PERFORMANCE OF POWER SECTOR IN MEGHALAYA :

An Analytical Study

BY

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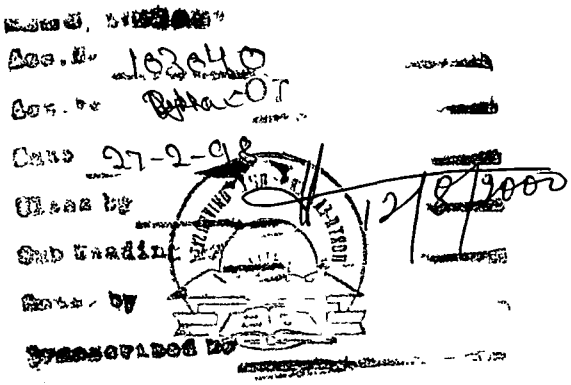

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CERTIFICATE

This is to certify that this dissertation entitled "Performance of Power Sector in Meghalaya : An analytical study", has been written as part fulfilment of Master of Philosophy Degree in Economics. This is an original piece of work of the scholar and to the best of my knowledge, no part of it has been published earlier in any form or has it been submitted to any other University for any other degree. I recommend that the scholar, Miss Mitali Dasgupta has done commendable work and she deserves an M.Phil Degree in Economics.

The dissertation may be presented before the Board of Examiners for Evaluation.

D Vikankar Srivastav.

Shillong
Dated 30.11.93

(Dr. N. Srivastav)
Supervisor

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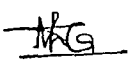

(Mitali Das Gupta)

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CHAPTER – 1

INTRODUCTION

INTRODUCTION

Power is a vital constituent of the process of economic development. It is considered as an essential infrastructural input requirement for economic upliftment as well as social welfare. The developed power sector leads to rapid growth of output, generation of employment and income. Thus for achieving an accelerated growth rate it is essential that the economy cannot afford to neglect its power sector. Considering power sector as an important segment of infrastructure, it is found that the rate of growth of an economy is directly linked with the utilization of power. This is obvious when we consider the fact that all sectors like agriculture, industry, business and commerce are essentially dependent upon power. It is found that there is a close relationship between per capita gross national product of a country and the per capita power consumption. Therefore, the consumption of power per head is a very relevant index of the level of development and the level of standard of living of people of any country. On the basis of this index India ranked quite low as compared with developed countries. Indeed, there is a correlation between per capita income and per capita electricity consumption even within various States of India. For example, in Punjab, we find that the per capita income and consumption of electricity is highest, followed by

Maharashtra and Gujrat and so on.

Power plays a decisive role in stimulating economic growth as a component of production processes and also as a fundamental element to human welfare. Therefore, the fruits of rapid economic development cannot be enjoyed by the people of any region without developing the power sector.

The development of power sector attached a great importance during the Five Year Plans period of India to achieve economic self-reliance. In order to achieve this goal speedier, it is proposed that special emphasis should be given to the plans related to power sector. It is evident that power sector was not so developed in the beginning of plan period. The level of consumption at national level during the year 1951-52 was 7.6 Kwh, which has increased more than ten time (84.4 Kwh by the year 1978-79, with the average annual rate of growth as 6.4 percent. This could be possible due to creation of large power generation capacity in India during Plan period.

On the basis of above discussion, it emerges that, in the broader sense the power has two different types of uses. Firstly, use of power for welfare activities for the people. Secondly, the use of power for production purposes. In the former category power would be used for schools, hospitals and for household

consumption. In the latter category, power would be used for industries, irrigation, transport and communication and construction sectors. Hence, the level of power consumption provides a measure for social as well as economic development of an economy.

The commercial consumption of power for the purpose of rapid economic growth depends on the utilization of power in the production process of goods and services as an input. The utilization of power for this purpose, is the direct function of the type of technology used. In most of the sectors, these days, the modern technologies of production are used, which are highly mechanized and where power is used to operate the machines. In such case entire production process is very much dependent on an economically viable and continuous supply of power as well as the suitable economic environment, like availability of raw materials, transport and communication system.

However, the power consumption from the welfare point of view is characterized by the consumption of power by private and public consumption. The private consumption of power is categorized by using power by the households for domestic purposes like, lighting, heating and cooking. Where as, the public consumption of power is defined for schools, hospitals, public building, street lighting. This type of power utilization depends upon the deliberate attempt of the

government towards this direction. It is understood that, to achieve this it is required to develop the power sector to satisfy the domestic demand of power in the region. Governments also do the efforts to generate the demand for domestic consumption where such power distribution system is not available. In case, power generation is surplus, this can be exported to other regions at competitive prices. In this way excess power can be proved as an important source of revenue earning for the power sector which government can utilize to strengthen the power sector for enhancing efficiency and productivity of this sector.

In view of the crucial role of power sector in economic development, as well as in social welfare, it is very important to enhance the power generation capacity in an economy. Importance should also be attached to well manage the power generation and distribution systems. This requires a constant and vigilant monitoring of the performance of power sectors, keeping the above view in mind we plan this study to evaluate the performance of power sector in Meghalaya, one of the States in North East India and it's role in the economic development of the State.

In the context of North Eastern Region where process of development lags behind in comparison to the rest of the country, the availability of power and the growth of power sector are of vital importance.

Keeping this in mind, the present study proposes to examine the performance of power sector in Meghalaya and it's role in the economic development of the State of Meghalaya in particular and in North East Region of India as a whole, in general.

A systematic review of available literature reveals that most of the studies deal with energy sector as a whole, where power is only one component of the study. Mahajan (1983) edited the papers on energy development in India. This work gives us a broad perspective of energy development and issues like energy sources, its consumption, rational use, conservation and demand and supply relationships. In a study about the power sector of India, Asha Hans (1986), discusses the major sources of power, available in India. She also explains the various potentialities of power generation for the future in India. Some studies are also available on the pricing of energy sector. Kadekodi (1988) evaluates the policy of energy pricing in India. He has also estimated the elasticities of substitution among various energy alternatives for a given period of time at constant prices. In an another study Kumar (1987) discusses the energy pricing policies in developing countries. There exist a limited number of other studies in form of reports prepared by various governmental agencies time to time about the power sector.

This brief review of literature reveals that only a limited number of studies are available about the power sector in India. To the best of our knowledge, we have not encountered with any systematic study about the performance of power sector on North Eastern State of India. However, various official reports and studies conducted by different committees appointed by power sector organizations, time to time, are of course available.

Keeping these fact in mind, our study is an humble pioneering attempt in the direction of analyzing the various aspects of power sector of Meghalaya. This study is carried out with the hope that this will generate some interest among the researchers to do more intense work in this field and this will help the policy makers of the State, to get some upto date information about the performance of power sector in Meghalaya.

1.2 Need and Scope of the Study :

It hardly needs to emphasize the important role of power sector in rapid economic development and in enhancing social welfare of an area. In view of the fact, it would be interesting to examine the association of development of power sector with the economic development of the region.

In case of Meghalaya, it is observed that it is one of the states of India where development of power has a long history. The power sector is relatively advanced in this state, in comparison to the most of the other neighbouring states of North East India. This gives an impression that Meghalaya should be relatively economically more advanced that other neighbouring states. But this is not the case. The various economic indicators reveal that Meghalaya is just at par with other North Eastern States, as far as the level of economic development is concerned. This factor further motivates us to investigate the role of power sector in the development of the State's economy.

As a first step, there is a need to understand the evolution of power sector and its process of development in Meghalaya. At the later stage, an evaluation can be made towards the performance of power sector. The performance is evaluated on the basis of examining the working of power generation and distribution system. The present study is an effort in this direction. The main objective of this study is to understand the operating system of power sector on the one hand and on the other hand, to highlight the process of development of power sector in Meghalaya.

We intend to achieve this goal by analyzing the followings :

(a) Development of power sector in Meghalaya; and

(b) Utilization of power as a resource for developmental and welfare activities.

(a) Development of Power Sector in Meghalaya :

We plan to analyze the power sector in Meghalaya on the number of accounts such as various stages and levels of power generation and distribution. This suggests to consider the following features

(i) Generation of Power

(ii) Transmission of Power

(i) Generation of Power : Our purpose here is to highlight the important factors and issues associated with the power generation. This analysis will be on the basis of power generation capacities like the installed and utilized capacities of power generation. We also propose to study the various types and sources of power available in the State. The attempt is made to record and analyze the major developmental change in this field in last twenty years or so.

(ii) Transmission of Power : After the power generation the next stage comes in order is power transmission. The efficient power transmission depends upon well organised transmission network. Such network covers maximum possible area of the region. It would

be interesting to examine the present day power transmission network in Meghalaya from this point of view. During the process of power transmission, some portion of power output gets lost on the way which is termed as transmission loss. In order to ensure the efficient transmission of power, it is necessary to minimize the losses during transmission and distribution. Efforts has been made to identify the factors responsible for transmission losses and to analyze that what is the situation of the losses of power transmission and distribution in Meghalaya.

(b) **Utilization of Power** : The utilization of power in an economy is the outcome of the peculiarities of power demand and supply. We have examined some of the issues related with the marketing of power in Meghalaya. For this purpose the distribution pattern of power has been analyzed. An attempt has been made to study the intersectoral distribution patterns. The magnitudes and direction of the structural changes in the sectoral distribution of power sector since last few years has been analyzed to highlight the direction and the pace of the economic development of the state.

The distribution pattern of power is generally affected by the rate of tariff and its structure of the power. Major changes in the tariff structure has been analyzed to study its' conduciveness with the overall development of the state economy.

1.3 Objectives :

The major objectives of our study are as follows.

i) To highlight the vital issues associated with the development of power sector in Meghalaya.

ii) To examine the physical performance of power sector in Meghalaya. This includes:

a) To analyze the growth of power, generation and distribution.

b) To analyze the patterns of power consumption and magnitudes of major structural changes in the sectoral distribution of power sector.

c) To critically evaluate the implementation of the rural electrification programme.

iii) To evaluate the financial performance of power sector. This includes :

a) To analyze major changes in revenue receipts and expenditure patterns of power sector.

b) To study the financial returns in terms of profits and losses.

c) To highlight the major changes in rates and structure of tariff.

d) To examine the cost tariff relationship.

1.4 Data sources & Research Methodology :

This study is mainly based on secondary data collected from various sources such as the office of Meghalaya State Electricity Board (MeSEB), North Eastern Electricity Power Corporation (NEEPCO),North Eastern Regional Electricity Board (NEREB), North Eastern Council (NEC) etc. Data from secondary sources consisting of books and unpublished research papers are also being taken.All possible efforts have been made to get as many information on the power sector of the state economy.

In our study we have analyzed the data using time series analysis.The cross section data is also tabulated and analyzed to assess the current situation of power sectors in Meghalaya. Whereas, the data from 1975-76 to1990-91 are being analyzed by using the appropriate estimation techniques. For example, we are using linear trend analysis, growth models and elasticity measures,by estimating linear, semi-log and double log functions. Such time series analysis has enabled us to study the major changes in the power sector over the given ,period of time.

1.5 Organisation:

The chapter plan and format of presentation of this dissertation are as follows:

Chapter I which is the Introduction presents role of power sector in economic development, need and scope of this study. The major sources of data and research methodology of this study are also the subject matter of this chapter.

Chapter II discusses The Development of Power Sector in Meghalaya, power scenario of Meghalaya with different energy resources, advantages of hydel power,hydel power in Meghalaya and its hydel projects with their installed capacities and generation, transmission and distribution system of state. This also includes the loss of power during transmission and distribution.

Chapter III entirely deals with the physical performance of power sector. The title of the chapter is Utilization of Power. This chapter analyses the relationship between per-capita consumption of power in Meghalaya and the economic development of the State, the sectoral distribution of power and consumption pattern of structural changes over the time is also being analyzed in this chapter. Besides, this chapter also discusses about the State of rural electrification in Meghalaya.

Chapter IV analyses the financial aspects of power sector.This chapter includes the major sources of revenue for the power sector-and its disbursement channels. The commercial profit loss account is also examined in this chapter. Efforts are also being made to highlight the cost tariff relationship and their inter state comparison along with major tariff changes.

Chapter V is the concluding chapter which sums up the major findings and record the conclusion that emerge from the study.

CHAPTER – II

DEVELOPMENT OF POWER SECTOR IN MEGHALAYA

Development of Power Sector in Meghalaya

Power Sector is the major component of energy sector and the development of power sector in any region is linked with the development of energy sector. This chapter discusses the various type of energy sources, their status and scope of development within the State. This chapter also highlights a brief history of development of Power Sector and emergence of major power projects in Meghalaya.

From the very outset, energy has played a vital role in the development of civilization. Starting with fire, the taming of each new and improved source of energy has produced outstanding advances in technology and has opened up new vistas.

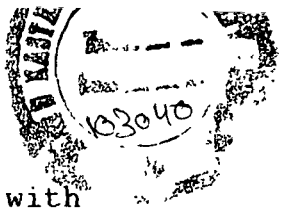
During Pre-independence period, the power supply industry, in the State and the nation as a whole received a scant attention for its development and mainly done by few private hands with sheer profit earning aim without any social objectives.

However, with the dawn of independence the need for economic independence became all the more greater. It is apparent that the economic development of a State and a national mainly depend on the extent of industrial expansion and which would get the due impetus if adequate power was made available at a cheap

rate. Power development in a state cannot be viewed in isolation with its requirement outside the geographical boundaries of a State. it is with this thought a programme of power development, harnessing resources wherever available at a minimum cost practicable, transcending State boundaries, by the integration of the power system into the State and regional grid has been formulated.

Meghalaya with its vast hydel potential of about 900 MW at 60 percent load factor lagged very much behind in the development of power development during pre-independence era and a few years even after India attained independence. The concept of power development in the State appeared on the scene only in the year 1952 when the Umtru Hydro Electric Project with an installed capacity of 8.4 MW was commissioned in the year 1957.

With the rapid growth in load demand and the commissioning of Khandong Power Station (2 x 25 MW) under North Eastern Electric Power Corporation Ltd. (NEEPCO) and Loktak Hydro Electric Project (3 x 35 MW) under National Hydel Power Corporation Ltd, the power system in North Eastern Region has gone through a dramatic change and warrants a special emphasis on the operation of integrated regional power grid. The Government of India through the North Eastern Regional Electricity Board have also initiated action for



establishment of load despatch centre along with setting up of State Load Despatch Centres with one at Shillong for Meghalaya for coordinated operation of all the generating stations and the stations under construction in the region.

2.1 Importance of Energy and Its Resources :

Energy constitutes an important component of the development process. It is needed in all such major spheres of life which are directly connected with man's survival and progress such as in cooking, lighting, heating, physical movement and operation of the infrastructure needed by society, namely schools, health centres and water supply. It is a vital input in agricultural operations, food processing, construction, transportation and in production of fertilizers, pesticides and farm equipment, Industrial operations that provide jobs and produce goods are also highly dependent on energy.

Energy resources are commonly classified as either renewable (Non-conventional) and non-renewable (Conventional) sources.

The forms of renewable energy which can be much more easily accessible than other sources are as follows - fuelwood , biogas from refuse and waste, solar, hydro, wind, tidal and geo-thermal energy. The

conventional sources of energy are as coal, oil and natural gas.

Meghalaya is fairly enriched with energy resources but most of them are not properly utilized and some of them are over utilized. For example, wood has been utilized extensively for fuel and other purposes in addition to produce charcoal. Other energy resources like coal, hydro-power, biomass, wind and solar energy are yet to be utilized in systematic, economical and scientific way. We have plenty of potential for conventional energy but our needs for energy cannot be met by conventional energy source alone. Today power is synonymous with economic development. But the conventional sources of energy viz., coal, oil, gas and wood are limited in stock. Hence, the development of alternative non-conventional energy is a must.

Meghalaya's power scenario for some major sources of conventional and non-conventional energy, have been discussed below in brief.

Fuelwood and Forestry :

Forest has been occupying an important place in the energy supply of Meghalaya, particularly in rural areas. The total area under forest in Meghalaya is 22,429 sq. km. out of which 15,690 sq.km. area is

under forestation. So far, rural energy is concerned, forest has been supplying a huge amount of fuelwood in Meghalaya's energy requirement. Demand can be met by systematic and scientific cutting of trees, bringing more areas under forestation and economic plantation.

Coal :

The total estimated reserve of coal in the State is of the order of 500 million tonnes. Though the State of Meghalaya is rich of coal reserves, mining has not been done in scientific way till today. Small scale cottage type coal mining was widely prevalent in different areas of Meghalaya like, Laitryngew and Bapung. Both of the two places are situated in East Khasi Hills and Jaintia Hills Districts of Meghalaya respectively. Additional production has been planned from Simsang and Namchik coalfields. Coal reserve has also been found in Garo Hills District recently.

The Jaintia Hills district produces bulk of Meghalaya's coal. In 1987, of the total coal production amounting 14,48,000 tonnes of Meghalaya, the Jaintia Hills District produces 3,21,000 tonnes. West Garo Hills district is the second largest producer of coal in the State. Since it is a non-renewable source of energy, care should be taken in exploiting and using it, wastage of coal should be checked so that production can be increased.

Solar Energy :

The high intensity of sunshine throughout the year supports the feasibility of the utilization of solar thermal systems, viz., solar cooker, solar water heater, solar dryer in the State. In Meghalaya, over 600 solar photovoltic street lighting systems and over 200 solar photovoltaic domestic lighting systems have been installed and over 500 solar cookers which are in great demand have been distributed. Over 9000 energy effective stoves of different types have been given out. In addition, over 40 commercial sized solar water heating systems have been established and set up in different areas of the State.

Wind Energy :

Generation of power by tapping the wind energy may be the solution of energy crisis of the remote places of the State. Wind energy can be exploited for water pumping by wind mills and generating electricity. Wind mills have been installed in seven different places of Meghalaya in an experimental basis.

In Meghalaya the wind starts blowing from the month of February to October. The State in influenced by South West Monsoon and North-East Wind which has great velocity. The maximum wind speed reaches upto over 34 Kmph in the month of April or May in some parts

of the State. There is a bright prospects of harnessing energy of this kind in future which is free from environmental hazards and pollution.

2.2 Development of Power Generation in Meghalaya :

Of all the sources of energy, Hydel power is one of the most efficient and relatively inexpensive method of producing electric power. For these and related reasons, it has always been a preferred form of energy and one heavily used in region where it is readily available.

Hydel power is renewable, cheap and most important commercial source of electric power in India. It accounts for 23 percent of total power production in the world. It is easily obtainable as it comes in mechanical form which does not need conversion. This source of energy is attractive because of being non-pollutant, low cost, its efficiency and suitability for peaking power. Its source is water.

Hydel Power In Meghalaya :

Meghalaya has huge hydro-electric potential. The land, unique in its physiology, receives heavy monsoon precipitations. The rain waters flow down the rugged slope and narrow valleys in the hills and descent rapidly to the plains. This situation is creating favourable conditions for harnessing hydro

power. The State is rich of hydel power also because as it has swift flowing rivers and water falls from which cheap hydro electric power can be generated.

The Meghalaya State Electricity Board (MeSEB) has following hydro electric projects and power station at different places with different installed capacity of generating energy.

(a) Umtru Power Station was commissioned in 1957. The construction of the project was taken by Government of Assam in early fifties. It has got four generating units. Out of four generating units, three units were commissioned in April 1957 and the 4th unit was commissioned in April 1968. The installed capacity of the generating units is 2.8 MW each. Estimated cost and the actual expenditure incurred against this power project are not available with MeSEB.

(b) Umium Hydro Electric Project - Connstruction work for this project was taken up erstwhile Assam State Electricity Board (A.S.E.B.) in 1960. The schemes comprises two component - (i) Umium Stage-I Power Station, and (ii) Umium Stage-II Power Station.

Stage-I Power Station was commissioned in 1965 and the Stage-II Power Station was commissioned in 1970. To commission both the Power Stations, an amount of Rs 14 crores was spent. Capacity of each generating

units at Stage-I and Stage-II Power Stations is 9 MW. Stage-I has four generating units and Stage-II has got two generating units. Cost per MW for Umium Project is Rs 0.26 crores.

(c) Umium Stage-III - Construction work for Umium Stage-III Power Station (Kyrdemkulai Power Station) was taken up during 1971-72 by erstwhile A.S.E.B. After bifurcation of A.S.E.B., the project was commissioned by MeSEB in 1979. The Power Station has 2 generating units with 60 MW installed capacity. The original estimated cost of the scheme was Rs. 9.24 crores and final expenditure against the project is 22.62 crores. Cost per MW for Kyrdemkulai Project is Rs. 0.38 crores.

(d) Umium-Umtru Stage-IV Power Station Construction of Umium-Umtru Stage-IV Hydro Electric Project with Upper Khri Diversion was taken up by MeSEB during 1979-80 at an estimated cost of Rs 38.79 crores. The scheme has two components :

(i) Umium Stage IV HEP (2 x30 MW)

(ii) Diversion of Upper Khri river.

Original estimated cost of Stage IV component was Rs.22.67 crores and that of Upper Khri was Rs 16.12 crores. Work on Stage IV component was completed in 11th August 1992. But work on Upper Khri Diversion project could not be started due to land problem. The final expenditure for Stage IV HEP is Rs 115.00 crores,

and cost per MW for Stage IV is Rs.1.92 crores. The reason for time and cost overrun at Stage IV Project is mainly due to land acquisition problem and inadequate cash flow due to financial constraint of the Board.

The installed capacity of various generating units are shown in Table 2.1.

Table - 2.1

Name of the Power Stations	No. and capacity of generating units (MW)	Installed Capacity (MW)
a) Umtru H.E.P.	4 x 2.8	11.20
b) Umium Stage I	4 x 9.0	36.00
c) Umium Stage II	2 x 9.0	18.00
d) Umium Stage III	2 x 30.0	60.00
e) Umium Stage IV	2 x 30.0	60.00
Micro Hydel Project		1.51
Thermal		5.00
Diesel		2.05

Source : MeSEB, Shillong.

It is seen from the above table that taking all the types of power together i.e. hydel, thermal and diesel, Meghalaya's installed capacity of power at present is 193.76 MW, and if we take installed capacity of hydel power only, then it is 186.71 MW. From 1979-80 to till 1991-92 Meghalaya was able to produce only 126.7 MW of hydel power and only after introduction of a new unit in Kyrdemkulai on 11.8.1992 the installed capacity has risen upto 186.71 MW.

Installed capacity of Meghalaya isolated from the grid is 8.56 MW.

The table 2.2 shows that the total installed capacity of the State for last eighteen years.

Table - 2.2

Year	Installed Capacity (MW)	Power Generated (MU)	In= Pt/Po x100
1975-76	66.50	176.08	100
1976-77	69.28	173.46	161.90
1977-78	71.11	222.76	208.00
1978-79	131.16	215.46	207.80
1979-80	133.66	315.58	294.70
1980-81	133.66	352.54	329.20
1981-82	133.76	369.66	345.20
1982-83	133.76	405.50	378.60
1983-84	133.76	414.67	387.20
1984-85	133.76	389.27	363.50
1985-86	133.76	355.44	331.90
1986-87	133.76	301.46	281.50
1987-88	133.76	462.06	431.50
1988-89	133.76	422.88	394.90
1989-90	133.76	402.23	375.60
1990-91	133.76	338.78	316.30
1991-92	193.76	421.69	393.80
1992-93	193.76	429.79	400.60

Source : Administrative Report (1975-88) MeSEB
Performance Highlights, 1992, MeSEB.

From this table, we see that total installed capacity of Meghalaya since 1980-81 to 1990-91 remained the same i.e. 133.76 MW taking all the powers together i.e. hydel, thermal and diesel, and only after installation of new power project of 60 MW i.e. Stage IV H.E.P. in 1992, the installed capacity rose to 193.76 MW.

In the North Eastern Region as a whole, total installed capacity increased from 410 MW in March 1981 to 1054.21 MW in March 1992.

Table - 2.3

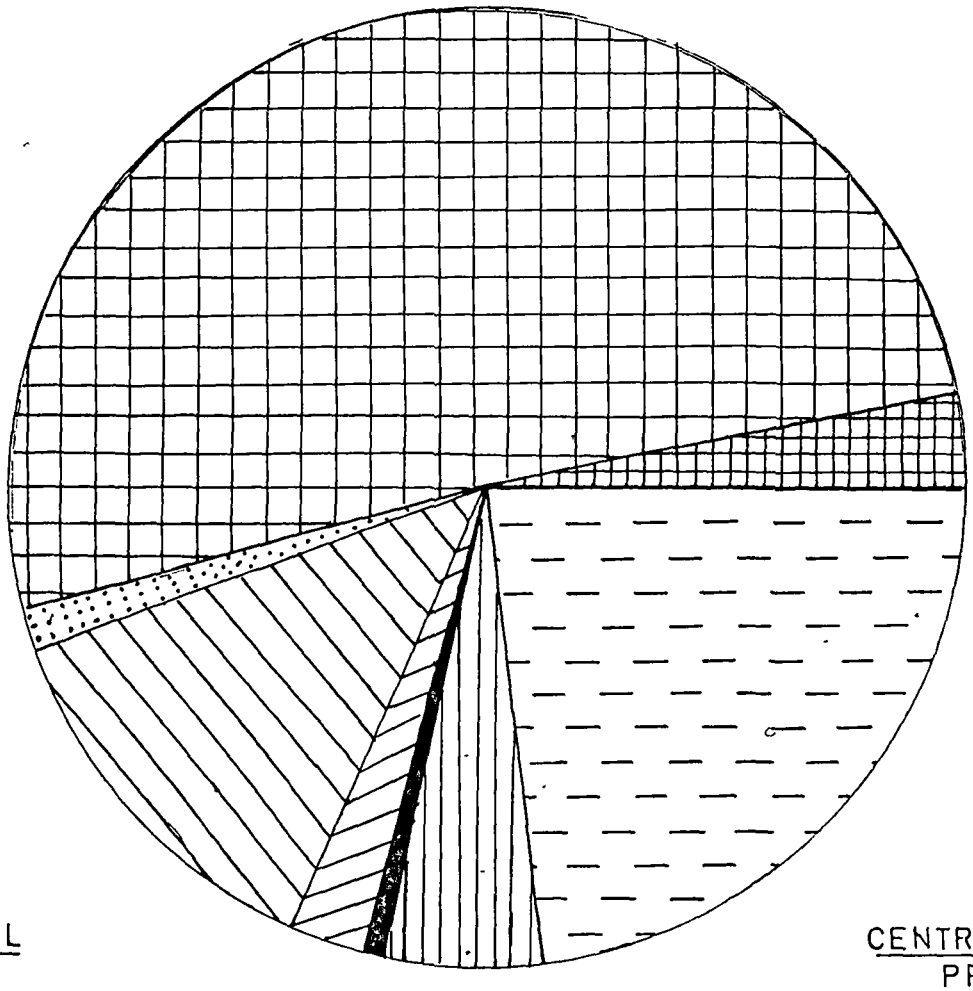
Installed Capacity of North Eastern Region as on 31.3.1992 (In MW)

States	Installed Capacity	In Percent
Arunachal Pradesh	30.59	2.9
Assam	537.19	50.9
Manipur	10.21	0.96
Meghalaya	133.76	12.68
Mizoram	26.70	2.53
Nagaland	6.12	0.58
Tripura	54.64	5.18
Central Sector	255.00	24.18
Total NE	1054.21	100

Source : Basic Statistics of NER, 1992, NEC, Shillong.

Figure 2(a)

INSTALLED CAPACITY OF POWER AS ON 31.3.'92 IN N.E REGION



ARUNACHAL PRADESH

CENTRAL SECTOR PROJECT

ASSAM

MANIPUR

MEGHALAYA

MIZORAM

NAGALAND

TRIPURA

Among all the States of NER, Assam has got the highest installed capacity of 537.19 MW followed by Meghalaya, Tripura, Arunachal Pradesh, Mizoram, Manipur and Nagaland which is also shown in the Fig-2(a). But in the entire North Eastern Region installed capacity of hydel power is the lowest in Assam, which is only 2 MW despite having maximum potential for hydel power in the State, the reason being its' hydel resources still remained unexploited.

Installed capacity of Meghalaya was very less according to the end of 1992 data is 193.7 MW as compared to all India total as 66,000 MW. Meghalaya comprises 0.29 percent of installed capacity of all India total.

The installed capacities of entire North East as on 31.3.92 is being focussed in the Fig. 2(a) represents the inter-state comparison of installed capacities of North Eastern Region as on 31.3.92 through the chart. It is seen from the figure that half of its total installed capacity is being enjoyed by Assam and then the next major share is enjoyed by Central Sector project which is almost 1/4th of the total, followed by Meghalaya of about 12.68 percent, Tripura (5.18 percent), Mizoram (2.53 percent), Manipur (0.96 percent) and Nagaland (0.58 percent). The share of installed capacities of Manipur and Nagaland is

negligible.

Table 2.2 represents power generated in Meghalaya since 1975-76. The gross generation or the total production of energy depends not only on the energy producing capacity of different unit but also on the loads and on weather. Smaller the load the greater will be the generation and greater the load, lesser will be the capacity of generating energy.

Suppose one day it is heavily raining so the water level rises and the different units can produce (say) 170 MKWH out of 185.2 MKWH on that day. But if on the next day if it does not rain and the water level decreases, the different units may be able to produce only say 90 MKWH of energy on that day. Thus because of various influencing factors the gross generation of energy for the whole year may be greater than the total installed capacity. So it is measured as the MKW per hour i.e. (MKWH) while installed capacity is measured as MW per day. The MKWH is called as Million Units. Generation also depends on the demand. If there is more demand, more power will be generated. Meghalaya is a State where its regional demand is very less, but it meets the demand of Assam which is very high. It has surplus power, so it exports power to Assam.

It is clear from the Table 2.2 that units generated of power in Meghalaya shows an upward trend

almost throughout except one of two instances since 1975-76 to 1983-84. State's generation of power rose from 176.08 MKWH in 1975-76 to 429.74 in 1992-93. In the year 1983-84 the units of power generated in Meghalaya was 414.67 MKWH which come down to 389.27 MKWH, 355.44 and 301.46 MKWH in the next three following years. The generation for those specified period was not satisfactory due to poor rainfall in the catchment areas and breakdown of machinery in the State II due to non-availability of spares.

Meghalaya's gross generation of power was 422.20 MKWH as against whole NER 3004.22 MKWH and all India average 24,153 MKWH in 1991-92.

In order to measure the growth of power generation, power Index is developed. If Po is the power generated for the initial time period (1975-76) and Pt is the power generated a 't' time period, then increase in the power generation can be measured in percentage form as follows :

$$In = \frac{Pt}{Po} \times 100$$

Where In is the power index which is shown in column in column III of table 2.2. From the table it is evident that power generation has increased by four times. Though we find a positive trend for the generation growth but still from the table it is understood that

power generation did not grow at a constant positive way, it had some fluctuations in between the eighteen years of time period.

2.3 Power transmission and distribution system:

With the growth of power generation capacity, transmission and distribution (T&D) system have also been expanded considerably. Continual development of higher transmission voltage has been achieved by the State Electricity Board (SEB) during the Five Year Plan. Power problem is two pronged; the first being financial and the second that it cannot be stored and consequently its immediate consumption becomes necessary. In this regard, transmission plays an important role in energy planning. A major case of power loss has been due to faulty transmission and distribution. If transmission does not keep up with supply, losses can be enormous. One of the major factors contributing to power shortages has been insufficient investment in this sector. New projects must have a good transmission network, otherwise investment in the unit is meaningless. Consequently, sophisticated infrastructure necessary for transmission which is not available. The load despatch centre, power system control and communication facilities are not developed enough to meet the demands of modern day power system. Inefficient and unskilled operating personnel have complicated the matter further. Increase in installed generating capacity has been

accompanied by an expansion of the T&D network also.

The total line length in North Eastern Region increased from 38,635 Ckt - km in March 1981 to 77,306 ckt-km in March 1988 at the rate of 40 percent per annum. The most notable feature of the expanding T&D network is the rising share of 11 KV lines, from 34 percent in March 1981 to nearly 41 percent in March 1988. This is the only region where the 400 KV lines for long-distance transmission have still to be introduced. Construction work is going on for 400 KV transmission line from Bongaigaon to Malda.

The emerging picture regarding surplus or deficit of power in the region is very misleading. The whole concept of a regional surplus or deficit of power begs the question of a regional transmission and distribution system which at present is non-existent. In the circumstances, surplus power from one area cannot be executed to areas which are deficit in power. Establishment of transmission and distribution network is very difficult and costly in the view of the terrain and the climate and it is not clear whether geography, climate and economics would work out towards the feasibility of an integrated regional grid connecting all areas. For quite sometime power generation might need to be considered along with power transmission schemes to progress towards a system of various smaller grids eventually connecting with one another into a

regional grid. The assessment made by the Central Electricity Authority is an indication of the fact that a high priority may need to be attached to the development of transmission and distribution network. The strategy should aim at development of power resources initially for supply at most economic rates to areas to be immediately served by them then to flow from one State to another as a common pool of resource to be shared by all, barring remote and inaccessible location which is not feasible to be brought on the grid as laying transmission lines to connect them would prove uneconomic.

Meghalaya is a state blessed with surplus power. The power generation potential of the region could be viewed from an industrial angle. In the context of this region, power should be treated as an industry, and bulk transmission of the same outside the region can become a substantial source of revenue for some of the State which would otherwise have no income generation for sustaining growth. While planning for regional power generation and transmission attention should be paid to the possibility of large scale export of power. It is worthwhile to tap as much as possible to hydel resources and create surplus condition within the permissible resources. This will enable availability of cheap power which may motivate power consumption and bring in its wake, new ventures to be set up in the region. It is quite possible that with cheap power availability the economy of the region may

have sudden boost up which once again will invite more generation capacity to be established and process would continue.

Table - 2.4

Transmission and Distribution Works - Existing Status

	At the time of formation of MeSEB 1975-76	Present Status 1992-93
1. Length of Transmission Lines :		
a) 132 KV line in ckt.km.	270.66	545.08
b) 33 KV line in ckt.km.	583.33	1031.00
c) 11 KV line in ckt. km.	684.95	6009.08
d) LT line in ckt.kmm.	533.61	4064.67
2) Connected load in KW	22972.2	120312
3) No. of consumers	7376 Nos.	78000 nos.
4) Transformer capacity 132/33 KW)	40 MVA	113 MVA

Source : Performance Highlights of MeSEB, 1992

On-going Transmission Schemes :

Modification, augmentation and extension of 132 kV Grid Sub-station and Power Station switchyard in Meghalaya and construction of new transmission lines. To make Meghalaya power system suitable for forming a part of the regional power system, this schemes was prepared. Implementation of the scheme was taken up in 1985-86 and likely to be completed by 1993.

At present there is only one 132 kV grid sub-station at Shillong city. This sub-station is catering to the needs of not only major portion of Meghalaya but also of Tripura, Mizoram and Southern Assam. The existing layout of the sub-station is such that future extension of the substation is difficult with operational flexibility. As per recommendation in the power system planning study report of Central Electricity Authority (CEA), it is proposed that Shilling city will be connected by other two 132 KV S/C transmission lines one from Umium Stage 1 power house and the other from Khliehriat sub station. The existing Mawlai (Shillong) sub-station is already cramped with different 132 KV, 33 KV and 11 KV lines and there is hardly any space for connecting two more vital links of regional importance keeping in view not only the electrical clearance but also adequate clearance for safety purpose and facilities for easy repairs and maintenance.

As such in the year 1985, MeSEB formulated a scheme for establishment of 132 KV substation at NEHU complex at an estimated cost of Rs. 216.50 lakhs. The schemes is under implementation of the Board since 1985-86. Construction work is in progress. Lilo of existing 132 KV S/C Shillong Khliehriat line at NEHU S/S has already been completed.

At present Nongstoin and its adjacent areas are fed from Mawlai (Shillong) Sub-station through a 33 KV single circuit line about 135 Km long. With such a long line, quality and reliability of supply at farflung places could not be guaranteed. Moreover, with the present subtransmission system of West Khasi Hills district, it will not be possible to cater to any additional load keeping the voltage regulation within the permissible limit.

To overcome this problem, it has been proposed to set up a new 132/133 Kv, 2x5 MVA sub-station at Nongstoin. The existing 132 KV S/C line from Shillong to Nangalbibra is passing through Nongstoin town. The new sub-station to be constructed at Nongstoin will give flexibility of operation of the said 132 KV lines.

Moreover, when Kynshi Hydro Electric Project will come up this sub-station will play a vital role for Meghalaya power system.

The growth of high voltage is more economical

as line loss in transmission and distribution are generally small, in comparison to low tension lines and thus there is more power availability to the consumers. The other advantage of high tension transmission is low cost for long distance power transmission.

In Meghalaya growth of high voltage transmission line is very less. Highest voltage transmission line available in the State is 132 KV lines which is only 454.08 ckt.km long at present as shown in the Table 2.4. 33 KV lines have extended from 588.33 ckt.km. at the time of formation of MeSEB to 1031.00 ckt km. 11 KV lines have extended most in the State since the formation of MeSEB i.e. from 684.95 ckt.km to 6009.08 ckt.km. and similar is the case with the LT lines in the State. But these low voltage lines are not economical.

Since the power is a product of voltage and current, low voltage means large current and large current means large conductor size to carry it, which means increases weight, cost and transmission loss. For long distance transmission, the voltage level has to be high.

Thus for transmitting power, first of all the voltage level has to be stepped up to an extent possible in that region, so as to reduce T & D loss. Usually generation starts from 33 KV or 11 KV. In our

State power is stepped up to 132 KV from 11 KV for transmission and then it is stepped down to 33 KV and 11 KV depending upon the distance to be transmitted and capacity of holding the load of the transformer. This power is then distributed to different sub-stations of the region and last the voltage level is further stepped down to very low volt of 33 KV or to 400 volt to distribute it to the ultimate consumers (consumer premises). Because if the voltage is not stepped down then the domestic consumer of power will not be able to handle the high volt, all the electric connections of houses will get burnt and it is very risky to deal with the high voltage.

But there should be a limit in stepping up of power, seeing the infrastructure and capacity of that transformer, because the price of conductor will be high. Besides it depends on the length of the distance where the power is to be transmitted. Higher the distance high voltage level will be economical.

2.4 Transmission and Distribution Loss :

The level of T&D loss is one of the index of the efficienty of a power system. In order to apply this index for the power sector of Meghalaya, we go for inter-state and all India comparison with the help of table 2.5

Table 2.5

Percentage of T&D Losses in SEBs

State	1985-86	1986-87	1987-88	1988-89	1989-90
Arunachal Pradesh	30.4	35.0	31.3	23.5	27.6
Assam	20.0	21.0	20.2	21.3	21.6
Manipur	45.0	37.1	27.6	21.6	20.8
Meghalaya	8.2	10.4	8.4	9.6	10.9
Mizoram	43.6	48.1	80.0	29.0	29.0
Tripura	30.5	29.5	29.3	28.5	29.8
All India	21.7	21.5	21.5	21.8	23.0

Source : Basic Statistics of NER 1992.

The above table reveals that Meghalaya has the lowest T&D loss within the North Eastern Region. It is also less than half of the all India average. The reason for less T&D loss in Meghalaya is that the State's T&D system is relatively more efficient than the T&D systems of the rest of India. It is reported that there is relatively less power pilferage and inbuilt inefficiencies in Meghalaya.

From the table it is found that T&D loss for the five years i.e. from 1985 to 1990 in Mizoram and Tripura were very high followed by Arunachal Pradesh and Assam. T&D loss in Manipur for the year 1985-86 to 1988-89 was very high but ultimately it came down fairly. Meghalaya is an unique state in this regard

and is very much fortunate as it has got lowest T&D loss in India. The reasons for low T&D loss of Meghalaya can set a good example to copy for the power sector of the rest of the country.

Transmission and distribution losses has been continuously rising. In India, the percentage of loss rose from 14.3 percent in 1965-66 to 22.99 percent in 1989-90. T & D losses in north eastern utilities are highest in the country. States like Mizoram and Tripura have reached almost 30 percent T & D loss in recent years. Other than these two States of North Eastern Region, Jammu and Kashmir continues to have high T & D loss in India. It was 39.63 percent in 1984-85 which increased to 49.46 percent in 1989-90.

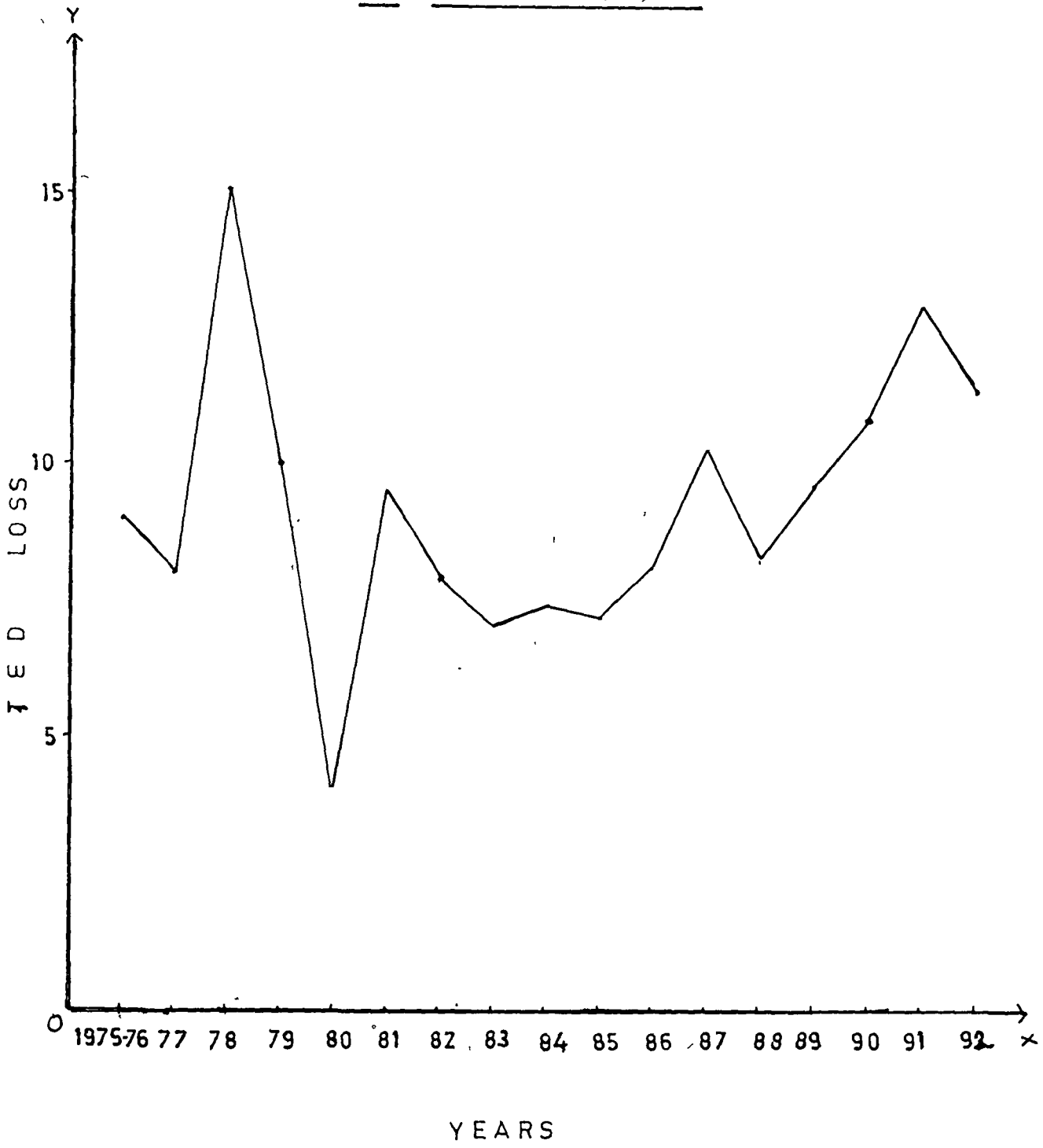
According to 1991-92 census, the percentage loss of T & D in Meghalaya was only 11.4 percent, as compared to all India average of 22.9 percent. The transmission and distribution losses in Meghalaya was the lowest in India within the period of 1984-85 to 1989-90, followed by Maharashtra.

The past trend of transmission and distribution losses of Meghalaya for the period 1975-76 to 1990-91 have been studied which shows that the losses in the first few years were fluctuating in nature but since 1987-88 to 1990-91 there was a continuous rising trend in losses. It increased from 8.3 percent in 1987-88 to 12.9 percent in 1990-91. T & D loss of Meghalaya can

Figure 2 (b)

T E D LOSS IN MEGHALAYA

(IN PERCENTAGE)



be viewed from the graph 2(b). Data for T&D loss of Meghalaya is presented in Table 3.1 as that table explains the process of calculating in that table in the next chapter.

Factors which has contributed to the rising trend in T & D losses are -

(i) Extension of L.T. network covering more and more areas of the State.

(ii) Low load densities and long lines.

(iii) Irregular checking, and irregular calibration of meters, improper billing are factors which have resulted in high non-technical losses.

The losses due to first two causes can be termed as 'Technical losses' and could be brought down by carrying out system improvements. The non-technical losses could be minimized by administrative steps setting up guards for surprise checks of meter, meter testing, detection of theft etc. Any reduction in losses brought down by such methods could be accompanied by a corresponding increase in the sale of energy. One percent reduction in overall transmission and distribution losses would be equivalent to an addition of 380 MW of generating capacity.

In a nutshell, Chapter II contains the various

aspects of the development of power sector in Meghalaya. It is noticed that there are lots of favourable conditions for the generation of energy from conventional and non-conventional sources in the State. Meghalaya is also enriched in natural resources like rivers and rain water reservoirs. So, there is a scope for hydel power generation within the State.

Development of an efficient transmission and distribution system is also as much important as the power generation. Efforts have been made in this direction with the development of power sector in the State. There is strong feeling, that national grid should be developed soon, so that surplus power generated within the State, can be transported to power deficit regions within and outside the State.

After reviewing the development of power sector in Meghalaya, the issues in which a research might be more interested, are related to the efficient working of existing power sector. In this pursuit the next chapter deals with the physical performance of power sector.

CHAPTER - III

UTILIZATION OF POWER

UTILIZATION OF POWER

The major developments in power sector in the State, Meghalaya, are outlined in the Chapter II. It categorizes the issues related to power sector, in two parts, formerly, it deals about generation of power and in latter, it discusses the aspects related to power transmission and distribution.

The issue which comes after power generation and transmission is power utilization. This analysis intends to answer the question like "who utilizes the power" and "how much" ? The issues like distribution of power to various sectors, and for various purposes, are the subject matter of this chapter. It deals with the aspects of utilization of power for welfare and commercial purposes and their structural changes in the sectoral distribution of power utilization with respect of time period.

3.1 Pattern of Power Utilization :

The utilization of power in an economy is the outcome of the peculiarities of power demand and supply. Table 3.1 demonstrates the details of the utilization of power generated within the State. The statistical information is tabulated for the seventeen years time period, from 1975 - 1992.

Table 3.1
Utilisation of Power

(In Million Kilowatt Per Hour)

1	2	3	4	5	6	7	8	9
Year	Total Power available forsale	Power Sold inside the State	Power exported	Total Power sold	Power Loss ($Y_5 = Y_1 - Y_4$)	Loss in Percent	Export in Percent	Power sold inside the State in %
t	Y_1	Y_2	Y_3	Y_4	Y_5	a	b	c
1975-76	175.47	33.43	125.54	158.89	16.58	9.40	71.50	19.05
1976-77	172.59	32.89	125.18	158.07	14.52	8.40	72.50	19.00
1977-78	240.99	29.95	172.23	202.18	38.31	15.90	71.60	12.40
1978-79	213.83	40.18	152.16	192.34	21.49	10.00	71.10	18.70
1979-80	310.27	45.22	251.84	297.07	13.20	4.20	81.10	14.50
1980-81	351.43	40.62	277.28	317.93	33.50	9.50	78.90	11.50
1981-82	371.10	62.29	279.22	341.51	29.59	7.90	75.20	16.70
1982-83	403.39	72.88	302.25	375.13	28.26	7.00	74.90	18.00
1983-84	412.62	92.46	289.20	381.66	30.96	7.50	70.00	22.90
1984-85	387.50	89.36	270.11	359.47	28.03	7.20	69.70	23.00
1985-86	374.85	107.33	236.77	344.14	30.71	8.10	63.10	28.60
1986-87	299.86	123.60	145.19	268.79	31.07	10.30	48.40	41.20
1987-88	460.00	129.22	292.19	421.39	38.61	8.30	63.50	28.00
1988-89	422.88	149.05	231.39	380.44	42.44	10.00	54.70	35.20
1989-90	402.23	175.55	181.19	356.74	45.49	11.30	45.00	43.60
1990-91	337.09	192.14	101.20	293.34	43.66	12.90	30.00	56.90
1991-92	471.21	217.66	199.38	417.04	54.17	11.40	42.30	44.00

Note : a. Power loss in% = $Y_5 / Y_1 \times 100$
b. Power export in% = $Y_3 / Y_1 \times 100$
c. Power sold inside the state in% = $Y_2 / Y_1 \times 100$

Source : Administrative report (1975-88) MeSEB and Performance highlights of MeSEB, 1992.

The second column of Table 3.1 reveals the statistics on total power available for sale. A portion of total power generated is utilized by the power station itself during the process of power generation, which is known as auxiliary power consumption. So, total power for sale is the difference of total power generated and auxiliary power consumption. During the time span of seventeen years total power available for sale has increased from 175.47 Mkwh to 471.21. This increase is almost two and half time. Meghalay's power is sold either within the State or exported to the neighbouring States mainly to Assam. In the year 1975-76, only 19.05 percent of total power available for sale was utilized by the State, whereas a major portion of power i.e. 71.5 percent exported to neighbouring States. The gap to make cent percent after adding both i.e. State's own consumption and consumption of power by outside the State is the percent of transmission and distribution loss. The low level of power consumption within the State can be attributed to many possible reasons like, low demand of power, underdeveloped transmission and distribution system and negligible efforts on rural electrification programme. But this is important to note that the power sector situation has changed in past few year. In the year 1991-92, the percentage share of power consumed within the State has increased from 19.05 percent to 44.0 percent of total power available for sale. At the same time share of power exported to neighbouring States has come down from 71.5

percent to 42.3 percent of total power available for sale. This change in situation is the result of increasing demand of power within the State due to improved network of transmission and distribution system and for relatively better standard of living of people of the State. On the other hand, exporting of power to Assam is not very attractive source of earning revenues these days. This is because of non-payment of power bills by them but the power sector of Meghalaya having no alternative, forced to sell its excess power to Assam only on unremunerative prices and through Assam it sells its power to other neighbouring States such as Tripura and Mizoram. Despite these facts, even today, a significantly large share of power generated is being exported to Assam.

A portion of power gets lost on the way of transmission and distribution of power from the power station to the consumers, this loss is known as transmission and distribution loss (T&D loss) of power. This loss of power is due to many technological reasons, system inefficiencies like poor maintenance of T & D lines etc. Power pilferage and theft of power also add to the T & D loss. The statistics on T & D loss is given in Table 3.1. This accounted 9.4 percent of total power available for sale in the year 1975-76 and it is 11.4 percent in the year 1991-92. Fluctuations in T&D loss are already being demonstrated in the Fig- 2(b).

The data demonstrated in Table 3.1 can be further analyzed by using appropriate estimation techniques. As a quick and ready method of computation, we have estimated the following model :

$$Y_t = B_1 + B_2 t + U_t \text{ ---------- } 3.1$$

i.e., we regress Y on time itself, where time is measured chronologically and Ut is the error term. Such model is called linear trend model and the time variable (t) is known as the trend variable. If the slope coefficient (B_2) in the model is positive, then there is an upward trend in Y whereas if it is negative, then there is a downward trend in Y.

The linear trend model, depicts only the directional change in the variable (Y_t) with respect to time. In case, we are interested in knowing the magnitude of the change in variable (Y_t) with respect to time, we have to measure rate of growth of variable (Y_t). Keeping this fact in mind, we have also estimated the growth model as follows :

$$Y_t = Yo\ (1 + r)^t \text{ --------- } 3.2$$

where,

Yo = the value of Y at initial period

Y_t = Y's value at time period t

r = the rate of growth of Y over time

The equation 3.2 can be manipulated by taking log on both sides, as,

$$\log Y_t = \log Yo + t \log (1 + r)$$

Now, let

$$B_1 = \log Yo$$

$$B_2 = \log (1 + r)$$

Therefore, we can express model 3.2 as

$$\log Y_t = B_1 + B_2 t \quad \text{---------3.3}$$

Now we add the error term Ut to the model 3.3 to obtain

$$\log Y_t = B_1 + B_2 t + U_t \quad \text{---- 3.4}$$

This model is like any other linear regression model where the parameters B_1 and B_2 are linear. The only difference is that here dependent variable is the logarithm of Y and independent variable is 'time'. Such models (like 3.4) are called 'Semi-log models', because only one variable (i.e. the dependent variable) appears in the logarithm form. In a semi-log model the slope coefficient (B_2) measures the proportional or relative change in Yt for a given absolute change in 'time'. If this relative change is multiplied by 100, we obtain the percentage change, or growth rate. Hence, such models are known as 'Growth models'.

We estimate the trend and growth models for total power available for sale ($\hat{Y}_1$), power sold within the State ($\hat{Y}_2$), power sold outside the State, i.e. export ($\hat{Y}_3$), total power sold ($\hat{Y}_4$) and power loss ($\hat{Y}_5$) for the seventeen years time period from 1975-76 to 1991-92.

A portion of total power generated is consumed by power house itself, which is known as auxiliary power consumption as already been explained. By substracting auxiliary power consumption from total power generated we get, the total power available for sale, which is shown as variable Y1 in the table 3.1 and appears in column no.2. The linear trend model for Y1 with respect to time is estimated as follows :

$$\hat{Y}_1 = 209.91 + 14.63\ t \quad \text{--------- 3.5}$$

$$t^* = (7.009) \quad (5.006) \quad \text{--------- 3.6}$$

$$R^2 = 0.6255, \quad DW = 1.3143$$

where t^* = estimated value for 't' statistic

The number of observation is seventeen. We know that at fifteen (17-2) degrees of freedom, the tabulated t value is 2.602 at 0.01 level of significance. Since, 't' value of estimated ($\hat{B}_2$) in equation 3.6 is higher than tabulated t value i.e. $5.006 > 2.602$. So the estimated value of $\hat{B}_2$ is statistically significant. This is a fairly good result. Similarly, the value of R^2 is 0.6255 which shows that 62.55 percent variation in Y_1 is explained by variable 't'. The time series

data is quite prone to auto correlation errors. To test this we run the Durbin Watson (DW) test, which gives the value of DW statistic. In a nutshell, we know that DW should lie between 0 and 4 such that $0 < DW < 4$

if DW = 4 -- Perfectly negative auto-correlation

DW = 2 -- No autocorrelation

DW = 0 -- Perfectly positive autocorrelation.

In equation 3.6 the value of DW statistic is 1.3143 which shows that data has inclination towards positive autocorrelation, but still within tolerant limits. So, the statistical results of the estimation of equation 3.6 are significant and reliable.

As the result of equation 3.6, over the seventeen year time period the power available for sale ($\hat{Y}_1$) had been increasing at the absolute (not relative) rate of 13.78 mkwh per year. Thus, over a period of time there is an upward trend in total power available for sale within the State, whereas the growth model shows the following results :

$$\log (\hat{Y}_1) = \hat{B}_1 + \hat{B}_2 t \quad \text{---------- 3.7}$$

$$\log (\hat{Y}_1) = 2.312 + 0.02t \quad \text{------- 3.8}$$

$$t^* = (52.207) \quad (4.945)$$

$$R^2 = 0.62 \qquad DW = 1.0162$$

The interpretation of equation 3.8 is as follows :

The estimated results are statistically significant and reliable. But rate of growth of power available for sale is 2 percent over the time. This appears to be too low, but this should be understood in light of upward and downward fluctuations in the Y_1 over the period of time.

Power sold within the State (Y_2) shows clearly a positive (upward) trend over the given period of time, as explained by given trend models.

$$Y_2 = 189.149 + 14.21t \quad \text{-------- 3.9}$$

$$t^* = (7.5206) \quad (5.788)$$

$$R^2 = 0.6907 \quad DW = 1.1918$$

whereas semi-log regression model gives following results :

$$Y_2 = 2.281 + 0.022\ t \quad \text{-------- 3.10}$$

$$t^* = (55.288)\ (5.550)$$

$$R^2 = 0.6725 \quad DW = 0.912$$

The slope coefficient for equation 3.10 is 0.022, which shows that sale of power within the State is increasing by 2.2 percent per annum over the given period of time.

It is clear from observing table 3.1 that there exists a significant positive difference between power available for sale (Y_1) and total power sold (Y_4). This difference is known as transmission and distribution (T&D) loss of power. This is the amount of power loss

during the process of transmission and distribution of power.

The T&D loss (Y_5), depicts an increasing trend over time, as shown in equation 3.11 below :

$$Y_5 = 15.499 + 1.799\ t \text{ --------3.11}$$

$$t^* = (4.601)\ (5.492)$$

$$R^2 = 0.6679 \quad DW = 2.228$$

whereas estimated semi-log model is -

$$\text{Log } (Y_5) = 1.2272 + 0.027\ t \text{ ------ 3.12}$$

$$t^* = (22.073)\ (4.984)$$

$$R^2 = 0.624 \quad DW = 2.564$$

It is clear from the above equation that T & D loss is growing at the rate of 2.7 percent per annum over the given period of time.

3.2 Sectoral Distribution of Power

The relationship between the economic development and use of energy has been very close one. Studies have shown that there is direct relation between the two. Industrial activities require the use of some form of energy to run the machines and hence energy consumption becomes necessary. The process of economic development shows the tendency of increasing share of secondary and tertiary sectors in economy and the natural relative decline in the share of primary sector. The increase in secondary sector means the development industries. With the growth of industrialization there is increase in the demand for trade and commerce on the one hand and the demand of transport on the other. All these lead to economic development.

Table 3.2

Sectoral Distribution of Power in Meghalaya (In Mkwh)

Sale of Power within the State\Year	1975-76	1976-77	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	1987-88	1988-89	1989-90	1990-91
A.																
Domestic	2.07	1.88	7.20	8.53	9.95	11.01	14.77	17.20	19.07	20.25	22.54	24.20	25.45	28.32	30.57	32.76
	(6.1)	(5.7)	(24.0)	(21.2)	(22.0)	(27.1)	(23.7)	(23.6)	(20.6)	(22.6)	(21.0)	(19.5)	(19.6)	(19.0)	(17.4)	(17.0)
Public Lighting	0.06	0.08	0.53	0.73	0.76	0.5	0.22	0.25	0.29	0.44	1.07	1.85	1.90	2.98	3.04	3.06
	(0.17)	(0.24)	(1.76)	(1.81)	(1.68)	(0.36)	(0.35)	(0.34)	(0.40)	(0.49)	(0.99)	(1.49)	(1.47)	(1.99)	(1.73)	(1.59)
Public Water Works	0.08	0.20	0.39	1.21	0.33	0.35	0.49	0.54	1.02	1.37	2.14	7.85	8.99	10.43	12.98	13.6
	(0.2)	(0.60)	(.130)	(3.01)	0.72)	(0.86)	(0.78)	(0.74)	(1.40)	(1.53)	(1.99)	(6.35)	(6.95)	(6.99)	(7.39)	(7.07)
TOTAL 'A'	2.22	2.17	8.12'	10.48	10.98	11.51	15.49	17.99	20.38	22.07	25.76	33.80	36.25	41.73	46.59	49.36
Welfare Purpose	(7.1)	(6.6)	(27.1)	(26.0)	(24.3)	(28.3)	(24.8)	(24.6)	(22.0)	24.7)	(24.0)	(27.3)	(28.0)	(27.9)	(26.5)	(25.6)
B.																
Commercial	0.34	0.32	4.54	6.89	7.70	6.89	9.64	12.50	16.76	18.06	21.47	22.41	22.95	26.83	29.48	31.84
	(1.0)	(0.9)	(15.1)	(17.1)	(17.0)	(16.9)	(15.4)	(17.1)	(18.1)	(20.2)	(20.0)	(18.1)	(17.7)	(18.0)	(16.7)	(16.5)
Industrial	13.35	11.61	10.39	13.63	14.46	16.06	27.31	31.37	39.58	38.07	41.8747.20		48.42	50.15	60.16	68.17
	(39.9)	(35.2)	(34.6)	(33.9)	(31.9)	(39.5)	(43.8)	(43.0)	(42.8)	(42.6)	(39.0)	(38.8)	(37.4)	(33.6)	(34.4)	(35.4)
Agricultural Pumping	Nil	Nil	1.13	0.65	0.02	0.01	0.01	0.02	0.02	0.03	0.05	1.13	1.21	1.40	1.50	1.50
			(3.77)	(1.61)	(0.04)	(0.02)	(0.01)	(0.02)	(0.02)	(0;03)	(0.04)	(0.91)	(0.93)	(0.09)	(0.85)	(0.78)
Bulk Suppply	17.53	18.75	5.77	8.54	12.06	6.15	9.85	11.00	15.72	11.14	18.19	18.96	20.30	28.94	37.82	41.21
	(52.4)	(57.0)	(19.2)	(21.2)	(26.6)	(15.1)	(15.8)	(15.0)	(17.0)	(12.4)	(16.9)	(15.3)	(15.7)	(19.4)	(21.5)	(21.4)
TOTAL 'B'	31.22	30.68	21.83	29.62	34.22	29.11	46.82	55.07	72.06	67.31	81.58	89.71	92.88	107.28	128.96	142.71
Productive Purpose	(93.3)	(93.4)	(72.8)	(73.6)	(75.6)	(71.0)	(75.1)	(75.5)	(77.3)	(75.3)	(76.0)	(72.5)	(71.9)	(72.0)	(73.5)	(74.2)
TOTAL SALE (A+B)	33.43	32.89	29.95	40.18	45.22	40.62	62.29	72.88	92.46	89.36	107.33	123.6	129.22	149.05	175.55	192.14

Note : (1) 'a' refers to power used for welfare purposes. (2) 'b' refers to power used for productive purposes. (3) Figures in parenthesis indicate share of different sectors out of total power sold inside the State in percent.

Source : Administrative report (1975-88) MeSEB, Performance Highlights of MeSEB, 1992, Shillong.

The present livelihood pattern has become more energy consumption oriented not only for the matter of domestic use of electricity but also due to the larger use of electricity in township requirement of lighting, water supply and transportation.

The Table 3.2 shows the sectoral distribution of power in Meghalaya since 1975-76 to 1990-91 sectorwise. The sectors are domestic, commercial, industrial, agricultural pumping, public lighting, public water works and bulk supply. As the power consumed in Meghalaya for agricultural pumping, public lighting and public water works are very negligible if they are calculated separately, so we have termed these three sector into one as public use sector. Besides, we have classified all other above mentioned sectors into two as utilization of power for productive purposes and utilization of power for welfare purposes. In productive sector we have included commercial, industrial and bulk supply which means electricity used for construction projects and other loads.

Commercial sector constitutes consumption in commercial establishments, cinema halls, government offices, shops, restaurants, market places which require lots of energy consumption for productive purposes. And power consumption in industrial sector is fully related to productive activity. All other sectors of power consumption come under welfare purposes of consumption.

We see from the table 3.2 that distribution of power for productive purposes is more than that of welfare purpose, which indicates there is growth of economic development in the State. In 1975-76 to 1980-81 power used for welfare purpose rose from 7.1 percent to 25.6 percent of total power available to sale, whereas in the same period share of power used for productive purposes has declined from 93.3 percent to 74.2 percent of total power available for sale.

The power consumption in the domestic sector can be taken as an index of the standard of living of the people. On the other hand, this amount for the industrial sector represents the index of the level of development of modern technology in the economy.

Table 3.2 also represents sectorwise energy utilization in percentage terms. Sales of power in Meghalaya have expanded continuously from the year 1984-85 onwards to 1990-91. But since 1975-76 to 1983-84 there were fluctuating trend in demand of power. The power demand growth of Meghalaya was sometimes positive and sometimes negative and to get a proper trend of growth, we have calculated growth rate by taking three-years moving average method.

For the purpose of analysis, the total power consumed inside the state, is divided broadly in two categories. Firstly, the consumption of power for

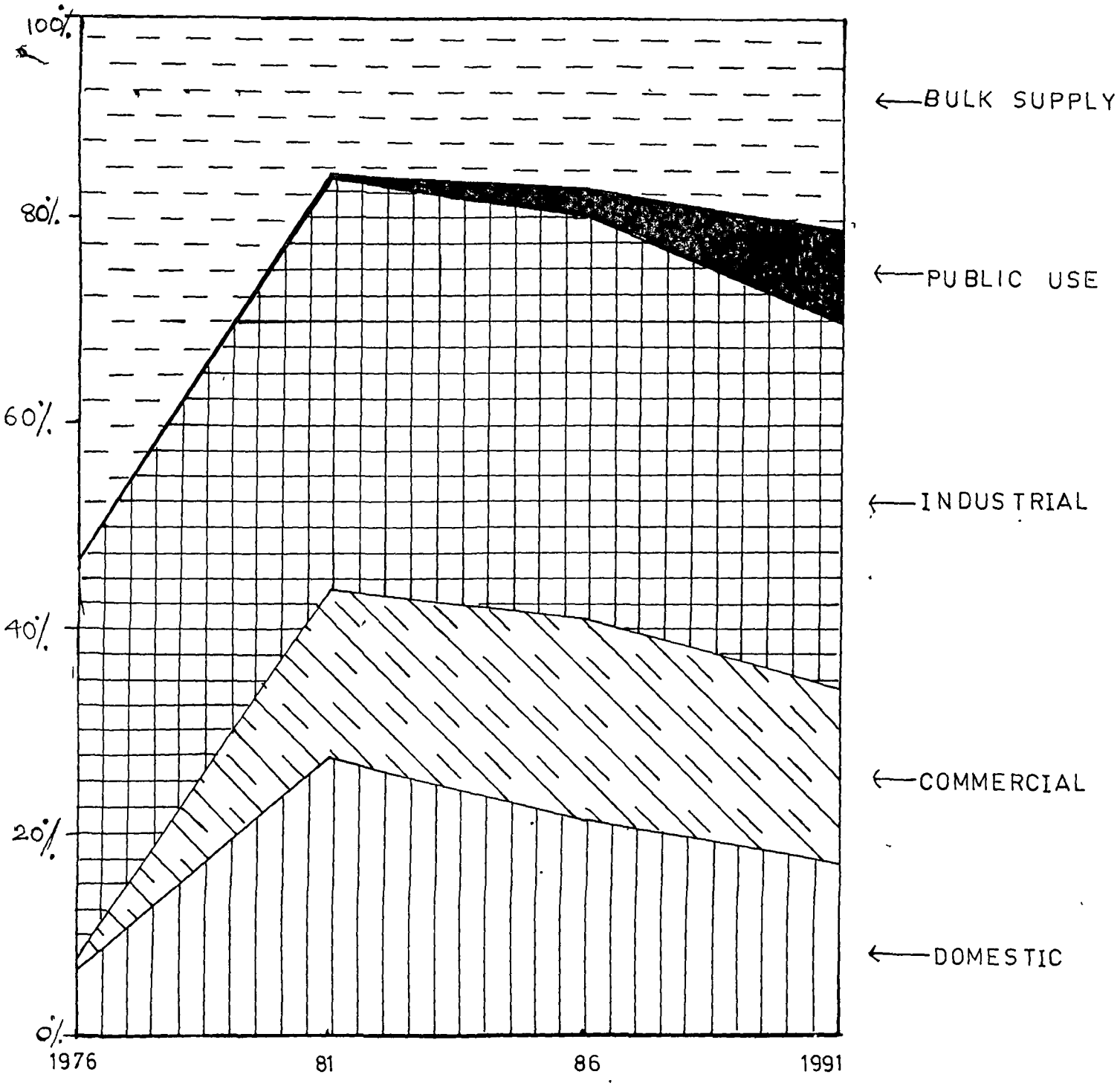
welfare purposes and use of power for productive purposes. The share of power used for welfare purposes of total consumption was only 6.6 percent in 1975-76 which had increased almost four times in the year 1990-91 comprised of 25.7 percent of total power consumption. At the same time, proportion of power for productive purposes has reduced from 93.4 percent to 74.3 percent. Within the welfare use of power, the largest share goes to power consumption for domestic consumption which shows increasing trend and it has increased from 6.1 percent to 17.0 percent within 1975-91. The other uses of power consumption for welfare purposes like public lighting and public water works are also showing a gradual positive increasing change with respect to time. This analysis of power consumption for welfare purposes out of total consumption reveals that the welfare of the people, and Meghalaya's standard of living is becoming higher.

The power consumption for productive purposes mainly belong to consumption by commercial, industrial and agricultural sectors and bulk supply. The share of using power in agricultural sector was almost negligible at the initial period of analysis while at the later period it shows an increasing trend, but its proportion to total power consumed by the State is still very small. Whereas the power used for commercial purposes has increased in percentage term from 3 to 16.7 of total power consumed. This is the result of

Figure 3(a)

SECTORAL DISTRIBUTION OF POWER IN MEGHALAYA

(IN PERCENTAGE)



increasing demand of power for commercial purposes as there are rapid expansion of service sectors in the economy. It rose from 0.343 mkwh in 1975-76 to 31.84 mkwh in 1990-91 of total power available for sale.

The use of power in the industrial sector shows the increasing trend in absolute amount of power consumption whereas the share of power consumption has decreased from 40 percent to 35.5 percent over the period of time. This highlights the fact that industrial use of power has not grown with the sectors. This also reveals the relatively slow rate of industrialization in the State.

Consumption in bulk supply means power used mainly in construction projects and other miscellaneous loads. It's share in the initial period was quite high, i.e. 52 percent in 1975-76 due to construction of hydel project but it came down to 21.4 percent in 1990-91. The sectoral distribution of power use in Meghalaya for the time period 1976-1991 is demonstrated in Figure 3(a).

A linear model is fitted to see the trend of power sale within the State.

$$\text{Total Sales} = -3.111 + 10.779t \quad \text{------- 3.13}$$

$$t^* = (-0.4249) \quad (14.238)$$

$$R^2 = 0.9354 \qquad DW = 0.53013$$

Equation 3.13 demonstrates a positive increased trend in total sale within the state during given time period. In order to get the idea of magnitudes of this change we need to analyse the following growth model :

$$\text{Log (Total Sales)} = 1.3832 + 0.0571t \quad \text{---- 3.14}$$

$$t^* = (53.315) \quad (21.2733)$$

$$R^2 = 0.9700 \quad DW = 1.6310$$

Slope coefficient of equation 3.14 is 0.0571, which means that total sale of power within the State is increasing at the growth rate of 5.71 percent over the period of time.

3.3 Structural Change in Sectoral Power Distribution :

Sectoral distribution of power available highlight the percentage change in the share of power consumed with respect to time. But this analysis does not reveal the proportionate change in sectoral use of power with respect to proportionate change to the power available for sale. For this purpose we need to estimate sectoral elasticities of power used in response to proportional change in total power sold within the State. This elasticity is defined as :

$$e = \frac{\Delta (S_1P)t \;/\; (S_1)t}{\Delta (P)t \;/\; (P)t}$$

where $\Delta (S_1P)t = S_1P_{t+1} - S_1P_t$

$\Delta (P)_t = P_{t+1} - P_t$

where 'e' measures elasticity, S1Pt = power used by sector 1, at time period t, Pt = total power sold within the state at time period t and Δ refers to significant change.

Elasticities can be conveniently estimated with the help of following double log function.

$$\text{Log } Pt = \alpha + B \log S1P1 \text{ --------3.15}$$

Table 3.3 demonstrates the estimations of sectoral elasticities by using equation 3.15.

Table 3.3

Log	α	B	R^2	DW Statistic	No.of Observation	Elasticity
Domestic use of Power	-1.1138 (-3.245)*	1.1984 (16.593)*	0.7564	0.8366	16	1.20
Commercial Use of Powe	-2.4054 (-3.6099)*	1.7979 (5.093)*	0.6494	0.7892	16	1.8
Industrial Use of Power	-0.4298 (-5.351)*	1.003 (23.578)*	0.9754	0.6348	16	1.0
Public Use	-0.9752 (-3.650)*	1.585 (5.316))*	0.6687	0.5243	16	1.6
Bulk Supply	-0.1051 (--0.3504)*	0.687 (4.3216)*	0.5716	0.9858	16	0.7

Note : 1. Figures in parenthees show estimated 't' values

2. * is the significant at 0.05 level of significance.

Rsesults of Table 3.3 reveal that estimations are statistically significant in most of the cases. Value of R^2 in all the cases are reasonably high and DW statistics are though not showing zero autocorrelation but are within the tolerant limit $2 < DW < 0$. There is a slight tendency towards positive autocorrelation in some estimations. In general, these statistical estimations can be treated as reliable.

The last column of Table 3.3 shows the elasticities of domestic power use, commercial power use and power consumption for public uses are greater than 1 where as elasticity of industrial use of power is 1 and the elasticity of bulk supply of power is less than 1. The greater than 1 elasticities show the proportionate increase of the sectoral use with respect to total power consumed whereas elasticity less than 1 shows the proportionate decrease in the sectoral power use to the total power sold within the State.

The domestic use of power has the elasticity measure as 1.2, which shows, it is growing at the faster rate than the total sale of power within the state is growing. So, the share of Domestic use of power is increasing. This can be attributed as increasing use of power for domestic purposes, due to higher standard of living, faster rate of urbanization and modernization of society and as a result of increasing number of power consumers.

Elasticity measure for commercial use of power is the highest among all the sectoral elasticities. This shows that this sector has grown with much faster rate than the total power used within the state at a point of time. This is the result of expansion of service sector in the state with faster rate.

Industrial use of power has increased with the same proportion as the total power used within the state has grown. In a developing economy it is expected that industrial use of power should be increased with faster rate during a give time span. In some economies the high level of industrial development is not possible because of unavailability of sufficient power. But, Meghalaya, is a typical example, where power generation is surplus, still industries are not growing or coming up to utilize the available power potential. Serious efforts should be made in this direction to identify the suitable industries for the State. At the same time, all efforts should be made to remove those hurdles which hampers the possible industrialization of Meghalaya.

The public use of power is growing with a faster rate. This is necessary, because of increasing number of public utilities and their modernization to cater the demand of public services, for increasing population of the State.

It is found that there is a positive relationship between the power consumption and level of economic development. To test this hypothesis in case of Meghalaya we have studied the relationship between the per capital State Domestic Product (SDP) and per capita consumption in the State from the year 1980-81 to 1989-90. The data for this period is given in table 3.4 below. The correlation coefficient between these two factors is 0.876 which is quite significant and further justifies the enhanced role of power generation and output produced.

Table 3.4

Year	Per capita consumption of power in Meghalaya (IN Kwhh)	Per capita State Domestic Product at constant (1980-81) prices in Rs.
1980-81	30.4	1361
1981-82	46.6	1379
1982-83	54.5	1361
1983-84	69.2	1354
1984-85	66.9	1385
1985-86	80.3	1412
1986-87	92.5	1397
1987-88	96.7	1485
1988-89	111.5	1514
1089-90	131.4	1515

Source : Basic Statistics NER, 1992

PER CAPITA CONSUMPTION OF POWER IN MEGHALAYA

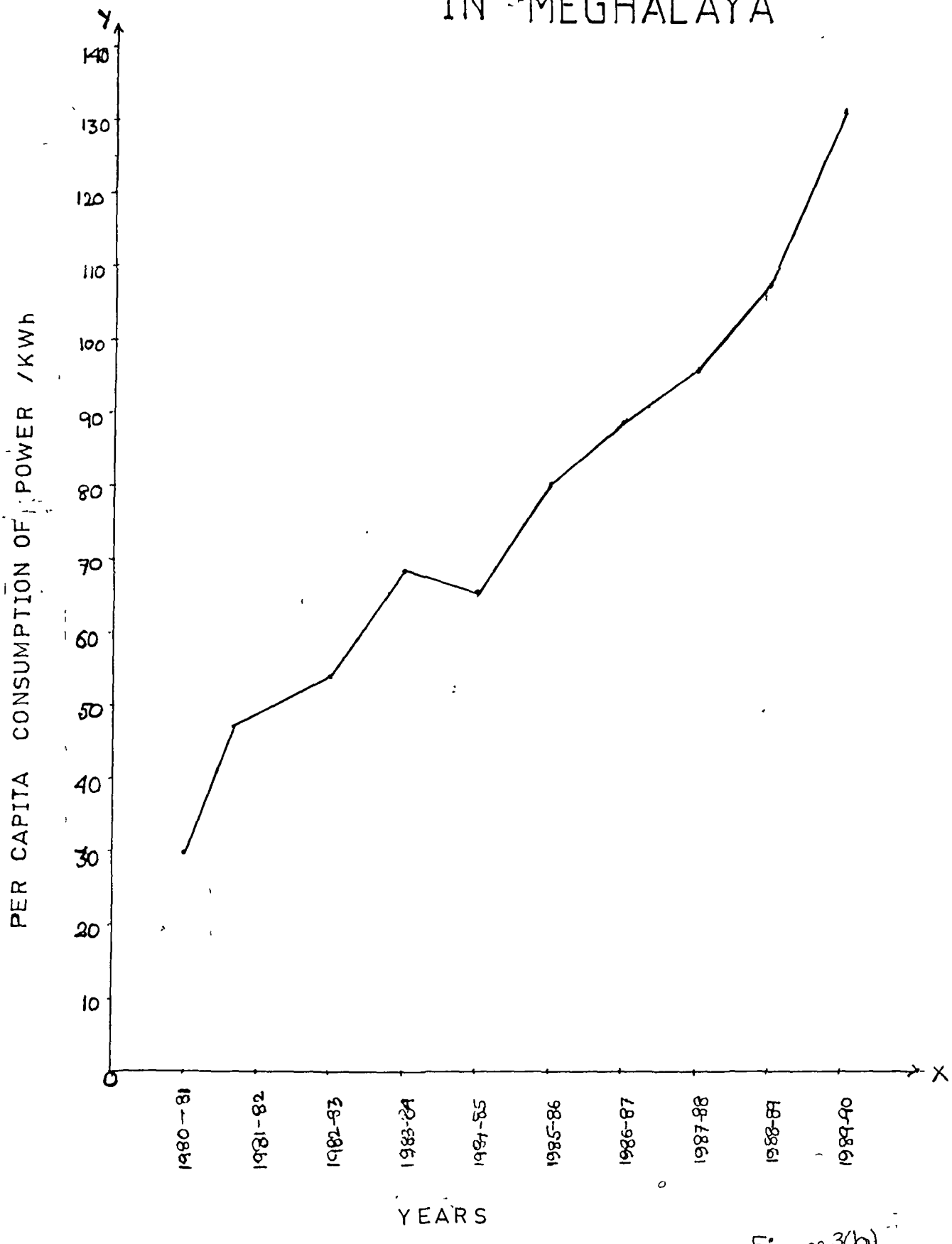


Figure 3(b)

The percapita consumption of power in Meghalaya along with other States of North Eastern Region is very less, i.e. according to latest estimate available, the per capital consumption of power in the State is 162 kwh as against an all India average of almost 250 kwh, it is due to lack of industrialization in Meghalaya which is considered as the main sector for consumption of power. But the per capita consumption of power in the State has increased over the period of time which is shown in the figure 3(b) which shows upward trend with respect to time. This means that there is growth in the economy with the pace of time as per capita consumption is regarded as the index for economic development.

Growth of rural electrification is generally associated with rising per capita income and better standard of living.

3.4 (Rural Electrification RE)

Rural electrification is comparatively a new field of investment in most of the developing countries. For both economic and social reasons, the rural electrification is a significant aspect of development. Rural electrification has been considered as an important instrument for stimulating agricultural activities through extensive network of minor irrigation and mechanization of farming. Increased agricultural output depends greatly on availability of

water in conjunction with other inputs and facilities.

Another most significant potential for economic development through wide spread application of electricity is the rural industry, like rice processing, refining mustard oil, rice and flour mills, timber mills etc. The availability of electric power has an impact on rural industries in two ways. First, the traditional existing units may change over to electric power and improve their productivity and profits. Secondly, new industrial units based on the use of electricity may come up which will put to productive use to the underemployed labour and locally available raw materials.

Some other major benefits expected to flow from rural electrification are improved social facilities, shops, commercial establishments, schools and health centres. The growth of rural electrification is generally associated with rising per capita income and better standard of living. These social facilities generally may not be directly affecting the productive activities in the short run but the interlinkage between these facilities and economic development in the long run is an empirical truth. The use of electricity being closely associated with rise in income and productivity more and more developing countries are taking initiative in electrification programme, particularly in rural areas where standard of living is very low.

There has been rise in income, employment and economic activities through agricultural processing and cottage industries which have come up in electrified villages. The flow of information through use of T.V. network in selected areas has also desired socio-economic impact on rural electrification.

Table 3.5

Number of Villages Electrified District-wise in Meghalaya

Year	Jaintia Hills	East Khasi Hills	West Khasi Hills	East Garo Hills	West Garo Hills	Total
1980-81	152	285	99	74	90	700
1981-82	171	352	117	96	132	868
1982-83	177	387	129	119	185	997
1983-84	188	429	149	149	222	1138
1984-85	197	461	167	174	263	1262
1985-86	199	471	186	190	275	1321
1986-87	207	488	186	201	315	1397
1987-88	216	524	194	256	421	1611
1988-89	231	556	222	311	517	1937
1989-90	242	703	256	326	589	2116
1990-91	261	784	270	340	616	2271

Source 1. MeSEB, Shillong

2. Basic Statistics of NER 1991.

Table 3.5 shows the number of villages electrified in Meghalaya as districtwise since 1980-81 to 1990-91. In this period total numbers of villages electrified in Meghalaya rose from 700 to 2271. Among all the five districts of the State, upto 1990-91, the highest numbers of villages electrified in East Khasi Hills district followed by West Garo Hills. In Jaintia Hills it increased to 261 from 152, in West Khasi Hills 270 from 99 and in East Garo Hills to 340 from 74 for the same period. At the initial stages or at the beginning of 80's the number of villages electrified in East Garo Hills were less, the reason being high initial investment cost associated with low density of population, remote from main distribution network.

East Khasi hills achieved maximum number of villages electrified in the State because villages are adjacent to State's capital where extension of transmission of distribution network is much easier.

Table - 3.6

Rural Electrification of Meghalaya\

Year	Total No. of villages electrified	Villages electrified in (%)	Energisation of Pumpsets
1975-76	261	5.6	-
1976-77	338	6.8	-
1977-78	395	8.0	-
1978-79	474	9.6	-
1979-80	546	11.1	41
1980-81	700	14.2	41
1981-82	868	17.7	47
1982-83	997	20.3	53
1983-84	1138	23.2	53
1984-85	1262	25.7	56
1985-86	1321	26.9	56
1986-87	1397	28.4	65
1987-88	1622	33.0	65
1988-89	1937	39.5	65
1989-90	2170	44.2	65
1990-91	2271	46.3	65
1991-92	2315	47.2	65

Note : Total villages of Meghalaya as on 1981 Census - 4902

Source :MeSEB, Admnistrative Report.

Table 3.6 presents the picture of total villages electrified in Meghalaya, percentage of villages electrified and number of energisation of pumpsets since 1975-76 to 1991-92. It is clear from the table that total number of villages electrified in Meghalaya yearwise shows that there was a steady increase throughout in each year there was an addition of village electrification, so there was a constant increasing trend in this work. It increased from 261 (in 1975-76) to 2315 (1991-92) electrifying 47.23 percent of total villages of the State, as we know total villages of Meghalaya as on 1981 Census were 4902. At the beginning of 1975-76 it was 5.6 percent and then it had gradual increase till 1083-84 but in the period 1984-85 to 1985-86 there was only 1.2 percent increase, but there after till 1991-92 there was an increase of 18.8 percent in village electrification.

With regard to number of energisation of pumpset we couldn't get data till 1978-79. Since 1979-80 to 1980-81, the number remained same as 41 then it gradually increased to 56 in 1984-85 and till 1992 it remained same. It was due to less agricultural development in that period and limited scope of mechanized way of farming in hills terrains of the State.

The task of rural electrification in the North

Eastern Region is relatively difficult because of its topography having a wide valley divided by mighty Brahmaputra across the whole of the Region with low density of population and with hill ranges all round where population are stills parsely located.

According to the latest data available (1992) percentage of rural electrification achieved in NER was highest in Assam (97.23) followed by Nagaland (98.83), Manipur (77.64), Mizaoram (71.71), Tripura (64.06), Arunachal Pradesh (49.89) and Meghalaya (47.23).

The States of Punjab, Haryana, Kerela, and Union Territories of Chandigarh, Delhi, Pondicherry, Lakshadeep and Dadra and Nagar Haveli have already achieved 100 percent electrification of villages. Other States/Union Territories are likely to achieve 100 percent electrification in near future are Tamil Nadu (99.8 percent), Goa and Daman and Diu (92.9 percent) and Maharashtra (92.8 percent). On the regional basis the southern region tops with (89.4 percent) of villages electrification followed by Western Region (72.0 percent), Northern Region (64.9 percent), Eastern Region (50.1 percent) and North Eastern Region (45.9 percent)

Performance of Meghalaya State Electricity Board in the field of rural electrification works is very poor. Against an all India average of 83.82 percent the achievement of Meghalaya is only 48.23

percent in 1992-93. Though high priority continues to be attached to the implementation of R.E. works, still Meghalaya occupies the bottom most position among all the States of the country in this regard. The high cost of electrification, inadequate and irregular flow and several other factors contributed to the unsatisfactory performance.

Though Meghalaya's power sector performance with regard to rural electrification is poor, but still, in brief, we can say that the overall physical performance of power sector in Meghalaya is quite encouraging. From the present chapter and the previous chapter as well, it is observed, that the physical performance of the power sector is showing positive results, for example, in the last chapter we have seen that the installed capacity of power and generating capacities of power have augmented considerably and in the present chapter we have seen that total utilisation of power inside the State have increased thereby increasing the per capita consumption, percentage of transmission and distribution loss is also very less. All these which are regarded as the index for power development prove that physical performance of power sector in Meghalaya is satisfactory.

But to see the over all performance of a sector, it's financial performances are also to be examined to draw the final conclusion. Our attempt in

this direction is being focussed in the next chapter regarding financial aspects of power sector of Meghalaya.

CHAPTER – IV

FINANCIAL ASPECTS OF POWER SECTOR

FINANCIAL ASPECTS OF POWER SECTOR

The evaluation of physical performance of power sector was the subject matter of previous chapters, where the issues of generation and utilization of power discussed at length. But to judge the overall performance of any industry or organization, the financial performance is also as relevant as it's physical performance.

4.1 Source of Finance and Its Utilization :

The financial aspects of any sector can further be divided into two broad categories. One is the source of finance and the second is it's effective utilization. Both of these aspects are discussed in the case of power sector of Meghalaya in this chapter. The major sources of finance and about their institutional structures are also the subject matter of this chapter. The efforts are also being made to analyze the structural changes in the financial sources during a given period of time. The major heads, in which the expenditure is made are the part of effective utilization of finance.

In order to achieve the above mentioned objectives, sincere efforts were made to gather the relevant statistical information from the various departments of power sector. But, with the limited

time period available to complete this study and other constraints beyond our control, we could not get the data about all the departments of power in Meghalaya. Nevertheless, we succeed in getting some data on the financial aspects of Meghalaya State Electricity Board (MeSEB). In the given circumstances, we are analyzing the available data, which could throw some light on the financial aspects of power sector.

In the beginning we intend to analyze the major source of finance to the MeSEB. In this context Table 4.1 is being presented.

Table - 4.1

Revenue Receipts (Rs. In Crores)

Sl. No.	Items	1990-91	1991-92	1992-93
A.	From the Sale of Power			
(i)	Within the State	10.52 (42.3)	14.98 (45.0)	24.45 (54.3)
(ii)	Outside the State	8.52 (34.4)	11.96 (35.9)	13.69 (30.4)
(iii)	Subsidy	5.5 (22.1)	6.00 (18.0)	6.50 (14.4)
(iv)	Miscellaneous	0.31 (1.2)	0.32 (0.96)	0.32 (0.7)
TOTAL	A	24.85 (100)	33.26 (100)	44.96 (100)

Source : MeSEB, Revenue Section 1993, (Unpublished)

N.B Figures in the parenthesis indicate the percentage of total revenue receipts.

Table 4.1 represents the revenue receipts by the Meghalaya State Electricity Board. Different sources of revenue receipts are the sale of power which is divided into two parts i.e. revenue earned through sale of power with the state and outside the State, then subsidy received by the Board and finally the miscellaneous revenue received by the Board such as revenue earning from the schools, hospitals etc. which are run by the Board.

This table demonstrates revenue receipt account for the last three years. It is observed from the table that in the year 1990-91 the share of revenue received within the State was 42.3 percent, from outside the State it was 34.4 percent, from subsidy 22.1 percent and from miscellaneous sources, it was only 1.2 percent of the total revenue receipts.

In the next year i.e. 1991-92 also the share of revenue receipts from the State occupied the major share of all other sources. It was 45 percent. Revenue receipts from the sale of power to outside the State comprised of 35.9 percent followed by subsidy and miscellaneous sources as 18 percent and 0.96 percent respectively.

In 1992-93, also major share of revenue receipts are received from sale of power within the State i.e. 54.3 percent followed by revenue receipts

from outside the state comprises of 30.4 percent, subsidy (14.4 percent) and miscellaneous source comprises of 0.7 percent only.

It is evident from the table that in the past three years, the power sector of Meghalaya depicts a proportionately increasing share of the sale of power within the state. It indicates that the state's own proportionate consumption of power is increasing with the pace of time.

The State also earn more than one third of total revenue receipts by exporting it's power to Assam. This export earning is increasing in absolute term.

It is important to note that the share of subsidies received by the board was 22.1 percent which has declined to 14.4 percent of total revenues. This is the outcome of constant efforts made by the board to earn maximum amount of revenue by its' own resources and to be less dependent on subsidies.

The total revenue earned by the Board is also increasing by more than 35 percent per annum. But this position would have been better if Assam State Electricity Board had cleared all it's dues to Meghalaya State Electricity Board. The total outstanding against power supply to ASEB is over Rs. 35 crores and this together with other claims amounts to

nearly Rs 42 crores which is almost one and half years revenue income of a small State Electricity Board.

Total revenue receipts of MeSEB are not enough to meet the total expenditure of the Board. Fall in revenue collection has a direct impact on the deficit faced by the power sector which is met by financial assistance from various institutions. Table 4.2 gives us the detail of various financial institutions. The largest amount of budget deficit is covered by loan provide by State Government itself. The other institutions which are paying loan to the Board are LIC and Rural Electrification Corporation (REC). But the share of market borrowing loan is the highest among the institutional loan.

Table - 4.2

Institutional Finance (Rs in Crores)

Types of Loan	1975-76	1992-93
State Govt. Loan	26.33	110.81
Institutional Loan :		
a) I.D.B.I.	NIL	3.52 (1.8%)
b) L.I.C.	5.03 (30.3%)	39.1 (20.1%)
c) R.E.C.	1.33 (8.1%)	50.19(25.8%)
d) Market borrowing	9.9 (60.8%)	101.42(52.2%)
Total Institutional Loan	16.26 (100%)	194.01 (100%)
Total Loan	42.59	304.82

N.B. The figures in parenthesis indicate the share of different loans out of total institutional loan in percent

Source: Revenue Section, MeSEB, Shillong.

From the table 4.2, it is seen that the share of market borrowing in 1975-76 comprised of 60.8 percent of total institutional loan and it is 52.2 percent in 1992-93. In the year 1992-93 it is found that the Board has also taken loan from IDBI. It is also relevant to mention that in the year 1975-76 the major portion of total loan of the Board was provided by the State Government, whereas this situation has changed in the year 1992-93, i.e. the Board is taking major portion of its loan from the financial institutions rather than the State Government.

LIC and REC also provide significant share of loan to the power sector of Meghalaya within the last 18 years institutional is from the beginning has been increased by more than 11 times, and the loan from the State Government has increased by only four (4) times within the same period, which means that now for meeting all the expenses, the power sector of Meghalaya depend more on institutional loan than on the State Government.

This is reported by the authorities of the Board that the problem of cash management in case of power sector of Meghalaya becomes more acute when cash inflow suffers from temporary non payment for supply of outside the state where revenue realization becomes difficult for sale inside the State.

The different issues such as taking of meter readings, submission of such readings, submission of proper bills, timely collection, disconnection for non payment should be started by the Board. This will provide a focus to ultimately achieve the objective for augmentation of revenue earning.

The patterns of revenue expenditure are shown in Table 4.3.

Table - 4.3

Revenue Expenditure (Rs in Crores)

Sl. No.	Items	1990-91	1991-92	1992-93
B				
(i)	Overall and maintenance charges	4.23 (22.9)	4.55 (27.2)	5.01 (24.4)
(ii)	Estt. and Admn. charges	11.95 (64.0)	12.12 (72.7)	13.04 (63.5)
(iii)	Miscellaneous	2.26 (12.2)	N.A. (-)	2.47 (12.0)
TOTAL B		18.44 (100)	16.67 (100)	20.52 (100)

Source : MeSEB (Accounts Section)

N.B. : Figures in parenthesis indicate percentage share of expenditure of various items to the total.

The power sector of Meghalaya largely spends its financial resources on the overall and maintenance (O&M), establishment and administrative and on other miscellaneous items.

It is evident from the table 4.3 that major expenditures of the power sector go on establishment and administrative charges. In 1990-91, it was 64 percent, in 1991-92 72.7 percent and in 1992-93 it was 63.5 percent of the total expenditure incurred by the power sector. Overall and maintenance charge is also quite high incurred by the power sector. In 1990-91, it comprised of 22.9 percent followed by 27.2 percent and 24.4 percent in the following two years.

Miscellaneous expenditure accounted for 12.2 percent in 1990-91 and in 1992-93 only 12.0 percent.

4.2 Commercial Profit / Loss Account :

Table 4.4 presents the commercial profit/loss account by substracting commercial liabilities from gross operating surplus (difference between Revenue receipt i.e. Table 4.1 and Revenue expenditure i.e. Table 4.3). This table shows the financial working of the power sector of Meghalaya since last three years.

Though the Sl. No. A and B of this table are being presented and explained separately while analyzing the financial aspects of power sector of Meghalaya in the beginning of this chapter, yet these two tables are presented again in table 4.4 to show the difference between these two and it's final result (commercial Profit/Loss) by incorporating other data regarding the financial aspect in convenient way.

Sl. No. C of this table (4.4) is the gross operating surplu s which is the difference between Sl. No.A and Sl. No. B.

Table - 4.4

Commercial Profit/Loss (Rs in crores)

Sl. No.	Items	1990-91	1991-92	1992-93
A.	Revenue Receipt from the sale of power :			
i)	Within the State	10.52	14.98	24.45
ii)	Outside the State	8.52	11.96	13.69
iii)	Subsidy (RE)	5.5	6.00	6.50
iv)	Miscl. receipts	0.31	0.32	0.32
	Total A	24.85	33.26	44.96
B.	Revenue Expenditures			
i)	O&M charges	4.23	4.55	5.01
ii)	Estt. & Admn. charges	11.95	12.12	13.04
iii)	Miscellaneous	2.26	-	2.47
	TOTAL B	18.44	16.67	20.52
C.	Gross operating Surplus (A-B)	6.41	16.59	24.44
D.	Commercial liabilities			
i)	Depreciation due	2.40	2.80	2.67
ii)	Int. due to institutional creditors	17.34	18.84	20.94
iii)	Interest due to State Govt.	-	6.34	6.48
	TOTAL D	19.74	27.98	30.09
E.	Commercial profit(+) /Loss (-) at current rates (C-D)	(-)13.33	(-)11.39	(-)5.65
F.	% of loss/ Total Revenue x 100	50%	33%	12.57%

Source : MeSEB, Commercial Section, Shillong.

Though we see in all the last three years the revenue received by the Board were more than the expenditure incurred, but we see that after clearing the commercial liabilities (Depreciation due, interest due to institutional creditors, interest due to State Government), the Board experiences quite a good amount of losses in all the years. We see the recent year's performance shows marked improvement where commercial loss is less comparatively. High level of liabilities are due to the extra ordinary high proportion of the interest of the institutional creditors. Although the Board is likely to have a gross surplus on actual basis by 1993-94 with the moderate revision of tariff, the commercial loss will still be substantial due to high interest burden. Restructuring of the capital, therefore is an immediate necessity for making the Board viable and enable the Board to attract investment from outside.

In table 4.4, Sl. No. D represents the commercial liabilities of the power sector which comprise of depreciation due, interest due to institutional creditors and interest due to State Government for the last three years. It evident from the table that the commercial liabilities of the power sector of Meghalaya kept on increasing every year. It was Rs 19.74 crores in 1990-91 and increased to Rs 30.09 crores in 1992-93.

Serial No. E of Table 4.4 represents the commercial profit (+)/loss (-) account of power sector of the State. It is the difference between the gross operating surplus and commercial liabilities. Gross operating surplus here means total revenue receipts minus total revenue expenditure. Sl. No. F present percentage of loss for last three years.

After all these calculations, it is found that in last all the three years the power sector of Meghalaya has been experiencing losses. In the first two years i.e. since 1990-92, losses were enormous but in the year 1992-93, it came down to a substantial amount.

Percentage of profit/loss margin can be calculated by the following formula for last three years.

$$\text{Profit/Loss margin} = \frac{\text{Profit/loss(in Rs)}}{\text{Net sales (in Rs)}} \times 100$$

$$\text{In 1990-91, -do -} = \frac{13.33}{19.04} \times 100 = 70\%$$

$$\text{In 1991-92, -do -} = \frac{11.39}{26.96} \times 100 = 42\%$$

$$\text{In 1992-93, -do -} = \frac{5.65}{38.14} \times 100 = 14\%$$

4.3 Cost-tariff Relationship :

Electricity prices are determined by the utilities cost of producing and delivering electric power to consumers. The regulation of utility prices is designed to ensure that revenues collected by a utility on service sold are equal to the cost of providing the service. The cost of electricity is generally divided into two major components, capital related costs and operating costs. The capital component represents the cost to the utility of capital assets needed to provide reliable service. It includes plant depreciation, taxes and sufficient return on invested capital to cover interest obligations on outstanding debt and to compensate stockholders. The operating cost component represents the cost for the utility to operate and maintain the physical plant required for serving the consumer. The major elements of this compound are fuel cost and other operating and maintenance (O&M) costs.

An increase in the price of energy has the effect of triggering product price increases. Energy prices affect aggregate demand. As a result, they also have an effect on the level of employment in the economy.

The electricity rate or charges is known as tariff. A tariff of electricity serves two purposes :

(a) To raise revenue to pay for or atleast to contribute towards, the cost of operating enterprise.

(b) To serve as a tool of implementing policy.

A good tariff should be equitable, practicable and politic. By equitable here we mean that tariff should be equal for the same class of consumer. It should be charged such a way that all consumers of certain category have to pay the same rate of tariff.

A tariff must also be practicable. For example, it must take into consideration the prices and availability of competitive sources of energy such as gas or kerosene which, for certain purposes, could perhaps provide a satisfactory and cheaper alternative to electricity.

Thirdly, a tariff should be politic, in that it should encourage growth and economy. That is to say,

it should be framed to include incentives conducive to those ends. The encouragement of growth does not imply that the enterprise wishes it's consumers to waste their substance in consuming electricity they do not want. The advantage of growth lie partly in the improved living standards that accompany the increased use of electricity and partly in the reduced costs that may be expected to follow.

Table 4.5 presents the tariff rate in Meghalaya for different utilities since 1977. It is observed that in 1992 all the rates have increased by more than 50 percent from 1977 rates. Tariff was revised four times over the period and in the first three years of revision, the rate of tariff for domestic sector was increased only marginally, only in 1992 it became high. Commercial tariff rate shows substantial increase with all the revision. Power tariff for public lighting became double from 1977 to 1982 and normal increase in the next revision. But in Meghalaya the tariff rate for agriculture, always remained very low, it is the lowest of all the utilities, but at present it has been increased by three times.

Table - 4.5

Tariff Rates in Meghalaya (Paise/kwh)

Utilities	1977	1982	1991	1992
Domestic	43	44	53	75
Commercial	48	75	90	125
Industrial	N.A.	N.A.	N.A.	125
Public lighting	34	60	72	105
Agriculture	17	30	36	50

Source : Commercial Section, MeSEB, Shillong.

N.B. : N.A. implies not available.

It is evident from the table 4.5 that power tariff in Meghalaya in 1992 had increased quite high within one year i.e. from 1991. The first being the reversal of the system of higher the consumption lower the rate has been revised to higher the consumption higher the rates. The position is like this :

	Slabs	Rates
1991 Tariff		
	(i)First 5000 kwh	78 p.
	(ii)Next 5000 kwh	72 p.
	(iiiFor the balance	66 p.
1992 Tariff		
	(i)First 750 kwh	100 p.
	(ii)Next 1250 kwh	115 p.
	(iii)Balance	125 p.

With the availability of surplus power and requiring rapid industrialization to conserve the exhaustible natural resources, this should have undertaken promotional tariff structure but the opposite had happened.

In the case of small and medium industries the first slab is fixed at 750 units, the second at 1250 units and the rest as the highest slab with maximum charge, as against the bottom slab of 5000 units in the earlier tariff. We cannot call it an industry which will consume only 750 units of electricity a month. It suggests that every small and medium range industries will be compelled to pay the charges at the highest rates. The 1992 hike will of course put a fix to the industrial growth but double the suffering of major of the population as 90 percent of the population depends upon agriculture for their livelihood and do not have stable income.

Seeing the negative effect of high rate of tariff in 1992, the rates have been further modified in the category of domestic consumption only. It has become 69 p/unit (gross rate) and 64 p/unit (net rate) with effect from 1st August 1993. All other rates and charges remains unaltered.

For obvious reasons it would be impolitic to alter tariff rate too frequently. Although price

reductions are always welcome to consumers, price increases are naturally resented, so if costs are likely to vary from year to year, it would be impracticable to modify tariff rates in such a manner as to reflect immediately the changing pattern of costs. Rate fixing must be a fairly long term operation so that consumers may sense some stability in electricity prices. It is, therefore, insufficient to base rates on costing results of a single year's trading. Costing is an operation that must be continually revised so that existing trends, as well as instaneous costs, may be constantly appraised.

Pricing policy can be used as a powerful instrument to realize some desirable socio-economic objectives. At present, average accounting cost is used as basis of pricing in electricity undertakings in India. Accounting cost criteria is not adequate and there is a need to base pricing on economic principles which will lead to efficient allocation of resources. Economic theory suggests that for efficient allocation of resources, price should be related to Marginal Cost.

It suggests that for efficient operation of the system, off-peak price should be related to the short-run marginal cost and peak period price should be related to long run marginal cost. At the operational level, short run marginal cost is the increase in output with a given installed capacity. This may also be called Marginal Capacity cost.

The Inter-State Comparison of Tariff Rates :

The tariff rates is not only low in Meghlaya but also in entire North Eastern States. The inter state tariff rate comparison can be viewed from table 4.6.

The first column of the table represent the name of all State Electricity Boards (SEBs) and Electricity Departments (ED), such as Arunachal Pradesh State Electricity Department (APSED), Assam State Electricity Board (ASEB), Meghalaya State Electricity Board (MeSEB) etc. The second to the sixth column represent tariff rate for different utilities and seven and eighth column represent average revenue realised and average cost per unit for all the States of North Eastern Region.

It is evident from the table that over all average revenue realised per kilo watt hour (kwh) sales in February 1990 was less than half of the average cost of generation and supply in all utilities of the region. Owing to the fact that these are small utilities, the tariff structure are rather simple. The low tariff rates has serious repercussions on the financial position of the utilities. It is clear that tariffs need to be raised rather quickly in all the utilities of the NER.

Table - 4.6

Average revenue realized per unit from different consumer categories during February 1990

(Paise/Unit)

SEB/ED	Domestic	Commercial	Agri	LT industry	HT industry	A.R. realised	Average Cost
APSED	45.0	45.0	-	45.0	-	45.0	217.2
ASEB	60.0	102.0	50.0	58.2	45.0	91.1	247.1
MeSEB	44.0	68.0	21.0	55.0	93.9	50.1	106.5
Manipur	52.5	52.5	52.5	52.5	55.0	52.5	150.9
Mizoram	75.0	85.0	-	85.0	-	89.0	347.7
Naga-land	100.0	100.0	-	100.0	-	100.0	205.2
Tripura	60.0	65.0	35.0	40.0	100.0	48.0	171.1

Source : Annual Report on the Working of SEBs and EDs, Planning Commission, GOI.

From the above table it is seen that average revenue realised by Mizoram was the 1/3rd of its' average cost and almost the same cases are with Arunachal Pradesh State Electricity Department (APSED) and Assam State Electricity Board (ASEB) and for other North East States, it is half of the average cost.

From the inter-state tariff structure of North East States regarding average revenue realised per unit from different consumer categories during February 1990, it is proved that all the north eastern states of India are running under losses. For each unit of sale of power, the average cost incurred are more than twice or thrice of the average revenue realised by the different states of North Eastern Region including the State of Meghalaya. In Meghalaya, it is seen that average cost of power per unit is more than double of its average revenue realised per unit for the same period.

On the basis of above analysis we feel that there is a need to improve the financial situation of the Board. There are various reasons which contribute to such deplorable state of financial position of the Board. The unsatisfactory performance of the Board in financial management is mainly attributable to the following factors :

1. Unfavourable financing pattern.
2. Poor prevailing tariff structure.

3. Capitalization of interest during construction not allowed.

To improve the financial position of the Board it is felt that the following steps should be taken.

Firstly, the financing pattern of the Plan schemes should be reoriented with atleast 70 percent of contribution from State Government and 30 percent loan from the financial institution.

Secondly, there is a need to adopt a suitable tariff structure based on commercial consideration.

Thirdly, as power is a capital intensive industry, its capital requirement is often large compare to total investment. As such, interest during construction is allowed to be capitalized.

Finally, MeSEB should be allowed to work as a commercial organization. At present State Electricity Board has large establishment expenditure and the number of employees per unit sold or per MW being high, the present act of labour laws which are prevalent are more suited for an industry within the four walls and not the Board which supplies electricity to thousands of villages in the whole of the States. This industry requires a separate labour law otherwise any expectation of curtailment in respect of establishment expenditure would not be forthcoming.

Besides, there is a need to change the ethos and culture of the Board.

From this chapter we have got the idea or view of financial performance of the power sector of Meghalaya, regarding its sources of revenues, expenditure of the Board, its tariff structure and commercial profit/loss account.

Physcial performance of the power sector of Meghalaya is already being presented in the last two chapters and on the basis of all foregoing analysis we draw our conclusion in the next chapter regarding overall performance of power sector in Meghalaya and about our major findings in this field of research work.

CHAPTER – V

CONCLUSIONS AND MAJOR FINDINGS

CONCLUSION AND MAJOR FINDINGS

We have clearly seen that power is an essential input and infrastructure and is very much related with economic development of a State. Electric power is a principal source of energy and its generation depends on an independent energy source which is running water. The hydro electric power schemes are often spectacular, involving the construction of large dams and other installations. There are a number of factors affecting the development of hydro electric power such as a head of water which can be obtained either in upland or low land areas by building a dam, a large volume of water by harnessing large rivers since they give far better returns than small stream, a regular and reliable water supply to give a steady output of power, presence of lakes along the course of a river help to store flood waters and regulate river flow naturally and render the construction of dams easier, a space for reservoir should be there.

Hydro electricity being generated by running water is thus a flow resource and is inexhaustible in nature. It is relatively easy to transmit electricity by means of wire and cables over moderate distance.

Major Findings :

Our study has made us aware of the fact that

the genesis of power sector of Meghalaya was based on the concept of accelerated development of its sector and for the harnessing the available vast hydro potential of the State.

The sector has grown systematically in size in respect of generation, sale, establishment of system network and in village electrification.

A linear trend model shows a significant positive upward trend in power generation over the period of time. The semi-log model fitted to estimate the growth rate of generation and it is found that generation of power is growing by the rate of 10.1 percent per annum.

Total power available for sale is further decomposed in two categories. First, the units sold inside the State, another is power sold outside the State. It is interesting to note the proportion of power exported to the total power available for sale was 71.5 percent in 1975-76 which has reduced to 30.0 percent in 1990-91. While the percentage of power sold inside the State to total power available for sale has increased from 19.05 percent in 1975-76 to 56.9 percent in 1990-91. This clearly indicates the growing demand of power within the State in absolute as well as in relative terms.

A significant amount of available power is lost

during the process of transmission and distribution (T&D). However, in case of Meghalaya the proportion of this loss to the total power available for sale varies from 4.2 percent to 15.9 percent over the time period. The time series data on T&D losses year wise does not show a clear cut positive or negative trend. For the year 1991-92 the all India average for T&D loss was 22.3 percent as against T&D loss in Meghalaya is only 11.4 percent. This suggests that T&D system in Meghalaya is more efficient than the T&D systems of the rest of India. It is reported that there is relatively less power pilferage and inbuilt inefficiencies.

For the purpose of analysis, the total power consumed inside the State, is divided broadly in two categories. Firstly, the consumption of power for welfare purposes and use of power for productive purposes. The share of power used for welfare purposes of total consumption was only 6.6 percent in 1975-76 which had increased almost four times in the year 1990-91 comprised of 25.7 percent of total power consumption. At the same time, proportion of power for productive purposes has reduced from 93.4 percent to 74.3 percent. Within the welfare use of power, the largest share goes to power consumption for domestic purposes. The share of power for domestic consumption shows increasing trend and it has increased from 6.1 percent to 17.0 percent within 1975-91. The other uses of power consumption for welfare purposes like public lighting and public water works are also showing a

gradual positive increasing change with respect to time. This analysis of power consumption for welfare purposes out of total consumption reveals that the welfare of the people, and the Meghalaya's standard of living has become higher.

The power consumption for productive purposes mainly belong to consumption by commercial sector, industrial, agricultural sector and bulk supply. The share of using power in agricultural sector was almost negligible at the initial period of analysis while at the later period it shows an increasing trend, but its proportion to total power consumed by the State is still very small. Whereas the power used for commercial purpose has increased in percentage term from 3 to 16.7 of total power consumed. This is the result of increasing demand of power for commercial purposes.

The use of power in the industrial sector shows the increasing trend in absolute amount of power consumption whereas the share of power consumption has decreased from 40 percent to 35.5 percent over the period of time. This highlights the fact that industrial use of power has not grown with the faster rate as the consumption of power has grown in other sectors. This also reveals the relatively slow rate of industrialization in the State.

Consumption in bulk supply means power used

mainly in construction projects and other miscellaneous loads. It's share in the initial period was quite high, i.e. 52 percent in 1975-76 due to construction of hydel project but it came down to 21.4 percent in 1990-91.

For the purpose of analyzing the structural change in the sectoral demand of power the elasticities of sectoral power consumption with respect to the total power consumption were estimated by using double log function. The analysis shows the elasticities of domestic power consumption, commercial power consumption and power consumption for public uses are greater than 1 whereas elasticity of industrial use of power is 1 and the elasticity of bulk supply of power is less than 1. The greater than 1 elasticities show the proportionate increase of the sectoral consumption with respect to total power consumed whereas elasticity less than 1 shows the proportionate decrease in the sectoral power consumption to the total power consumed as shown in the figure for sectoral distribution of power in Meghalaya.

It is found that there is a positive relationship between the power consumption and level of economic development. To test this hypothesis in case of Meghalaya we have studied the relationship between the per capita State domestic product and per capital consumption in the State from the year 1980-81 to

1989-90. The correlation coefficient between these two factors is 0.876 which is quite significant and further justifies the enhanced role of power generation and output produced. Growth of rural electrification is generally associated with rising per capita income and better standard of living. In Meghalaya number of villages electrified increased from 261 (5.6 percent) in 1975-76 to 2384 (48 percent) in 1992--93. But the State's status in rural electrification is very poor compared to all India average of 83 percent in 1992-93. The high cost of electrification, and its geographical condition of high mountain areas, scattered and remote areas contribute to the unsatisfactory performance in this programme. But on the whole the physical performances of the power seem to be quite encouraging, this study shows that there is a positive physical growth in the power sector of Meghalaya.

But to judge the performance of any industry or organization, its financial performance is also counted along with physical performance to see whether the sector is running under profit or loss. In our investigation we have noticed that though the overall physical performance of power sector in Meghalaya is satisfactory, but its financial performance is not that satisfactory. The power sector of Meghalaya also like most of the State Electricity Boards of India is running under losses. The operation expenditure including employees cost has gone up by 600 percent from the level of 7.39 P/unit to 46 P/unit during the

time period 1975--1993. The interest charges to institutional creditors which attract priority has gone up from 1.34 P/unit to 49.89 P/unit i.e. a rise of 3723 percent. The payment towards interest on Government loan could not be appropriated. The cost of depreciation went up from 4.15 P/Unit to 6.9 P/unit.

While the overall cost has gone up by nearly 1000 percent the average rate of supply could not be correspondingly increased. The logical conclusion is the unsatisfactory financial performance. Such financial performance will ultimately manifest itself in feeble technical performance. Although, the consumers in general may be happy for paying a lower rate - rate below the cost of supply, they are going to be most unhappy in future for poor quality and quantity of supply. This is bound to happen when power supply industry is compelled to continue supply and services far below the cost of such supply.

On the perusal of table of financial status, it will be clear that the Board which started with no deficit has been crippled with huge deficit, which reflects the financial performance is very unsatisfactory. The operating surplus registered comparative marginal decrease on a percentage basis but the unbearable interest burden without corresponding appropriate revision of tariff contributed considerably towards increase in deficit. The revision of tariff for sale and services could not be implemented

reasonably due to compulsion beyond the control of the Board, and the compromises were made at the cost of the Board.

With respect to the distribution of power inside the state, the whole State can be divided broadly into two areas on the basis of generation of the net income from the sale of power :

(a) Profit making areas; and

(b) Loss making areas.

Profit making areas cover Shillong city and greater Shillong area, and all the district headquarters, and main places of the State.

Other than these area, there is extensive area covered under rural distribution network. The electricity supply in these areas are done only to serve the social objective without any possibility for earning profit in near future. The loss incurred for supply in these areas can be attributed to several factors, as -

(a) Sparesely populated remote rural areas without any industrial or agricultural load.

(b) High cost of supply and services.

(c) The low tariff applicable to consumption.

(d) High cost involved in thee construction

as well as maintenance of supply due to difficult terrain.

On management of Board's finance for operation, the Board depends mainly on the cash flow from sale of power and also on the assistance available from the State Government. The picture of gross operating surplus available to the Board which by itself is not enough gets further deteriorated due to the problems of outstanding dues against various consumers and mainly from accumulation of huge outstanding for sale to Assam State Electricity Board (ASEB). As the Board cannot directly supply from its network to any other agency other than ASEB, the problem is compounded as the sale is subjected to buyers' choice with regard to rate of supply and its timely and regular payment. By the end of September 1993, the accumulated outstanding dues payable by Assam State Electricity Board has become more than Rs 35 crores equivalent to 3 years due under normal rate and quantum of sale to A.S.E.B. Therefore, it is urgent to consider appropriate arrangements to save the MeSEB from a serious problem of liquidity due to non-availability of adequate and timely cash in flow for its operation.

The future of MeSEB, provided its capital structure is restructured, its collection, revenue streamlined, its loss due to social obligation are appropriately subsidized depends on the generation of surplus power and sale of such power. This inter-alia

can ensure generation of income. With the steps taken for efficient management of its profit centres, it will be proper to consider appropriate market avenues projects. Only the generation of power and its subsequent sale with reasonable profit can ensure the prosperity of MeSEB.

The State of Meghalaya is endowed with natural resources for generation of power. It has enormous potential in respect of Hydel, Thermal and also various forms of renewable sources for power generation. However, at present the installed capacity connected to the grid is of the order of 185 MW only and this capacity is entirely from Hydel sources. It is weather dependent. In the years, when there is heavy rainfall, the total generation exceeds the designed generation of 430 Mkwh. From the report, it is expected that during the year 1993-94 the generation will be 500 Mkwh against 436 MU as targeted during the Annual discussion in the Planning Commission, Government of India.

Poor industrialization in Meghalaya did not permit so far the full utilization of the available power. In the absence of industrial development, generation of power can be considered as a commercial venture if the power surplus to the need of Meghalaya can be marketable with reasonable profit outside the State. This can be done if proper facility for transmission and inter-connected grid operation is available.

Government should have a plan for the use or conservation or augmentation of State's power resources. Since the State still lacks in efficient use of resources, it is suggested that more research and development efforts should be substantially done to search for less intensive goods and services for use. Exploration should also be extended to help in the discovery of new resources. Next comes minimizing the waste in the use of resources by adopting better technologies or appropriate technologies. Conservation measures should also be adopted as they help to sustain output over a longer period.

Since the development and the power resources in vital to the economic development of the country, we need to have a country wide perception and long-term perspective. Government can be regarded as the best agency for taking care of optimum use of resources.

Power supply is the life blood of development. Without it, we cannot create and operate our industries, without it we cannot multiply the number of tubewells that are are bringing about a revolution in agriculture, without it we cannot achieve the improvement of life in our towns and villages that are brought by light for our houses, power for our activities, the fans and air conditioning to mitigate some of the severities of the climate. To improve the food production and improve the standard of living of

villagers, electricity will have to be applied in rural areas on a very large scale.

To sum up it can be said that power plays a vital role in the growth of an economy. It is the proper development planning, and distribution of energy that would ultimately have an important impact on the rate at which an economy is capable of growing. Obviously, if there is poor development of the power sector, there would be slow growth in output, employment and income. Thus, for achieving an accelerated growth rate, it is essential that the Government should accord highest priority for the development of the power sector.

BIBLIOGRAPHY

Choudhury, M.R. - Power resources of India (1970), Oxford & IBM Publishing Company.

Guru D.D. & Ashan Qamar - Energy and economic development (1987). H.S. Juneja for Amar Prakashan, Delhi.

Gujrati Damodor - Essentials of econometrics (1992) Mc. Graw-Hill International Edition.

Hans Asha - The power sector of India (1986). Sterling Publishing Private Ltd.

Klein L.R. - An intorduction to econometrics (1965). Prentic Hall of India Ltd., New Delhi.

Kumar, M.S. - Energy Pricing policies in developing countries (1987) (ARTEP)

Koutsoyiannis, A. - Theory of econometrics (1984). Macmillan Publishers Limited, London.

Mahajan, V.S. - Energy development in India (1983). Deep & Deep Publications.

Pacahauri R.K. - Energy Environment Development.

Phillip Pryde - Non-conventional energy resources (1982), San Diego, California.

Sarkar Hiren & Kadekodi Gopal - Energy Pricing in India, Perspective, issues and options (1988) (ARTEP)

JOURNALS AND ARTICLES

Bajoria B.P. - 'Tariff and it's effect on Meghalaya' in The Meghalaya Guardian, Tuesday, 20th October, 1993.

Bhattacharjee, C.R. - ' North East Power Scenario', in Urja, vol. 30, No.2, Aug, 1991.

Chidambaram R. - 'Measures of development' in the Sunday Times of India, Sep 12, 1993.

Jagadesan J.D. - 'Reviewing the power sector' in The Shillong Times, Thursday, 20th May 1993.

Maccune Dalip - 'Power to the People' in Rashtriya Sahara, Oct. 1993.

Phukan, S.N. - 'Hydro power potentialities' in Yojana, 16-31 Aug. 1982.

Phukan , S.N. 'Power Development in NER of India' in a book on Social and Economic profile of N.E. India by Dutta Roy.

Ramachandran, M. - 'Energy management in the industrial sector and the role of renewable resources of energy (RRE)' Journal of the NEC, No.3, July-Sep 1993.

Ramachandran, M. - 'Power Generation in the NER, Problems, prospects and NEC's role ?' Journal of the NEC on commemoration of two decades of service 1972-93.

Ray K.P. - 'Power development in NER - few issues'. Journal of NEC, Vol.XII, No.2, 1991.

REPORTS

1. 'MeSEB lack billing system' in the Meghalaya Guardian, Wed 27th Oct' 1993.

2. 'Electricity cost and tariffs' - A general study. United Nations, New York.

3. Administrative Report (1975-1988), MeSEB.

4. Report of the Working Group on development of NER during the Seventh Five Year Plan March, 1985 - 'Power and renewable resources of energy' - Published by M.P. Hazarika (DIPR), NEC, Shillong.

5. Ministry or irrigation and power, GOI, New Delhi (1984-85) Dept. of Power.