to supplement the existing power supply and cater for future increases in the demand for electricity supply, Nigeria must in addition to rehabilitating existing plants, examine the possibilities, of developing power plants over a planned period of time.

If these potentials are developed, the nation will be able to export more power to neighboring nations and still have enough for industrial and domestic consumption.

She can choose to either develop some of the already evaluated potential hydrosites listed in table 2 (Sharma,V.C., Sharma,A.) or resort to developing thermal power plants.

Table 2: Potential Hydropower Sites in Nigeria

LOCATION	RIVER	ESTIMATED INSTALLED CAPACITY (MW)
Onitsha	Niger	750
Zungeru 1	Niger	500
Zungeru 2	Kaduna	450
Yola	Benue	350
Katisna Ala	Kastina Ala	260
Beli	Taraba	240
Afikpo	Cross River	180
Afam	Cross River	180
Garin Dali	Taraba	135
Gembu	Donga	130
Karamti	Kam	115
Total		3290

In making a choice between the development of thermal or hydro plant installations, the economic and environmental implications for the nation must be considered.

Hydropower installations mean utilizing more of the nations water resources, which is more economical and ultimately gives a better turnover. Hydropower development, though heavily dependent on international loans from industrialized nations at usually very high interest rates, has important multipurpose economic features and is more environmentally friendly than thermoelectric plants.

On the other hand, loans for thermoelectric generators are usually available at lower interest rates, which makes them a more attractive option than hydropower. They also run on oil and gas, which are presently abundant in Nigeria. The question is, can Nigeria afford the cost of running thermoelectric generators on oil and gas in the long run? Will these resources in question not run low? As there is no energy plan, which balance's nor substitutes their utilization in other areas of the economy. The choice is the Government's prerogative!

If government decides on hydro-installations, then it must aspire to develop one or more of the potential hydro sites listed in table 2. Two potential sites, Zungeru and Mambila have already been surveyed, their soil tests conducted an their plans drawn up. (Sharma,V.C., Sharma,A.).

Zungeru, downstream of Shiroro, is capable of producing 950Mw and Mambila, 3,960Mw. If Mambila is developed, it would bring loads from the North Eastern part of Nigeria nearer to big power stations and reduce transmission losses due to the very long distances that have to be traversed to transmit power to load centres. This will then alter the electricity consumption and supply pattern of the nation to one similar to that depicted in Fig.3 from that of Fig.2.

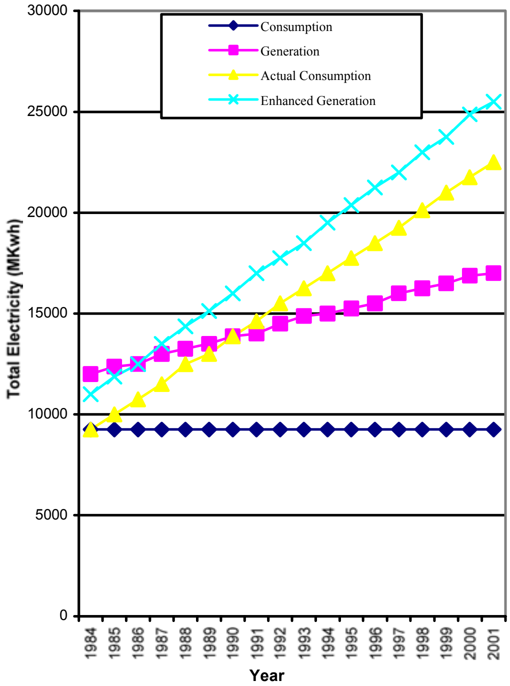


Fig. 3: Enhanced electricity generation in Nigeria

If the above concepts are applied to Nigeria's electricity system depicted in Fig1 and assuming initial system collapse in 1990, we obtain a linear trend (line A) which represents the real (actual) consumption of electricity in the nation (by joining points O and B). Line A is composed of consumption by registered and unregistered consumers. An analysis of electricity consumption as represented by line A gives a more realistic picture of Nigeria's consumption of electricity than line C (linear consumption trend obtained from statistical data). Therefore, by comparison actual electricity consumption in Nigeria is about 1.86 times on the average, more than that reflected in statistical data obtained from NEPA. See table 3.

Table 3: Comparison of real (adjusted) and Data consumption of Electricity

Electricity Consumption (KWh)	1990	1994	1998
Real (adjusted)	13875.0	17000.0	20125.0
Data	9250.0	9159.2	9159.2
Ratio	1.5	1.89	2.2

From the consumption trend line analysis obtained using data obtained from NEPA reports it can be seen that consumption has remained constant over the years. If this is true and NEPA'S generation has been adequate, then why do Nigerians still experience blackouts? The answer can be found when illegal consumers are reckoned with!

Assuming there has never been any occurrence of system collapse and that the situation above (Fig.3) holds true, then we have to enhance electricity generations and supply before 1990 when consumption will equal supply and system collapse is anticipated.

To avert this then, we must commence the development of Mambila at least five to six years before the anticipated system collapse year (1990). This implies that assuming we start developing Mambila in 1981, then by 1986 when it would become functional, the power generation trend of the country would change form line D to line E, with the effect that generation (supply) will always be greater than consumption. See fig. 3.

In determining the equation of line E, we must first determine the gradient of line A (real/adjusted consumption) such that enhanced generation will run parallel to real consumption but will be greater than it. Line A has a gradient given by

$$M \quad = \quad \frac{=}{X_2 - X_1} \quad \frac{QR}{QP}$$

Substituting values,

$$M = \frac{24{,}000 - 13{,}000}{2003 - 1989} = 785.7 \text{ million kwh/year}$$

M = 785.7million kwh/year. Thus from the principle of parallelism of lines, line E also has a gradient of 785.7 million kwh/year.

When Mambila commences operation in 1986, the electricity generation trend will change from line D to line E at point F. In 1986, 12,625 million kilowatt hour of electricity was generated.

Utilizing the equation for straight line,

$Y = MX + C$ -----------------------------(1)

Where, Y = electricity generated
M = gradient
C = Intercept
X = time (year (s))

From line D (Electricity generation) in 1986,
Y = 12,625 million kwh
M = 785.7 million kwh/year
X = 2 years.

Substituting in (1)

12625 million kwh = 785.7million kwh/years x 2years + C implying,

C = Intercept = 11,053.6 million kwh.

Therefore, we have 2 points for the enhanced generation line (line E.)

These are C = 11,053.6 millions kwh and y = 12,625 million kwh for the year 1984.

If the Mambila plant is to have any influence on the power generation and consumption pattern in the country at the time of its introduction, it must be able to generate at lest 12625 million kwh. This generation must increase either to 16,000kwh by the year 1990 or consumption must drastically decrease within the same year in order to avert the system collapse expected that year.

It is important to note however, that in this conceptual presentation, the effect of the addition of only one power station "Mambila", has been analyzed. If Nigeria is to maintain an electricity supply and consumption trend similar to that depicted in Fig.3, she must constantly try to develop her potential power plants and who increase production from existing plants in order to increase her available capacity and maintain an electricity generation level far in excess of consumption.

Options For The Future

It would seem like NEPA has already achieved its target of generating an additional 2000Mw as far back as December 2001 (Olowu, B, 2002). Yet power outages are still experienced in the nation. As NEPA strives to live to the expectations of the Nigerian public it must also be given cooperation by other government parastatals; Town planning Authorities, water board and relevant government parastatals should cooperate with NEPA to be able to know the power requirements in a given area over a minimum of 5year period. This will enable NEPA replan accordingly.

In the long run, government plans deregulate the electricity industry by privatizing NEPA as well as encourage private/sector investments in the development of independent power plants in the country. When these power plants come on stream, an additional 1000Mw to 2000Mw of electricity is expected to be generated to complement existing supply. This should mark the beginning of the end of power failures in Nigeria.

Bibliography

1. Central Bank of Nigeria (1999), Annual Report and Statement of Account. Dec., pp 57 - 58, 129.Nigeria.
2. Central Bank of Nigeria (1999), CBN Statistical Bulletin. Dec., pp vol.10 No.2. pp 124.
3. Fawibe, O. (1977): Liberalizing Nigerian Energy and Mineral Industries. International Energy Services Ltd., Lagos. Nigeria.
4. Lipchuthz and Poe, Programming in Fortran and Schuams Outline Series "McGraw-Hill Book Co., U. S. A.
5. Murray, R. S. "Theory and Problems of Statistics and Schuams Outline Series", 1st ed., McGraw - Hill Book Co., U. S. A.
6. National Electric Power Authority (1999). NEPA Review, Jan - Mar. PRO Division, National Electric Power Authority, Nigeria.
7. National Electric Power Authority (1999). NEPA Review, Dec., PRO Division National Electric Power Authority, Nigeria.
8. Olowo, B. (2002): NEPA Meets The Challenge. African Review. April, pp 42. U.K.
9. Osakwe, E. C. N. (1979): Towards a Comprehensive Energy Policy for Nigeria. Proc. Energy Policy Conf., National Policy Development Center. Nigeria.
10. Osamgbi, I. (2001): Energy. This Day Publications, Vol. 7, No. 2424. pp 27. Nigeria.
11. Sharma, V. C. and Sharma, A.(1981). Development of Hydropower in Nigeria. Energy. Vol. 6. pp 475 – 478. U.K.

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C         ENERGY DEMAND PROJECT FOR
          NIGERIA  BY A STATISTICAL METHOD
C          OF MOVING AND SEMI-AVERAGES.
C         SAMPLE PROGRAM: TOTAL
          ELECTRICITY CONSUMPTION
          TRENDS.
          DIMENSION
R(20),A(20),AA(20),AP(20),Z(20)
          OPEN (UNIT = 6, FILE'E2K. OUT' STATUS=
          'NEW')
          OPEN (UNIT = 5, FILE ='RF.IN' OUT'
          STATUS='OLD')
C          TO IMPORT INPUT DATA FROM RF.IN
          READ (5,*) (R(J), J =1,11)
C          ENERGY TYPE = ELECTRICITY
C          ENERGY UNIT = MWh
C          CF = CONVERSION FACTOR
C          PJ = PETAJOULES = 10.0E-15
           CF = 3.6**12
           WRITE (6,7)
7         FORMAT (//8X, 'TOTAL ELECTRICITY
          CONSUMPTION TRENDS (1990-2000)')
           WRITE (6,10)
10        FORMAT
          (//2X,'NYEAR',2X,'CONSUMPTION',2X,'4
          YEAR',5X,'2YEAR', 8X,'4YEAR',
  1            7X, 'TREND VALUE)
           WRITE (6,20)
20        FORMAT (10X, 'UNIT', 9X, 'MOVING
          TOTAL', 'CENT. MOV. AVE.')
           WRITE (6,30)
30        FORMAT (3X, ' (10)', 5X, '(1)', 7X, '(2)', 10X,
          '(3)', 10X, '(4)', 11X, '(5)')
C          FOUR YEAR MOVING TOTAL
COMPUTATION
           A(3)    =R(1) + R(2) + R(3) + R(4)
           A(4)    =R(2) + R(3) + R(4) + R(5)
           A(5)    =R(3) + R(4) + R(5) + R(6)
           A(6)    =R(4) + R(5) + R(6) + R(7)
           A(7)    =R(5) + R(6) + R(7) + R(8)
           A(8)    =R(6) + R(7) + R(8) + R(9)
           A(9)    =R(7) + R(8) + R(9) + R(10)
           A(10)=R(8) + R(9) + R(10) +R(11)
C          TWO YEAR MOVING TOTAL
COMPUTATION
           AA(3)   =A(3) + A(4)
           AA(4)   =A(4) + A(5)
           AA(5)   =A(5) + A(6)
           AA(6)   =A(6) + A(7)
           AA(7)   =A(7) + A(8)
           AA(8)   =A(8) + A(9)
           AA(9)   =A(9) + A(10)
C         FOUR YEAR CENTERED MOVING
          AVERAGE COMPUTATION
           AP(3) =AA(3) / 8.0
           AP(4) =AA(4) / 8.0
           AP(5) =AA(5) / 8.0
           AP(6) =AA(6) / 8.0
           AP(7) =AA(7) / 8.0
           AP(8) =AA(8) / 8.0
           AP(9) =AA(9) / 8.0
C         TWO POINT TREND COMPUTATION BY
          SEMI AVERAGE METHOD
C         P =      MEAN    VALUE
          CORRESPONDING TO THE YEAR 1993
C         Q =      MEAN    VALUE
          CORRESPONDING TO THE YEAR 1997
           P =     AP(3)+ AP(4) + AP(5)/ 3.0
          Q  =     AP(7)+ AP(8) + AP(9)/ 3.0
           RT =    (P – Q) /4.0
C         EVP = MEAN ENERGY VALUE
          CORRESPONDING TO THE YEAR 1993
C         EVQ = MEAN ENERGY VALUE
          CORRESPONDING TO THE YEAR 1997
           EVP = P * CF
           EVQ = Q * CF
           NBEG = 1989
           DO 100  I  = 1, 11
          NYEAR = NBEG + 1
          IF (I.EQ.1. OR.I EQ.2.OR.I.EQ.11) GOTO 5
          IF (I.GE.3.AND I.LE.9) GOTO 3
          WRITE (6,42) A (I)
42         FORMAT (18X, F8.1)
           WRITE (6, 41) NYEAR,R(I)
41         FORMAT (1X, 15, 1X F8. 1)
           GOTO 100
12         FORMAT (/1X, I5,1X, F8.1)
           GOTO 100
3          WRITE (6,31) A(I)
31         FORMAT (18X,F8.1)
           IF (I.EQ.3) GOTO 37

           K = I-4
           XX = P + K * RT
           Z (I) = XX
           GOTO 34
37         K = I – 2
           Z(I) = P – K * RT
34         WRITE (6,32) NYEAR, R(I),
AA(I),AP(I),Z(I)
32        FORMAT
          (1X,I5,1X,F8.1,15X,F8.1,5X,F8.1,8X,F8.1)
100        CONTINUE
           WRITE (6,160) P,Q
60        FORMAT (/// 2X,F10.2, '= MEAN VALUE
          CORRESPONDING TO 1993'//
          1           2X, F10.2, ' = MEAN
                      VALUE CORRESPONDING
                      TO 1997')
          WRITE  (6, 161) EVP, EVQ
61        FORMAT (// 5X, F12.1, 'PJ = ENERGY
          VALUE CORRESPONDING TO 1993 ' //
          1        5X, F12.1, ' = ENERGY VALUE
          CORRESPONDING TO 1997 ')
           STOP
          END
```


C   ENERGY DEMAND PROJECT FOR
          NIGERIA BY A STATISTICAL METHOD
C   OF MOVING AND SEMI-AVERAGES.

```
C        SAMPLE PROGRAM: TOTAL
         ELECTRICITY CONSUMPTION
         TRENDS.
         DIMENSION
R(20),A(20),AA(20),AP(20),Z(20)
         OPEN (UNIT = 6, FILE'E2K. OUT' STATUS=
         'NEW')
         OPEN (UNIT = 5, FILE ='RF.IN' OUT'
         STATUS='OLD')
C          TO IMPORT INPUT DATA FROM RF.IN
         READ (5,*) (R(J), J =1,11)
C          ENERGY TYPE = ELECTRICITY
C          ENERGY UNIT = MWh
C          CF = CONVERSION FACTOR
C          PJ = PETAJOULES = 10.0E-15
           CF = 3.6**12
           WRITE (6,7)
7        FORMAT (//8X, 'TOTAL ELECTRICITY
         CONSUMPTION TRENDS (1990-2000)')
           WRITE (6,10)
10       FORMAT
         (//2X,'NYEAR',2X,'CONSUMPTION',2X,'4
         YEAR',5X,'2YEAR', 8X,'4YEAR',
  1            7X, 'TREND VALUE)
           WRITE (6,20)
20       FORMAT (10X, 'UNIT', 9X, 'MOVING
         TOTAL', 'CENT. MOV. AVE.')
           WRITE (6,30)
30       FORMAT (3X, ' (10)', 5X, '(1)', 7X, '(2)', 10X,
         '(3)', 10X, '(4)', 11X, '(5)')
C        FOUR YEAR MOVING TOTAL
COMPUTATION
           A(3)     =R(1) + R(2) + R(3) + R(4)
           A(4)     =R(2) + R(3) + R(4) + R(5)
           A(5)     =R(3) + R(4) + R(5) + R(6)
           A(6)     =R(4) + R(5) + R(6) + R(7)
           A(7)     =R(5) + R(6) + R(7) + R(8)
           A(8)     =R(6) + R(7) + R(8) + R(9)
           A(9)     =R(7) + R(8) + R(9) + R(10)
           A(10)=R(8) + R(9) + R(10) +R(11)
C        TWO YEAR MOVING TOTAL
COMPUTATION
           AA(3)    =A(3) + A(4)
           AA(4)    =A(4) + A(5)
           AA(5)    =A(5) + A(6)
           AA(6)    =A(6) + A(7)
           AA(7)    =A(7) + A(8)
           AA(8)    =A(8) + A(9)
           AA(9)    =A(9) + A(10)
C        FOUR YEAR CENTERED MOVING
         AVERAGE COMPUTATION
           AP(3) =AA(3) / 8.0
           AP(4) =AA(4) / 8.0
           AP(5) =AA(5) / 8.0
           AP(6) =AA(6) / 8.0
           AP(7) =AA(7) / 8.0
           AP(8) =AA(8) / 8.0
           AP(9) =AA(9) / 8.0

C        TWO POINT TREND COMPUTATION BY
         SEMI AVERAGE METHOD
C        P =       MEAN     VALUE
         CORRESPONDING TO THE YEAR 1993
C        Q =       MEAN                VALUE
         CORRESPONDING TO THE YEAR 1997
           P  =     AP(3)+ AP(4) + AP(5)/ 3.0
         Q    =     AP(7)+ AP(8) + AP(9)/ 3.0
           RT  =    (P – Q) /4.0
C        EVP = MEAN ENERGY VALUE
         CORRESPONDING TO THE YEAR 1993
C        EVQ = MEAN ENERGY VALUE
         CORRESPONDING TO THE YEAR 1997
           EVP = P * CF
           EVQ = Q * CF
           NBEG = 1989
           DO 100  I  = 1, 11
         NYEAR = NBEG + 1
         IF (I.EQ.1. OR.I EQ.2.OR.I.EQ.11) GOTO 5
         IF (I.GE.3.AND I.LE.9) GOTO 3
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42         FORMAT (18X, F8.1)
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         (1X,I5,1X,F8.1,15X,F8.1,5X,F8.1,8X,F8.1)
100        CONTINUE
           WRITE (6,160) P,Q
60       FORMAT (/// 2X,F10.2, '= MEAN VALUE
         CORRESPONDING TO 1993'//
         2              2X, F10.2, ' = MEAN
                        VALUE CORRESPONDING
                        TO 1997')
         WRITE  (6, 161) EVP, EVQ
61       FORMAT (// 5X, F12.1, 'PJ = ENERGY
         VALUE CORRESPONDING TO 1993 ' //
         1          5X, F12.1, ' = ENERGY VALUE
         CORRESPONDING TO 1997 ')
           STOP
         END
```