

CHAPTER - 3

ENERGY REQUIREMENT

3.1 Category-wise Demand Projections and Total Demand

3.1.1 General

The accurate projection of category-wise sales is very essential for the assessment of the energy input requirement so as to determine the quantum of generation, power purchase requirement and for the assessment of the revenue. The Commission has assessed the veracity of the sales projections carried out by TNEB in preparing the ARR and Tariff Application. The Commission's analysis and sales projections are detailed in this section.

The TNEB has submitted that it has employed a variety of projection methodologies to assess the sales against the various categories of metered and un-metered consumers. They have projected the sales to each consumer category for FY03 and FY04 based on the energy consumption as well as the demand pattern exhibited in the past years

3.1.2 Un-metered Sales

There are two un-metered categories, viz. agriculture and huts. The TNEB has submitted that the sales for these two categories have been estimated based on the assessed consumption norm.

The TNEB has submitted that it has nearly 17 lakh agricultural consumers with a connected load of 83 lakh HP . The TNEB has assessed the annual consumption norm for agricultural connections as 1051 units per HP of connected load, based on a sample metering of 3% of the agricultural connections in each distribution circle, to project the sales to this consumer category.

The TNEB has submitted that each hut service connection is permitted to have a 40W electric lamp load. The TNEB has assumed an average supply of 8 hours per day to each hut service connection (between 1800 hours to 2200 hours and 0400 hours to 0800 hours), to estimate the sales to the un-metered hut service category.

3.1.3 Frequency Impact

The TNEB has submitted that it has taken into account the orders of the Central Electricity Regulatory Commission (CERC) on the grid frequency and likelihood of the implementation of the Availability Based Tariffs (ABT) for projection of sales during FY04. The resultant increase in energy consumption during FY04 on account of the frequency correction from 48 Hz to 49 Hz has been projected by TNEB as 4.5%.

3.1.4 Overall Growth rate

The overall growth in sales projected by TNEB for the Low Tension category is very high at 8% and 12% during FY03 and FY04, respectively. The domestic category is expected to be the principal contributor to this growth with sales expected to grow by 13% and 15% in FY03 and FY04 respectively, while LT industrial sales have been projected to grow at 10% and 9% during the same period. TNEB expects an addition of 6 lakhs domestic consumers annually.

Table : TNEB Sales Projections

(MU)

Consumer Category	FY03	% Increase over FY02	FY04	% Increase over FY03
Domestic	8724	13.1%	10032	15.0%
Huts	170	6.3%	187	10.0%
Public Lighting & Public Water Supply	1092	10.1%	1250	14.5%
Educational Institutions	427	12.7%	493	15.5%
Cottage and Tiny Industries	736	9.4%	810	10.1%
LT Industries	3176	10.1%	3452	8.7%
Agriculture	9694	2.2%	10609	9.4%
Commercial	2760	12.8%	3174	15.0%
Total LT Category	26779	8.3%	30007	12.1%
HT Industry & Railways	8821	3.9%	9466	7.3%
Educational Institutions	470	7.8%	526	11.9%
Commercial	1208	8.3%	1365	13.0%

Lift Irrigation Societies	11	0%	11	0%
Supply to Pondicherry	235	70.3%	258	9.8%
Total HT Category	10745	2.6%	11626	8.2%
TOTAL	37524	6.6%	41633	10.9%

The overall growth projected by TNEB for the HT category is 3% and 8%, with HT industrial consumption projected to grow at 4% and 7% in FY03 and FY04 respectively. The TNEB has submitted that the consumption of the three rural electricity co-operative societies has been merged with the sales of the respective categories. The TNEB has thus projected an overall sales growth of 7% and 11% during FY03 and FY04, respectively. The category-wise sales projected by TNEB are summarized in the above Table . It may be seen that the TNEB has projected very substantial growth in sales for FY03 and FY04. It is also noteworthy that the bulk of the growth as per TNEB's projections has been indicated against the LT categories, which are lower revenue earners due to historically depressed tariffs. The actual sales reported during the first half of FY03 would have given a good indication of the veracity of the TNEB's projections, for FY03. However, despite the Commission's request to the TNEB to submit details regarding the actual category-wise sales in the first half of FY03, the TNEB has not done so. The Commission has hence separately addressed the assessment of metered and un-metered sales as well as the impact of the frequency correction, in order to arrive at more realistic projections of sales in FY03 and FY04.

3.1.5 Commission's Projections

a) Metered Categories

The Commission had asked the TNEB to provide the consumption data as per the RRT Formats specified by the Commission in the Tariff Guidelines, to enable the Commission to project the demand more accurately, as well as assess the slab-wise consumption of categories wherever consumption slabs exist. The TNEB carried out a sample study through an independent agency and submitted the sales data for FY03 as per the sample study, to the Commission. The sales projected for FY03 based on the sample study are lower than that stated in the ARR and Tariff Petition. The Commission

is of the opinion that the sample study results are realistic and has hence accepted the revised category-wise sales projected by the TNEB for FY03, for metered categories. The category-wise sales for FY04 have been projected based on the Compounded Annual Growth Rate (CAGR) of sales during the period FY93 to FY03. In cases where separate break-up of consumption data was not made available for the past years, 2 year CAGR has been used.

b) Un-metered Categories

The Commission has carefully analyzed the TNEB’s submissions in regard to the assessment of the sales to un-metered consumers. The Commission’s projection of sales to the agricultural category and the hut service connections are discussed in the subsequent paragraphs.

(i) Agricultural consumers

The most crucial issue in assessment of agricultural consumption is the consumption norm to be adopted, as the entire agricultural consumption is un-metered. The Commission has compared the agricultural consumption norm projected by the TNEB with the consumption norm being applied in other States, as given in the Table below:

Table :Comparative Agricultural consumption norms

(kWh/HP per year)

State	Agricultural Consumption Norm
Maharashtra	933
Uttar Pradesh	820
Rajasthan	1029
Andhra Pradesh	895
Punjab	1268
Haryana	1083
Karnataka	1186
Tamil Nadu	1051

Note: Based on the most recent Tariff Orders issued by respective State ERCs

The Commission is of the opinion that the consumption pattern in the States discussed above would be comparable to those existing in the State of Tamil Nadu. However, there appears to be wide range of consumption norms being applied in these States, with the norm in Uttar Pradesh being the lowest at 820 units/HP/year and the norm in Punjab being the highest at 1268 units/HP/year. It should also be noted that the consumption norms being adopted in different States are all based on sampling data and none of the States has metered consumption data on the entire agricultural consumption in the State.

The Commission is of the opinion that the consumption norm being reported by the TNEB appears to be on the higher side. However, in the absence of any better quality data to assess the agricultural consumption more accurately, the Commission has accepted the consumption norm proposed by the TNEB. In the long run, the agricultural consumption will have to be metered. However, this process will take time. In the meantime, the TNEB is directed to improve the level of metering and conduct more energy audits at the 11 kV feeder level to enable more accurate estimation of agricultural sales.

Further, the Commission has noted that TNEB's submission that the agricultural consumption has been assessed based on the consumption norm of 1051 units per HP of connected load is inconsistent with the sales projected by the TNEB for this category. The effect of this overestimation of the agricultural sales has been the suppression of the T & D loss levels, as discussed in the next section. The Commission has assessed the agricultural sales based on the consumption norm of 1051 units/HP/year. The connected load of this category for FY03 and FY04 has been projected by the Commission based on the average connected load per agricultural connection (around 5 HP per connection) as in FY02, and the projected number of agricultural connections in FY03 and FY04. The TNEB has considered an annual increase of 40,000 number of agricultural connections, which has been accepted by the Commission.

(ii) Hut Service connections

The Commission has accepted the TNEB's submission that each hut service connection avails of 8 hours of supply for a 40 W electric lamp connection. However, the TNEB has projected an increase in the specific consumption of the hut service connections, which is inconsistent with the assumption of 8 hours supply given for a 40 W bulb. Any increase in consumption has to be on account of increase in the number of consumers only, and not due to increase in the specific consumption. The Commission has hence projected the sales to this category based on the consumption norm equivalent to 8 hours supply for a 40 W bulb and the projected number of consumers in this category.

c) Frequency Impact

The TNEB has submitted that the average grid frequency in FY03 is expected to be 48 Hz. The TNEB has further added that the formula given by the Southern Regional Electricity Board (SREB) has been used to estimate the impact of the improvement of the grid frequency levels from 48 Hz to 49 Hz. TNEB has estimated that for every 1 Hz improvement in the grid frequency, they would require additional generation capacity of 225 MW, which translates to an additional energy requirement of 1971 MU. This additional consumption of 1971 MU has been allocated to all categories in proportion to their share in the TNEB's sales.

The Commission has analyzed the veracity of TNEB's claim that increase in the grid frequency would result in higher sales, and has discussed this aspect with eminent technical experts in this field. Based on these discussions, the Commission has come to the conclusion that improvement in the grid frequency will result in increased sales only in the cases where motive load exists, viz. HT and LT industrial and agricultural category. The agricultural consumption has been projected based on assessed consumption norms, hence, no increase has been projected in agricultural sales on account of improvement in grid frequency. The impact of the improvement in grid frequency has been considered in case of LT and HT industrial category in proportion to their share of sales out of the total sales, for FY04.

The Commission has obtained the hourly load despatch data from the TNEB for FY02, which also gives the data on the grid frequency during this period. The Commission's analysis of the frequency data shows that the average grid frequency during FY02 was 48.54 Hz, which has been maintained at similar levels during FY03 also. Hence, the actual improvement in grid frequency expected is only 0.46 Hz, as compared to TNEB's assumption of 1 Hz. The calculation of the impact on the sales in FY04 is given in the Table below:

Table : Assessment of additional sales due to Frequency Improvement

Particulars	Unit	TNEB	TNERC
Frequency Correction for TN as per SREB	MW per Hz	225	225
Average Frequency of Operation during FY02	Hz	48	48.54
Capacity required for operating at 49 Hz	MW	225	103.5
Energy Correction Required (SREB Formula)	MU	1971	907

A part of the total energy correction required of 907 MU has been allocated to the HT and LT industrial sales in proportion to their sales.

d) Total Sales Projections

Based on the above analysis, the Commission has arrived at the category-wise sales projections in FY03 and FY04. The total category-wise sales projected by the Commission is shown in the Table below :

Table : Commission's Sales Projections for FY03 and FY04

(MU)

Sl. No	Consumers Category	FY 02-03			FY 03-04		Growth rate %
		TNEB as per ARR	Revised based on sample study	TNERC	TNEB as per ARR	TNERC	
	HT SERVICES						
1	HT Industries	8395	Sample study not applicable in HT	8395	9008	8939	6.48
2	Railway Traction	426		426	458	454	6.57
3	Recognised Educational Institution	468		468	524	489	4.49
4	Actual places of Public worship	2		2	2	2	0.00
5	Commercial	1208		1208	1365	1258	4.14
6	Lift Irrigation	11		11	11	11	0.00
7	Supply to Pondicherry	235		235	258	258	9.79
8	Rural Electric Co-operative Society	0		0	0	0	
	TOTAL HT	10745		10745	11626	11411	6.20
	LT SERVICES						
9	Domestic	8724	8480	8480	10032	9417	11.05
10	Huts	170	170	166	187	167	0.60
11	Public Lighting	1092	1038	1038	1250	1113	7.23
12	Recognised Educational Institutions	403	225	225	467	257	14.22
13	Actual places of Public worship	24	16	16	26	19	18.75
14	Cottage and Tiny Industries	287	138	138	316	145	5.07
15	Powerlooms	449	474	474	494	500	5.49
16	Industries	3085	4082	4082	3351	4629	13.40
17	Information Tech.	89	73	73	99	83	13.70
18	Agriculture and Govt. seed farm	9694	9694	9021	10609	9247	2.51
19	Commercial	2760	2266	2266	3174	2468	8.91
20	Temporary supply	2		2	2	2	0.00
	TOTAL LT	26779	26656	25981	30007	28047	7.95

The Commission's projection of sales is thus lower than the TNEB's projections by 677 MU and 2175 MU in FY03 and FY04, respectively. A major contributor to this difference is the agricultural sales, which had been projected incorrectly by the TNEB. This alone accounts for almost the entire difference in FY03 (673 MU) and 1362 MU of difference in FY04. The balance difference in FY04 is accounted for by the lower projection of sales to HT industrial category and domestic category by the Commission.

The Commission has thus projected sales of 36726 MU and 39458 MU in FY03 and FY04, respectively.

3.2 Transmission & Distribution (T & D) Loss

The TNEB has assessed the T & D loss as the difference between the energy input and the estimated sales. The TNEB has projected that the T & D loss level would remain constant at 16.25% of the energy input over the three-year period FY02 to FY04. The TNEB has clarified that it does not have a detailed estimation of the technical and non-technical losses in the system. However, the TNEB has added that it has already installed meters on the distribution feeders and is in the process of calibrating the meters to conduct a detailed energy audit of its system, which would enable the TNEB to ascertain the true levels of losses in its system.

The TNEB has assessed the average line losses at the HT level as 7.71%, based on the sample data available from 7 circles, which in its opinion is within normative levels. The TNEB has further submitted that the bulk of the losses are technical in nature and that the TNEB is taking due measures to strengthen the system and reduce the losses. Introduction of tamperproof meters at some of the HT consumers' premises alongwith a check meter facility has helped in reducing the incidence of meter tampering.

The TNEB has further submitted that the State has a low incidence of losses in the LT system and that the incidence of theft and tampering of the meters is minimal. Further, surprise checks are conducted regularly on LT industrial and large commercial establishments comprising of plastic industries, ice factories, stainless steel units, small

lodges, hotels, restaurants, etc. where relatively higher incidence of thefts have been reported. In the ARR Application, the TNEB has projected the losses at LT level (22/11 kV and below) as 8.85%.

The TNEB has added that it has taken several preventive measures to curb energy thefts including:

- Fixing of numbered seals at all vulnerable places in the metering system
- Installing electronic meters in all HT/LT CT services
- Installation of metering points near approach road for easy inspection

The TNEB has concluded that its reported T & D loss levels are based on reasonably accurate data adequately supported by ground realities. The TNEB has stated that its losses are the lowest as compared to many other utilities of similar size and consumer mix. The TNEB has requested the Commission to permit it to correct its T & D loss levels in case the energy audit, to be carried out by an independent agency, presents different results.

A closer analysis of the circle-wise HT losses submitted by the TNEB reveals that though the average line losses at HT level have been assessed at 7.71% by the TNEB, the circle-wise losses show wide fluctuations, with Coimbatore circle displaying the highest loss level of 12.05%, while Tirunelveli circle has displayed the lowest loss level of 3.5%. Such a wide difference in the T & D loss levels at the HT level is a cause for concern, and casts doubts regarding the validity of these sample data. Moreover, if the TNEB's assertion that the losses are mainly technical in nature is true, then there is more reason to believe that this sample data is not reliable. The Commission directs the TNEB to conduct independent energy audits at the HT and LT levels and submit a Report on the same to the Commission within six months of the issue of this Order.

The Commission is of the opinion that this approach to assess T & D losses for future years is incorrect. Ideally, the loss levels should be assessed first, and the energy input requirement should be a computed number. The Commission has assessed the T & D loss levels as discussed below.

In the earlier discussion on the consumption norm for agriculture, the Commission has noted that the TNEB has over-estimated agricultural consumption to the extent of 675MU and 1362 MU in FY03 and FY04, respectively. Assuming the energy input numbers as projected by the TNEB at the same level, it effectively means that the T & D loss levels are higher, as shown in the Table below:

Table : Reassessed T & D Losses

Particulars	FY03		FY04	
	Petition	Corrected	Petition	Corrected
Energy Input	44805	44805	49712	49712
Sales	37524	36726	41633	40271
T & D Losses (MU)	7281	8079	8079	9441
T & D Losses (%)	16.25%	18.03%	16.25%	18.99%

The above Table shows that the actual loss levels projected by the TNEB are at least 18% and 19 % in FY03 and FY04, respectively, which contradicts the TNEB's stand that the losses have been maintained constant at 16.25% over the three year period. The ERC Act mandates that the Commission should bring about economy and efficiency in the Utility's operations. Several State ERC's have issued Tariff Orders by this time and each ERC has set targets for reduction in the T & D loss levels over a period of time. However, the Commission has refrained from setting targets for reduction in the loss levels in FY04, considering that (a) this is the first tariff process, (b) the assessment of the un-metered agricultural consumption is very rudimentary and (c) the fact that the assessed T & D loss levels of the TNEB appear to be lower than that existing in other States. However, the Commission will set targets for reduction in T & D losses in the subsequent years, once better quality information is made available.

At the same time, the Commission cannot permit deterioration in the T & D loss levels, while determining the energy input requirement. The Commission has hence considered the loss level as 18% for both FY03 and FY04, for projecting the energy input requirement.

3.3 Energy Input Projections

The Energy Input required has been determined by the Commission based on the estimated sales and the allowed T & D losses of 18%, as given in the Table below:

Table : Projected Energy Input Requirement

Particulars	FY03		FY04	
	TNEB	TNERC	TNEB	TNERC
Sales	37524	36726	41633	39458
T & D Losses (% of Energy Input)	16.25%	18.00%	16.25%	18.00%
Energy Input Required	44805	44788	49712	48120

The Energy Input requirement as projected by the Commission is thus **44788 MU** and **48120 MU** in **FY03** and **FY04**, respectively.