

## CHAPTER - 4

### EXPENDITURE

#### 4.1 Generation Expenses

##### 4.1.1 Hydel Generation

TNEB has nearly 34 small hydel generating stations with a total installed capacity of 1995.9 MW. The electricity generation from most of the hydel generating stations except those located in the Nilgiris is linked to irrigation. The State has almost fully utilized its available hydro generation potential. TNEB has further submitted that due to the failure of the southwest monsoon during the current financial year, it has projected lower generation from hydel generation stations. However, for FY 2003-04, the TNEB has projected hydro generation based on past trends.

During the course of scrutiny and assessment of the TNEB petition, the Commission had asked TNEB to provide additional information on month-wise and station-wise hydel generation during FY02 and FY03, and the rationale for projecting the generation from hydel stations for the balance period of FY03 and FY04.

The Commission has analysed the station-wise data furnished in respect of the hydel generation for the past 20 years from FY 83 to FY 02. The statistical summary of the hydel generation for the past 20 years is presented in the following Table.

(MU)

| <b>Gross hydel generation over past 20 years (FY83 to FY02)</b>   | <b>Average</b> | <b>Maximum (94-95)</b> | <b>Minimum (87-88)</b> |
|---|----------------|------------------------|------------------------|
| Gross hydel generation excluding Mettur hydel generating stations | 3469           | 4472                   | 2010                   |
| Hydel generation from Mettur hydel generating stations            | 718            | 1375                   | 174                    |
| <b>Total Gross hydel generation</b>                               | <b>4187</b>    | <b>5847</b>            | <b>2184</b>            |

The Commission has also analysed the station-wise data furnished in respect of the inflows, storage, discharge and corresponding hydel generation for the past 20 years from FY 83 to FY 02.

For projecting the hydel generation for FY03 and FY04, the Commission has adopted the following methodology:

- For FY03, actual hydel generation from Apr-02 to Sep-02 has been considered. TNEB has submitted that the Gross hydel generation during Apr-02 to Sep-02 has been around 1250 MU including generation at Mettur hydel stations of 143 MU. The Commission has accepted the same.
- For balance period of FY03 (i.e. from Oct-02 to Mar-03), the Commission has considered the fact that the failure of the southwest monsoon during the current year has adversely affected the water levels (inflows and storage) of the hydel stations. Hence, it may not be appropriate to consider the average generation for the past 20 years as the basis for projecting generation during Oct-02 to Mar-03. The Commission has noted that gross hydel generation during FY87-88 of 2184 MU including generation of 174 MU from Mettur hydel generating stations, corresponds to worst year for hydel generation during past 20 years. Further, the level of inflows during the six months of FY03 (from Apr-02 to Sep-02), of 1382 MU in equivalent energy unit terms is higher than the level of inflows during the corresponding period of FY 87-88, which was around 939 MU. Hence, the Commission has considered the level of generation during October to March of FY87-88 as the basis for projecting the hydel generation for the balance period of FY03 (i.e. Oct-02 to Mar-03). Accordingly, the Commission has projected the gross hydel generation of 1142 MU including generation from Mettur generating station of 104 MU.
- For projecting hydel generation for FY04, the Commission has considered the average generation over the past 20 years.
- As regards the hydel generation from Mettur, the Commission has noted that the average generation over past 20 years from Mettur hydel generating stations

(Dam, Tunnel and Barrages) has been 718 MU. The actual generation during Apr -02 to Sep-02 during FY03 has been 143 MU only. Hence, the Commission has projected generation from Mettur hydel generating stations as 247 MU (during FY03) and 718 MU (during FY04) as against TNEB's submission of 457 MU (during FY03) and 706 MU (during FY04).

- The Commission has further noted that the projected auxiliary power consumption of 117 MU and 123 MU amounts to 5.72% and 3.51% of the Gross generation in FY03 and FY04, respectively. Upon verification with TNEB, the Commission has noted that the above auxiliary consumption levels include self-consumption of around 95 to 100 MU by the Kadamparai station, as Kadamparai hydel station operates as a pumped storage scheme. Hence, adjusting for generation from Kadamparai hydel station, the Commission has considered auxiliary power consumption of 0.5% to project the net hydel generation units available during FY03 and FY04.

The summary of the Commission's analysis in respect of hydel generation is presented in the following Table.

(MU)

| Hydel Generation                                  | FY02        | FY03        |             | FY04        |             |
|---|-------------|-------------|-------------|-------------|-------------|
|   |             | TNEB        | TNERC       | TNEB        | TNERC       |
| Gross Generation excl. Mettur                     | 3572        | 1588        | 2145        | 2800        | 3469        |
| Generation at Mettur<br>(Dam, Tunnel and Barrage) | 778         | 457         | 247         | 706         | 718         |
| <b>Gross Generation incl. Mettur</b>              | <b>4350</b> | <b>2045</b> | <b>2392</b> | <b>3506</b> | <b>4187</b> |
| Auxiliary consumption                             | 19          | 22          | 12          | 23          | 21          |
| Self consumption at Kadamparai                    | 96          | 95          | 95          | 100         | 100         |
| <b>Total aux. and self consumption</b>            | <b>115</b>  | <b>117</b>  | <b>107</b>  | <b>123</b>  | <b>121</b>  |
| <b>Net Hydel Generation</b>                       | <b>4235</b> | <b>1928</b> | <b>2285</b> | <b>3383</b> | <b>4066</b> |

## **4.1.2 Thermal Generation**

### **(i) Coal Based Thermal Generation**

The TNEB has 2970 MW of coal based thermal generation capacity comprising four thermal power stations, viz. 450 MW Ennore Thermal Power Station (ETPS), 1050 MW Tuticorin Thermal Power Station (TTPS), 840 MW Mettur Thermal Power Station (MTPS) and 630 MW North Chennai Thermal Power Station (NCTPS). The TNEB has submitted that the station-wise generation has been projected based on the annual maintenance plan and the historical efficiency levels of the individual station. The TNEB has further submitted that the refurbishment programme of Units III, IV and V of Ennore TPS has been completed and the units are back in operation. The renovation and modernisation of Unit I and II is scheduled during the current year. This is expected to result in improvement in the plant load factor from a level of 19% during FY 2000-01 to 46% during FY 2002-03.

The auxiliary consumption is also expected to be contained at a level of 8% as compared to previous year's level of 15%. One of the units of NCTPS was under major overhaul at the beginning of the current year, however, the station performance has since been stabilised and higher generation has been projected during the current year. The TNEB has projected generation from TTPS and MTPS at 87% PLF. The TNEB has clarified that due to lower generation in hydel stations, the thermal stations are expected to be under operation for the maximum period during current year, by postponing the scheduled maintenance outages. The TNEB intends to make full use of its thermal stations and planned maintenance in some of the stations has been shifted to the next year in view of the monsoon failure and the resultant poor storage levels in hydel reservoirs

### **(ii) Gas Turbine based Thermal Generation**

In case of Gas turbine based thermal generation, TNEB has submitted that Basin Bridge station is mainly employed as a peaking station. Currently, the station is operated using naphtha as fuel, which is very expensive. The other Gas turbine based station at Kovilkalappal is projected to operate at nearly 74% PLF. The TNEB has stated that

Valathur and Kuttalam Gas turbine stations are expected to be available for generation only during FY04.

The Commission had asked TNEB to provide additional information in respect of thermal generation including gas turbine based generating stations, including month-wise and station-wise details of actual thermal generation during the period FY02 and FY03, and the rationale for projecting the generation from thermal stations for the balance period of FY03 and FY04, etc.

The Commission has analysed the performance of each station in terms of following key parameters, viz. plant load factor and auxiliary consumption, for projecting the energy units available (gross generation units and net generation units) from each thermal station. The Commission has projected the energy units available as the best of

- i. the station's average performance over the past five years,
- ii. its actual performance during the previous financial year FY02, and the first half of FY03
- iii. the TNEB's projections in respect of these parameters for FY03 and FY04.

In addition, while projecting the generation during FY03, the Commission has taken into account the actual performance during six months of current year (from Apr-02 to Sep-02). For projecting the generation during FY04, the Commission has noted the fact that in case of some of the generating units, TNEB has deferred the planned major overhaul to the next year (i.e. to FY04) instead of undertaking the same during FY03 on account of reduced level of hydel generation during the current year (i.e. FY03).

### **(iii) Plant Load Factor**

The Commission's analysis and projection of the station-wise plant load factor is presented in the following Table. The Commission has noted that in case of TTPS and MTPS, the PLF achieved during the first six months of the current year (FY03) is already in excess of 90% (TTPS – 91.5% and MTPS – 90.5%), hence the Commission has considered PLF level at 90% for FY03.

| Plant Load Factor (%) | 5 year Average | FY02  | FY03  |       | FY04  |       |
|-----------------------|----------------|-------|-------|-------|-------|-------|
|                       |                |       | TNEB  | TNERC | TNEB  | TNERC |
| ETPS                  | 35.1%          | 29.0% | 47.0% | 47.0% | 47.0% | 47.0% |
| TTPS                  | 80.4%          | 88.1% | 88.6% | 90.0% | 86.1% | 86.1% |
| MTPS                  | 79.0%          | 87.0% | 87.0% | 90.0% | 88.0% | 88.0% |
| NCTPS                 | 74.1%          | 85.0% | 83.0% | 83.0% | 83.0% | 83.0% |
| Basin Bridge          | 11.3%          | 7.9%  | 6.9%  | 11.3% | 6.9%  | 11.3% |
| Kovilkalappal         | 73.8%          | 73.8% | 74.1% | 74.1% | 74.1% | 74.1% |
| Valuthur              |                |       |       |       | 79.0% | 79.0% |
| Kuttalam              |                |       |       |       | 34.0% | 34.0% |

Further, in case of NCTPS, although the PLF achieved during previous year (FY02) is 85%, the Commission has noted that one of the units of NCTPS was under maintenance at the beginning of current year (FY03), hence the Commission has accepted the TNEB's projection at 83%.

Considering the TNEB's submission that it has deferred the planned maintenance in case of most of the units to next year (FY04), the Commission has accepted the TNEB's projection of station-wise PLF for FY04 except in case of Basin Bridge gas turbine station. The Basin Bridge station is used as a peaking station and the Commission has noted that the PLF stated by the TNEB is not in line with the level of generation considered by TNEB. The Commission has considered five year average PLF for projecting generation from this station.

#### **(iv) Gross Generation of Energy Units (MU)**

From the table below, it may be noted that the projected generation from TTPS and MTPS in FY03 by the Commission is higher than the five-year average, actual generation in FY02 and TNEB's projection for FY03, on account of the fact that the actual generation from these TPS' during the first six months is higher.

| Gross Generation (MU)           | 5 year Average | FY02         | FY03         |              | FY04         |              |
|---------------------------------|----------------|--------------|--------------|--------------|--------------|--------------|
|                                 |                |              | TNEB         | TNERC        | TNEB         | TNERC        |
| ETPS                            | 1384           | 1149         | 1835         | 1853         | 1835         | 1853         |
| TTPS                            | 7395           | 8105         | 8150         | 8278         | 7930         | 7919         |
| MTPS                            | 5816           | 6396         | 6400         | 6623         | 6500         | 6475         |
| NCTPS                           | 4091           | 4675         | 4600         | 4581         | 4600         | 4581         |
| Basin Bridge                    | 119            | 173          | 200          | 119          | 200          | 119          |
| Kovilkalappal                   | 691            | 697          | 700          | 694          | 700          | 694          |
| Valuthur                        |                |              |              |              | 660          | 657          |
| Kuttalam                        |                |              |              |              | 300          | 298          |
| <b>Gross Thermal Generation</b> | <b>19496</b>   | <b>21195</b> | <b>21885</b> | <b>22147</b> | <b>22725</b> | <b>22596</b> |

**(v) Auxiliary Power Consumption Factor (%)**

The Commission's analysis and projection of the station-wise auxiliary consumption is presented in the following Table.

| Auxiliary Power Consumption (%) | 5 year Average | FY02  | FY03 |       | FY04 |       |
|---------------------------------|----------------|-------|------|-------|------|-------|
|                                 |                |       | TNEB | TNERC | TNEB | TNERC |
| ETPS                            | 14.3%          | 15.5% | 8.0% | 8.0%  | 8.0% | 8.0%  |
| TTPS                            | 7.8%           | 7.6%  | 8.0% | 7.6%  | 8.0% | 7.6%  |
| MTPS                            | 8.5%           | 8.0%  | 7.9% | 7.9%  | 7.9% | 7.9%  |
| NCTPS                           | 9.5%           | 8.9%  | 8.0% | 8.0%  | 8.0% | 8.0%  |
| Basin Bridge                    | 0.9%           | 2.0%  | 5.0% | 0.9%  | 5.0% | 0.9%  |
| Kovilkalappal                   |                | 5.7%  | 5.0% | 3.0%  | 5.0% | 3.0%  |
| Valuthur                        |                |       |      |       | 5.0% | 3.0%  |
| Kuttalam                        |                |       |      |       | 5.0% | 3.0%  |

In case of Gas turbine based stations excluding Basin Bridge, the Commission has noted that the Kovilkalappal and Valathur station have been commissioned in FY03,

whereas Kuttalam is scheduled for commissioning during FY04. The Commission is of the opinion that the performance standard of the new stations should be well within the norms prescribed under CERC guidelines. Hence, the Commission has considered the auxiliary consumption factor at 3% applicable for combined cycle gas turbine stations.

**(vi) Net Generation of Energy Units (MU)**

| DESCRIPTION                    | 5 YEAR AVERAGE | FY02         | FY03         |              | FY04         |              |
|--------------------------------|----------------|--------------|--------------|--------------|--------------|--------------|
|                                |                |              | TNEB         | TNERC        | TNEB         | TNERC        |
| ETPS                           | 1191           | 970          | 1688         | 1705         | 1688         | 1705         |
| TTPS                           | 6821           | 7485         | 7498         | 7645         | 7296         | 7314         |
| MTPS                           | 5324           | 5884         | 5888         | 6097         | 5980         | 5961         |
| NCTPS                          | 3705           | 4257         | 4232         | 4214         | 4232         | 4214         |
| Basin Bridge                   | 118            | 170          | 190          | 118          | 190          | 118          |
| Koilkalappal                   | 652            | 657          | 665          | 673          | 665          | 673          |
| Valathur                       |                |              |              |              | 627          | 638          |
| Kuttalam                       |                |              |              |              | 285          | 289          |
| <b>NETT THERMAL GENERATION</b> | <b>17811</b>   | <b>19423</b> | <b>20161</b> | <b>20452</b> | <b>20963</b> | <b>20912</b> |

The net thermal generation projected by the Commission is higher than the TNEB's projections by 291 MU in FY03 and lower than the TNEB's projection by 51 MU in FY04, on account of the fact that the Commission has considered the incidence of the planned maintenance in FY04, which was originally scheduled for FY03.

**(vii) Fuel Cost**

The parameters that affect the fuel cost include station-wise heat rate, specific coal consumption, specific oil (HFO) consumption and specific support fuel consumption (HSD/LDO) and the landed cost of each fuel in case of each thermal generating station.

The Commission has projected the station-wise performance on efficiency parameters (such as heat rate, specific oil consumption, specific support fuel consumption) for each thermal station, as the best of :



- i. the station's average performance for the past five years,
- ii. its actual performance during the previous financial year FY02 and
- iii. the TNEB's projections for FY03 and FY04.

The best performance (lowest heat rate or lowest specific fuel consumption) amongst these has been taken as the basis for the Commission's projection in respect of these efficiency parameters.

| Heat Rate<br>(kcal/kWh) | 5 year<br>Average | FY02 | FY03 |       | FY04 |       |
|-------------------------|-------------------|------|------|-------|------|-------|
|                         |                   |      | TNEB | TNERC | TNEB | TNERC |
| ETPS                    | 3257              | 3283 | 3662 | 3257  | 3500 | 3257  |
| TTPS                    | 2505              | 2453 | 2470 | 2453  | 2470 | 2453  |
| MTPS                    | 2527              | 2529 | 2545 | 2527  | 2554 | 2527  |
| NCTPS                   | 2563              | 2479 | 2393 | 2393  | 2400 | 2393  |
| Basin Bridge            | 3330              | 3499 | 3499 | 3330  | 3499 | 3330  |
| Kovilkalappal           | 1720              | 1720 | 1720 | 1720  | 1720 | 1720  |
| Valuthur                |                   |      |      |       | 1720 | 1720  |
| Kuttalam                |                   |      |      |       | 1720 | 1720  |

It should be noted that the TNEB has used the projected specific consumption of coal to compute the coal consumption, rather than the heat rate and the calorific value. The above Table shows that the heat rates projected by the TNEB are very high as compared to past trends, and the Commission has accordingly specified a lower value of heat rate thus directing the TNEB to strive for improvement in the efficiency parameters of the generating stations.

The Tables below reveal that the TNEB has projected very high rates of specific consumption as compared to normative levels and previous trends. The Commission has rectified this, and has considered the specific consumption on normative levels, rather than the TNEB's projections

| Sp. Oil (HFO)<br>Consumption<br>(ml/kWh) | 5 year<br>Average | FY02  | FY03  |       | FY04  |       |
|--|-------------------|-------|-------|-------|-------|-------|
|  |                   |       | TNEB  | TNERC | TNEB  | TNERC |
| ETPS                                     | 11.49             | 23.88 | 12.53 | 11.49 | 12.53 | 11.49 |
| TTPS                                     | 1.11              | 0.99  | 0.99  | 0.99  | 0.99  | 0.99  |
| MTPS                                     | 4.18              | 0.77  | 2.96  | 0.77  | 2.96  | 0.77  |
| NCTPS                                    | 16.37             | 6.77  | 7.30  | 6.77  | 7.30  | 6.77  |

| Sp. (HSD/LDO)<br>Consumption<br>(ml/kWh) | FY02 | FY03 |       | FY04 |       |
|--|------|------|-------|------|-------|
|  |      | TNEB | TNERC | TNEB | TNERC |
| ETPS                                     | 0.81 | 2.47 | 0.81  | 2.47 | 0.81  |
| TTPS                                     | 0.11 | 0.26 | 0.11  | 0.26 | 0.11  |
| MTPS                                     | 0.03 | 0.04 | 0.03  | 0.04 | 0.03  |
| NCTPS                                    | 0.17 | 0.20 | 0.17  | 0.20 | 0.17  |

#### (viii) Coal Cost

The TNEB has submitted that it procures coal from the Eastern coal fields (ECL) at Raniganj and Mahanadi coal fields (MCL) at Talcher and Ib Valley. The TNEB receives 'F' grade coal (UHV range 2400 – 3360 kcal/kg) from MCL and 'B' and 'C' grade coal (UHV range 4940 – 6200 kcal/kg) from ECL. The TNEB has clarified that coal prices have been projected for FY03 based on ECL/MCL price revision effective from 16.08.2002. In addition, the statutory duties such as Royalty, Excise duty, Cess, Sales Tax, levied by Central Government, local authorities or legal charges are payable. The TNEB has projected an increase of 5% in the basic cost of coal for the years FY03 and FY04.

The TNEB has submitted that it uses multi modal transport (rail-sea-rail) route to transport coal to its stations, which has resulted in high transportation costs and consequently high landed cost of coal at the TNEB's thermal generating stations. Moreover, additional costs have to be borne by the TNEB to meet the Ministry of

Environment and Forests stipulation on environmental pollution as well as the disposal of fly ash. The TNEB has submitted that on account of these factors, the variable cost of thermal generation in the TNEB's generating stations is high.

The TNEB's station-wise projection of the landed cost of coal is summarized in the following Table.

| Landed coal cost (Rs / MT) |            | FY02      |              |             | FY03      |              |             | FY04      |              |             |
|----------------------------|------------|-----------|--------------|-------------|-----------|--------------|-------------|-----------|--------------|-------------|
| Thermal Stations           | 5 year Ave | Base cost | Transp. Cost | Landed cost | Base cost | Transp. Cost | Landed cost | Base cost | Transp. Cost | Landed cost |
| ETPS                       | 1325       | 382       | 850          | <b>1232</b> | 508       | 1115         | <b>1623</b> | 534       | 1191         | <b>1725</b> |
| TTPS                       | 1893       | 957       | 1007         | <b>1964</b> | 954       | 919          | <b>1873</b> | 1002      | 981          | <b>1983</b> |
| MTPS                       | 1658       | 471       | 1267         | <b>1738</b> | 508       | 1348         | <b>1856</b> | 534       | 1448         | <b>1982</b> |
| NCTPS                      | 1443       | 485       | 934          | <b>1419</b> | 508       | 1051         | <b>1559</b> | 534       | 1121         | <b>1655</b> |

In this context of station-wise landed cost of coal, the Commission has noted that

- There is a significant variation in the projections of landed cost of coal at each station for FY03 and FY04 against the average landed cost of coal over the past five year period as well as during the previous year FY02.
- Despite availability of mechanized coal handling facilities at Ennore and Paradip ports, it appeared that the benefit of reduction in the handling cost has not been factored in while projecting the Transportation and Handling cost.

The Commission had asked TNEB to provide additional information in respect of quantum of coal consumed at each station and landed cost of coal at each station, including details of basic coal cost, transportation and handling cost at each of the generating stations for FY02 and FY03, etc.

The Commission has scrutinized the various submissions made by TNEB including quarterly coal cost schedule and detailed computation of the coal consumption, mix of coal used at each station and coal cost thereof. TNEB has submitted that it utilizes MCL – F grade coal at ETPS, MTPS and NCTPS stations, whereas at TTPS it utilizes a mix of MCL – F grade, ECL – B grade and ECL – C grade coal. The Commission has analyzed the two components of the station-wise landed cost of coal separately. The two components of the landed cost of coal at each station comprise:

- i. Basic Coal Cost which comprises Base Coal price (ROM price), Sizing charges, Royalty, Stowing Excise duty, Surface transport and sales tax,
- ii. Transportation Cost which comprises railway freight, ocean freight and handling charges.

For projecting the basic coal cost for the second half of FY03, the Commission has considered the basic coal cost as was revised in Aug-02 to be applicable for Sep-02 to Mar-03. For projecting the same for FY04, the Commission has considered an increase at the rate of 4% in the base ROM price of the MCL coal. TNEB has not projected any increase in ROM price for ECL-B and C grade coal during FY04, hence, the Commission has considered TNEB projection of ROM price for ECL-B and C grade coal. For projecting the transportation cost (incl. Railway freight, ocean freight and handling charges) for FY03 and FY04, the Commission has considered rates prevalent during FY02 with an average increase at the rate of 3% per annum.

On the coal handling and transportation cost, the Commission notes that with the introduction of mechanization at Ennore port and Paradip port, the coal handling cost should decrease which should reflect in reduction in the landed cost of coal at each station. However, TNEB has projected an increase in the coal handling and transportation cost. The Commission has noted that other users of coal in the State such as Cement manufacturing units have shifted to imported coal of higher calorific value. The Commission feels that use of imported coal for power generation may benefit TNEB on account of its higher calorific value and less number of handling stages as against indigenous coal. However, the pros and cons of usage of imported coal vis-à-vis indigenous coal for power generation may be juxtaposed to explore whether usage of

imported coal would be technically feasible and economically viable. TNEB has submitted that the coal handling facilities at Ennore as well as Paradip port were installed at the instance and the commitment of TNEB. In view of the above, the Commission directs the TNEB to explore the use of imported coal for power generation purposes in order to optimize the cost of thermal generation.

The Commission's projection of the landed cost of coal is summarized in the following Table.

| <b>Landed cost (Rs / MT)</b> | <b>FY03 (Apr 02 – Aug 02)</b> |                   |                    | <b>FY03 (Sep 02 – Mar 03)</b> |                   |                    | <b>FY04 (Apr 03 – Mar 04)</b> |                   |                    |
|------------------------------|-------------------------------|-------------------|--------------------|-------------------------------|-------------------|--------------------|-------------------------------|-------------------|--------------------|
|                              | <b>Base Cost</b>              | <b>Tran. Cost</b> | <b>Landed Cost</b> | <b>Base Cost</b>              | <b>Tran. Cost</b> | <b>Landed Cost</b> | <b>Base Cost</b>              | <b>Tran. Cost</b> | <b>Landed Cost</b> |
| ETPS                         | 493                           | 1029              | <b>1522</b>        | 513                           | 1029              | <b>1542</b>        | 528                           | 1060              | <b>1588</b>        |
| TTPS                         | 962                           | 853               | <b>1815</b>        | 1013                          | 853               | <b>1866</b>        | 1023                          | 879               | <b>1901</b>        |
| MTPS                         | 493                           | 1256              | <b>1749</b>        | 513                           | 1256              | <b>1768</b>        | 528                           | 1294              | <b>1822</b>        |
| NCTPS                        | 493                           | 951               | <b>1444</b>        | 513                           | 951               | <b>1464</b>        | 528                           | 980               | <b>1508</b>        |

The landed coal cost as projected by the Commission is lower than that projected by the TNEB, on account of the lower escalation rate considered by the Commission, as well as the reduction in the transportation cost considered by the Commission. In case of projection of naphtha cost for Basin Bridge gas turbine station, the Commission has noted that the TNEB projection of naphtha cost at Rs 12440 per MT for FY03 may not be adequate based on prevalent market prices of naphtha, hence the Commission has projected the same at the rate of Rs 16586 per MT for FY03 and at the rate of Rs 17416 per MT for FY04. Further, the Commission has accepted the TNEB projection of other fuel related expenses including the projection of the costs for lubricants, consumables, station supplies and water charges for each station.

The projected fuel costs for the projected levels of generation is given in the Table below:

| Fuel costs (Cr)                                     | FY02        | FY03        |             | FY04        |             |
|---|-------------|-------------|-------------|-------------|-------------|
| Base Fuel Costs (Rs Cr)                             |             | TNEB        | TNERC       | TNEB        | TNERC       |
| ETPS  | 147         | 310         | 289         | 329         | 299         |
| TTPS  | 1046        | 962         | 964         | 991         | 953         |
| MTPS  | 831         | 926         | 869         | 1005        | 881         |
| NCTPS   | 514         | 552         | 498         | 586         | 516         |
| Basin Bridge  | 88          | 116         | 64          | 122         | 67          |
| Kovilkalappal                                       | 57          | 48          | 45          | 50          | 47          |
| Valuthur  |             |             |             | 47          | 45          |
| Kuttalam  |             |             |             | 21          | 20          |
| <b>Total base fuel cost</b>                         | <b>2682</b> | <b>2914</b> | <b>2730</b> | <b>3151</b> | <b>2829</b> |
| <b>Support and Other fuel related costs (Rs Cr)</b> |             |             |             |             |             |
| ETPS  | 35          | 38          | 31          | 40          | 32          |
| TTPS  | 16          | 19          | 18          | 20          | 19          |
| MTPS  | 11          | 28          | 11          | 29          | 11          |
| NCTPS   | 39          | 42          | 39          | 44          | 41          |
| Basin Bridge  | 0.12        | 0.15        | 0.15        | 0.15        | 0.15        |
| Kovilkalappal                                       | 0.27        | 0.41        | 0.41        | 0.41        | 0.41        |
| Valuthur  |             |             |             | 0.40        | 0.40        |
| Kuttalam  |             |             |             | 0.25        | 0.25        |
| <b>Total Support and other fuel Cost (Rs Cr)</b>    | <b>101</b>  | <b>127</b>  | <b>99</b>   | <b>134</b>  | <b>105</b>  |
| <b>Total Fuel Cost (Rs Cr)</b>                      |             |             |             |             |             |
| ETPS  | 182         | 347         | 320         | 369         | 332         |
| TTPS  | 1063        | 981         | 982         | 1011        | 972         |
| MTPS  | 841         | 954         | 880         | 1034        | 891         |
| NCTPS   | 553         | 594         | 538         | 630         | 558         |
| Basin Bridge  | 88          | 116         | 64          | 122         | 67          |
| Kovilkalappal                                       | 57          | 48          | 46          | 50          | 48          |
| Valuthur  | 0           | 0           | 0           | 47          | 45          |
| Kuttalam  | 0           | 0           | 0           | 22          | 21          |
| <b>Total fuel Cost (Rs Cr)</b>                      | <b>2784</b> | <b>3041</b> | <b>2829</b> | <b>3285</b> | <b>2934</b> |

Thus, while the Commission has projected higher net generation of 291 MU during FY03 and lower net generation by 51 MU during FY04 as compared to TNEB projections, it has projected lower fuel costs to the extent of Rs. 212 crore during FY03 and to the extent of Rs. 351 crore during FY04 due to adoption of specific consumption based on heat rate , calorific value and reduced landed cost.

### **(ix) Wind Based Generation**

TNEB has submitted that it has nearly 120 small and medium sized wind mills with an aggregate generation capacity of 19.5 MW. Several places in the State have conducive natural meteorological and topographical setting to get the desired level of wind speed for power generation. Three passes, mainly Aralvaimozhi, Shencottah and Palaghat on the Western Ghat influence heavy wind flow because of the tunneling effect during southwest monsoon. TNEB receives power from these stations on infirm basis as they are dependent on the wind conditions in the area. The average PLF of these wind farms ranges from 10% to 15%. The Commission has accepted the TNEB projections in this respect as they are in line with the past trend.

| <b>Net wind based generation (MU)</b> | <b>FY02</b> | <b>FY03</b> |              | <b>FY04</b> |              |
|---------------------------------------|-------------|-------------|--------------|-------------|--------------|
|                                       |             | <b>TNEB</b> | <b>TNERC</b> | <b>TNEB</b> | <b>TNERC</b> |
| Net generation units from wind energy | 17          | 19          | 19           | 17          | 17           |

### **(X) Summary Of Generation (Hydel, Thermal, Wind)**

The per unit generation cost including thermal, hydel and wind generation is projected at Rs 1.24 per kWh during FY03 and Rs. 1.17 per kWh during FY04. However, it may be noted that despite factoring the increase in landed cost of fuel, the Commission does not envisage the per unit generation cost to be significantly different from actual levels in FY02 on account of the projected improvement in the performance parameters such as plant load factor, heat rates and specific fuel consumption and also on account of improvement in the hydel generation projected for FY04. The per unit generation cost for FY03 is projected to be higher mainly on account of reduced level of hydel generation.

**Table : Net Generation of Energy Units (MU)**

| DESCRIPTION                                | FY02         | FY03         |              | FY04         |              |
|--|--------------|--------------|--------------|--------------|--------------|
|  |              | TNEB         | TNERC        | TNEB         | TNERC        |
| <b>Net Generation Units (MU)</b>           |              |              |              |              |              |
| Hydel Generation                           | 4235         | 1928         | 2285         | 3383         | 4066         |
| Thermal Generation                         | 19429        | 20165        | 20452        | 20967        | 20912        |
| Wind Generation                            | 17           | 19           | 19           | 17           | 17           |
| <b>Total Net Generation</b>                | <b>23681</b> | <b>22112</b> | <b>22756</b> | <b>24367</b> | <b>24995</b> |
| <b>Fuel and other Fuel Costs (Rs.Cr.)</b>  | <b>2784</b>  | <b>3041</b>  | <b>2829</b>  | <b>3285</b>  | <b>2934</b>  |
| <b>Per Unit Generation cost ( Rs./kWh)</b> | <b>1.18</b>  | <b>1.38</b>  | <b>1.24</b>  | <b>1.35</b>  | <b>1.17</b>  |

## 4.2 Power Purchase Expenses

### 4.2.1 General

The TNEB has submitted that it sources power from the Central Sector stations of National Thermal Power Corporation (NTPC) at Ramagundam and Talcher (scheduled for purchase from FY04 onwards), Neyveli Lignite Corporation's Thermal Station Unit - I (NLC -I) and Thermal Station Unit – II (NLC-II Stage 1 and 2), Nuclear Power Corporation's (NPC) - Madras Atomic Power Station (MAPS) at Kalpakkam and Kaiga Atomic Power Station (KAPS). Apart from this, the State has a number of private captive, co-generation and wind energy projects, which supply power to the Board. The State also has five Independent power projects, viz. GMR Vasavi (GMR), P.P. Nallur (PPN), Samalpatti (SPS), Samayanallur or Madurai Power Co. (MPC) and Neyveli zero unit – STCMS. The Neyveli Zero Unit - STCMS with a capacity of 250 MW has commenced commercial operation in December 2002.



The Tamilnadu grid is connected to the grids in Karnataka, Andhra Pradesh and Kerala through the 400 kV and 230 kV transmission lines. The 400 kV inter-state lines are utilised to transfer the power generated at Central Sector generating stations to the respective beneficiaries. The Southern Regional Electricity Board (SREB) at Bangalore co-ordinates the inter-State power flows over the 400 kV and 230 kV lines.

#### **4.2.2 Determination of Power Purchase Quantum**

The Commission has noted that the power purchase quantum constituted around 44% of the total energy input requirement of the Board during FY02 and it is projected to increase to almost 50% of the energy input requirement during FY03 and FY04. In terms of the costs, the power purchase costs constituted almost 41% of the annual revenue requirement during FY02. TNEB has projected that the power purchase cost would constitute around 46% and 48% of the annual revenue requirement during FY03 and FY04, respectively. Hence, it is important that the power purchase costs and quantum be optimized and the principle of least cost power procurement be adopted.

Based on the analysis of the data submitted by the TNEB in the ARR and Tariff Application, the Commission identified several additional data requirements that are essential to project the power purchase quantum and cost more accurately. The Commission asked the TNEB to provide additional information in respect of power purchase such as monthly station-wise details of energy units already purchased and the cost thereof from Apr-02 to Sep-02, monthly station-wise Power Purchase Plan for energy units sent out (ESO) for FY03 and FY04 and the basis for projections, allocated and unallocated share of CGS stations, etc.

#### **4.2.3 Least cost power purchase plan - Simulation of merit order dispatch**

Ideally, in order to simulate the merit order dispatch, one needs to know the hourly demand projections (i.e. restricted and un-restricted demand projections) over the period (FY03 and FY04), the station-wise generation capacity of each source (including generating stations owned by the TNEB and various sources of power purchase), the availability projections of each source, the variable cost of each station and details of

TNEB's allocated/unallocated share of power from CGS Stations. Each source of power, including generating stations owned by the TNEB is then required to be ranked in order, with sources having the least variable cost being ranked highest in the merit order.

The station-wise dispatch schedule would be simulated based on the merit order stack and the hourly demand projections. However, for simulating such merit order dispatch, the hourly demand projections of TNEB over FY03 and FY04 as also the station-wise hourly availability projections are not available. Hence, the Commission has limited the simulation of the merit order dispatch schedule to determination of the quantum of energy units (in MU terms) over the period (FY03 and FY04) and the balancing of the power in MW terms for hourly demand and station-wise dispatch is not simulated. Further, the exercise is limited to simulation of the least cost power purchase quantum and the thermal generating stations are excluded from this exercise. The Commission has considered the fact that the variable cost of generation of all the TNEB's own thermal generating stations except Basin Bridge gas turbine station is lower than some of the highest sources of power procurement. Hence, the TNEB's thermal generating stations would need to be dispatched all the time. The methodology adopted by the Commission for determining the least cost power procurement is elaborated in the following paragraphs.

#### **4.2.4 Commission's approach for determination of the power purchase quantum**

- The quantum of energy units required to be purchased has been derived based on the Energy Input requirement for FY03 and FY04, less the quantum of energy units generated/ to be generated through TNEB's hydel, thermal and wind energy generating stations.
- For determining the quantum of power purchase for FY03, the actual units already purchased during Apr-02 to Sep 02 from various sources of power purchase have been factored in.
- The energy units available to TNEB from each external source (such as CGS, Inter-State, IPPs, cogen/captive/wind) has been determined considering the allocated/unallocated share of TNEB and past trend of energy units availability in case of infirm sources such as wind/captive and co-generation sources. The cost of power purchase from inter-State sources is lower than the variable cost of

power purchase from some of the sources such as IPPs. The only exception is the purchase from Kerala State, however, the purchase from Kerala is limited to actual units already purchased from Apr-02 to Sep-02. Hence, the Commission has accepted the TNEB projections for inter-State power purchase.

- The quantum of energy units to be procured from ‘Must Run’ stations such as nuclear stations (KAPS, MAPS), infirm power sources such as co-generation, captive, wind and other States, is outside the purview of merit order despatch and has been determined separately.
- All other firm power sources have been ranked in terms of merit order with the least cost source being ranked highest for dispatch (i.e. first to be dispatched).
- The quantum of energy units to be procured from each source over the balance period of FY03 (Oct-02 to Mar-03) and FY04 has been determined based on the Merit Order ranking.
- The rate for power purchase from each source has been determined based on Power Purchase Agreements, GOI notifications, Tariff Orders issued by CERC or petitions filed before CERC and scrutiny of energy bills provided by TNEB.

**Table : Power Purchase Quantum through merit order ranking**

| Description  | (MU)         |              |
|--|--------------|--------------|
|  | FY03         | FY04         |
| <b>Energy Input requirement</b>  | <b>44788</b> | <b>48120</b> |
| Net energy units available through own generation (hydel, thermal and wind energy sources of TNEB) | 22756        | 24995        |
| <b>Energy units required to be purchased</b>   | <b>22032</b> | <b>23125</b> |
| Energy units already purchased from Apr-02 to Sep-02   | 8017         | NA           |
| Energy units available from infirm sources and nuclear stations                                    | 6055         | 5029         |
| <b>Energy units purchase to be determined through merit order stack</b>                            | <b>7961</b>  | <b>18096</b> |

Thus, 7961 MU and 18096 MU have to be procured through the merit order dispatch principle during balance period of FY03 and FY04, respectively. The merit order of the various sources available to the TNEB has been shown in the following Table:

**Table : Merit Order Ranking**

| Power Purchase Source                          | PU Variable cost<br>(Rs/kWh) |      | Merit Order<br>Ranking |      |
|--|------------------------------|------|------------------------|------|
|  | FY03<br>(Oct-Mar)            | FY04 | FY03<br>(Oct-Mar)      | FY04 |
| Neyveli Lignite Corporation - I                | 1.69                         | 1.78 | 5                      | 7    |
| Neyveli Lignite Corporation - I<br>(Expansion) | 2.78                         | 2.32 | 8                      | 8    |
| Neyveli Lignite Corporation-II Stage I         | 1.15                         | 1.20 | 2                      | 4    |
| Neyveli Lignite Corporation-II Stage II        | 1.65                         | 1.73 | 4                      | 6    |
| NTPC - SR (Ramagundam)                         | 1.26                         | 1.32 | 3                      | 5    |
| NTPC - Talcher Thermal Station                 |                              | 1.00 |                        | 1    |
| G.M.R. Vasavi                                  | 2.67                         | 2.81 | 7                      | 9    |
| Madurai Power Corporation                      | 2.81                         | 2.95 | 10                     | 11   |
| Samalpatti Power                               | 2.79                         | 2.93 | 9                      | 10   |
| P.P. Nallur                                    | 1.95                         | 1.00 | 6                      | 1    |
| S.T.C.M.S.                                     | 1.10                         | 1.16 | 1                      | 3    |

The per unit variable cost of power purchase considered by the Commission in respect of the Central Generating Stations and Independent Power Producer's projects, are based on the extant rules and orders of appropriate authorities and other relevant submissions made by TNEB in this respect. They do not supplant the jurisdiction of the other statutory authorities like the Central Electricity Regulatory Commission to determine the rate of power generated by Central Sector Generating stations, changes in statutory rates like income tax, cess and changes in contractual provisions. Further, the per unit cost of power purchase from IPPs considered here is for the purpose of estimating the power purchase cost of TNEB over FY03 and FY04, and should not be construed as approval of the rate by the Commission.

For projecting the variable cost for Oct-02 to Mar-03, the Commission has considered the per unit cost incurred during Apr-02 to Sep-02 after thorough scrutiny of the submissions made by TNEB including the sample energy bills for Sep-02 provided by TNEB. For projecting the per unit variable cost for FY04 from various sources of

power purchase, the Commission has accepted the TNEB's projection of rate of escalation at 5%.

In case of Central Generating Stations, the Commission has noted that the only Agreement currently valid during the period FY03 is the Agreement for purchase of power from KAPS (Kaiga Atomic Power Station). The Agreement for power purchase from NLC-I covered the period FY97 to FY02 and that for NLC -II (Stage I and II) covered the period FY96 to FY01. However, the agreements specify the rates to be applicable for the additional period of one year till the agreements are renewed. Further, the CERC is yet to approve the tariff rates for purchase of power from these stations for FY03 and FY04.

The Commission has projected the per unit cost of power purchase based on the energy bills raised during Apr 02 -Sep 02 and projected an increase of 5% during FY04.

Scrutiny of the energy bill of the Central Generating Stations such as NTPC-SR (Ramagundam thermal power station) shows that to derive per unit cost of power purchase from this source, the notified rate needs to be adjusted to account for the fuel charge component, and the income tax component. The same has been factored in while projecting the per unit cost of power purchase from these Stations.

In case of IPP stations, the per unit variable cost prevalent as on Sep-02 has been considered as the basis for projecting the rates for the balance period of FY03 and FY04. However, in case of PPN combined cycle power project, the Commission has noted that the station is expected to operate using mix of naphtha (55%) and natural gas (45%) as fuel during the balance period of FY03 and using 100% natural gas as fuel during FY04. The per unit cost of power purchase has accordingly been considered for estimating the variable cost of power purchase from this source.

In addition, while determining the ranking of IPP stations, the Commission has considered the fact that as per PPA provisions with the IPPs, the IPPs would be entitled to receive an incentive for generation beyond the normative PLF levels (68.4932%). Hence, for the purpose of ranking within the merit order stack, the variable cost of power purchase from IPP stations corresponding to the generation beyond normative PLF levels should include fuel cost plus the incentive component as well. The same has been factored in while determining the quantum of power purchase from these sources.

Though the Per Unit (pu) Variable cost of Madurai Power Corporation in 9/02 was higher than that of Samalpatti power, the average pu variable cost of Madurai Power Corporation was lower. Hence it has been decided that both these IPPs may be asked to dispatch power equally during FY 04, as the difference in cost also not substantial.

The quantum of power purchase from various sources within the merit order stack is presented in the following Table.

| Quantum of Energy Units Purchase (MU)     | FY03        |             |              | FY04         |
|---|-------------|-------------|--------------|--------------|
|   | (Apr-Sep)   | (Oct-Mar)   | (Apr-Mar)    |              |
| Neyveli Lignite Corporation - I           | 1841        | 1416        | 3258         | 3258         |
| Neyveli Lignite Corporation - I (Exp)     |             | 166         | 166          | 1049         |
| Neyveli Lignite Corporation-II Stage - I  | 567         | 606         | 1173         | 1243         |
| Neyveli Lignite Corporation-II Stage - II | 733         | 930         | 1662         | 1859         |
| NTPC SR- (Ramagundam)                     | 2302        | 2098        | 4400         | 4410         |
| NTPC-Talcher Thermal Station              |             |             |              | 830          |
| G.M.R. Vasavi                             | 713         | 559         | 1272         | 1141         |
| Madurai Power Corporation                 | 388         | 222         | 610          | 245          |
| Samalpatti Power                          | 387         | 222         | 609          | 245          |
| P.P. Nallur                               | 1085        | 1229        | 2314         | 2458         |
| S.T.C.M.S.                                |             | 513         | 513          | 1358         |
|   | <b>8016</b> | <b>7961</b> | <b>15977</b> | <b>18096</b> |

The station-wise detailed analysis of the Commission is presented in the following paragraphs.

#### 4.2.5 Central Generating Stations

The TNEB has submitted that the tariff for the stations is based on the equal landed cost approach, wherein the constituents are allocated the power from all the stations, so that the average cost of power is nearly the same for all. The cost of power payable for the use of Central Sector power is dependent on the quantum of power drawal by the respective constituent. In the pre-ABT regime, the rate payable for purchase from CGS was the pooled rate and the allocated share of each constituent has no bearing on the actual cost.

The TNEB submitted the details of the firm allocation of energy units and share of un-allocated quota in response to the Commission's query. Based on these details, the Commission has determined the energy credit entitlement / availability of energy units to TNEB from each Central Generating Station.

**Table : Allocation of Central Sector Power to TNEB**

| <b>Central Generating Stations</b>          | <b>Capacity (MW)</b> | <b>Firm allocation (%)</b> | <b>Share of Un allocated quota</b> | <b>Energy unit entitlement FY04 (MU)</b> |
|---|----------------------|----------------------------|------------------------------------|--|
| Neyveli Lignite Corporation - I             | 600                  | 83.3%                      |                                    | 3258                                     |
| Neyveli Lignite Corporation - I (Expansion) | 420                  | 40.0%                      |                                    | 1049                                     |
| Neyveli Lignite Corporation-II Stage I      | 630                  | 27.9%                      | 1.5%                               | 1243                                     |
| Neyveli Lignite Corporation-II Stage II     | 840                  | 31.5%                      | 1.5%                               | 1859                                     |
| NTPC - SR (Ramagundam)                      | 2100                 | 24.8%                      | 3.7 to 6.0%                        | 4075 to 4410                             |
| NTPC - Talcher Thermal Station              | 500                  | 27%                        |                                    | 830                                      |
| Kaiga Atomic Power Station - KAPS           | 440                  | 23.9%                      | 3.8%                               | 815                                      |
| Madras Atomic Power Station - MAPS          | 470                  | 55.1%                      | 0.6%                               | 601                                      |

For projecting the quantum of energy units to be purchased from various Central Generating stations, the Commission has noted the following points based on submissions of TNEB.

- One unit of NLC Expansion project has achieved commercial operation from mid-December-02. Accordingly, the Commission has projected the procurement of energy units available from this station based on the share of TNEB .
- In case of projection of energy units from NLC - II Stage-II , the Commission has projected power purchase of 1859 MU from this station during FY04.
- In case of NTPC- SR (Ramagundam thermal station), the TNEB is entitled to a share of 4075 MU, however, TNEB has been purchasing around 4400 MU from this source for the past two years and during Apr-02 to Sep-02, it has already purchased 2302 MU from this station. Further, TNEB has submitted that it intends to purchase approx. 4400 MU during FY03 and FY04. The Commission has accepted the TNEB projections in line with the past trend.
- In respect of NTPC- Talcher station, TNEB has a share of 135 MW in the first unit of the 4 x 500 MW Talcher Thermal Station-II. TNEB expects to receive power from FY2003-04 (from Jul-2003 on firm basis) from this Station. Accordingly, the Commission has considered the energy units to be available for procurement from this source during FY04.
- TNEB has projected power purchase quantum of 815 MU for FY04 from KAPS.
- In case of Madras Atomic Power Station (MAPS), the TNEB has projected a lower power purchase quantum as compared to its entitlement, on account of the planned outage of this station. The Commission has accepted the TNEB's projections of energy units purchase from this station for FY03 and FY04.



**Table: Power Purchase Units from CGS**

(MU)

| Central Generating Station                         | FY02         | FY03         |              | FY04         |              |
|--|--------------|--------------|--------------|--------------|--------------|
|  |              | TNEB         | TNERC        | TNEB         | TNERC        |
| Neyveli Lignite Corporation - I                    | 3375         | 3200         | 3258         | 3200         | 3258         |
| Neyveli Lignite Corporation - I<br>(Expansion)     |              | 498          | 166          | 1640         | 1049         |
| Neyveli Lignite Corporation-II<br>Stage I          | 1221         | 1173         | 1173         | 1250         | 1243         |
| Neyveli Lignite Corporation-II<br>Stage II         | 1552         | 1706         | 1662         | 1620         | 1859         |
| NTPC - SR (Ramagundam)                             | 4552         | 4400         | 4400         | 4390         | 4410         |
| KAPS<br>(Kaiga Atomic Power Station)               | 857          | 1390         | 1390         | 1390         | 815          |
| MAPS<br>(Madras Atomic Power Station)              | 601          | 350          | 350          | 601          | 601          |
| NTPC - Talcher Thermal Station                     |              |              |              | 865          | 830          |
| <b>Sub-total (Central generating<br/>stations)</b> | <b>12158</b> | <b>12717</b> | <b>12399</b> | <b>14956</b> | <b>14065</b> |

For projecting the per unit cost of power purchase for purchase of power from various Central Generating Stations, the Commission has noted the following points based on TNEB's submissions.

- In respect of the NLC-I station, the TNEB has submitted that the tariff rates are governed by the Agreement with NLC. This Agreement has been effective for the period 1997-98 to 2001-02 and specifies applicable tariff of 158.92 paise per unit for 2001-02 for operation upto 6000 Hrs and above 6150 Hrs. The above Agreement also provides for extending the validity of the Agreement for an additional period of one year until the renewal of the Agreement at a specified rate of additional 3.5 paise per unit over the last prevalent tariff. However, the TNEB has projected an average rate of 171 paise per unit for FY03 and 179.55 paise per unit for FY04 on account of anticipated increase in rate due to

additional cost of operation of Mine -1 and expansion of the plant by NLC. The Commission has noted the above submissions and pending approval of tariff by CERC in this respect, the Commission has considered the average billing rate by NLC to TNEB over Apr-02 to Sep-02 (169.3 paise per unit) as the basis for projecting the per unit cost of power purchase from this station for FY03 with an escalation of 5% for FY04.

- In respect of the NLC-II station (Stage - I & II) the TNEB has submitted that the tariff rates are governed by the Agreement with NLC which was valid for the period 1996-97 to 2000-01. This Agreement specifies a tariff of 108.16 paise per unit for Stage-I and 158.80 paise per unit for Stage II for the period 2000-01 for operation upto 6000 Hrs and above 6150 Hrs. The above Agreement also provides for extension of the validity of the Agreement for an additional period of one year until the renewal of the Agreement at a specified additional rate of 3 paise per unit over the last prevalent tariff. However, the TNEB has projected an average rate of 117.62 paise per unit for Stage-I and 168.22 paise per unit for Stage-II for FY03. The Commission has noted the above submissions and pending approval of tariff by CERC in this respect, the Commission has considered the average billing rate by NLC to TNEB over Apr-02 to Sep-02 (114.6 paise per unit for Stage-I and 165.2 paise per unit for Stage - II) as the basis for projecting the per unit cost of power purchase from this station for FY03 with an escalation of 5% for FY04.
- The TNEB has submitted that as per the recent petition filed by NLC before the CERC for the determination of tariff for the sale of power from NLC - Expansion facility, the per unit variable cost of power purchase is linked to the pooled cost of lignite and the proposed tariff is Rs 2.77 per unit and Rs 2.32 per unit for FY03 and FY04, respectively. Pending disposal of the above petition, the Commission has projected the per unit variable cost of power purchase from this source at the same rate proposed in the petition of NLC to CERC.
- In case of NTPC-SR, the TNEB has submitted that per unit cost of power as per CERC Order works out to 128.40 paise per unit for FY02, which comprises a fixed charge component of 31.86 paise per unit, notified variable cost of 37.66 paise per unit, average FCA for the year of 46.46 paise per unit and other

charges of 12.42 paise per unit. The per unit power purchase cost needs to factor in other components such as income tax. The Commission has noted that the average per unit billing rate charged by NTPC to TNEB for the period Apr-02 to Sep-02 has ranged between 111.4 paise per unit (Apr-02) to 137.8 paise per unit (Sep-02) including the income tax component for the applicable period. Accordingly, the Commission has considered the average billing rate charged by NTPC to TNEB over Apr-02 to Sep-02 (125.5 paise per unit) as the basis for projecting the per unit cost of power purchase from this station for FY03 with an escalation of 5% for FY04.

- In respect of NTPC- Talcher station, the TNEB has submitted that the rate of Rs 3.50 per unit is based on the pre-agreed rate between NTPC - Talcher and TNEB. However, TNEB has not provided the copy of the agreement or commercial understanding for the Commission's scrutiny. Further, to the best of the Commission's knowledge, the NTPC has not filed any petition before CERC for approval of the rate for sale of power from its Talcher's thermal power project. Hence, the Commission has assumed a per unit cost of power purchase from this source at Rs 3 per unit including fixed cost at Rs 2 per unit and variable cost at Rs 1 per unit benchmarked to pit-head based thermal power station using coal as fuel.
- In respect of KAPS, the Commission has noted that the TNEB has entered into an Agreement with KAPS, which is valid upto FY05. The Agreement outlines the rate of power purchase for FY03 as Rs 3.25 per unit and for FY04 as Rs 3.40 per unit. The Commission has also verified the same from the bills raised during Apr-02 to Sep-02, and has hence considered these rates for projecting the power purchase cost from KAPS.
- In case of MAPS, the TNEB has submitted that the average power purchase rate is 193 paise per unit in FY03, comprising variable cost component of 135.69 paise per unit, FCA component of 26.9 paise per unit and heavy water charges of 30.41 paise per unit. However, based on the assessment of the bills raised during Apr-02 to Sep-02, the average per unit cost of power purchase from this station works out to 200.2 paise per unit, hence, the Commission has considered

this rate as the basis for projecting the power purchase cost for the balance period of FY03, with an escalation of 5% for FY04.

The projection of total power purchase cost from various Central Generating Stations is summarized in the following Table.

**Table : Cost of Power Purchase from CGS**

(Rs. Crore)

| Central Sector Station                             | FY02        | FY03        |             | FY04        |             |
|--|-------------|-------------|-------------|-------------|-------------|
|  |             | TNEB        | TNERC       | TNEB        | TNERC       |
| Neyveli Lignite Corporation - I                    | 563         | 547         | 551         | 575         | 579         |
| Neyveli Lignite Corporation - I<br>(Expansion)     |             | 120         | 46          | 413         | 243         |
| Neyveli Lignite Corporation-II<br>Stage I          | 143         | 138         | 134         | 154         | 150         |
| Neyveli Lignite Corporation-II<br>Stage II         | 261         | 287         | 275         | 286         | 323         |
| NTPC - SR (Ramagundam)                             | 584         | 584         | 552         | 611         | 581         |
| KAPS<br>(Kaiga Atomic Power Station)               | 266         | 452         | 450         | 473         | 277         |
| MAPS<br>(Madras Atomic Power Station)              | 116         | 68          | 70          | 122         | 127         |
| NTPC - Talcher Thermal Station                     |             |             |             | 303         | 235         |
| <b>Sub-total (Central generating<br/>stations)</b> | <b>1932</b> | <b>2195</b> | <b>2079</b> | <b>2937</b> | <b>2515</b> |

#### 4.2.6 Inter-State power purchase

In case of inter-State power purchases, the TNEB has submitted that it purchases power from other States such as Eastern region, Western region, Kerala, and Andhra Pradesh to meet its shortage situation. This energy is purchased on an infirm basis based on requirement, except for 100 MW from Eastern region, which is on a firm basis. During FY03, higher energy purchase from various sources has been projected by

TNEB to meet the shortage created as a result of lower availability of hydel generation. Based on the availability and the negotiated rates, TNEB has projected the energy units to be purchased from various inter-State sources for FY03 and FY04.

The Commission has noted the actual energy units purchased by TNEB from various inter-State sources during Apr-02 to Sep-02 and accordingly determined the energy units to be procured during Oct-02 to Mar-03 from these sources.

The quantum of energy units (MU) and corresponding power purchase cost (Rs Cr) for procurement of energy from these sources as approved by the Commission has been summarized in the following Tables.

**Table : Quantum of Power Purchase from Inter-State Sources**

(MU)

| Inter- State Source                     | FY02       | FY03        |             | FY04        |             |
|---|------------|-------------|-------------|-------------|-------------|
|   |            | TNEB        | TNERC       | TNEB        | TNERC       |
| Maharashtra                             | 35         |             |             |             |             |
| Eastern Region                          | 813        | 1459        | 1459        | 919         | 919         |
| Western Region                          |            | 100         | 100         | 100         | 100         |
| Kerala State Electricity Board          | 12         | 116         | 115         |             |             |
| Pondy Power Corporation                 | 47         |             |             |             |             |
| Andhra Pradesh                          |            | 380         | 380         | 110         | 110         |
| <b>Sub-total (Inter-state purchase)</b> | <b>907</b> | <b>2055</b> | <b>2054</b> | <b>1129</b> | <b>1129</b> |

For determining the power purchase cost from these sources, the Commission has considered the actual cost of power purchase per unit during Apr-02 to Sep-02 as submitted by TNEB, as the basis for projecting the same for the remaining period of FY03 (Oct-02 to Mar-03). The Commission has accepted the escalation of 5% projected by the TNEB for FY04.

**Table : Cost of Power Purchase from Inter-State Sources**

(Rs. Crore)

| Inter- State Source                     | FY02       | FY03       |            | FY04       |            |
|---|------------|------------|------------|------------|------------|
|   |            | TNEB       | TNERC      | TNEB       | TNERC      |
| Maharashtra                             | 10         |            |            |            |            |
| Eastern Region                          | 160        | 303        | 274        | 193        | 182        |
| Western Region                          |            | 22         | 22         | 23         | 23         |
| Kerala State Electricity Board          | 5          | 52         | 47         |            |            |
| Pondy Power Corporation                 | 10         |            |            |            |            |
| Andhra Pradesh                          |            | 95         | 95         | 29         | 29         |
| <b>Sub-total (Inter-state purchase)</b> | <b>185</b> | <b>472</b> | <b>438</b> | <b>245</b> | <b>234</b> |

**4.2.7 Transmission charges for PGCIL**

The TNEB has submitted that it pays the transmission charges notified by GOI / CERC for various transmission lines in the Southern Region. Fixed transmission tariff is payable to PGCIL for use of its lines, which is billed on the basis of usage of the lines by the TNEB for wheeling of power. Currently, the TNEB uses NTPC - Ramagundam-Chandrapur line, Chandrapur HVDC line, Jaypore-Gazawakka NLC line etc.

The Commission had solicited information regarding the transmission charges including rebates, if any, billed by PGCIL for the period Apr-02 to Sep-02. The Commission has noted that currently the transmission charges for use of transmission lines are charged to the constituents based on the proportion of the usage/drawal by various constituents. Further, TNEB has submitted that PGCIL has charged Rs. 55 Cr to the TNEB towards transmission charge for the period from Apr-02 to Sep-02. Accordingly, the Commission has projected the transmission charges for the balance period of FY03 (Oct-02 to Mar-03) and FY04 based on the projected drawal of power through PGCIL transmission lines for the evacuation and transmission of power from Central Generating Stations and inter-State power purchases.

The Commission's projection of the cost towards transmission charges is summarized in the following Table.

**Table : Transmission charges payable to PGCIL**

(Rs. crore)

| Particulars                  | FY02 | FY03 |       | FY04 |       |
|------------------------------|------|------|-------|------|-------|
|                              |      | TNEB | TNERC | TNEB | TNERC |
| PGCIL - transmission charges | 100  | 120  | 123   | 130  | 131   |

#### **4.2.8 Power purchase from captive, co-generation and wind energy sources**

In case of purchase of power from captive, co-generation and wind energy sources, the TNEB has submitted that it has entered into Agreements with several private players owning captive generating sources and co-generation power plants, who wheel the surplus power into TNEB grid. In addition, private wind power producers also sell their power to TNEB based on the option exercised by them. The estimation of quantum of power likely to be made available is based on Power Purchase Agreements and past trends. The State has 3045 private wind mill generators, with installed capacity of 843.14 MW. About 65% of the wind energy produced by private wind generators is wheeled to their own /subsidiary industries and only 35% of the energy is sold to TNEB. Further, the State has 13 sugar mills with installed co-generation capacity of 186.6 MW and 2 bio-mass plants with capacity of 13 MW. The sugar mills consume 40% of energy produced by the co-generation plants and balance is sold to the TNEB. The industries and commercial establishments have installed captive power plants of 3450 MVA capacity. Most of the captive generation is consumed in-house, however, few industries do sell their surplus power to TNEB.

The Commission solicited specific clarification as to accounting of purchase from wind energy generation. The Commission has noted that the power purchase from wind energy sources with installed capacity of 843 MW and operating at 15% - 20% PLF and with 35% sale to TNEB would amount to around 387 MU to 516 MU. However, TNEB has reported the power purchase from wind energy sources at 1249 MU (FY02), 1370 MU (FY03) and 1383 MU (FY04). In this respect, the TNEB has responded that as per the accounting procedure followed by TNEB, the energy wheeled and adjusted against the HT consumption of the consumers is debited in Power Purchase Account (gross energy wheeled - 100%) and credited in Sale of Power account (after deduction of wheeling charges of 5%) and Miscellaneous Receipts (wheeling charges of 5%) at HT Tariff - I rate. Thus, the 65% of the left over energy as pointed out is adjusted against HT consumption and accounted for under power purchase and Sale of Power.

The Commission has noted that accurate projection/estimation of quantum of energy available to TNEB through these sources is difficult mainly on account of its infirm nature. Accordingly, the Commission has accepted the projections of TNEB as regards quantum of energy units to be procured from above sources such as captive stations, co-generation plants and wind mills. The Commission has noted the actual energy units already purchased by TNEB from these sources during Apr-02 to Sep-02 and accordingly determined the energy units to be procured during Oct-02 to Mar-03 from these sources. The Commission has accepted the TNEB's projection of quantum of energy units for FY04.

TNEB is directed to reconcile the total energy generated by the private Wind Energy Generators with the units consumed by them in their HT / LT services and the balance energy for which cost is paid to them. This information should be made available in the next tariff revision proposal.

The quantum of energy units (MU) and corresponding power purchase cost (Rs Cr) for procurement of energy from these sources as approved by the Commission has been summarized in the following Tables.



**Table : Quantum of Purchase from Captive, Co-generation and Wind Sources**

(MU)

| Source  | FY02        | FY03        |             | FY04        |             |
|---|-------------|-------------|-------------|-------------|-------------|
|   |             | TNEB        | TNERC       | TNEB        | TNERC       |
| Captive power plant   | 437         | 426         | 426         | 466         | 466         |
| Co-generation   | 362         | 465         | 465         | 635         | 635         |
| Wind energy sources   | 1249        | 1370        | 1370        | 1383        | 1383        |
| <b>Sub-total (Captive, co-generation and wind energy sources)</b> | <b>2048</b> | <b>2261</b> | <b>2261</b> | <b>2484</b> | <b>2484</b> |

The Commission has noted that as per terms of Agreement between the TNEB and the captive generators, the agreed rate for firm power was 225 paise per unit during FY00, with an escalation of 5% per annum for the next nine years. As per the Agreement with wind energy projects, the tariff has been fixed at 270 paise per unit since 27<sup>th</sup> – September 2001 for the next five years. The rate for purchase of energy from co-generators has been fixed at 273 paise per unit (using bagasse as fuel during crushing season) with effect from 1.04.2000 with escalation at the rate of 5% per annum for next five years, whereas the rate has been fixed at 248 paise per unit (using coal/lignite as fuel during season and off-season) with effect from 16.05.2000 with escalation at the rate of 5% per annum for next five years.

For determining the power purchase cost from these sources, the Commission has considered the actual cost of power purchase per unit during Apr-02 to Sep-02 as submitted by TNEB, as the basis for projecting the same for the remaining period of FY03 (Oct-02 to Mar-03). Further, the escalation rate for projections for FY04 has been considered in line with the agreement terms already in place.

**Table : Cost of Purchase from Captive, Cogeneration and Wind sources**

(Rs. Crore)

| Source  | FY02       | FY03       |            | FY04       |            |
|---|------------|------------|------------|------------|------------|
|   |            | TNEB       | TNERC      | TNEB       | TNERC      |
| Captive power plant   | 114        | 116        | 114        | 134        | 131        |
| Co-generation   | 104        | 133        | 132        | 191        | 190        |
| Wind energy sources   | 337        | 370        | 370        | 373        | 373        |
| <b>Sub-total (Captive, co-generation and wind energy sources)</b> | <b>555</b> | <b>620</b> | <b>616</b> | <b>698</b> | <b>694</b> |

#### **4.2.9 Independent Producers (IPP Generating Stations)Power**

In case of power purchase from IPP's, the TNEB has submitted that it has entered into Power Purchase Agreements with several Independent Power Producers for purchase of power. The generation from these stations for FY03 has been projected by TNEB based on their performance during the first four months of the current financial year. The ensuing year's projection has been made considering the availability from all internal generating sources and cheaper central sector sources.

The Commission has noted that the Power Purchase Agreements (PPAs) provide for generation from these sources at normative PLF levels of 68.4932%. The PPA's provide for recovery of entire fixed charges at the normative level of generation. In case the generation is lower than the normative level due to backing down instructions by the Load Despatch Centre or other Force Majeure conditions, the IPP is entitled for deemed generation and hence recovery of fixed charges, whereas for any generation beyond normative level, the IPP is entitled to incentive payments in accordance with the provisions in the PPA's.

The Commission has elaborated in detail in previous sections, the methodology adopted by it to determine the quantum of energy to be procured from each source in

accordance with the merit order stack developed for the purposes in order to optimise the cost of power purchase.

While determining the quantum of power purchase from IPPs for FY03, the Commission has taken into account the submission made by TNEB in response to its query about the energy units already purchased by TNEB from IPP generating stations during Apr-02 to Sep-02. Further, the Commission has noted that ST-CMS IPP project commenced commercial operation from middle of Dec-02. The energy units required to be purchased from IPP generating stations during balance period of FY03 (i.e. Oct-02 to Mar-03) has been determined by matching the energy input requirement and the energy units available from each of these generating stations strictly in line with the least cost power procurement principles (Merit Order Ranking) outlined earlier. The Commission has also taken into consideration that the IPPs shall be entitled to receive an incentive payment for generation and sale beyond the normative level of PLF. The Merit Order Stack has been modified accordingly and the energy procurement has been determined after factoring such incentive provisions. In case of PPN Power Project, the TNEB has submitted that the project would be utilising mix of naphtha (55%) and natural gas (45%) as fuel during Oct-02 to Mar-03 and would use natural gas (100%) as fuel during FY04.

The quantum of energy units (MU) and corresponding power purchase cost (Rs Cr) for procurement of energy from these sources as approved by the Commission has been summarized in the following Tables.

**Table : Quantum of Power Purchase from IPPs**

(MU)

| IPP Source                                  | FY02        | FY03        |             | FY04        |             |
|---|-------------|-------------|-------------|-------------|-------------|
|   |             | TNEB        | TNERC       | TNEB        | TNERC       |
| G.M.R. Vasavi                               | 1193        | 1400        | 1272        | 1400        | 1141        |
| Madurai Power Corporation                   | 331         | 740         | 610         | 740         | 245         |
| Samalpatti Power                            | 644         | 740         | 609         | 740         | 245         |
| P.P. Nallur                                 | 1077        | 2284        | 2314        | 2400        | 2458        |
| S.T.C.M.S.                                  |             | 500         | 513         | 1500        | 1358        |
| <b>Sub-total (Power purchase from IPPs)</b> | <b>3245</b> | <b>5664</b> | <b>5318</b> | <b>6780</b> | <b>5447</b> |

As regards rate of power purchase from various IPP sources, the TNEB has submitted that the provisions of the applicable PPA with these projects govern the purchase price from these sources. The tariff rates are based on the fixed and variable charge payable. The fixed charge elements comprise depreciation, interest on loan capital, return on equity, O&M expenses including insurance, taxes, interest on working capital. Further, various elements are linked to variation in the foreign currency exchange rates, PLR and LIBOR rates, taxes. The energy charge element comprises cost of primary fuel and cost of secondary fuel, and is linked to variation in the market rate for fuels and calorific value of fuel.

For determining the power purchase cost from these sources, the Commission has considered the actual cost of power purchase per unit during Apr-02 to Sep-02 as submitted by TNEB as the basis for projecting the same for the remaining period of FY03 (Oct-02 to Mar-03). Further, per unit variable cost of power purchase has been projected at an escalation rate of 5% for FY04.

As regards fixed cost projections, the Commission has noted that in case the quantum of power purchase over the yearly period falls below normative level of PLF on account of dispatch instructions from TNEB, the TNEB would have to still service the fixed costs components corresponding to normative level of PLF, as per the deemed generation provisions under the PPAs. The Commission has noted the annualised fixed costs claimed by the IPP generators as per the electricity bills raised by them for Sep-02 and also total fixed costs claims raised on TNEB for the energy units purchased during Apr-02 to Sep-02. The same has been considered as the basis for projecting the fixed cost for the IPP sources for FY03 and FY04. However, the Commission has noted that the interest costs claimed in the fixed cost components in case of most of the IPP projects are very high and the Commission is of the opinion that there is substantial scope for reducing the same particularly during the current low interest rate regime, both for Rupee currency borrowing and the foreign currency borrowing by the IPPs.

The Commission has noted that in the 'White Paper on the Tamil Nadu Government's Finances' placed in the floor of the Legislative Assembly, it is stated that the TNEB has been borrowing heavily to meet its revenue expenditure on purchase of

power, fuel, payment of salaries and interest payments. The main reasons for increase in deficit of the TNEB has been attributed as follows :-

- *The unreasonably high cost of purchasing electric power from independent power producers (IPP) in the private sector has made a serious dent in TNEB's finances. The Board now proposes to re-negotiate its power purchase costs with the private sector IPPs.*
- *While the cost of power generated by TNEB's captive power stations range from 21 paise per unit for hydel power to Rs 2.14 per unit for thermal power, the cost of power purchased from IPPs range from Rs 3.96 per unit to Rs. 5.27 per unit. The TNEB has been asked to bring out a White paper on the state of its finances.*

In this context, the Commission hereby directs the TNEB to explore the options with concerned IPP generators at the earliest in order to optimise its cost of power purchase from IPP sources.

The summary of power purchase cost from IPP sources as approved by the Commission is presented in the following Table.

**Table : Cost of Power Purchase from IPPs**

(Rs. Cr)

| IPP SOURCE                                  | FY02        | FY03        |             | FY04        |             |
|---|-------------|-------------|-------------|-------------|-------------|
|   |             | TNEB        | TNERC       | TNEB        | TNERC       |
| G.M.R. Vasavi                               | 460         | 612         | 558         | 642         | 533         |
| Madurai Power Corporation                   | 136         | 330         | 284         | 347         | 193         |
| Samalpatti Power                            | 273         | 330         | 290         | 347         | 197         |
| P.P. Nallur                                 | 552         | 758         | 949         | 613         | 653         |
| S.T.C.M.S.                                  |             | 190         | 153         | 599         | 498         |
| <b>Sub-Total (Power purchase from IPPs)</b> | <b>1421</b> | <b>2220</b> | <b>2234</b> | <b>2548</b> | <b>2074</b> |

### Summary of Power Purchase

The power purchase quantum and cost from various sources of power purchase has been summarized below.

**Table : Summary of Power Purchase Quantum**

(MU)

| Power Purchase Source  | FY02         | FY03         |              | FY04         |              |
|--|--------------|--------------|--------------|--------------|--------------|
|  |              | TNEB         | TNERC        | TNEB         | TNERC        |
| Central Generating Stations                                  | 12158        | 12717        | 12399        | 14956        | 14065        |
| Inter-state power purchase                                   | 907          | 2055         | 2054         | 1129         | 1129         |
| Purchase from captive, wind and co-generation energy sources | 2048         | 2261         | 2261         | 2484         | 2484         |
| Purchase from IPPs   | 3245         | 5664         | 5318         | 6780         | 5447         |
| <b>Total (Power purchase Energy Units - MU)</b>              | <b>18358</b> | <b>22697</b> | <b>22033</b> | <b>25349</b> | <b>23125</b> |

As is evident from the Table above, the Commission has projected substantial reduction in the purchase of energy units (664 MU during FY03 and 1870 MU during FY04) as compared to TNEB projections. The reduction is mainly on account of the difference in the energy input requirement projected by the Commission as compared to that projected by TNEB. However, in comparison to power purchase from IPP sources during FY02, the Commission has projected an increase of 2073 MU (during FY03) and an increase of 2558 MU (during FY04). Further, the Commission has noted that during Apr-02 to mid- Oct-02 (six and half month period of FY03) TNEB has so far purchased energy units only up to 2574 MU from various IPP sources.

#### 4.2.10 Summary of Power Purchase Cost

(Rs Crore)

| POWER PURCHASE SOURCE  | FY02        | FY03        |             | FY04        |             |
|--|-------------|-------------|-------------|-------------|-------------|
|  |             | TNEB        | TNERC       | TNEB        | TNERC       |
| Central Generating Stations                                  | 1932        | 2195        | 2079        | 2937        | 2515        |
| Inter-State Power Purchase                                   | 185         | 472         | 438         | 245         | 234         |
| Purchase from Captive, Wind and Co-Generation Energy sources | 555         | 620         | 616         | 698         | 694         |
| Purchase from IPPs   | 1421        | 2220        | 2234        | 2547        | 2074        |
| Power Grid   | 100         | 120         | 123         | 130         | 131         |
| <b>TOTAL( Power Purchase Cost - Rs.Cr.)</b>                  | <b>4193</b> | <b>5627</b> | <b>5490</b> | <b>6557</b> | <b>5648</b> |

The Commission has thus projected, in comparison to TNEB submission, a reduction in power purchase cost by Rs. 137 crore in FY03 and Rs. 909 crore in FY04 respectively.

#### 4.3 Other Expenditure

##### 4.3.1 Interest Expenditure

The TNEB has projected gross interest expenditure of Rs. 1050 crore and Rs. 1120 crore in FY03 and FY04 respectively, in its Tariff Application. The interest expenditure, net of normal capitalization and interest during construction has been projected by TNEB at Rs. 866 crore and Rs. 923 crore in FY03 and FY04, respectively. The interest expenditure comprises primarily of interest on loans from institutions, bonds issued by TNEB and Open Market Loans (OML). The TNEB has provided detailed computations of the interest on the long-term loans in the ARR Formats specified by the Commission. However, the detailed computations provided by the TNEB does not tally with the long-term interest expenditure stated in the Tariff Application, as shown in the Table below. The TNEB has clarified that the interest expenditure as projected in the

Tariff Application was correct, and the data provided in the ARR formats was based on the prevalent interest rates, rather than the weighted average interest rates applicable to loans from each institution.

(Rs. Crore)

| SI | Particulars                         | FY03               |               | FY04               |                |
|----|-------------------------------------|--------------------|---------------|--------------------|----------------|
|    |                                     | Tariff<br>Petition | ARR           | Tariff<br>Petition | ARR            |
| 1  | Institutional Loans                 | 657.39             | 591.59        | 690.17             | 698.59         |
| 2  | Bonds/OML                           | 286.72             | 266.96        | 315.35             | 315.35         |
|    | <b>Total Long-Term<br/>Interest</b> | <b>944.11</b>      | <b>858.55</b> | <b>1005.52</b>     | <b>1013.94</b> |

As the TNEB has taken loans from each Financial Institutions in several tranches, the TNEB submitted the revised long-term interest calculations based on the weighted average interest applicable on the outstanding loans. The Commission scrutinized the additional submission on tranche-wise details, and has verified the weighted interest rate applicable. The weighted average interest rate considered by the TNEB for the outstanding loans is correct, except in the case of bonds and Open Market Loans (OML), where the weighted average interest rate works out to 12.37 % against the interest rate of 13.9% projected by the TNEB.

In projecting the long-term interest, the TNEB has considered additional loans to fund the uncovered revenue gap, in addition to the loans required to fund the capital investment. The Commission is of the opinion that this method of computation results in increasing the revenue gap further, and is inappropriate. Further, as the Commission is matching the revenue requirement through the revised tariffs, there is no need to consider additional loans to fund the revenue gap. Hence, the Commission has considered additional loans to the extent of the projected capital investment only, by proportionately reducing the amount of additional loan from each institution. The capital investment projected by the TNEB is Rs. 1390.4 crore and Rs. 1481.3 crore in FY03 and FY04, which has been accepted by the Commission. The Commission has computed



the interest on long-term loans based on the average balance of the outstanding loans (average of opening and closing levels of long-term loans during the year) and the average interest rate applicable on these loans as submitted by TNEB. The projected institution-wise interest payments have been shown in the following Table. The other heads of interest expenditure are interest on working capital, interest on provident fund, other finance charges and guarantee commission. The Commission has accepted the interest computation submitted by the TNEB as regards the other heads of expenditure. The TNEB's income is linked to its billing and collection cycle, which is such that the revenue is realized during the second half of the month. However, its payables occur more evenly during the month.

(Rs. Crore)

| Financial Institution | FY03          |               | FY04           |               |
|-----------------------|---------------|---------------|----------------|---------------|
|                       | TNEB          | TNERC         | TNEB           | TNERC         |
| PFC                   | 199.89        | 187.37        | 203.46         | 171.06        |
| REC                   | 116.93        | 92.44         | 169.01         | 108.50        |
| REC/Bk                | 2.59          | 2.59          | 0.63           | 0.63          |
| Bond/OML              | 313.73        | 263.19        | 295.31         | 255.84        |
| TNPFC                 | 188.48        | 166.84        | 209.45         | 152.90        |
| IDBI                  | 3.00          | 3.00          | 0.86           | 0.86          |
| SIDBI                 | 3.80          | 3.80          | 1.70           | 1.70          |
| NSIC                  | 0.84          | 0.84          | 0.28           | 0.28          |
| LIC                   | 76.17         | 76.17         | 67.35          | 67.35         |
| Medium Term Loan      | 26.13         | 22.66         | 29.80          | 20.57         |
| APDRP                 | 7.09          | 5.57          | 15.44          | 9.90          |
| NABARD                | 5.04          | 2.59          | 12.23          | 6.38          |
| <b>TOTAL</b>          | <b>943.69</b> | <b>827.06</b> | <b>1005.52</b> | <b>795.97</b> |

The mismatch in the timing of the revenue receipts and payables under various categories is managed by the TNEB by utilizing its cash credit limit of Rs. 120 crore available with various banks. The TNEB incurs interest on the Working Capital Demand Loan equivalent to 80% of the cash credit limit. The Commission has hence allowed the working capital interest as claimed by TNEB. The normal capitalization projected by

TNEB has been accepted by the Commission, while the interest during construction has been maintained at FY02 levels, as the level of asset addition has been maintained by the TNEB. The interest expenses have been summarized in the following Table:

**Table: Approved Interest Expenditure**

(Rs. Crore)

| SL. NO | PARTICULARS                    | FY02          | FY03           |               | FY04           |               |
|--------|--------------------------------|---------------|----------------|---------------|----------------|---------------|
|        |                                |               | TNEB           | TNERC         | TNEB           | TNERC         |
| 1      | Interest on Security Deposit   | 2.04          | 0.00           | 0.00          | 0.00           | 0.00          |
| 2      | Interest on Working Capital    | 5.13          | 6.10           | 6.10          | 6.40           | 6.40          |
| 3      | Interest on CPF.FSF & SPFG     | 3.26          | 3.54           | 3.54          | 3.74           | 3.74          |
| 4      | Interest on GPF                | 61.92         | 66.74          | 66.74         | 70.09          | 70.09         |
| 5      | Other Finance Charges          | 16.70         | 7.44           | 7.44          | 10.21          | 10.21         |
| 6      | Guarantee Commission           | 20.00         | 22.00          | 22.43         | 24.00          | 24.00         |
|        | Long-Term Loans                | 778.66        | 943.69         | 827.06        | 1005.52        | 795.97        |
|        | <b>Sub-Total</b>               | <b>887.71</b> | <b>1049.51</b> | <b>933.31</b> | <b>1119.96</b> | <b>910.41</b> |
|        | Normal Capitalization          | 2.53          | 2.98           | 2.98          | 3.01           | 3.01          |
|        | Interest during Construction   | 235.00        | 181.35         | 235.00        | 194.15         | 235.00        |
|        | <b>TOTAL INTEREST EXPENSES</b> | <b>650.18</b> | <b>865.18</b>  | <b>695.33</b> | <b>922.80</b>  | <b>672.40</b> |

The total interest expenditure has been projected to reduce in FY04 as compared to FY03, based on the TNEB's submission that there is expected to be a reduction in the weighted average interest rates due to the prevailing low interest rates. **Thus, the total interest expenditure approved by the Commission is Rs. 695.33 crore and Rs. 672.40 crore for FY03 and FY04, respectively.** The Commission's projected interest expense is lower than the TNEB's projections by Rs. 169.85 crore and Rs. 250.4 crore in FY03 and FY04, respectively, mainly on account of the disallowance of the interest projected by the TNEB for funding the projected revenue gap and maintaining the interest during construction for FY03 and FY04 at the same level of FY02 .

### **4.3.2 Employee Expenses**

Employee expenses comprise salaries, dearness allowance, other allowances, bonus, employee benefits such as medical expenses reimbursement, earned leave encashment, staff welfare expenses and terminal benefits in the form of pension and gratuity. The TNEB has projected an increase of 8% and 3% in the employee expenses in FY03 and FY04, respectively. The TNEB has considered Dearness Allowance at 47% of the salary expenses, based on the anticipated increase of about 4 % in DA every year.

The TNEB has assumed a normal increase of 3% in basic pay in FY03 over FY02 expenses. A further increase of 5% has been projected on account of the wage revision. The TNEB has clarified that wage revision is done once in four years, and is currently due with effect from 1<sup>st</sup> December 2000. As the provision for the wage revision has been included in FY03, the TNEB has projected an increase of 3% over FY03 levels in the employee expenses.

The TNEB has retained the staff welfare expenses and the other allowances at the same levels for FY03 and FY04. The provision for terminal benefits has been assessed by the TNEB based on the actual commitment on account of provision and gratuity. The TNEB has submitted that its employee strength has reduced by about 3300 numbers in FY02 alone, and that the employee strength has been steadily reducing over the past three years, as several employees have opted for voluntary retirement during this period.

The TNEB has provided a comparison of employee productivity and stated that the number of employees per MU sold is comparable with other Utilities. However, the comparison provided by TNEB itself shows that the number of employees per MU sold is higher than that in Maharashtra, Gujarat, Rajasthan and Kerala, and is lower than that in MPSEB and Karnataka. The Commission has undertaken the comparison of the employee productivity with more States, as given in the Table below:

| State                     | Number of employees per MU of energy sold |
|---------------------------|---|
| Maharashtra               | 2.37                                      |
| Andhra Pradesh*           | 2.61                                      |
| Karnataka*                | 5.07                                      |
| Kerala                    | 2.38                                      |
| Gujarat                   | 1.46                                      |
| Madhya Pradesh            | 3.34                                      |
| Rajasthan                 | 2.51                                      |
| <b>Tamil Nadu</b>         | <b>2.57</b>                               |
| All India Average (SEB's) | 2.53                                      |

**Source:** Planning Commission Report on SEB's, 2002

**Note:** \* - consolidated for SEB

The above analysis shows that the employee productivity of TNEB is slightly higher than that seen in many other States, as well as higher than the all-India average.

The TNEB's salary expenses have reduced in FY02 over FY01 levels on account of the substantial reduction in the number of employees, due to natural reduction and voluntary retirement of the employees. The Commission is of the view that the reduction in the number of employees by about 3.5% in FY02 will result in at least a 5% reduction in the salary expenses, as these retiring employees would be at the senior level.

The Commission has considered a normal increase of 3% in salary expenses over this reduced level of salary expenses, and a 5% increase on account of the wage revision, to project the employee expenses in FY03. The Dearness Allowance has been considered at 45% of the basic salary for the period April to September 2002, and at 49% from October 02 to March 03, based on the GoTN's Order on the same. For FY04, the Commission has projected a normal increase of 3% in the basic salary over FY03 levels, and has projected the DA at 52% of the basic salary, based on the assumption that the GoTN will follow the Central Government decision in this regard. The terminal benefits have been projected based on the past trend in this regard, as indicated by the share of terminal benefits as a percentage of basic salary and DA over the past five years.

The Commission has accepted the TNEB's projections of other allowances, bonus, medical expenses reimbursement, earned leave encashment, and staff welfare expenses, as the TNEB's projections are in line with the past trend exhibited by these expense heads. The capitalization of employee expenses has been maintained at the same levels as in FY02 in absolute terms, as the pace of asset addition is being maintained.

**Table : Approved Employee Expenditure**

(Rs. Crore)

| SL. NO. | PARTICULARS                       | FY02           | FY03           |                | FY04           |                |
|---------|-----------------------------------|----------------|----------------|----------------|----------------|----------------|
|         |                                   |                | TNEB           | TNERC          | TNEB           | TNERC          |
| 1       | Salaries                          | 711.59         | 768.95         | 731.11         | 776.77         | 753.04         |
| 2       | Overtime                          | 10.99          | 5.50           | 5.50           | 5.50           | 5.50           |
| 3       | Dearness Allowance                | 297.79         | 361.02         | 343.62         | 396.15         | 391.58         |
| 4       | Other Allowance                   | 54.17          | 61.83          | 61.83          | 62.00          | 62.00          |
| 5       | Bonus/Ex-gratia                   | 35.59          | 23.89          | 23.89          | 24.61          | 24.61          |
|         | <b>Sub-Total (1 to 5)</b>         | <b>1110.13</b> | <b>1221.19</b> | <b>1165.94</b> | <b>1265.03</b> | <b>1236.73</b> |
| 6       | Medical Expenses Reimbursement    | 6.98           | 7.92           | 7.92           | 7.92           | 7.92           |
| 7       | Leave Travel Assistance           | 1.14           | 1.96           | 1.96           | 4.00           | 4.00           |
| 8       | Earned Leave Encashment           | 78.87          | 86.17          | 86.17          | 82.20          | 82.20          |
| 10      | Terminal Benefits                 | 392.18         | 400.02         | 375.86         | 408.02         | 403.19         |
| 11      | Staff Welfare Expenses and others | 9.46           | 11.11          | 11.11          | 13.04          | 13.04          |
|         | <b>TOTAL</b>                      | <b>1598.76</b> | <b>1728.37</b> | <b>1648.97</b> | <b>1780.21</b> | <b>1747.08</b> |
|         | LESS: CAPITALISATION              | 154.08         | 148.40         | 154.08         | 120.91         | 154.08         |
|         | <b>NET EMPLOYEE EXPENDITURE</b>   | <b>1444.68</b> | <b>1579.97</b> | <b>1494.89</b> | <b>1659.30</b> | <b>1593.00</b> |

Thus, the total employee expenditure approved by the Commission is Rs. 1494.89 crore and Rs. 1593 crore for FY03 and FY04, respectively. The Commission's projected employee expenditure is lower than the TNEB's projections by Rs. 85 crore and Rs. 66.3 crore in FY03 and FY04, respectively, mainly on account of the Commission's lower projections of salary, DA and terminal benefit and the higher level of capitalization projected by the Commission.

#### 4.3.3 Administration and General Expenses

Administration expenses comprise rents, insurance, conveyance, professional charges, telephone and other communication expenses. The TNEB has submitted that the estimation of the A & G expenses in FY03 has been done based on data available for the period April to July 02, and based on a 3 % growth rate for FY04.

The overall increase in A & G expenses projected by TNEB is 4.5% and 3% in FY03 and FY04, respectively. The Commission has projected an increase of 3.6% in the A & G expenses which is the average increase in the Wholesale Price Index (WPI) for all commodities in FY02 over FY01. The level of capitalization of A & G expenses has been retained at FY02 levels in absolute value terms, on the rationale that there has been no reduction in the capital investment. The A & G expenses allowed by the Commission are given in the Table below:

**Table: Approved A & G Expenditure**

(Rs. Crore)

| Particulars                   | FY02         | FY03         |              | FY04         |              |
|-------------------------------|--------------|--------------|--------------|--------------|--------------|
|                               |              | TNEB         | TNERC        | TNEB         | TNERC        |
| <b>A &amp; G Expenses</b>     | <b>144.7</b> | <b>151.2</b> | <b>149.9</b> | <b>155.7</b> | <b>155.3</b> |
| Less: Capitalization          | 21.8         | 18.2         | 21.8         | 18.7         | 21.8         |
| <b>Total A&amp;G Expenses</b> | <b>122.9</b> | <b>133.0</b> | <b>128.1</b> | <b>137.0</b> | <b>133.5</b> |

Thus, the total A & G expenditure approved by the Commission is Rs. 128.1 crore and Rs. 133.5 crore for FY03 and FY04, respectively. The allowed expenditure for FY04 includes the tariff fee payable to the Commission for the next tariff revision. The

Commission's projected A&G expenditure is lower than the TNEB's projections by Rs. 5 crore and Rs. 3.5 crore in FY03 and FY04, respectively.

#### 4.3.4 Repairs and Maintenance Expenses

A major portion (around 69%) of the R & M expenses are incurred towards the generating stations. The TNEB has projected R & M expenses for FY03 at 1.05% of the opening level of Gross Fixed Assets in FY03. The TNEB has submitted that as the planned maintenance of most of the generating stations has been postponed to FY04, the R & M expenditure in FY03 would be on the lower side. The TNEB has hence assumed a 5% increase in the R & M expenditure for FY03 over FY02 levels, and a 15% increase in R & M expenditure for FY04 over FY03 levels. The Commission has accepted the TNEB's projections of R & M expenditure. The R & M expenses allowed by the Commission are given in the Table below:

**Table: Approved Repairs & Maintenance Expenditure**

(Rs. Crore)

| Particulars                     | FY02         | FY03         |              | FY04         |              |
|---------------------------------|--------------|--------------|--------------|--------------|--------------|
|                                 |              | TNEB         | TNERC        | TNEB         | TNERC        |
| <b>R &amp; M Expenses</b>       | <b>129.4</b> | <b>135.7</b> | <b>135.7</b> | <b>156.0</b> | <b>156.0</b> |
| Less: Capitalization            | 2.9          | 2.9          | 2.9          | 3.3          | 3.3          |
| <b>Total R &amp; M Expenses</b> | <b>126.5</b> | <b>132.8</b> | <b>132.8</b> | <b>152.7</b> | <b>152.7</b> |

**Thus, the total R & M expenditure approved by the Commission is Rs. 132.8 crore and Rs. 152.7 crore for FY03 and FY04, respectively.**

#### 4.3.5 Depreciation

The TNEB is charging depreciation by the Straight Line Method (SLM) on the Gross Fixed Assets in use at the beginning of the year. The opening GFA of FY03 is 12922.14 crore, excluding leased assets. The TNEB has submitted that it plans to add assets valued at Rs. 1500 crore on account of completion and capitalization of the refurbishment of its ETPS station and other project works. Hence, the GFA at the beginning of FY04 has been projected at Rs. 14422.14 crore.

The Commission is of the opinion that the quantum of asset addition projected by the TNEB is on the higher side, as compared to the trend exhibited in the past. The Commission has hence projected the asset addition in FY03 based on the 6-year CAGR (from FY98 to FY03) of 10.4% to compute the opening GFA for FY04.

The Commission has verified the depreciation rates being charged by the TNEB vis-a-vis the Ministry of Power's (MoP) notification in 1994, and the depreciation rates being considered by the TNEB are in order. The Commission has hence adopted the same depreciation rates applicable to the family of assets for computing the chargeable depreciation. The projected opening GFA levels and the corresponding depreciation expenses chargeable are shown in the Table below:

**Table: Approved Depreciation Expenditure**

(Rs. Crore)

| Particulars  | FY02  | FY03  |       | FY04  |       |
|--------------|-------|-------|-------|-------|-------|
|              |       | TNEB  | TNERC | TNEB  | TNERC |
| Opening GFA  | 11608 | 12922 | 12922 | 14369 | 14219 |
| Depreciation | 589.5 | 693.2 | 693.2 | 762.6 | 749.5 |

**Thus, the total depreciation expenditure approved by the Commission is Rs. 693.2 crore and Rs. 749.5 crore for FY03 and FY04, respectively.**

#### **4.3.6 Provision for Bad and Doubtful Debts**

In response to a query from the Commission, the TNEB has submitted that the arrears are mainly due from

- i. Disconnected services,
- ii. Local bodies, and
- iii. Government departments.
- iv. MALCO



TNEB has added that in case of arrears from disconnected services, a “termination of agreement “notice is issued on expiry of 3 months of disconnection, which gives three months time for the consumer to resume supply. If the consumer does not come forward to resume supply within the notice period, the accounts of the respective consumer are closed and the available security deposit is adjusted against the dues payable to the TNEB. If any additional amount is to be recovered, then action is initiated under Tamil Nadu Revenue Recoveries ( Recoveries of Dues) Act.

TNEB has submitted that in case of Local Bodies, the dues are collected piecemeal. As the payment of dues to the Board by the Local Bodies are being made on allotment of funds from Government, as soon as the fund allotment is made by Government, suitable instructions are given to field officers to follow up the matter and collect the amount.

In case of Government Departments, as per B.P.Ms 160 (Administrative) dated 28.11.1979, the Government Department has to be allowed 2 months additional time from the due date of payment of current consumption bills. In respect of arrears pertaining to earlier periods, the Heads of Office concerned are given 3 months time for payment of arrears with specific mention that supply would be disconnected

The TNEB has submitted that it has healthy collection levels from its LT and HT consumers and hence the level of provisioning required is lower than that in other States. The TNEB maintains the accumulated provision at 2.5% of the sundry debtors at the end of the year. However, the TNEB has not made any provision for bad and doubtful debts in FY03 and FY04. The Commission has accepted the TNEB’s submission in this regard.

#### **4.3.7 Other Expenses**

The miscellaneous expenses and the prior period expenses have been considered under this expenditure head. The miscellaneous expenses include material cost variance, miscellaneous losses and write-offs, etc. The Commission has accepted the TNEB’s projections of the miscellaneous expenses. As regards prior period

expenses, the TNEB has submitted that it has made a normal provision of Rs. 10.46 crore and Rs. 6.50 crore in FY03 and FY04, respectively, on account of expenses such as fuel related expenses, overtime and traveling allowance payments, where no/short provisioning has been made in the previous year's accounts.

The Commission has carefully analyzed the TNEB's accounts and has found that it has made excess provisioning towards payment of bonus to employees in FY02, to the extent of Rs. 13 crore. The Commission has hence considered this as a prior period credit. The TNEB has added that Rs. 28 crore has been provisioned in FY04 towards wage arrears relating to the period up to March 2002. The Commission has disallowed this prior period expenditure on account of wage arrears, and directs the TNEB to account for it when it is actually incurred. The other expenses allowed by the Commission is shown in the Table below:

**Table : Approved Other Expenses**

(Rs. Crore)

| Particulars                  | FY02         | FY03        |             | FY04        |             |
|------------------------------|--------------|-------------|-------------|-------------|-------------|
|                              |              | TNEB        | TNERC       | TNEB        | TNERC       |
| <b>Prior Period Expenses</b> | 456.9        | 10.5        | -2.5        | 34.5        | 0.0         |
| <b>Other Expenses</b>        | 24.1         | 14.2        | 14.2        | 15.8        | 15.8        |
| <b>Total</b>                 | <b>480.9</b> | <b>24.7</b> | <b>11.7</b> | <b>50.3</b> | <b>15.8</b> |

**Thus, the total other expenses approved by the Commission is Rs. 11.7 crore and Rs. 15.8 crore for FY03 and FY04, respectively.**

#### **4.3.8 Return on Fixed Assets**

As per the Section 59 of the ESA, 1948, the TNEB is entitled to a reasonable return of 3% on the Net Fixed Assets (NFA) at the beginning of the year. The Commission has computed the reasonable return on the revised NFA based on the Commission's projections of GFA for FY04, as follows:

**Table: Reasonable Return**

(Rs. Crore)

| Particulars                    | FY02    | FY03    |         | FY04    |         |
|--------------------------------|---------|---------|---------|---------|---------|
|                                |         | TNEB    | TNERC   | TNEB    | TNERC   |
| Opening GFA                    | 11496.6 | 12922.1 | 12922.1 | 14368.7 | 14219.0 |
| Less: Accumulated Depreciation | 3837.4  | 4480.2  | 4480.2  | 5120.2  | 5120.2  |
| Net Fixed Assets               | 7659.1  | 8441.9  | 8441.9  | 9248.5  | 9098.2  |
| Less: Consumer Contribution    | 899.5   | 1059.3  | 1059.3  | 1309.3  | 1309.2  |
| Capital Base                   | 6759.7  | 7382.6  | 7382.6  | 7939.2  | 7789.7  |
| Return @ 3% of Capital Base    | 202.8   | 221.5   | 221.5   | 238.2   | 233.7   |

**Thus, the reasonable return approved by the Commission is Rs. 221.5 crore and Rs. 233.7 crore for FY03 and FY04, respectively.**