



# 24 X 7 POWER FOR ALL - MANIPUR

A Joint Initiative of Government of India and  
Government of Manipur





Government of India



## Piyush Goyal

Minister of State (Independent Charge) for  
Power, Coal, New & Renewable Energy

### Foreword

Electricity consumption is one of the most important indicator that decides the development level of a nation. The Government of India is committed to improving the quality of life of its citizens through higher electricity consumption. Our aim is to provide each household access to electricity, round the clock. The 'Power for All' programme is a major step in this direction.

This joint initiative of Government of India and Government of Manipur aims to further enhance the satisfaction levels of the consumers and improve the quality of life of people through 24x7-power supply. This would lead to rapid economic development of the state in primary, secondary & tertiary sectors resulting in inclusive development.

I compliment the Government of Manipur and wish them all the best for implementation of this programme. The Government of India will complement the efforts of Government of Manipur in bringing uninterrupted quality power to each household, industry, commercial business, small & medium enterprise and establishment, any other public needs and adequate power to agriculture consumer as per the state policy.



Government of  
Manipur



## **Okram Ibobi Singh** **Chief Minister of Manipur**

### **Foreword**

Electricity is critical to livelihoods and essential to well-being. Dependable electricity is the lifeline of industrial and commercial businesses, as well as a necessity for the productivity and comfort of residential customers.

The implementation of 24x7 “Power For All” programme is therefore a welcome initiative.

The utilities of Manipur are committed to provide reliable electricity to all sections of consumers. Further, even though our terrain is difficult, the State is committed to overcome the challenges and provide electricity to even the most remote habitations. We have accordingly captured the requirement in the roadmap to achieve this objective in time bound manner and funding requirements have been spelt out.

The programme of 24x7 “Power For All” will help us further improve the quality of our service delivery. The roadmap provides clear sight of the expectations from both Government of India and the State Government in ensuring desired outcomes.

I strongly believe that the 24 x 7 initiative must help address the issues of reduction of AT&C losses, bridging the gap between ACS & ABR as well as customer centric initiatives for ultimate customer satisfaction.

I am optimistic that this 24x7 “Power For All” document, prepared after several rounds of negotiations and meetings between personnel at State and Central level, facilitated by senior officers of Ministry of Power, will play a pivotal role in paving the way forward for accomplishing Manipur Government’s commitment and preparedness towards reinforcing the status of Manipur as a power-cut free state and providing every citizen access to 24x7 reliable, quality and affordable power supply.





Government of India



Government of Manipur

## Joint Statement

'24x7 Power for All' (PFA) programme will be implemented by Government of Manipur (GoM) with active support from Government of India. With the objective to connect the unconnected in phased manner by FY 2018-19, ensure 24x7 quality, reliable and affordable power supply to all Domestic, Commercial and Industrial consumers and adequate supply to agriculture consumers as per the state policy within a fixed time frame.

Development and improvement of power sector is the highest priority of Government of Manipur. GoM is committed to provide full support to all utilities for ensuring quality power supply.

Government of Manipur would try to ensure that all the necessary steps outlined in the PFA document are taken up effectively. This would include village electrification, capacity addition, power purchase planning, system strengthening, required transmission and distribution network, encouraging renewables, undertaking customer centric initiatives, reduction of AT&C losses, bridging gap between ACS & ARR, and following good

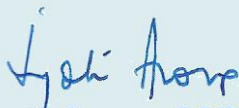
governance practices in implementation of all central and state government schemes.

Government of India (GoI) would supplement the efforts of Government of Manipur by fast tracking resolution of key issues pertaining to generation & transmission and ensuring optimum allocations in various distribution schemes as per the provisions of applicable policies/schemes.

It is envisaged to cover the entire state under PFA programme for providing 24x7 power supply to all connected domestic consumers, industries and commercial consumers from FY 2016-17 itself and to all un-connected households by FY 2018-19.

However, Government of Manipur would endeavor to implement the programme much earlier than the targeted timelines.

The central and state governments would meet regularly to review the progress of the programme over next 3 years and would strive to achieve the objectives of the programme by taking the necessary steps as envisaged in the PFA document.

  
**Jyoti Arora, IAS**  
Joint Secretary  
Ministry of Power (GoI)

  
**Vineet Joshi, IAS**  
Commissioner, Department of Power  
Government of Manipur

**(VINEET JOSHI)**  
Commissioner (Power)  
Government of Manipur

## EXECUTIVE SUMMARY

24x7 Power for All is a Joint Initiative of Government of India (GoI) and State governments with the objective to provide 24x7 power to all households, industries, commercial consumers, public needs & any other electricity consuming entities and adequate power to agriculture farm holdings as per the policy of State government by FY 2018-19. This roadmap document aims to meet the above objectives for the state of Manipur.

### ELECTRIFICATION IN MANIPUR

Population of Manipur has grown from 22.93 lakh in 2001 to 28.56 lakh in 2011 at a decadal growth of more than 24%. The number of households in Manipur in 2011 was at 5.54 lakh with 1.7 lakh households un-electrified.

As per census 2011, there are 2379 villages in the state of Manipur. As on March 2016, 2178 villages have been electrified leaving a balance of 201 un-electrified villages in the state. These villages are planned to be electrified by March 2018 under DDUGJY.

During the last four years, the state has undertaken extensive electrification of households under Government of India's RGGVY scheme. As on March 2015 there were about 155,060 (108,674 rural and 46,386 urban) household left for electrification in the state of Manipur. The electrification of rural households have been planned under different electrification schemes while households in urban area will be covered through system strengthening measures being taken up in urban areas under IPDS/RAPDRP. In DDUGJY, the state has planned to cover electrification of 19,000 households, while RGGVY 11<sup>th</sup> and 12<sup>th</sup> plan covers around 52,000 rural

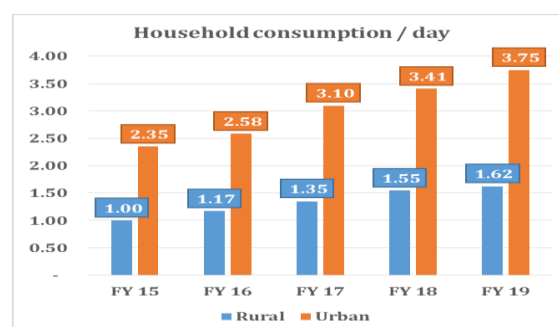
households. Balance 37,647 rural households covering 100 villages are proposed to be electrified under State Plan.

### DEMAND ESTIMATION

Energy requirement of Manipur during FY 2015 was 705 MU with 3.8% of deficit. The state currently provides on an average 20 hours of power supply in urban areas to domestic consumers and 16-18 hours in rural areas. With the above hours of supply, the average daily consumption of registered rural domestic consumers is 1.00 kWh in FY 2015. On the other hand, the average daily consumption of registered domestic urban consumers is 2.35 kWh in FY 2015.

For projection of demand for FY 2016 to FY 2019, CAGR of previous 6 years has been considered for all categories other than domestic consumers. Additionally, the expected demand from 100 km new railway line expected by FY 2019 and new commercial development in the state have also been considered for demand projections.

In case of domestic consumers, the electrification target along with daily household consumption based on historical trend and increase in number of hours of supply has been factored in. The projected daily household consumption till FY 2019 is projected as given below:

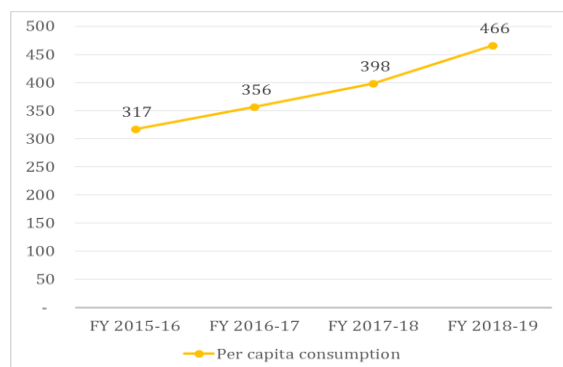


Keeping above in view, maximum demand of the state is expected to increase from 150 MW in FY 15 to 357 MW by FY 2019 and the energy requirement is projected to rise from 705 MU in FY15 to 1,325 MU in FY 2019.

Load factor in Manipur is around 42% and the same has been considered for computing the peak demand till FY 2019. Further, projections are based on AT&C loss reduction trajectory proposed by state from level of 52.33% in FY 2015 to 15% by FY 2019.

FY 5	FY 16	FY 17	FY 18	FY 19
<b>Energy Demand (MU)</b>				
705	890	893	1050	1325
<b>Maximum Demand (MW)</b>				
150	254	242	292	357

The above projections will also lead to increase in per capita electricity consumption to 466 kWh from 317 during FY 15 but it would be still lower than all India average of 1010 kWh in FY 2015.



## SOURCE OF POWER

The own generation in the state of Manipur is very less therefore it heavily relies on the allocations of power from Central Generating Stations like NHPC, NEEPCO, OTPC Pallatana Unit I and Tripura based Baramura power plant to meet its electricity requirement. The total installed capacity available for Manipur including firm share in Central Generating Stations (CGS) as on 31<sup>st</sup> March 2015 (allocated capacity in state, private, joint and CGS) is 182 MW. .

To meet the projected demand of 357 MW by FY 19, The State has been allocated 45.29 MW from Central Generating Stations and 23.66 MW from hydro stations in Bhutan. The state has also planned 15 MW renewable plants comprising solar PV and small hydro stations to meet the expected demand of the state in 2019. However, with this allocation, the state would still have power deficit in FY 2019 and would have to procure the additional energy from market on short-term basis.

With allocation from new generating sources such as NEEPCO Kameng HEP Stage I & II, Monarchak Gas Based Power Project, Punatsangchhu-II HEP, etc. the average cost of power is expected to increase from Rs. 2.97 / kWh to Rs. 3.46 / kWh. This is also on the account of increase in renewable capacity as per the target set by state.

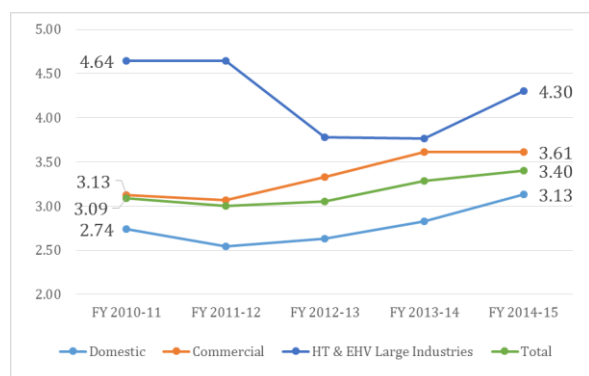
The present peak demand of Manipur is about 150 MW, the transformation capacity available at 132kV level is 517 MVA (100: Inter-state + 417: Intra-state) and there are 7 nos. of 132kV inter-state CTU lines (6 nos of 132kV lines and 1 no. of 400kV line charged at 132kV level) to feed power to Manipur. Thus, the existing transmission system is adequate to meet the present peak demand of the state.

The peak demand of Manipur in FY 19 period would be about 357 MW. The total planned transformation capacity by FY 19 would be around 832 MVA (100: Inter-state + 732: Intra-state) at 132kV level and 945 MVA (630: Inter-state + 315: Intra-state) at 400 kV level. With considerable capacity addition and system strengthening initiatives taken up by MSPCL, the planned transmission system seems to be adequate to meet future load demand of Manipur.

## DISTRIBUTION PLAN

Till February 2014, function of Transmission and Distribution in the state remained with Electricity Department of Manipur. From February 2014, Electricity Department of Manipur (EDM) was restructured and separated into two different entities, MSPCL and MSPDCL. MSPCL is responsible for transmission in the state while MSPDCL is the distribution company in the state.

MSPDCL is currently serving more than 2.8 lakh consumers of the State. Sales mix is significantly dependent on the domestic consumers to the extent of around 59%. Based on the electrification targets this share is expected to remain near 57% by FY 2019. The average billing rate for domestic consumers has reduced in past years with higher rural electrification, which has less tariff than urban areas. The average billing rate during last 5 years is shown below:



A snapshot of the existing distribution system in Manipur is shown below:

Particulars	Unit	FY 2015
Consumers	Lakh	2.8
Peak Demand	MW	150
Energy available	MU	678
33/11 KV S/s	Nos.	59
DTR	MVA	469
HT Line	kms	1221
LT Line	kms	7498

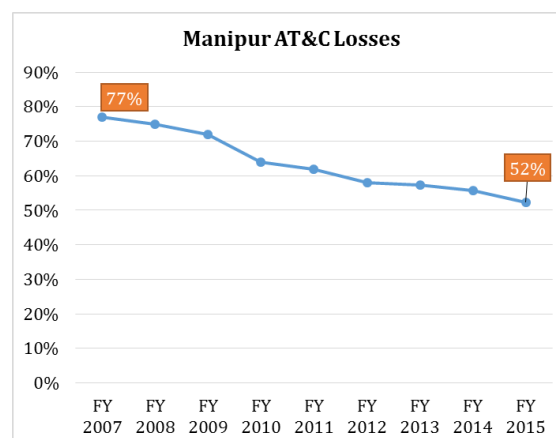
Metering in the state has been taken up on a large scale where electromechanical meters have been replaced with static meters at consumer level. State has also taken aggressive measures to install prepaid meters. Out of 2,80,783 consumers 1,38,930 consumers have prepaid meters and 81,128 consumers have post-paid meters.

### Prepaid metering plan:

The MSPDCL has planned to cover all its consumers in valley areas along with District Headquarters in Hilly areas with prepaid meters to cover its 85% to 90% consumers under this plan. Installation of prepaid metering will help MSPDCL in reducing its AT&C losses and improve its realization. Some of the improvements that MSPDCL has observed during last one year while implementing prepaid metering are:

- Drastic reduction in load demand
- Quality of power improved
- Multi fold increase in revenue collection
- 100% consumers satisfaction service delivery achieved
- 100% collection efficiency and billing efficiency for prepaid consumers
- Lower pilferage

The AT&C losses in Manipur has reduced from 77% in FY 07 to 52% in FY 15, which is an overall reduction of more than 24%.



MSPDCL has planned to further reduce its AT&C losses from 52% in FY 15 to 15% by the end of FY 19.

FY 15	FY 16	FY17	FY 18	FY 19
AT&C Losses				
52.33%	44.20%	25.15%	18.7%	15.0%

**Measures envisaged by state for bringing down AT&C losses are:**

1. Disconnection on non-payment of bills is being enforced stringently
2. Lodging of theft cases
3. Incentivizing consumers on arrear payment
4. Focus on bulk consumers
5. Coverage of 80% to 90% consumers under prepaid metering system
6. Timely completion of R-APDRP scheme
7. Increased use of underground cabling
8. Replacement of all existing LT cables with ABC cable for controlling pilferage by October 2016
9. 100% feeder metering for accurate energy accounting.

**To achieve the electrification target and AT&C loss reduction target, the distribution company would require an investment of 1399 Crores out of which 404 Crores are yet to be tied up.**

**The state requests Government of India to fund the gap for distribution network for achieving the 24 x 7 Power for All target.**

## FINANCIAL SUSTAINABILITY

After the unbundling of Electricity Department, MSPDCL prepared its first financial accounts in FY 2014. The accumulated reserves and surplus in books of account for MSPDCL as on 31<sup>st</sup> March, 2014 was Rs 1,238 Crore.

In normal circumstances i.e. adhering to the PFA targets and with no tariff hike in FY 18 and FY 19 and to achieve the objective of 24X7 power supply in the state, the state will be incurring annual loss of Rs. 185 crore in FY 19.

However, for state discom to start earning operating profit by FY 19 it will require yearly average tariff increase of 16% in each financial year FY 18 & FY 19.

On the basis of above considerations, a roadmap to achieve '24x7 Power for All' targets has been formulated and detailed in the report.

The financials as per the projections shows that MSPDCL will require considerable tariff hike in time along with subsidy support, which also include revenue and capital subsidy.



## TABLE OF CONTENTS

CHAPTER 1: INTRODUCTION.....	1
CHAPTER 2: ABOUT MANIPUR .....	3
CHAPTER 3: DEMAND AND SUPPLY SCENARIO .....	5
CHAPTER 4: GENERATION PLAN.....	11
CHAPTER 5: TRANSMISSION PLAN.....	16
CHAPTER 6: DISTRIBUTION PLAN .....	22
CHAPTER 7: RENEWABLE ENERGY.....	28
CHAPTER 8: ENERGY EFFICENCY.....	31
CHAPTER 9: FINANCIAL SUSTAINABILITY .....	32
CHAPTER 10:OTHER INITIATIVES .....	42
CHAPTER 11:ROLL OUT PLAN.....	45
ANNEXURES.....	47

# CHAPTER 1:INTRODUCTION

Power sector is a critical infrastructure element for growth of an economy. The availability of reliable, quality and affordable power is vital for rapid growth in agriculture, industry and for overall economic development of a State. An efficient, resilient and financially healthy power sector is an essential requirement for growth of a State and economic empowerment of the common man.

Under the Indian Constitution, electricity is a concurrent subject. As per Electricity Act 2003, it is the duty of a distribution licensee to develop and maintain an efficient, coordinated and economical distribution system in the mandated area of supply as well as to supply electricity in accordance with the provisions of the Act. The State Electricity Regulatory Commission (SERC), as per the provisions of the Act, specifies and enforces the standards with respect to quality and reliability of supply by licensees and monitors the performance of distribution companies (Licensees) based on notified performance standards.

## OBJECTIVES AND KEY OUTCOMES OF THE 24X7 POWER FOR ALL – JOINT INITIATIVE

The 24x7 Power for All (24x7 PFA) is a Joint Initiative of Government of India (GoI) and Government of Manipur (GoM) with the objective to make 24x7 power available to all households, industry, commercial businesses, public needs, any other electricity consuming entity.

Towards this goal the 24x7 PFA initiatives seeks to:

- i. Ensure reliable 24x7 supply to consumers within a period of three years

of commencement of the program.

- ii. The agricultural consumer on dedicated feeders will be provided with 10 hours of power supply.
- iii. Ensure that all unconnected households are provided access to electricity in a time bound manner in the next three years i.e. by end of FY 2019.
- iv. Ensure adequate capacity addition planning and ups with different power generation sources for availing power at affordable price to meet the projected power demand in future.
- v. Strengthen the transmission and distribution network to cater the expected demand growth.
- vi. Assess the financial measures including optimization of investments and measures for restructuring the balance sheet to ensure liquidity in the finances of the utility.
- vii. Strategic planning to ensure reduction of AT&C losses as per the agreed loss reduction trajectory between the GOI and Utilities and steps required to be taken.
- viii. Identify steps for implementation and adoption of modern technologies to monitor reliability of supply.
- ix. Identify steps for monitoring timely commissioning of various generating plants and transmission and distribution infrastructure to meet the expected growth in demand.
- x. To take measures for meeting the performance standards as laid down by SERC.

**This document is an action plan drawn to achieve the above aims and objectives. The Government of Manipur with support of Government of India will execute the plan, wherever necessary, as per their approved plans, schemes and policies.**

#### METHODOLOGY FOR PREPARATION OF THE ACTION PLAN FOR 24X7 POWER FOR ALL

The plan aims at the following:

- 1) Bridging the gap between the demand and supply for the existing and future growth,
- 2) Power Supply connection to all households and farm holdings.

Accordingly, the methodology adopted to prepare the 'Action Plan' for 24x7 PFA includes inter-alia:

- 1) Projection for average per day consumption of rural and urban households is taken considering the compounded annual growth rates (CAGR) during the past five years. Projection for demand growth of commercial, industrial and agriculture consumers is based again on the CAGR recorded during the past five years.
- 2) Assess the power requirement for all un-electrified households and preparation of a time bound plan for electrification of all households.
- 3) Project the annual energy requirement and maximum demand by aggregating the requirement of all consumer categories and using an appropriate load

factor and diversity factor for calculating the maximum demand.

- 4) Draw up a broad plan to meet power demand in future through
  - ✓ State's own upcoming generation sources.
  - ✓ Allocation from upcoming central sector power plants
  - ✓ Quantum of additional procurement required.
- 5) Assess the additional energy requirement for providing 24x7 power supply to all households in the State as well as to other consumer categories and determine financial implications on utilities for procuring additional energy and its implication on tariff.
- 6) Assess the adequacy of the network - both inter-State and intra State transmission as well as distribution so as to meet the projected power requirement of all consumer categories of the State.
- 7) To incorporate futuristic initiatives like smart grid, energy efficiency measures etc.
- 8) Conduct sensitivity analysis for cost of service and resulting financial gap under multiple scenarios, namely, tariff hike, reduction in power procurement cost and increase in interest and moratorium period and AT&C loss reduction, etc.
- 9) Set monitorable targets to achieve the goal of 24x7 Power for All in a cost effective manner to the consumers of the State.

## CHAPTER 2: ABOUT MANIPUR



Key Statistics	
Total Area	22,327 sq.km
Population	28,55,794
Population density (per.sq.km)	128
Per capita consumption of electricity	295 (against 1010 of India in FY 2014-15)
Total Installed Capacity in State	45 MW (Small hydro and Diesel)
Forest cover	77.4%
SGDP	3.95% for FY 2013
Literacy Rate	59.89%
Valley Districts	Imphal East, Imphal West, Thoubal and Bishnupur
Hill Districts	Ukhrul, Senapati, Tamenglong, Chandel, Churachandpur

**Manipur literally means “A jeweled land” nestle deep within a lush green corner of North East India.**

The state of Manipur is located in the North Eastern corner of India, with the city of Imphal as its capital. Manipur is bordered by the Indian states of Nagaland in the north, Mizoram in the south and Assam in the west. It also border Myanmar in the east as well as in the south.

According to the Census 2011 provisional population data, the population of Manipur was 28,55,794. The population density of the state is 128 persons per sq. km while the same for India was 382 persons per sq. km. The Manipur economy is mainly driven by secondary and tertiary sectors. The key industries in the state are tourism, handloom and handicraft, sericulture, food processing, khadi and bamboo processing. As per the Government of Manipur statistics, out of the estimated 34,358 manufacturing enterprises, 45.32% enterprises were engaged in Manufacture of textiles followed by 38.73% enterprises engaged in Manufacture of wearing apparel and 4.75% engaged in ‘Manufacture of wood and

products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials.

### POWER SECTOR DEVELOPMENTS IN MANIPUR

Electricity was introduced in the state of Manipur in 1930 with the commissioning of two micro hydel power stations having capacities of 100 KW and 56 KW. The capacity remained the same till the end of first five (5) year plan. An 11 KV transmission line was commissioned between Imphal and Leimakhong to evacuate power from these power stations. The state had only 26 km of 11 KV lines and 45 km of domestic lines to serve the limited number of consumers. The above assets were owned by Manipur State HE Board. Later the administrative control over electricity was transferred to Public Works Department, Government of Manipur. Subsequently from February 1970 onwards it was separated from Public Works



Department and started functioning independently.

The Electricity Department, Government of Manipur (EDM) was an integrated power utility in the state of Manipur since 1970. EDM was the deemed licensee and it was responsible for generation, transmission and distribution in the state.

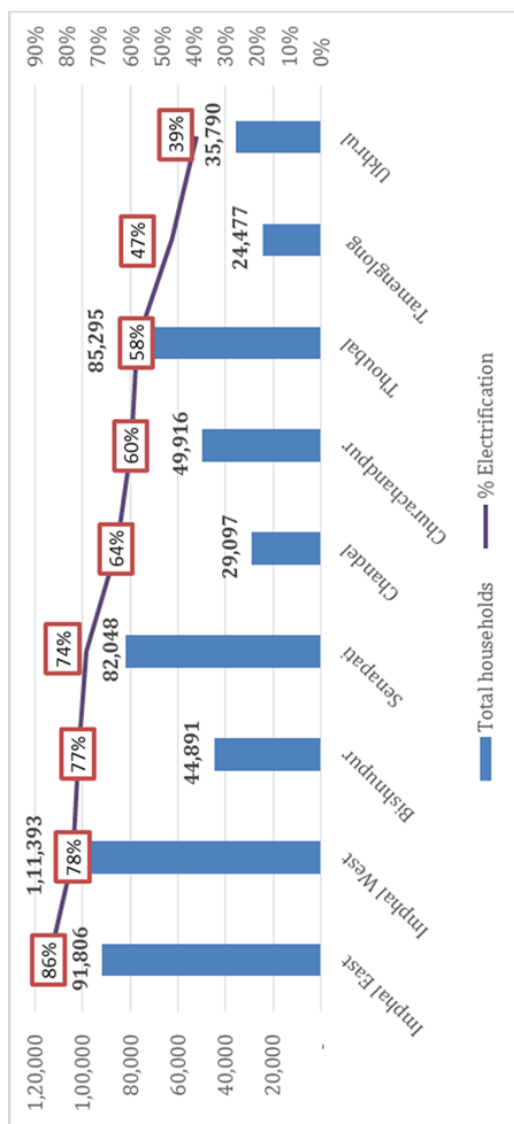
However, with effect from 1<sup>st</sup> February'2014, the Electricity Department of Manipur was restructured into two companies, the Manipur State Power Distribution Company Limited (MSPDCL) responsible for distribution and the Manipur State Power Corporation Limited (MSPCL) responsible for transmission function.

## CHAPTER 3: DEMAND AND SUPPLY SCENARIO

### STATUS OF ELECTRIFICATION

As per the census 2011, Manipur had 9 districts and a total of 5,54,713 households. The district wise total number of households and electrification is given below:

**Figure 1: Electrification status as per Census 2011**



- *Ukhrul and Tamenglong had the lowest electrification*
- *Imphal west had the highest number of households*

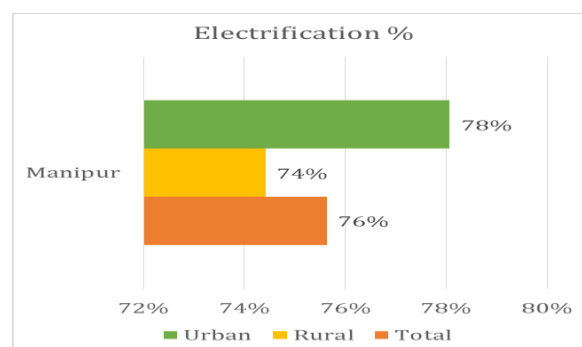
- *Imphal east had the highest electrification*

Based on the growth rate between census 2001 and census 2011, projected number of households in FY 2015 comes out to be 6,36,393. This is based on the yearly growth rate of 2.61% and 5.40% observed in rural and urban areas. The same has been compared with number of consumers in the system as on FY 15 under MSPDCL.

**Table 1: Projection of Census 2011 vs. State's Consumer**

	Particulars	Total	Rural	Urban
2001	Total Households	3,97,656	2,96,354	1,01,302
	Electrified Households	2,38,733	1,55,679	83,054
2011	Total Households	5,54,713	3,84,533	1,70,180
	Electrified Households	3,84,533	2,43,342	1,41,191
2015 Projections	Total Households	6,36,393	4,24,865	2,11,528
	Electrified Households	4,81,333	3,16,191	1,65,142
Consumers FY 15	Consumers	2,42,562	1,41,748	1,00,814

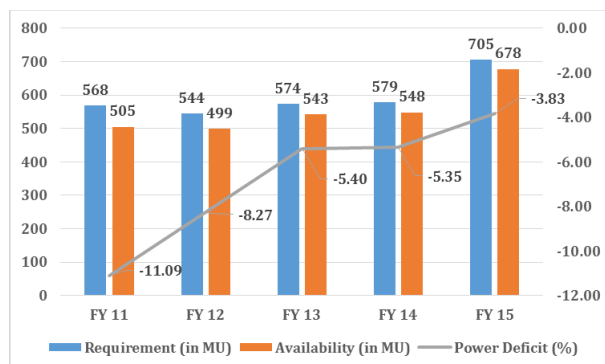
Electrification in the state at end of FY 15 based on the above calculation is shown below:



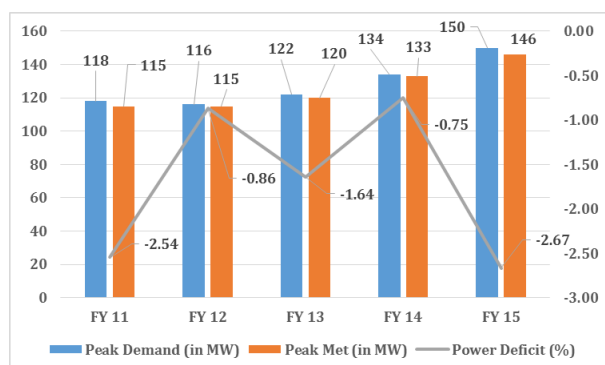
## PRESENT POWER SUPPLY POSITION

The actual energy and demand scenario during the past 5 years is shown below:

**Figure 2: Energy Requirement vs. Availability<sup>1</sup> (in MU)**



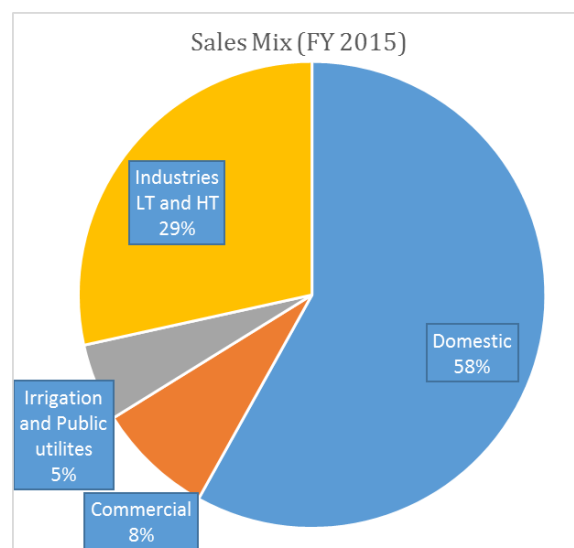
**Figure 3: Peak Demand vs. Peak Met (in MW)**



- *The peak demand deficit is being progressively bridged by Manipur*
- *The energy requirement in the State has increased on account of increase in domestic consumers which has increased its share from 54% to 58% in past 4 years*
- *However, the share of demand from HT and EHT consumers has remained constant at 28%*
- *The peak demand in the State has increased at a CAGR of 6% in past 5 years*

The sales mix in the state for FY 15 is as shown below:

**Figure 4: Sales Mix (FY 2015)**



## DEMAND PROJECTIONS

The energy requirement of Manipur during FY 2015 was 705 MU as per the CEA. Currently, the state is supplying on an average 18 hours of power to rural households and 20 hours of power supply to urban households. With 24 x 7 power supply planned across the State, the demand is likely to increase for all existing as well as new consumers in the State. The demand can be classified in three broad categories.

- Demand on account of 24x7 power supply to already electrified and newly built domestic households
- Demand from electrification of un-electrified domestic households.
- Demand on account of 24x7 power supply to other than domestic category.

<sup>1</sup> As per CEA data

## DEMAND ESTIMATION FOR DOMESTIC CONSUMERS AND HOUSEHOLD ELECTRIFICATION

The total number of households in Manipur as per Census 2011 was 5,54,713. Based on the growth rates observed during Census 2001 and Census 2011, total number of households for 2015 comes to around 6,36,393. Similarly, for calculating number of electrified households as on 2015, addition during 2011 and 2015 has been calculated under various schemes of Central Government and State Government. The same has been shown below:

**Table 2: Electrified Households in Manipur**

	2011 census	2015
<b>Particulars</b>		
<b>Total No. of Households</b>		
<b>Total</b>	<b>5,54,713</b>	<b>6,36,393</b>
Rural	3,83,313	4,24,865
Urban	1,71,400	2,11,528
<b>Electrified Households</b>		
<b>Total</b>	<b>3,84,533</b>	<b>4,81,333</b>
Rural	2,43,342	3,16,191
Urban	1,41,191	1,65,142
<b>Un-electrified</b>		
<b>Total</b>	<b>1,70,180</b>	<b>1,55,060</b>
Rural	1,39,971	1,08,674
Urban	30,209	46,386
<b>Discom Consumers</b>		
<b>Total</b>	<b>1,79,577</b>	<b>2,42,562</b>
Rural	1,02,714	1,41,748
Urban	76,863	1,00,814

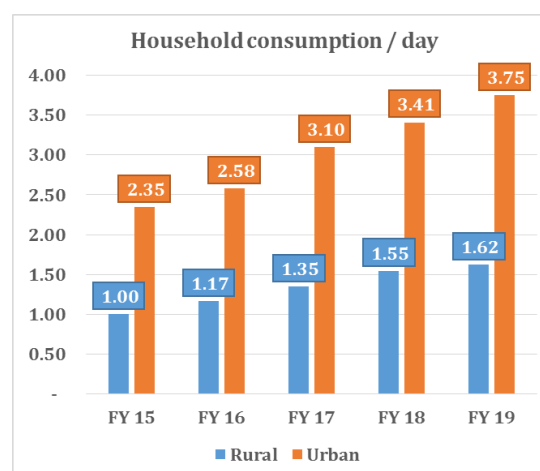
From the above table it is quite evident that, the number of electrified households in Manipur is very high compared to number of consumers in the ambit of MSPDCL. This is mainly attributed to high number of multiple households using single connection and unauthorized used of electricity by some households.

Considering the number of electrified households as per the projections, the actual daily electricity consumption in rural households comes to about 1.00 kWh in FY 2015. On the other hand, the daily electricity consumption of urban household comes to about 2.35 kWh in FY 15.

The broad approach considered for projections till FY 19 is highlighted below:

- (1) The daily household consumption has been computed separately for rural and urban households for FY 15 and escalated based on the expected growth rate of 5% and 10% in rural and urban areas to arrive at the daily household consumption up to FY 19. The growth rate for rural & urban areas has been taken after discussion with the State Government.
- (2) Increased number of supply hours has also been factored in for demand calculation.
- (3) Annual sales in domestic category has been arrived considering the projected households in both rural and urban categories would be consuming electricity at their respective projected daily household consumptions.

**Figure 5: Projected household consumption**



The average daily household consumption of existing electrified rural and urban households in FY 15 has been arrived by dividing actual sales in rural and urban areas for the whole State by the projected number of electrified rural and urban households in FY 15 respectively.

However, it may also be kept in view that the geographical features of the State (i.e. the location, accessibility, weather) along with current tariff structure are likely to play a



significant role in determining the current and future demands. The number of electrified households is expected to grow at the decadal CAGR of 2.67% in rural areas and at the decadal CAGR of 5.5% in urban areas. Also, to electrify the remaining 1,08,674 households in rural areas, phasing of electrification of 29% households in FY 2016, 46% households in FY 2017, 19% in FY 18 and remaining 5% in FY 2019 has been

considered. For electrification of balance 46,386 urban households, the connections will materialize along with the system strengthening works proposed under urban strengthening schemes like IPDS/ RAPDRP and accordingly phasing of electrification of 20% in FY 2016, 40% in FY 2017 and 40% in FY 2018 has been considered. Accordingly, the annual consumption of the domestic households is tabulated below for MSPDCL:

**Table 3: Projected Sales from Existing and Newly Electrified Households (Manipur)**

S.N.	Particulars	FY 15	FY 16	FY 17	FY 18	FY 19
<b>A</b>	<b>Rural - Electrified Consumers (Existing + Projected Growth)</b>					
	Electrified Consumers Rural (in Nos.)	3,16,191	3,24,432	3,32,888	3,41,564	3,50,467
	Actual Metered Sales (in MU)	116				
	Actual Daily Household Consumption	1.00				
	Projected Daily Household Consumption	5.00%	1.17	1.35	1.55	1.62
	Projected Annual Consumption		138	164	193	208
<b>B</b>	<b>Rural - Electrification of Un-Electrified Consumes</b>					
	Targeted Annual Addition Rural (in Nos.)		32,000	50,174	21,000	5,500
	Cumulative Annual Addition (In Nos.)		32,000	82,174	1,03,174	1,08,674
	Projected Annual Consumption		7	28	52	63
	<b>Total Projected Rural Consumption (MU)</b>		<b>145</b>	<b>192</b>	<b>245</b>	<b>270</b>
<b>D</b>	<b>Urban - Electrified Consumers (Existing + Projected Growth)</b>					
	Electrified Consumers Urban (in Nos.)	1,65,142	1,74,059	1,83,458	1,93,364	2,03,805
	Actual Metered Sales (in MU)	141				
	Actual Daily Household Consumption	2.35				
	Projected Daily Household Consumption	10.00%	2.58	3.10	3.41	3.75
	Projected Annual Consumption		164	207	241	279
	<b>Urban - Electrification of Un-Electrified Consumes</b>					
	Targeted Annual Addition urban (in Nos.)		9,277	18,554	18,554	
	Cumulative Annual Addition (In Nos.)		9,277	27,832	46,386	46,386
	Projected Annual Consumption		4	21	46	63
<b>E</b>	<b>Total Projected Urban Consumption (In MU)</b>		<b>168</b>	<b>228</b>	<b>287</b>	<b>342</b>
	<b>Total Projected Domestic Urban Consumption (In MU)</b>		<b>314</b>	<b>421</b>	<b>532</b>	<b>613</b>

#### DETERMINATION OF CONSUMPTION OF OTHER CONSUMERS

For projection of sales for FY 16 to FY 19, the CAGR of previous 6 years has been considered for all categories. A discrete load of 40 MW from traction in FY 19 and

incremental load from commercial development in Moreh border of 10 MW has also been factored in while projecting sales.

Based on this, the category wise sales for the state are summarized in the following table:

Figure 6: Consumption Share

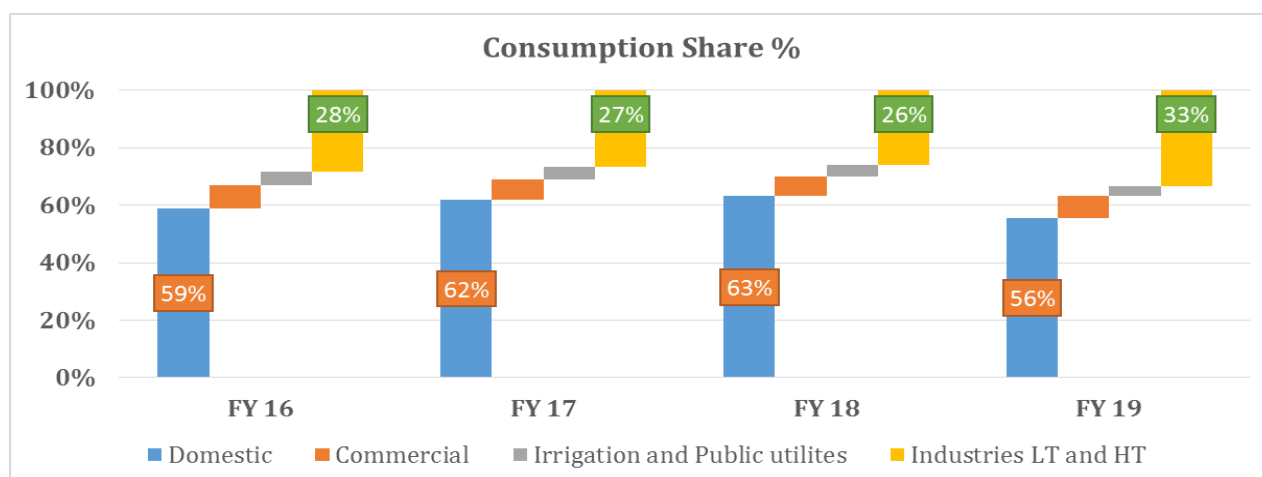


Table 4: Projected Category wise Sales (In MU)

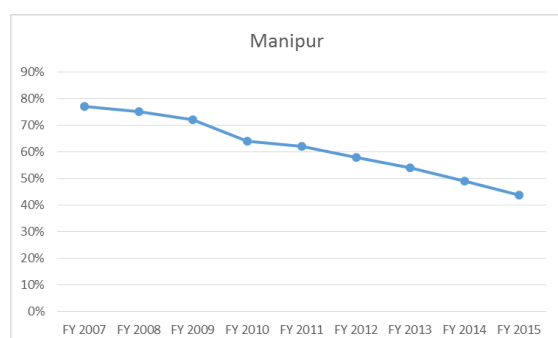
	FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19
Domestic	314	421	532	613
Commercial	42	49	57	85
Irrigation/ Pumping	3	3	3	3
Public Lighting	5	6	7	9
LT Industrial (Low & Medium)	21	25	29	34
Public water works	19	21	23	25
HT Bulk Supply (Domestic)	112	131	152	177
HT & EHV Large Industries	17	25	40	156
<b>Total</b>	<b>532</b>	<b>680</b>	<b>843</b>	<b>1101</b>

- As seen from above, the share of HT and EHT is likely to increase to 32% from 28% considering load from traction
- Domestic consumption will increase by 138% while its share is likely to reduce with higher consumption in commercial and HT and EHV consumers

## ENERGY AND DEMAND REQUIREMENT

The trajectory for AT&C loss reduction as per State targets has been taken into account for preparing this document.

Figure 7: Historical AT&C losses



Considering the collection efficiency to increase to 99% in Manipur from existing 85%, AT&C Loss trajectory, estimated

energy requirement and maximum demand is shown in the following table:

Table 5: AT&C loss targets and demand estimates for Manipur

FY 15	FY 16	FY 17	FY 18	FY 19
<b>AT&amp;C Losses</b>				
52.33%	44.20%	25.15%	18.7%	15.0%
<b>Energy Demand (MU)</b>				
705	890	893	1050	1325
<b>Maximum Demand (MW)</b>				
150	254	242	292	357

Load factor in Manipur is around 42% and the same has been considered for computing the peak demand till FY 19. Maximum demand of the State is projected to increase from ~150 MW in FY 15 to **357 MW in FY 19**. As per projections made in 18<sup>th</sup> EPS of CEA, projected energy requirement and maximum demand for the State was 1405

MU and 399 MW in FY 19 as against the now calculated energy requirement of 1325 MU and maximum demand of 357 MW in FY 19.

An assessment of adequacy of generation,

transmission and distribution infrastructure for meeting projected annual energy requirement of 1325 MU and maximum demand of 357 MW has been made in subsequent chapters of this document.

**Table 6: Energy Requirement (In MU) and Peak Demand (in MW)**

Source	Energy Scenario			
	FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19
<b>Energy Requirement within State</b>				
<i>Sales (MU)</i>	532	680	843	1101
Distribution loss	38.00%	21.21%	17.04%	14.14%
AT&C losses	44.20%	25.15%	18.70%	15.0%
Collection Efficiency	90%	95%	98%	99%
Transmission losses	3.60%	3.40%	3.20%	3.20%
<b>Total Energy Requirement within State (MU)</b>	<b>890</b>	<b>893</b>	<b>1050</b>	<b>1325</b>
<b>Maximum Demand (MW)</b>	<b>254</b>	<b>242</b>	<b>292</b>	<b>357</b>

## CHAPTER 4: GENERATION PLAN

### CUMULATIVE AVAILABILITY

### GENERATION

Commissioning of the two hydel sets having capacities of 100 KW and 56 KW at Leimakhong in 1930 by the then Manipur State Hydro Electricity Board marked the beginning of the use of electricity in Manipur. The Royal palace and main areas of Imphal Town had access to electricity from this hydel station. Later on with increase in demand in the state, diesel generation sets were added which however did not meet the overall state's demand.

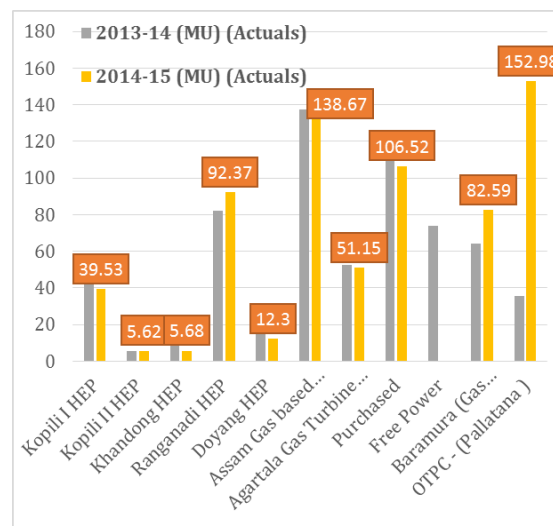
At present, own generation in the state of Manipur is very less therefore it heavily relies on the allocations of power from Central Generating Stations like NHPC, NEEPCO, OTPC Pallatana Unit I and Tripura based Baramura power plant to meet its energy requirement.

Manipur has been gifted with a fairly high hydro power potential. However, the major portion still remaining untapped due to financial and environmental bottlenecks. Currently, the State is having one furnace oil based generating station at Leimakhong (6x6 MW) in standby mode, a few diesel generating stations along with one micro hydroelectric generating plants with an installed capacity of 0.60 MW. Manipur in total has an installed capacity of 45.11 MW.

Manipur is highly dependent on power sources outside its state. It currently gets power from NHPC, NEEPCO, ONGC Tripura Power Corporation (OTPC) Unit I and

Baramura gas turbine power project. The allocated firm share from the Central sector generating stations is currently around 182 MW.

Figure 8: Source of power outside Manipur



Manipur has met a maximum demand of 146 MW in FY 2015 and the present annual energy requirement of the State is of the order of 705 MU. By FY 19 the maximum demand and the energy requirement in the state is expected to increase to 357 MW and 1,325 MU respectively.

### PLANNED CAPACITY ADDITION

To meet the increasing demand, state has been allocated the share in number of generating stations (hydro, coal based etc.) by FY 19. Existing and additional capacity available from various sources (along with the expected year of commissioning) is summarized below:



**Table 7: Summary of Existing Firm Availability from Various Sources**

Source	Type	Capacity (MW)	Latest Firm Entitlement		Gross Generation (MU)
			%	MW	
<b>Central Generating Stations</b>					
NHPC LOKTAK (Free power)	Hydro	105.00	37.73%	39.62	121.46
<b>Central Generating Stations</b>		<b>105</b>	<b>37.73%</b>	<b>39.62</b>	<b>121.46</b>
<b>Availability Within State</b>				<b>39.62</b>	<b>121.46</b>
<b>Availability Outside State</b>					
<b>Independent Power Producers / Join Ventures (IPPs / JVs)</b>					
TSECL BARAMURA UNIT IV AND V	Gas	42.00	25.00%	10.50	78.18
<b>Independent Power Producers / Join Ventures (IPPs / JVs)</b>		<b>42.00</b>	<b>25.00%</b>	<b>10.50</b>	<b>78.18</b>
<b>Central Generating Stations</b>					
NEEPCO KOPILI	Hydro	200.00	7.39%	14.78	51.79
NEEPCO KOPILI – II	Hydro	25.00	6.95%	1.74	6.09
NEEPCO KHANDONG	Hydro	50.00	6.56%	3.28	11.49
NEEPCO DOYANG	Hydro	75.00	7.87%	5.90	20.68
NEEPCO RANGANADI	Hydro	405.00	8.37%	33.90	118.78
OTPC PALATANA	Gas	726.00	6%	42.04	202.53
Assam Gas based Power Project	Gas	291.00	8.11%	23.60	155.05
Agartala Gas Turbine Power Project	Gas	84.00	8.31%	6.98	48.92
<b>Central Generating Stations</b>				<b>132.21</b>	<b>615.33</b>
<b>Availability Outside State</b>				<b>142.21</b>	<b>693.51</b>
<b>Grand Total</b>				<b>181.84</b>	<b>814.51</b>

**Table 8: Summary of Additional Firm Availability from Various Sources**

Source	Type	Capacity (MW)	Latest Firm Entitlement		Gross Generation (MU)	Tentative Expected date
			%	MW		
<b>Availability Within State</b>						
<b>Renewable Energy Sources</b>						
Phase1	Solar	7	100%	7	9	FY 2017
Phase 2	Solar	3	100%	3	4	FY 2018
Hydro	Small Hydro	5	100%	5	17	FY 2019
<b>Renewable Energy Sources</b>		<b>15</b>		<b>15</b>	<b>30</b>	
<b>Availability Within State</b>		<b>15</b>		<b>15</b>	<b>30</b>	
<b>Availability Outside State</b>						
<b>Central Generating Stations</b>						
NTPC BONGAIGAON UNIT 1	Gas	250.00	5.33%	13.33	99.22	FY 2016-17
NEEPCO Kameng HEP Stage I	Hydro	300.00	2.33%	6.99	24.49	FY 2016-17
NEEPCO Kameng HEP Stage II	Hydro	300.00	2.33%	6.99	24.59	FY 2017-18
NEEPCO Pare HEP	Hydro	110.00	7.00%	7.70	26.98	FY 2016-17
NEEPCO Turial HEP	Hydro	60.00	7.00%	4.20	14.72	FY 2017-18
Agartala Gas Turbine Power Project- EXT	Gas	51.00	4.00%	2.04	13.40	FY 2016-17
Monarchak Gas Based Power Project	Gas	101.00	4.00%	4.04	26.54	FY 2016-17
<b>Central Allocation</b>				<b>45.29</b>	<b>229.94</b>	

Source	Type	Capacity (MW)	Latest Firm Entitlement		Gross Generation (MU)	Tentative Expected date
			%	MW		
Punatsangchhu-II HEP	Hydro	1020.00		13.87	103.28	FY 2017-18
Mangdechhu HEP	Hydro	720.00		9.79	72.90	FY 2018-19
<b>Power from Bhutan</b>				<b>23.66</b>	<b>176.18</b>	
<b>Availability Outside State</b>				<b>68.95</b>	<b>406.12</b>	
<b>Grand Total</b>				<b>84</b>	<b>436</b>	

\* Share allocation of some of the CGS is tentative as firm allocation is yet to be done by MoP.

The table below summarizes the availability of power from various sources including the existing and upcoming capacity availability in FY 19:

**Table 9: Projected Firm Share Allocations from Various Sources (in MU)**

Sr. No.	Source	Energy Availability in MU			
		FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19
	<b>Availability Within State</b>				
<b>A</b>	Renewable Energy Sources	0	9	12	30
<b>B</b>	Central Generating Stations	109	109	109	109
<b>Sub total</b>	<b>Availability Within State</b>	<b>109</b>	<b>118</b>	<b>120</b>	<b>139</b>
	<b>Availability Outside State</b>				
<b>A</b>	Central Generating Stations	551	726	826	918
<b>B</b>	Other Generating Sources	74	74	74	74
<b>Subtotal</b>	<b>Availability Outside State</b>	<b>624</b>	<b>800</b>	<b>900</b>	<b>992</b>
<b>Grand Total</b>		<b>733</b>	<b>918</b>	<b>1020</b>	<b>1131</b>

\*Renewable energy source factored

Availability from hydro and other renewable sources, which inherently have low capacity utilization factor, has been appropriately factored for computation of energy availability from existing and upcoming generating stations. The year wise energy requirement and energy availability in the state is as under-

**Table 10: Projected Energy Availability from Firm Share/Long Term Tie-Ups (in MU)**

Source	Adequacy of Energy Availability			
	FY 16	FY 17	FY 18	FY 19
<b>Total Energy Requirement</b>	<b>890</b>	<b>893</b>	<b>1050</b>	<b>1325</b>
Proposed Energy Availability from Long Term Firm Tie-ups	733	918	1020	1131
Targeted Energy Availability from Long Term Firm Tie-ups	801	804	945	1193
<b>Adequacy of Power Supply</b>	<b>Inadequate</b>	<b>Adequate</b>	<b>Adequate</b>	<b>Inadequate</b>
<b>Excess energy (MU)</b>	<b>-</b>	<b>24</b>	<b>-</b>	<b>-</b>

For determining the adequacy of energy availability, it is considered that the State should be able to meet 90% of its projected energy requirement through firm allocations/tie-ups only. For the balance

10%, the State has to effectively plan (through comprehensive power procurement planning on short term and medium term basis) and look for procurement of power either through

competitive bidding or power exchange or through other sources on short term/medium term basis. It is seen from above table that availability from tied-up firm share will be inadequate during FY 16 and FY 19.

As Manipur is expected to see a short fall in its power availability, it has to plan for tying up of additional power requirement. The state will also have to plan for capacity addition in its own by tapping the hydro potential.

#### INITIATIVES TAKEN UP THE STATE FOR TAPPING THE HYDRO POTENTIAL

Manipur has an estimated hydropower potential of about 2190 MW, which is exclusive of the potential pertaining to the small hydropower projects. Out of this available potential, so far only 105 MW Loktak Hydroelectric Project could be developed under Central Sector. Thus, there is ample scope of Hydro Power Development in Manipur.

The State Power Department has so far identified eight numbers of hydropower projects, which are at different stages of implementation. Details of the status of these projects is shown in Table 11:

**Table 11: Hydropower projects identified by the State**

Sr. no.	Name of Project	Capacity (MW)	Agency	Status/Remarks
1.	Loktak Down Stream HE-Project	66	Jointly by NHPC & Manipur	Being implemented
2.	Tipaimukh HE-Project	1500	Jointly by NHPC, NEEPCO & Manipur	Being implemented
3.	Irang HE-Project	60	NEEPCO	Survey & Investigation is in progress by NEEPCO
4.	Tuivai HE-Project	51	-do-	-do-
5.	Nungleiband HE-Project	105	LDHCL	Being allotted to Loktak Downstream Hydroelectric Corporation Limited (a JV Company formed between NHPC and Govt. of Manipur)
6.	Pabram HE-Project	190	NEEPCO	Survey & Investigation is in progress by NEEPCO
7.	Khongnem Chakha HE-Project	67	-do-	-Do-
8.	Maklang – Tuyungbi HE-Project	45	Yet to be allocated	PFR available

Meanwhile, the State Government in its effort for proper and speedy development of its hydro potential has also adopted a state Hydro Power Policy called “Manipur Hydro Power Policy-2012” with effect from 29th October, 2012. The Policy covers

development of the Hydro Power projects having capacities more than 5 MW.

Further, the State Government is also trying to reassess / study the hydropower potential of the state including that of the Small Hydro

Power projects with the latest available technology and modern approach. Identification of each project sites on the ground shall be also a part of the study.

#### ACTION POINTS FOR THE STATE

##### OPTIMIZED POWER PURCHASE AND SALE PLANNING

As seen from previous sections, there is considerable shortfall in power available (10%-15%) during FY16 and FY19. The State needs to optimize its power purchase and should look forward for tying up additional power through short, medium

and long term basis to meet its energy requirement.

#### GOVERNMENT OF INDIA INTERVENTION

##### SURRENDERING OF POWER

Since, the upcoming power allocation of 40 MW from all the three units of NTPC Bongaigaon Thermal Power Station is expected, it is requested that GoI may limit its allocation to 13.33 MW (Only from unit-1). The state would like to surrender the remaining 26.66 MW of power from this plant.



## CHAPTER 5: TRANSMISSION PLAN

The transmission function in the state of Manipur is performed by Manipur State Power Company Ltd (MSPCL). MSPCL is responsible for the intra-state network in the state till 33 kV level. A well planned and strong transmission system will ensure not only optimal utilization of transmission capacities but also of generation facilities and would further facilitate achieving ultimate objective of cost effective delivery of reliable power to end consumers.

The total energy requirement for Manipur for the FY 2018-19 is estimated at 1,325 MU and the maximum demand as 357 MW. Since, most of this power will be wheeled into Manipur from neighboring states, assessment of Interstate transmission network becomes very important. This chapter will discuss about the existing network and upcoming network planned to meet the increasing demand both at interstate and intrastate.

### EXISTING INTER-STATE TRANSMISSION SYSTEM (ISTS)

The Inter-state power transmission is operated at 400 kV and 132 KV voltage system constituting the existing Dimapur-Imphal and Leimatak- Jiribam 132 KV lines of Power Grid Corporation of India Limited (PGCIL) and 400 kV Silchar Imphal line, as shown below:

**Table 12: Interstate Transmission Lines**

Sl. No.	Line Name	Ckts	Length (Ckt-km)
<b>400 kV</b>			
1	Imphal(PGCI) - Silchar	D/C	166
<b>132 kV</b>			
1	Leimatak - Jiribam (PGCI)	S/C	82.4

Sl. No.	Line Name	Ckts	Length (Ckt-km)
2	Leimatak - Imphal (PGCI)	S/C	35
3	Imphal (PGCI)- Dimapur	S/C	168.9
4	Jiribam (PGCI) - Aizawl (PGCI) via Tipaimukh	S/C	172.3
5	Imphal (PGCI) - Imphal (Yurembam)	S/C	0.8

The total transformation capacity of **100 MVA at 132 kV** is currently being maintained at Imphal sub-station to serve Manipur and another 132 kV Switching Station is maintained at Jiribam by PGCIL.

### PLANNED INTER-STATE TRANSMISSION SYSTEM (ISTS)

Since, most of the power is planned to be procured through sources outside the state, it has been planned to upgrade one of 132/33kV substation at Imphal to 6x105 MVA (6 single-phase transformers plus one spare) 400/132kV to cater to the load growth of the State. Further, about 240 ckm of 400 kV lines would be implemented through TBCB to provide better connectivity to the state.

- A. Future System Strengthening Schemes (PGCIL)
  - a. NERSS-IV [Upgradation 6x105 MVA (6 single phase transformers plus one spare), 400/132 kV S/s at Imphal]
  - b. Operation of Silchar-Imphal 400kV D/c line to its rated voltage
- B. NERSS-VII [Re-conductoring: Imphal (PG) – Yerumbam 132kV S/c line with HTLS]

C. Future System Strengthening Schemes (Through TBCB)

- a. NERSS-VI [Imphal – New Kohima – New Mariani 400kV D/c] 230 ckm

Under NERPSIP (Tranche-1) PGCIL has planned to establish

- i. New 132/33 kV sub-station at Gamphazol of capacity 2x20 MVA and establish new 132/33 kV sub-station at Tamenglong of capacity 2x20 MVA and augmentation of existing 132/33 KV Sub-Station at Kongba, Ningthoukhong, Jiribam and Ukhrul by installation of additional 20 MVA transformer.
- ii. New 13 nos of 33/11 KV Sub-Station with 131.5 MVA
- iii. Augmentation of 22 nos of existing 33/11 KV Sub-Station with additional 146.5 MVA.

#### EXISTING POWER EVACUATION & INTRA STATE TRANSMISSION SYSTEM

To evacuate power from captive micro hydel power station (100 + 56) kW at Leimakhong to specific load centres of Palace Compound and main bazaar area of Imphal, 20 km long, 11 KV line between Imphal & Leimakhong was constructed for the first time in 1930. Owing to increased demand, 132 kV Intra state transmission line from Imphal to Dimapur and 6.3 MVA (132/33 kV) substation at Yurembam were commissioned in December 1981 to purchase power from Assam. The situation further alleviated with commissioning of Loktak Hydel Electric Project of capacity 3x35 MW in 1984.

During the years from 1984 to 1996, a number of Central Sector Power Projects, mostly hydel projects in the North Eastern Region were commissioned. Every project has a share of about 7% for Manipur.

After enactment of Electricity Act 2003 various reforms have been initiated in power sector and finally Electricity Department Manipur (EDM) has been restructured into two separate entities from 1st February, 2014, viz.

- Manipur State Power Distribution Company Limited(MSPDCL)
- Manipur State Power Company Limited(MSPCL)

MSPCL is looking after transmission function up to the level of 33 kV.

The following are the network details of MSPCL

- i. Leimatak, Imphal, Dimapur 132 kV Line.
- ii. Leimatak, Jiribam 132 kV line.

Manipur, being a hilly state with its population unevenly dispersed and spread over remote corners, it is having large network of transmission and Sub transmission system.

**Table 13: Existing Intrastate lines**

Voltage	Transmission Line	
	Double ckm	Single ckm
132 kV	87.4	472.7
33 kV	69.0	1403.6

**Table 14: Existing Intrastate Substations**

Voltage	Sub Station (Nos)	Capacity (MVA)
132 kV	11	417
33 kV	71	492

#### PLANNED INTRA-STATE TRANSMISSION SYSTEM UP TO FY 2019

The demand in state is expected to increase to 357 MW which will be met through allocation from central generating stations and plants mainly located outside the state.

The contracted capacity as on date in Manipur is 182 MW which is expected to increase up to 223 MW, 246 MW and 266 MW respectively in FY 2016-17, FY 2017-18 and FY 2018-19. The expected commissioning of new generating units namely NTPC Bongaigaon Unit I, NEEPCO Monarchak Gas Based Power Project, Kameng HEP, Pare HEP, Tuirial HEP and solar based renewable power as per the MNRE targets will also add up the capacity. The required transmission network at 132 kV and 33 kV has been planned by MSPCL to meet the required demand in the state.

The MSPCL has started construction of 5 (five) new 132/33 KV Sub-Stations at Thanlon, Tipaimukh, Elangkhangpokpi, Moreh and Thoubal with planned capacity addition of 155 MVA with addition of 355 ckm of 132 kV line by FY 2019. In addition there is plan to enhance transformation capacity at 33 kV level to 648.35 MVA by FY 2019 (including NERPSIP Tranche-I schemes).

Transformation capacity enhancement plan at 33 KV level includes construction of 2 (two) nos. of GIS Sub-Stations at (i) Capitol Project and (ii) Pishum. These two sub-stations will be supplied from Imphal P/H sub-station by 33 KV underground cable. 39 (thirty nine) nos. of old 33 KV sub-stations are being renovated and modernized.

Manipur is also constructing a new 315 MVA 400/132kV sub-station at Thoubal (single phase transformer with one spare), along with Imphal (PG) – Thoubal 400 kV D/c line (45.1 ckm).

**Table 15: Planned intra-state transmission line addition by FY 19**

Voltage	Transmission Line	
	Double ckm	Single ckm
400 kV	45	0
132 kV	14	341
33 kV	6	386

**Table 16: Planned accumulated capacity for Intrastate**

Particulars	Existing	FY 2019
400 kV intra state (MVA)	0	315
132 kV intra State (MVA)	417	732
33 kV Transformation capacity (MVA)	492	1140

## ADEQUACY OF NETWORK ADDITION

The present peak demand of Manipur is about 150 MW, the transformation capacity available at 132kV level is 517 MVA (100: Inter-state + 417: Intra-state) and there are 7 nos. of 132kV inter-state CTU lines (6 nos of 132kV lines and 1 no. of 400kV line charged at 132kV level) to feed power to Manipur. Thus, the existing transmission system is adequate to meet the present peak demand of the state.

The peak demand of Manipur in FY 19 period would be about 357 MW. The total planned transformation capacity by FY 19 would be around 832 MVA (100: Inter-state + 732: Intra-state) at 132kV level and 945 MVA (630: Inter-state + 315: Intra-state) at 400 kV level. With considerable capacity addition and system strengthening initiatives taken up by MSPCL, the planned transmission system seems to be adequate to meet future load demand of Manipur.

## SYSTEM STRENGTHENING INITIATIVES (INTRA-STATE)

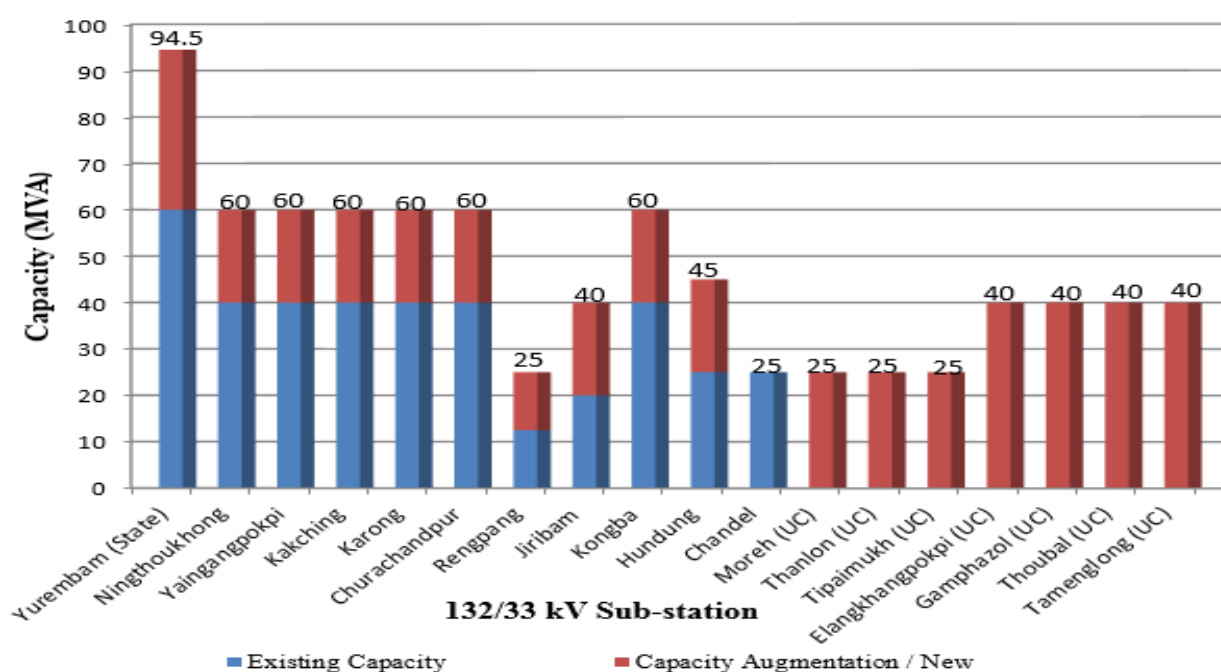
To enhance reliability in delivering power to all, MSPCL has taken up the following initiatives on priority:

- Completion of second circuit Yaingangpokpi – Kongba – Kakching 132 kV line under North Eastern Region System Improvement Project (NERSPIP) to complete Yurembam – Ningthoukhong – Churachandpur –

- Kakching – Kongba – Yaingangpokpi – Yurembam 132 kV Ring Main Double Circuit.
- ii) Construction of Yurembam (PGCIL) to Ningthoukhong D/C line under NERSPIP.
  - iii) Renovation of Yurembam – Karong – Mao (Manipur-Nagaland border) section of Yurembam – Karong – Kohima 132 kV S/C line under NERSPIP.
  - iv) Renovation of Leimatak – Jiribam (State) 132 kV S/C line under NERSPIP.
  - v) Construction of additional Leimatak – Ningthoukhong S/C line on D/C Tower to mitigate 97 MW loading on the existing S/C line projected by Load Flow Study.
  - vi) Construction of third 132 kV link between Yurembam, (PGCIL) & Yurembam (State) with provision for replacement with HTLS conductor later on to enhance power availability at Yurembam (State) Bus.
  - vii) Construction of Yurembam (PGCIL) – Yurembam (State) 33 kV link on 4 Multi-circuit Towers, 4 feeders.
  - viii) Construction of Yaingangpokpi – Khuman Lampak 33 kV D/C line on steel tubular pole (STP).
  - ix) Renovation & Modernisation of 39 nos. of old 33 kV Substations.
  - x) Imphal (PGCIL) 400 KV sub-station is planned to feed the 132 KV substations at Yurembam, Ningthoukhong, Karong, Churachandpur, Thanlon, Elangkhangpokpi.
  - xi) Thoubal 400 KV Sub-station is planned to feed the 132 KV substations at Kongba, Yaingangpokpi, Hundung, Kakching, Thoubal, Moreh

In case of eventuality of any one of the two 400 kV Sub-stations going out of service, the remaining healthy 400 KV sub-station will act as the Nodal Injection Point for Yurembam – Yaingangpokpi – Kongba – Thoubal – Kakching – Elangkhangpokpi – Churachandpur – Ningthoukhong – Yurembam 132 kV Ring Main Circuit. This will bring about overall improvement and flexibility in supply and distribution of electricity in the state.

Figure 9: Capacity enhancement of 132/33 kV sub-station in Manipur



## INTRA-STATE GRID MANAGEMENT

As stipulated in the Section 31 of the Electricity Act 2003, State Load Despatch Centre is being established at Yurembam, Imphal for efficient intrastate grid management. The project is being taken up by PGCIL based on recovery of investment through tariff fixed by CERC with target completion by November 2016. The project envisages providing of RTU with SCADA facility in the existing 11 (eleven) nos. 132 kV Sub-Stations. In addition, under the NER Wide Band Expansion Project, PGCIL has also taken up the work for providing communication link of 365 km OPGW with the above 132 KV sub-stations to main control center under the existing SLDC Scheme. The scheme will connect intra-state and inter-state link at 132 kV grid and this will further link to NRELDC at Shillong.

Meanwhile, MSPCL has also planned to take up a project for integration of 81 nos. 33 kV sub-station (including newly planned sub-station) to Control Center at SLDC, Manipur at an estimated cost of Rs 77 crore (inclusive of ED, SCT, Manipur Sales Tax and other necessary charges) with assistance from any available funding

agency. The project highlights is given below:

Particulars	Details
<b>Name of the project</b>	33kV System integration with SLDC system in Manipur
RTUs	81 Nos.
Fiber Optic Cable Network	i) ADSS - 1366 kms ii) OPGW - 30 km
Communication Channel Capacity	STM1/4, 155Mbps/622Mbps
Wide Band Nodes	81 Nos.

## FUND REQUIREMENT (INTRA-STATE)

Apart from funding by State Government, around 15 substations are planned to be funded by World Bank under NERPSIP scheme to be implemented by PGCIL but would be part of intra-state network.

Other planned projects including new substations and lines, renovation and augmentation of existing projects and construction of SLDC would require around Rs. 1177 crore by end of FY 19. Summary of total fund requirement for intra-state network by FY 19 is as shown in the table below:

**Table 17: Fund requirement for intra-state schemes**

Sl. No.	Category of Scheme	Amount in Rs. crore			
		FY 2016-17	FY 2017-18	FY 2018-19	Total
1	400/132 kV Substation	102.28	68.19	-	170.47
2	400 kV line	118.55	79.03	-	197.58
3	132/33 kV Substations	77.92	79.48	-	157.40
4	132 kV lines	117.63	77.95	67.93	263.50
5	33/11 kV Substations	33.39	37.82	85.04	156.25
6	33 kV lines	13.76	11.98	26.93	52.67
7	33 kV System Integration with SLDC system in Manipur	23.10	23.10	30.80	77.01
8	Renovation and Upgradation of Grid Substations in Manipur	14.71	22.07	-	36.78
9	Renovation and Modernization of 33/11 kV substations in Manipur	41.48	41.48	55.30	138.25
10	Project under NERPSIP Tranche-I	161.67	121.25	121.25	404.17
<b>Total fund requirement :</b>		<b>704.49</b>	<b>562.34</b>	<b>387.26</b>	<b>1654.08</b>



## ACTION POINT FOR STATE GOVERNMENT

- The State will implement all the existing and the planned projects on time to ensure availability of transmission system for 24 x 7 power supply.
- The State government shall provide the necessary help (i.e. Right of Way clearance, Forest clearance if any, land acquisition etc) to STU for installation of new substation and associated transmission lines to provide 24x7 power to all in Manipur.
- State needs to make adequate budgetary provision towards building transmission infrastructure and eliminating bottlenecks.
- MSPCL will monitor the loading of lines and substations on periodic basis keeping in view the actual growth in loading of the

load centres along with changes in consumer mix.

- Evaluate Smart Grid related interventions and prepare phased introduction plan in view of the emerging needs of the State. Government of Manipur may also seek funding under National Smart Grid Mission (NSGM) for development of Smart cities in the state.

## GOVERNMENT OF INDIA INTERVENTIONS

- **Mitigation of Right of way constraints and availability of land:** GoI, MoP has issued guidelines on 15<sup>th</sup> October 2015 on providing compensation for acquiring Right of way for Transmission Line.
- Support MSPCL in securing financing for the remaining schemes proposed under the PFA Roadmap from suitable multilateral/ bilateral donor funding organizations.

## ROLL OUT PLAN - TRANSMISSION

**Table 18: Rollout Plan (Transmission)**

S. No.	Category	Base year scenario (FY 15)	FY 16	FY 17	FY 18	FY 19	Total Length/ Capacity added	Total at end of FY 19
<b>TRANSMISSION</b>								
<b>Transmission Lines (CKM):</b>								
1	132kV Lines	475	85	54	132	170	441	915
2	33 kV lines	1250	154	98	105	190	546	1796
3	400kV Lines	0	0	0	45	0	45	45
	<b>Total Length :</b>	1724	239	152	282	359	1032	2757
<b>Transformation Capacity (MVA):</b>								
1	400/132				315	630	945	945
2	132/33 kV	469	48	25	130	160	363	832
3	33/11 kV	434.2	58	35	41	572	706	1140
	<b>Total Transformation Capacity</b>	<b>903</b>	<b>106</b>	<b>60</b>	<b>486</b>	<b>1362</b>	<b>2014</b>	<b>2917</b>



## CHAPTER 6: DISTRIBUTION PLAN

### CONNECTING THE UNCONNECTED HOUSEHOLDS

Electricity was introduced in the state of Manipur in 1930 with the commissioning of two micro hydel power stations having capacities of 100 KW and 56 KW. The capacity remained the same till the end of first five year plan. An 11 KV transmission line was commissioned between Imphal and Leimakhong to evacuate power from these power stations.

The state had only 26 km of 11 KV lines and 45 km of domestic lines to serve limited number of consumers. Above assets were owned by Manipur State HE Board. Later the administrative control over electricity was transferred to Public Works Department, Government of Manipur. Subsequently, it was separated from Public Works Department and started functioning independently from February 1970.

The Electricity Department, Government of Manipur (EDM) was an integrated power utility in the state of Manipur since 1970. EDM was the deemed licensee and it was responsible for generation, transmission and distribution in the state.

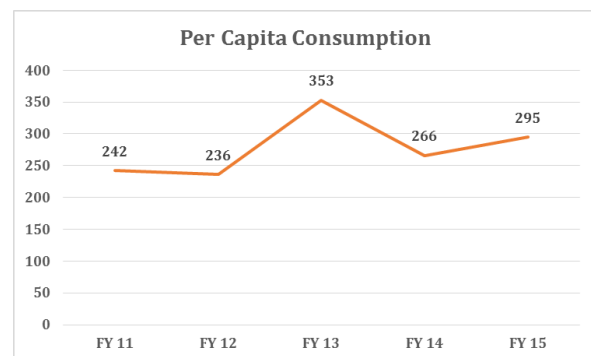
With effect from 1<sup>st</sup> February, 2014, the Electricity Department of Manipur was restructured into two companies, the Manipur State Power Distribution Company Limited (MSPDCL) responsible for distribution and the Manipur State Power Corporation Limited (MSPCL) responsible for transmission function.

### PER-CAPITA CONSUMPTION

### ELECTRICITY

Population of Manipur has grown from 22.93 lakh in 2001 to 28.56 lakh in 2011 at an annual growth of more than 2%. The per-capita consumption of electricity as per the CEA during last 5 years has been shown below:

**Figure 10: Per Capita Consumption (in kWh) <sup>2</sup>**



- *Per capital electricity consumption is one of the lowest in the country (India is at 1010 kWh in FY 2015)*
- *Manipur has the lowest per capita electricity consumption among the north east states*
- *The per capita electricity consumption has grown at annual growth rate of 10.9%*

Household electrification in the State as per the census 2011 was 69% which has increased to 76% by FY 15 which leaves 1.5 lakh unelectrified households at end of March, 2015. The State has electrified around 72,849 households in past 5 years under RGGVY and under state funded Schemes.

<sup>2</sup> Based on CEA inputs

As per census 2011, there are 2379 villages in the state of Manipur. As on March 2016, 2178 villages have been electrified leaving a balance of 201 un-electrified villages in the state. These villages are planned to be electrified by March 2018 under DDUGJY.

Some of the electrification challenges for state:

- ✓ Dearth of local contractors who can take up large scale works on EPC basis
- ✓ Weak Financial Status of DISCOM who are not in a sound position to mobilise counterpart funding or invest in backend infrastructure
- ✓ Lack of skilled manpower
- ✓ High cost of material due to remote locations

To connect the un-connected, the State has planned to use Central funded schemes and also use State Government funds wherever necessary. Electrification of 201 villages is currently being undertaken in Manipur under the DDUGJY/RGGVY 12th Plan. The State proposes to electrify a total of 52,000 households under RGGVY 12th plan scheme and 19000 under recently approved DDUGJY. The state has also planned to undertake intensive electrification using State Plan funds which will cover 100 villages and help connecting 37,674 households by the end of FY 2019.

**Table 19: Electrification of Households**

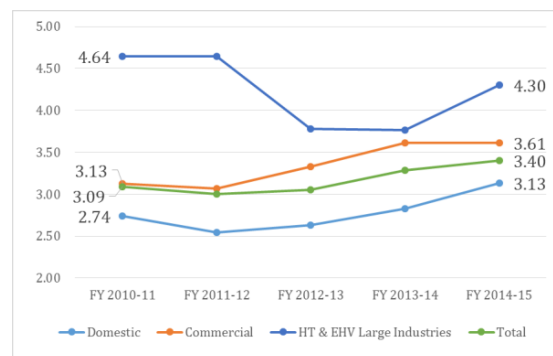
Particulars	
Total Rural UE HHS	1,08,674
RGGVY 12 <sup>th</sup> plan	52,000
DDUGJY	19,000
State Plan	37,674

### EXISTING DISTRIBUTION SYSTEM

MSPDCL is currently serving more than 2.8 lakh consumers of the State. MSPDCL overall sales mix is significantly dependent on the domestic consumers to the extent of around 59%. This share is expected to remain near

57% by FY 19 based on the electrification targets. The average billing rate for domestic consumers has reduced in past years with higher rural electrification which has less tariff than urban areas. The average billing rate during last 5 years is shown below:

**Figure 11: Average Billing Rate**



A snapshot of the existing distribution system serving Manipur is given below:

**Table 20: Distribution System (FY 15)**

Particulars	Unit	FY 2015
Consumers	Lakh	2.8
Peak Demand	MW	150
Energy availability	MU	678
33/11 KV S/s	Nos.	59
DTR	MVA	469
HT Line	kms	1221
LT Line	kms	7498

### PERFORMANCE OF DISCOM

#### METERING STATUS

Energy accounting can only be possible if efficient metering infrastructure is build. Status of metering in state is shown below:

FY 2015	No	% Metering
At 33 kV feeders	55	40%
At 11 kV feeders	1300	20%
At Distribution transformers (11/0.4 & 33/ 0.4 kV)	3569	8%

Consumer metering	2,80,783	78%
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Metering in the state has been taken up on a large scale where electromechanical meters have been replaced with static meters at consumer level. The state has taken aggressive measures to install prepaid meters. Out of 2,80,783 consumers, 138,930 consumers have prepaid meters and 81,128 consumers have post-paid meters.

#### Prepaid metering plan:

The MSPDCL has planned to cover all its consumers in valley areas along with District Headquarters in Hilly areas with prepaid meters to cover its 85% to 90% consumers under this plan. Installation of prepaid metering will help MSPDCL in reducing its AT&C losses and improve its realization. Some of the improvements that MSPDCL has observed during last one year while implementing prepaid metering are:

- Drastic reduction in load demand
- Quality of power improved
- Multi fold increase in revenue collection
- 100% consumers satisfaction service delivery achieved
- 100% collection efficiency and billing efficiency for prepaid consumers
- Lower pilferage

Quarterly performance	Pre-Installation	Post - Installation
Load profile	100%	56%
Revenue	3.18	6.07
No of consumers	9300	12000
Billing Efficiency	63%	100%
Collection Efficiency	64%	100%

The above improvement was observed during the first phase of prepaid meter

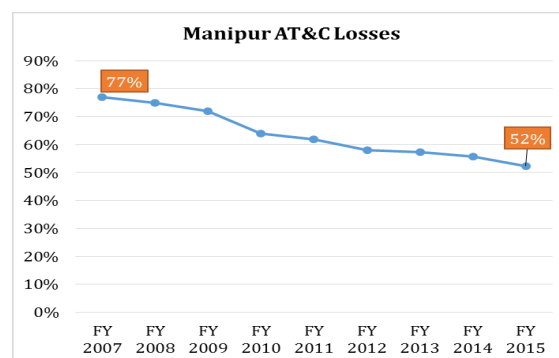
installation. MSPDCL has reaped benefit under this project and has planned to cover all its consumers under this project.

#### AT&C LOSSES

A distribution business incur losses of two different types: one is technical losses and other one is non-technical losses. Technical losses are due to energy dissipated in the conductors and equipment used for sub-transmission line, distribution line and magnetic losses in transformers. While non technical losses are commercial in nature and occur due to theft of power & less metering, collection, billing etc. The sum of both technical and non-technical is AT&C losses which gives overall performance of the distribution company.

AT&C losses in Manipur has reduced from 77% in FY 2007 to 52% in FY 2014-15, which is an overall reduction of more than 24%.

Figure 12: Historical Losses



MSPDCL has further planned to reduce its losses from 52% in FY 15 to 9.9% by the end of FY 19.

Table 21: AT&C targets

FY 15	FY 16	FY 17	FY 18	FY 19
<b>AT&amp;C Losses</b>				
52.33%	44.20%	25.15%	18.7%	15.0%
<b>Energy Demand (MU)</b>				
705	890	893	1050	1325
<b>Maximum Demand (MW)</b>				
150	254	242	292	357

**Measures envisaged for bringing down AT&C loss as per the above trajectory are:**

- i. Disconnection on non-payment of bills is being enforced stringently
- ii. Lodging of cases
- iii. Incentivizing consumers on arrear payment
- iv. Focus on bulk consumers
- v. Coverage of 80% to 90% consumers under prepaid metering system
- vi. Timely completion of R-APDRP scheme
- vii. Increased use of underground cabling
- viii. Replacement of all existing LT cables with ABC cable for controlling pilferage by October 2016
- ix. 100% feeder metering for accurate energy accounting

**In view of the above targets, MSPDCL has planned to undertake investment towards rural electrification and strengthening of distribution network.**

## INVESTMENTS PROPOSED

The Discoms have planned many investment schemes for System Strengthening and rural electrification. Some of the schemes are listed below:

### RURAL ELECTRIFICATION

**Rajiv Gandhi Grameen Vidyutikaran Yojana - II (RGGVY- II)**

This flagship programme of Govt. of India launched in April, 2005 to provide access to electricity to villages having population of 100 or more envisages 90% capital subsidy and 10% as loan component for the State. Financial assistance to the tune of Rs. 204 Crore has been envisaged under this scheme. There is a target to electrify un-electrified villages to the tune of 201 having 52,000 number of households in the state.

The Government of Manipur is supporting the Discom through funding of 4% of the project cost towards agency charges, additional cost towards bid premium and increase in scope of work, approval of electrical inspections by Discom engineers to avoid delay, dedicated nodal officers for each package to assist in RoW forest clearance, site selection.

### DDUGJY

The main agenda in rural area is to provide access to electricity to each households and provide power round the clock. The Government of India under the flagship scheme of DDUGJY has an estimated outlay of Rs. 43,033 Crores including a budgetary support of Rs. 33,453 Crores. The scheme of RGGVY as approved by CCEA for continuation in 12<sup>th</sup> and 13<sup>th</sup> plans has been subsumed in this scheme as a separate rural electrification component for which CCEA has already approved the scheme cost of Rs. 39,275 Crores including a budgetary support of Rs. 35,447 Crores. This outlay will be carried forward to the new scheme of DDUGJY in addition to the outlay of Rs. 43,033 crore. REC is the nodal agency for the operationalization of DDUGJY in the Country.

Manipur had a total requirement of Rs 139 Crores under DDUGJY against which Government of India has sanctioned Rs. 55 Crores.

However, the project cost against system strengthening and connection to un-connecting households in PE villages has not been approved under DDUGJY. For electrifying unelectrified rural households further fund of Rs 84 Crore is required. This additional funding is being requested from Government of India for achieving the given target.

## State Rural Electrification Plan

In order to ensure “Electricity to all” the Government of Manipur has planned to support MSPDCL in undertaking intensive electrification in the State. A total of 37,674 households are planned to electrify under this plan.

## SYSTEM IMPROVEMENT

### IPDS

The Central Government has sanctioned “Integrated Power Development Scheme” (IPDS) on 3<sup>rd</sup> December, 2014 for urban area for:

1. Strengthening of sub-transmission and distribution networks in the urban areas.
2. Metering of distribution transformer/feeders/consumers in the urban areas.
3. IT enablement of distribution sector and strengthening of distribution network, for completion of the targets laid down under R-APDRP for 12th and 13th Plans by carrying forward the approved outlay for R-APDRP to IPDS.

The approved project cost under IPDS may not be sufficient to implement the IT initiatives and system strengthening initiatives in selected towns. Therefore, State would like to request for additional funding of Rs. 200 Crore during FY 2016-19 for building an efficient system and reduce AT&C losses in the State.

**From the above investments, the MSPDCL will add following new assets by FY 19 in the State:**

**Table 22: Additional planned network**

Particulars	Unit	Quantity
11 kV Line	Km	1913
11/0.4 kV DT S/S and Capacity	MVA	58
LT Line	Km	2823

## ASSESSMENT OF ADEQUACY OF DISTRIBUTION SYSTEM

### AT 11/.04 KV LEVEL

The existing aggregate 11/ 0.4 KV distribution transformer capacity of MSPDCL is about 469 MVA in FY 2015.

Further, an additional transformer capacity of 58 MVA is planned to be added by FY 2019 under various initiatives which will result in overall distribution transformation capacity of 527 MVA by FY 2019.

Given that, the billed maximum demand of 11 kV consumers totals around 68 MW. This leaves a demand of 82 MW (150-68) to be met at LT (415 V) level which corresponds to 91 MVA considering a power factor of 0.9.

Against this peak demand, the aggregate installed capacity of DT transformers in the State is 469 MVA. This translates to an average loading of 20% on distribution transformers under peak demand conditions.

Following the same logic and taking the projected peak demand of 357 MW in FY 2019 and assuming the proportion of demand met at 11 kV in relation to the total peak demand remains the same as at present, the contribution of 11 kV direct consumers to the peak demand of the State comes to 161 MW.

Correspondingly, the demand met below 11 kV would be around 195 MW, which corresponds to 216 MVA considering a power factor of 0.9. Against this peak requirement, the installed capacity of distribution transformers in FY 2019 is projected at 527 MVA. This translates to an average loading of 41% on distribution transformers under peak demand conditions.

## FUND REQUIREMENT

The fund requirement for State projects is summarized below:

**Table 23: Fund Requirement for Distribution Projects (in Rs Crore)**

Scheme	Required	Sanctioned	State/Utilities	Central	Additional Support required
RGGVY (XI and XII)	231	231	-	231	-
DDUGJY	139	55	-	55	84
IPDS	250	129	-	129	121
RAPDRP	285	285	-	285	-
State Funded Rural Electrification	118	118	118	-	-
State Funded Infrastructure Development	176	176	176	-	-
Additional Support	200	-	-	-	200
<b>Total</b>	<b>1399</b>	<b>994</b>	<b>294</b>	<b>700</b>	<b>405</b>

**Table 24: Roll out plan (Distribution)**

Sl. No.	Category	Base year scenario (FY 15)	FY 16	FY 17	FY 18	FY 19	Total	Total at end of FY 19
<b>DISTRIBUTION</b>								
<b>Connecting the Unconnected</b>								
1	Target Electrification – Rural	3,16,191	32,000	50,174	21,000	5,500	1,08,674	4,24,865
2	Target Electrification – Urban	1,65,142	9,277	18,554	18,554	-	46,386	2,11,528
<b>F</b>	<b>Efficiency Improvement</b>							
1	T&D Losses	43.92%	38.00%	21.21%	17.04%	14.14%		14.14%
2	AT&C Losses	52.33%	44.20%	25.15%	18.70%	15.0%		15.0%
<b>Capacity Addition/Augmentation</b>								
1	11 kV Lines (CKT Km.)	6,310	394	1,275	245	-	1,914	8,223
2	LT Lines (CKT Km.)	7,498	972	1,177	674	-	2,823	10,322
3	DT Capacity	469	27	21	11	-	58	527

## ACTION POINTS FOR STATE

1. State will implement the projects as listed on time to ensure access to power to each household 24 x 7.

## GOVERNMENT OF INDIA INTERVENTION

1. In order to ensure reliable and secure 24x7 quality power supply to all, the State requests that the full investment

sought under IPDS and DDUGJY needs to be sanctioned expeditiously by GoI.

2. Manipur has planned to undertake capex plan as shown in the above table, which shows that there is around Rs 405 crore still left as gap for funding the project. **The state requests Government of India to provide 100% of the additional fund required left as gap in the above plan.**



## CHAPTER 7: RENEWABLE ENERGY

### RENEWABLE POTENTIAL

Manipur Renewable Energy Development Agency (MANIREDA) is the nodal agency to develop renewable energy resources. The State has a total of 2190 MW of hydro potential and 10,630 MWe of solar.

### RENEWABLE PROJECTS

MANIREDA has so far undertaken many projects. MANIREDA has assisted in developing 7 Wind Solar Hybrid Power Project, each having a capacity of 10 KW at 7 different places. It has also assisted in developing 3 Pico Hydel Project, each having a capacity of 5 KW, under Small Hydro Power (SHP) Development Programme.

MANIREDA has also distributed 3000 Solar Home Lighting Systems and 7000 Solar lanterns to far flung villages of the State which are not connected to the State Grid, under Remote Village Electrification (RVE) through solar. MANIREDA has also experimented with 3 Biomass gasifiers of 200 KW Capacity each at Tora, Damdei and Songtal.

In addition, MANIREDA has taken up 7 new schemes at different sites to harness the wind potential under Wind Energy Development Programme. Two more New Micro Hydel Projects of 20 KW capacity each and R&M of 2x200KW at Gelnel Mini Hydel Project have also been taken up under SHP Development Programme.

### POLICIES AND INITIATIVES

- ✓ Manipur Grid Interactive Rooftop Solar Photo Voltaic (SPV) Power Policy, 2014

was introduced in year 2014. As per the policy, all are eligible to set up projects under this policy for a capacity of 1 kW to 5 kW. The policy states that the power supplied by the solar roof top plants to the grid shall be settled based on the feed-in-tariff to be notified by JERC.

- ✓ Manipur Solar Power Policy 2015 is also being drafted to boost solar grid connected power generation in the state.
- ✓ Micro grid for small hamlets is also being planned in the state on experimental basis with the help of MNRE of capacity 4-5 MW.

### ACTION PLAN FOR SOLAR ENERGY SECTOR & RPO IN MANIPUR.

The Ministry of New and Renewable Energy, Govt. of India, under its National Solar Mission has fixed a target of 1.0 lakh MW installed capacity of grid connected solar power by the year 2022. As part of the Mission, the Ministry has set a target of 105 MW for Manipur, comprising of 50 MW from rooftop systems and 55 MW from ground mounted and other mode of installations, to be achieved within the stipulated timeframe. Further, the State Regulatory Commission has specified the target for RPO (Renewable Purchase Obligation) as 13.50% of total energy requirement out of which 10.50% should be from solar energy by the year 2022. The present rate of RPO of the state is 5% consisting of 0.25% for solar energy. Considering annual consumption of 1000 MU approx. of the state during FY 2015-16, the RPO requirement comes about 50 MU. The figure of RPO will increase from year to year as both consumption and rate of allocated RPO is increasing.

In view of allocated target of solar capacity and RPO of the state, MANIREDA proposes to

implement the following projects on priority within the year 2019.

**1. Installation of 3.4 MW aggregate capacity grid connected rooftop solar systems on Government Buildings:**

MANIREDA has identified 21 Government buildings for installation of grid connected rooftop solar systems with total estimated cost of about Rs. 30 crore. The MNRE has accorded sanction of Rs. 8.84 crore as CFA of the project. Estimated balance fund requirement for the project is about Rs. 21.60 crore.

Installation of solar power plant is to be carried out at the identified 21 government buildings or any other technically convenient government buildings. The project is expected to generate about 4 MU of solar power per year which can be fed to grid through gross metering which can be accounted in RPO.

It is requested that GoI support for the Roof Top Grid Interactive System Project for Government buildings shall be increased to 70% subsidy support against the benchmarked cost. This would benefit States like Manipur wherein the Investor / Developers are not keen to develop infrastructure on a viable Revenue Model. Once initial investments would flow from Government towards this new sector, it is believed that private investments shall follow. It is proposed that MNRE subsidy shall be increased from 30% to 70%.

**2. Implementation of 5.0 MW capacity demonstration grid connected solar power plant near the 33/11 KV Mayanglangjing electrical sub-station, Imphal West district:** The MNRE, GoI, has fixed a target of 55 MW capacity grid connected solar power plants for MANIPUR to be achieved within the year 2022. However, no investors are coming forward to set up such power plants in the state due to technical, social and other reasons as such

not a single large scale solar power plant has been installed till date. In order to attract and motivate investors to develop such power plants it will be beneficial to install a MW scale solar power plant in the state as a pilot cum demonstration project.

MANIREDA in consultation with Deputy Commissioner, Imphal West, identified a suitable piece of land adjacent to 33/11 KV electrical sub-station at Mayanglangjing village, Imphal West. Proposal for allocating the land measuring an area about 10.00 ha to MANIREDA was already submitted to Power Department Govt. of Manipur requesting necessary formalities with Revenue Department. Total estimated cost of the project including civil works and power evacuation shall be about Rs. 50.00 crore.

- i. Financial Implication: Rs. 50.00 crore
- ii. Government share: Rs. 50.00 crore
- iii. Installed capacity of solar power: 5.0 MW

**3. Installation of 10.0 MW capacity grid interactive rooftop solar systems for domestic and private sector buildings:**

The MNRE, GoI, has set a target of 40,000 MW of grid connected rooftop solar within the year 2022 and allocated target of 50 MW for Manipur. For promoting the sector, the Ministry is providing capital subsidy up to 70% of the benchmark cost for installation of such systems for power consumers under domestic and private parties / institutions. MANIREDA has fixed a target of 10 MW under the sector during FY 2016-19 and proposal for 5 MW during FY 2016-17 was already submitted to MNRE. Due to high cost of solar materials and transportation & other incidental charges, share of promoters of such plants is very high despite 70% of benchmark central government subsidy. Therefore it is requested that benchmarking for States like Manipur with accessibility issues should be reframed. Presently the benchmarked cost - per KW- under Solar Roof Top Grid interactive system is Rs

75,000/- only. This may be increased to Rs 85,000/- only.

4. **Installation of 50,000 nos. of 100 LPD solar water heaters:** Considering geographical limitations and climatic condition of less sun-hours comparing to other western & other mainland's of the country, it will be technically & economically difficult to cope up with RPO only through RE power generation. Rather it will be more feasible to bring down consumption of electrical power/energy through application of RE devices and other energy efficient systems, wherever possible. MANIREDA have implemented about 3500 sets of 100 LPD (litres per day) capacity solar water heaters in recent years. The heaters works well in local conditions and has an electric backup heater element for cold & non-sunny days. Installing such a heater is equivalent to reducing a connected load of 2.00 KW from the grid, which can save up to 1500 kWh and equivalent saving of 1.5 tons of carbon emission in a year.

Cost of the system including incidental charges, taxes & installation is about Rs. 30,000. It is proposed for installation of 50,000 such heaters during FY 2016-19 through part funding between government and user by sharing Rs. 22,500/- and Rs. 7,500/- respectively.

- i. Financial Implication: Rs. 150.00 crore.
- ii. Government share: Rs. 112.50 crore
- iii. Beneficiary/User's share: Rs. 37.50 crore.
- iv. Equivalent in reduction of connected load to power grid: 100 MW

5. **Solar Water pumps:** Solar water pumping systems are useful for pumping of water for irrigation, water supply and farming applications especially in un-electrified/ intermittent power supply areas. These pumps are a suitable and economical alternative in saving of HSD oil. Although such pumps has negligible operational cost, however, application of such pumps is restricted due to high initial cost. The MNRE, GoI is providing capital subsidy at Rs. 0.47 lakhs per HP capacity of solar pumps. The actual cost of such plant is about Rs. 1.50 lakh as such the beneficiary has to contribute balance cost of Rs. 1.03 lakh. It is proposed for installation of 100 (one hundred) numbers of solar water pumps under PFA. The estimated project cost is Rs. 1.50 crore and proposed funding is:

- i. MNRE, GoI is Rs. 47.00 lakh and
- ii. MoP, GoI, Rs. 1.03 crore.

## CHAPTER 8: ENERGY EFFICIENCY

### EESL'S NATIONAL LEVEL LED PROGRAMME

#### DOMESTIC EFFICIENT LIGHTING PROGRAMME (DELP)

The service model enables domestic households to procure LED lights at an affordable price of Rs. 10 each and the balance on easy instalment from their electricity bill. DELP is under implementation in AP, Delhi, Rajasthan, UP, Himachal Pradesh, Maharashtra. EESL is providing to consumers at a rate of Rs. 10 each as against their market price of Rs. 200-350. The average cost saving per LED for a domestic consumer is estimated between Rs. 160 – Rs. 400 (depending upon replacement of CFL or ordinary bulb) based on 4 hour use every day is more than the total cost of LED bulb. The total cost charged to consumers by EESL is Rs. 95-105 (based of applicable VAT/Octroi in a state) and is less than the savings of 1 year. The bulb will function for at least 10-15 years and all savings after one year is of the consumer. The cost of LED bulbs and programme administration cost is recovered from consumers by deduction of easy instalments of Rs. 10 every month for 8-12 months from their electricity bills. The programme is delivering energy savings of 400 MU in Puducherry and AP as per the online monitoring system installed by EESL. So far, more than 106 Lakh LED bulbs have been distributed in 22 cities across India. MSPCL has planned to provide 1 lakh LED lights under above scheme till FY 19 in following phases:

**Table 25: DELP plan of State**

Activity	Total	FY 17	FY 18	FY 19
<b>LED Bulb</b>	1.00	0.60	0.20	0.20

### STREET LIGHT NATIONAL PROGRAMME (SLNP)

EESL has evolved a service model to enable Municipalities to replace conventional lights with LEDs at no upfront cost. The balance cost is recovered through the municipalities by monetizing the energy savings. EESL has implemented about 92,000 street light retrofit project in Vizag this project will reduce the energy consumption by 50%. The entire upfront capital of Rs. 64 crore has been invested by EESL and will be recovered over a 7 year period. The municipality will pay EESL a sum of Rs. 18.5 crore every year whereas its overall costs savings would be Rs. 31 crore annually. The actual energy saving achieved 50% in electricity bill of Greater Vizag Municipal Corporation (GVMC) during January to April this year as compared to same period last year. More than 2.3 Lakh LED Street Lights have been installed so far across India.

The state has aggressively gone ahead with street lighting programme. MSPDCL has planned to replace 1908 streetlights with LED bulbs in Imphal city. MSPDCL has also planned to replace streetlight with LED in 12 divisions with 585 LED lights.

#### ACTION POINTS FOR STATE

1. The State will co-ordinate with BEE to conduct a load research study with a view to improve load factor and reduce energy demand by promoting energy efficiency.
2. The state will implement DELP programme

## CHAPTER 9: FINANCIAL SUSTAINABILITY

### FINANCIAL POSITION OF DISTRIBUTION UTILITIES

After unbundling of Electricity Department, MSPDCL prepared its first financial accounts in FY 2014. The accumulated reserves and surplus as on 31<sup>st</sup> Mar, 2014 in books of account for MSPDCL for the FY 2014 was Rs 1,238 Crores. As per the projections, the accumulated reserves and surplus will reduce to Rs 1,175 Crores with Rs 63 Crores of losses expected in FY 2015. However, there is considerable support of Rs ~250 Crores from State Government in the form of subsidy or budgetary support to meet its expenses.

Since, the utility has a gap in average revenue and average cost of supply, corrective actions needs to be taken so that utility can undertake initiative of “24 X 7 Power For All” while converting itself into a financially sustainable company.

Further, in absence of audited accounts for a complete financial year, certain data has also been sourced from Tariff Order issued by JERC.

The below table shows projected financials of MSPDCL for FY 2014-15:

**Table 26: Profit and loss Statement for FY 2014-15 (Rs Crores)**

Particulars	31-Mar-15
Net Sales	151
Other Income	0
Subsidy	250
<b>Total Income</b>	<b>401</b>
<b>Expenditure</b>	
Transmission Charges	83
Power Cost	281
Employee Cost	73
R&M cost	4

Particulars	31-Mar-15
A&G Cost	2
<b>Total Expenses</b>	<b>443</b>
PBDIT	-42
Finance costs	13
PBDT	-55
Depreciation	7.7
<b>Profit Before Tax</b>	<b>-63</b>

A detailed scenario analysis has been done to measure the financial performance in coming 3 years.

This analysis provided hereafter decipher that with improvement in performance to the required levels, and how the operating losses/profits will be impacted while targeting to provide 24x7 Power to all in the State. The following scenarios have been detailed in subsequent sections:

- At targeted growth rate as per “24x7 Power for All” road map (base case).
- At targeted growth rate as per “24x7 Power for All” along with financial turnaround.
- Non-adherence to loss reduction trajectory and subsequent dependence on higher tariff hike.
- Funding of grant through loan.

### COMMON ASSUMPTIONS

- ✓ Any change in the power purchase cost will be taken care by the Fuel and Power Purchase Cost Adjustment mechanism.
- ✓ Rate of sale of surplus power considered at the average rate of power purchase.



- ✓ Escalation towards employee cost has been considered at 10% based on increase observed in CPI for FY 2013-14 and for A&G expenses 6% has been considered based on WPI inflation index for the FY 2013-14. In the FY 2016-17 escalation in employee expense has been considered at 18% to factor in the impact of 7<sup>th</sup> pay commission.
- ✓ R&M cost has been computed at in proportion of the GFA of utility.
- ✓ Phasing of capital expenditure in IPDS and DDUGJY schemes has been considered as 10% in FY 2015-16, 60% in FY 2016-17 and 30% in FY 2017-18.
- ✓ Asset Additions has been considered as 50% in same year of capital expenditure and balance in the next year. Interest is calculate on assets capitalized only and no IDC has been considered.
- ✓ Interest computations for incremental debt has been done taking into consideration an interest rate of 12%.
- ✓ Interest on working capital and cash deficit loan at 14%.
- ✓ Category-wise average billing rate for computation of revenue for FY 2015-16 and FY 2016-17 is as per the tariff order and onwards has been taken as per the tariff hike provided.
- ✓ Transmission charges has been escalated in proportion to the increase in power purchase quantum and allocation.
- ✓ Depreciation has been computed at the actual average depreciation rate for FY 2014-15 for existing assets and 5.28% for new assets.
- ✓ Debt: Equity ratio is 70:30 wherever applicable for internal schemes.
- ✓ Grant, Loan and equity ratio has been considered based on the guidelines of centrally sponsored schemes (except scenario 4 where no grant has been considered against IPDS and DDUGJY). Further, additional grant of 5% has been considered as per the terms and conditions in IPDS and DDUGJY.
- ✓ The capital expenditure pertaining to energy efficiency measures has not been considered as either these schemes are primarily funded through grant or have short payback period, thus having negligible impact on the financials of the distribution company.
- ✓ The Average Cost of Supply (ACS) has been computed by dividing the total expenditure (including purchase of surplus power) by total sale of power within the State.
- ✓ Similarly, O&M cost per unit and interest cost per unit has been calculated by dividing their respective cost by sale of power within the State.



## SCENARIO A: AT TARGETED GROWTH RATE AS PER 24X7 ROAD MAP (BASE CASE)

### ASSUMPTIONS

- ✓ No tariff hike.
- ✓ T&D losses as per targeted trajectory.
- ✓ Cash deficit loan in case of shortfall.
- ✓ Subsidy tapering down from existing amount.

**Table 27: Key assumptions**

	Units	31-Mar-16	31-Mar-17	31-Mar-18	31-Mar-19
Energy Demand	MU	890	893	1,050	1,325
Sales	MU	532	680	843	1,101
Power Available	MU	733	918	1,020	1,131
Power purchase rate	Rs/kWh	3.01	3.36	3.40	3.47
AT&C losses	%	44.20%	25.15%	18.70%	15.00%
Distribution Loss	%	38.00%	21.21%	17.04%	14.14%
Collection Efficiency	%	90%	95%	98%	99%

**Table 28: Key parameters**

Key Parameters	Units	31-Mar-16	31-Mar-17	31-Mar-18	31-Mar-19
Revenue (Including Subsidy)	Rs Crores	339	456	499	604
Total Expense excluding other income	Rs Crores	462	527	625	789
PBT	Rs Crores	-124	-79	-127	-185
ABR	Rs/ kWh	4.24	4.45	4.43	4.53
ACS	Rs/ kWh	8.69	7.75	7.42	7.16
Interest Cost	Rs crores	14	31	47	68
<b>O&amp;M cost per unit</b>	<b>Rs/ kWh</b>	<b>1.58</b>	<b>1.42</b>	<b>1.26</b>	<b>1.06</b>
R&M cost per unit	Rs/ kWh	0.10	0.06	0.05	0.04
Employee cost per unit	Rs/ kWh	1.43	1.32	1.17	0.99
A&G cost per unit	Rs/ kWh	0.05	0.04	0.03	0.03
Interest cost per unit	Rs/ kWh	0.26	0.46	0.56	0.62

**Table 29: Profit and loss Statement under Scenario A (Rs Crores)**

P&L (Rs crores)	31-Mar-16	31-Mar-17	31-Mar-18	31-Mar-19
<b>Sales Turnover</b>				
Net Sales	226	303	374	499
Other Income	0.32	0.34	0.35	0.37
Revenue from surplus power	0	8	0	0
Subsidy	113	145	125	105
<b>Total Income</b>	<b>339</b>	<b>456</b>	<b>499</b>	<b>604</b>
<b>Expenditure</b>				
Transmission Charges	90	90	106	134
Power Cost	268	309	356	460
Employee Cost	76	90	99	109

P&L (Rs crores)	31-Mar-16	31-Mar-17	31-Mar-18	31-Mar-19
R&M cost	5	4	5	5
A&G Cost	2	3	3	3
<b>Total Expenses</b>	<b>441</b>	<b>495</b>	<b>568</b>	<b>710</b>
PBDIT	-102	-39	-69	-106
Finance costs	14	31	47	68
PBDT	-116	-70	-116	-174
Depreciation	8	9	10	11
<b>Profit Before Tax</b>	<b>-124</b>	<b>-79</b>	<b>-127</b>	<b>-185</b>

In the above scenario, it is evident that utility will continue to incur losses from FY 2016 and start eroding its accumulate reserves and surplus. However, even with drastic reduction in AT&C losses the Average Cost of Supply will still be higher than the average realization due to unfavorable mix of consumer. In Manipur, utility has 56% of its sale coming from domestic consumers who has lower realization.

Table 30: Cash flow Statement (Rs Crores)

Cash Flow (Rs crores)	31-Mar-16	31-Mar-17	31-Mar-18	31-Mar-19
<b>Cash flow arising from Operating Activities</b>	<b>(110)</b>	<b>(48)</b>	<b>(80)</b>	<b>(117)</b>
Depreciation and Amortisation expenses	8	9	10	11
Operating profit	(102)	(39)	(69)	(106)
Subsidy	-	-	-	-
Increase / (Decrease) in current liability	108	73	123	181
(Increase) in current Asset	-	-	-	-
Cash Flow from Operation	6	34	53	75
Cash from Investment Activities	-	-	-	-
<b>Capex</b>	<b>(353)</b>	<b>(662)</b>	<b>(248)</b>	<b>(32)</b>
<b>Net Cash from Investment Activities</b>	<b>(353)</b>	<b>(662)</b>	<b>(248)</b>	<b>(32)</b>
<b>Cash from Financing Activities</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>
Equity Investments	1	6	3	-
Debt Drawn	15	39	10	-
Loan Repayment	(2)	(3)	(6)	(7)
WC loan	(108)	(73)	(123)	(181)
Interest cost	(14)	(31)	(47)	(68)
Grant	337	618	236	32
Net Cash from Financing Activities	229	555	72	(224)
<b>Net Cash Balances</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>
Cash BF	9	(108)	(182)	(304)
Cash Flow during the year	(118)	(73)	(123)	(181)
Cash	(108)	(182)	(304)	(485)
Cash CF to balance sheet - post deficit loan	-	-	(0)	(0)
<b>Cash deficit Loan</b>				
Opening loan	-	108	182	304
Additions	108	182	304	485
Repayment	-	108	182	304
Closing	108	182	304	485
	14%	14%	14%	14%
Interest on cash deficit loan	7.32	19.57	32.78	53.25

## SCENARIO B: AT TARGETED GROWTH RATE AS PER 24X7 ROAD MAP PLUS FINANCIAL TURNAROUND

### ASSUMPTIONS

- ✓ Tariff hike of 16% in FY 2017-18 and FY 2018-19 on latest category-wise average billing rates as per the existing tariff to recover its losses.
- ✓ AT&C losses as per targeted trajectory.

**Table 31: Key assumptions**

	Units	31-Mar-16	31-Mar-17	31-Mar-18	31-Mar-19
Energy Demand	MU	890	893	1,050	1,325
Sales	MU	532	680	843	1,101
Power Available	MU	733	918	1,020	1,131
Power purchase rate	Rs/kWh	3.01	3.36	3.40	3.47
AT&C losses	%	44.20%	25.15%	18.70%	15.00%
Distribution Loss	%	38.00%	21.21%	17.04%	14.14%
Collection Efficiency	%	90%	95%	98%	99%

**Table 32: Key parameters**

Key Parameters	Units	31-Mar-16	31-Mar-17	31-Mar-18	31-Mar-19
Revenue (Including Subsidy)	Rs Crores	339	456	559	777
Total Expense excluding other income	Rs Crores	462	527	622	772
PBT	Rs Crores	-124	-79	-64	5
ABR	Rs/ kWh	4.24	4.45	5.14	6.10
ACS	Rs/ kWh	8.69	7.75	7.38	7.01
Interest Cost	Rs crores	14	31	44	51
O&M cost per unit	Rs/ kWh	<b>1.58</b>	<b>1.42</b>	<b>1.26</b>	<b>1.06</b>
R&M cost per unit	Rs/ kWh	0.10	0.06	0.05	0.04
Employee cost per unit	Rs/ kWh	1.43	1.32	1.17	0.99
A&G cost per unit	Rs/ kWh	0.05	0.04	0.03	0.03
Interest cost per unit	Rs/ kWh	0.26	0.46	0.52	0.46

**Table 33: Profit and loss Statement under Scenario B (Rs Crores)**

P&L (Rs crores)	31-Mar-16	31-Mar-17	31-Mar-18	31-Mar-19
<b>Sales Turnover</b>				
Net Sales	226	303	433	671
Other Income	0.32	0.34	0.35	0.37
Revenue from surplus power	0	8	0	0
Subsidy	113	145	125	105
<b>Total Income</b>	<b>339</b>	<b>456</b>	<b>559</b>	<b>777</b>
<b>Expenditure</b>				
Transmission Charges	90	90	106	134
Power Cost	268	309	356	460
Employee Cost	76	90	99	109
R&M cost	5	4	5	5
A&G Cost	2	3	3	3
<b>Total Expenses</b>	<b>441</b>	<b>495</b>	<b>568</b>	<b>710</b>

P&L (Rs crores)	31-Mar-16	31-Mar-17	31-Mar-18	31-Mar-19
PBDIT	-102	-39	-9	67
Finance costs	14	31	44	51
PBDT	-116	-70	-54	16
Depreciation	8	9	10	11
<b>Profit Before Tax</b>	<b>-124</b>	<b>-79</b>	<b>-64</b>	<b>5</b>

Based on the above assumptions, it is evident that if MSPDCL adheres to the target electrification, reduce losses, and receives tariff increase of 16% In the FY 2017-18 and FY 2018-19 as per the assumptions, the year on year losses will progressively reduce and MSPDCL will be able to function without any stress on its revenue with the required subsidy support.

Table 34: Cash flow Statement (Rs Crores)

Cash Flow (Rs crores)	31-Mar-16	31-Mar-17	31-Mar-18	31-Mar-19
<b>Cash flow arising from Operating Activities</b>	<b>(110)</b>	<b>(48)</b>	<b>(20)</b>	<b>56</b>
Depreciation and Amortisation expenses	8	9	10	11
Operating profit	(102)	(39)	(9)	67
Subsidy	-	-	-	-
Increase / (Decrease) in current liability	108	73	60	(9)
(Increase) in current Asset	-	-	-	-
Cash Flow from Operation	6	34	51	58
Cash from Investment Activities	-	-	-	-
<b>Capex</b>	<b>(353)</b>	<b>(662)</b>	<b>(248)</b>	<b>(32)</b>
<b>Net Cash from Investment Activities</b>	<b>(353)</b>	<b>(662)</b>	<b>(248)</b>	<b>(32)</b>
<b>Cash from Financing Activities</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>
Equity Investments	1	6	3	-
Debt Drawn	15	39	10	-
Loan Repayment	(2)	(3)	(6)	(7)
WC loan	(108)	(73)	(60)	9
Interest cost	(14)	(31)	(44)	(51)
Grant	337	618	236	32
Net Cash from Financing Activities	229	555	138	(17)
<b>Net Cash Balances</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>
Cash BF	9	(108)	(182)	(241)
Cash Flow during the year	(118)	(73)	(60)	9
Cash	(108)	(182)	(241)	(232)
Cash CF to balance sheet - post deficit loan	-	-	0	0
<b>Cash deficit Loan</b>		<b>-</b>	<b>-</b>	<b>-</b>
Opening loan	-	108	182	241
Additions	108	182	241	232
Repayment	-	108	182	241
Closing	108	182	241	232
	14%	14%	14%	14%
Interest on cash deficit loan	7.32	19.57	28.55	31.99

## SCENARIO C: NON-ADHERENCE TO PERFORMANCE PARAMETERS (LOSS REDUCTION TRAJECTORY) AND SUBSEQUENT DEPENDENCE ON HIGHER TARIFF HIKE

### ASSUMPTIONS

- ✓ **Distribution losses higher than the targeted trajectory.**
- ✓ Higher Tariff Hike of 19.2% hike in FY 2017-18 and FY 2018-19 on latest category-wise average billing rates.

**Table 35: Key assumptions**

	Units	31-Mar-16	31-Mar-17	31-Mar-18	31-Mar-19
Energy Demand	MU	890	1,006	1,161	1,388
Sales	MU	532	680	843	1,101
Power Available	MU	733	918	1,020	1,131
Power purchase rate	Rs/kWh	3.01	3.36	3.40	3.47
AT&C losses	%	44.20%	33.50%	26.50%	18.82%
Distribution Loss	%	38.00%	30.00%	25.00%	18.00%
Collection Efficiency	%	90%	95%	98%	99%

**Table 36: Key parameters**

Key Parameters	Units	31-Mar-16	31-Mar-17	31-Mar-18	31-Mar-19
Revenue (Including Subsidy)	Rs Crores	339	448	571	814
Total Expense excluding other income	Rs Crores	462	579	681	814
PBT	Rs Crores	-124	-131	-111	0
ABR	Rs/ kWh	4.24	4.45	5.28	6.44
ACS	Rs/ kWh	8.69	8.51	8.08	7.39
Interest Cost	Rs crores	14	34	54	65
<b>O&amp;M cost per unit</b>	<b>Rs/ kWh</b>	<b>1.58</b>	<b>1.42</b>	<b>1.26</b>	<b>1.06</b>
R&M cost per unit	Rs/ kWh	0.10	0.06	0.05	0.04
Employee cost per unit	Rs/ kWh	1.43	1.32	1.17	0.99
A&G cost per unit	Rs/ kWh	0.05	0.04	0.03	0.03
Interest cost per unit	Rs/ kWh	0.26	0.50	0.64	0.59

**Table 37: Profit and loss Statement under Scenario C (Rs Crores)**

P&L (Rs crores)	31-Mar-16	31-Mar-17	31-Mar-18	31-Mar-19
<b>Sales Turnover</b>				
Net Sales	226	303	445	709
Other Income	0.32	0.34	0.35	0.37
Revenue from surplus power	0	0	0	0
Subsidy	113	145	125	105
<b>Total Income</b>	<b>339</b>	<b>448</b>	<b>571</b>	<b>814</b>
<b>Expenditure</b>				
Transmission Charges	90	101	117	140
Power Cost	268	338	394	482
Employee Cost	76	90	99	109
R&M cost	5	4	5	5
A&G Cost	2	3	3	3

P&L (Rs crores)	31-Mar-16	31-Mar-17	31-Mar-18	31-Mar-19
<b>Total Expenses</b>	<b>441</b>	<b>536</b>	<b>617</b>	<b>738</b>
<i>PBDIT</i>	-102	-88	-47	76
Finance costs	14	34	54	65
<i>PBDT</i>	-116	-122	-101	11
Depreciation	8	9	10	11
<b>Profit Before Tax</b>	<b>-124</b>	<b>-131</b>	<b>-111</b>	<b>0</b>

Based on the above assumptions, it is evident that if MSPDCL does not adheres to the target electrification and reduction of losses as envisaged, it will have to depend on the higher tariff hikes of the order of 19.2% in FY 2017-18 & FY 2018-19 to achieve the financial turnaround. Which inter-alia means that the MSPDCL will have to stick to the loss trajectory as planned in this road map to be self-sustainable on its own in long run with lesser dependency on tariff hike.

**Table 38: Cash flow Statement (Rs Crores)**

Cash Flow (Rs crores)	31-Mar-16	31-Mar-17	31-Mar-18	31-Mar-19
<b>Cash flow arising from Operating Activities</b>	<b>(110)</b>	<b>(97)</b>	<b>(57)</b>	<b>65</b>
Depreciation and Amortisation expenses	8	9	10	11
Operating profit	(102)	(88)	(47)	76
Subsidy	-	-	-	-
Increase / (Decrease) in current liability	108	125	107	(4)
(Increase) in current Asset	-	-	-	-
Cash Flow from Operation	6	37	61	72
Cash from Investment Activities	-	-	-	-
<b>Capex</b>	<b>(353)</b>	<b>(662)</b>	<b>(248)</b>	<b>(32)</b>
<b>Net Cash from Investment Activities</b>	<b>(353)</b>	<b>(662)</b>	<b>(248)</b>	<b>(32)</b>
<b>Cash from Financing Activities</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>
Equity Investments	1	6	3	-
Debt Drawn	15	39	10	-
Loan Repayment	(2)	(3)	(6)	(7)
WC loan	(108)	(125)	(107)	4
Interest cost	(14)	(34)	(54)	(65)
Grant	337	618	236	32
Net Cash from Financing Activities	229	500	81	(36)
<b>Net Cash Balances</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>
Cash BF	9	(108)	(234)	(341)
Cash Flow during the year	(118)	(125)	(107)	4
Cash	(108)	(234)	(341)	(336)
Cash CF to balance sheet - post deficit loan	-	-	0	0
<b>Cash deficit Loan</b>				
Opening loan	-	108	234	341
Additions	108	234	341	336
Repayment	-	108	234	341
Closing	108	234	341	336
	14%	14%	14%	14%
Interest on cash deficit loan	7.32	23.08	38.75	45.69



## SCENARIO D: FUNDING OF GRANTS THROUGH LOAN & EQUITY

### ASSUMPTIONS

- ✓ Funding of grant through loan & equity
- ✓ Tariff Hike of 25% each in FY 2017-18 and FY 2018-19.

**Table 39: Key assumptions**

	Units	31-Mar-16	31-Mar-17	31-Mar-18	31-Mar-19
Energy Demand	MU	890	893	1,050	1,325
Sales	MU	532	680	843	1,101
Power Available	MU	733	918	1,020	1,131
Power purchase rate	Rs/kWh	3.01	3.36	3.40	3.47
AT&C losses	%	44.20%	25.15%	18.70%	15.00%
Distribution Loss	%	38.00%	21.21%	17.04%	14.14%
Collection Efficiency	%	90%	95%	98%	99%

**Table 40: Key parameters**

Key Parameters	Units	31-Mar-16	31-Mar-17	31-Mar-18	31-Mar-19
Revenue (Including Subsidy)	Rs Crores	339	456	592	885
Total Expense excluding other income	Rs Crores	479	577	710	879
PBT	Rs Crores	-140	-130	-118	5
ABR	Rs/ kWh	4.24	4.45	5.54	7.08
ACS	Rs/ kWh	9.00	8.49	8.43	7.98
Interest Cost	Rs crores	26	67	104	120
O&M cost per unit	Rs/ kWh	<b>1.58</b>	<b>1.44</b>	<b>1.29</b>	<b>1.10</b>
R&M cost per unit	Rs/ kWh	0.10	0.08	0.09	0.09
Employee cost per unit	Rs/ kWh	1.43	1.32	1.17	0.99
A&G cost per unit	Rs/ kWh	0.05	0.04	0.03	0.03
Interest cost per unit	Rs/ kWh	0.49	0.99	1.23	1.09

**Table 41: Profit and loss Statement under Scenario A (Rs Crores)**

P&L (Rs crores)	31-Mar-16	31-Mar-17	31-Mar-18	31-Mar-19
<b>Sales Turnover</b>				
Net Sales	226	303	467	780
Other Income	0.32	0.34	0.35	0.37
Revenue from surplus power	0	8	0	0
Subsidy	113	145	125	105
<b>Total Income</b>	<b>339</b>	<b>456</b>	<b>592</b>	<b>885</b>
<b>Expenditure</b>				
Transmission Charges	90	90	106	134
Power Cost	268	309	356	460
Employee Cost	76	90	99	109
R&M cost	5	5	8	9
A&G Cost	2	3	3	3
<b>Total Expenses</b>	<b>441</b>	<b>496</b>	<b>571</b>	<b>715</b>
<i>PBDIT</i>	-102	-40	21	170
Finance costs	26	67	104	120

P&L (Rs crores)	31-Mar-16	31-Mar-17	31-Mar-18	31-Mar-19
PBDT	-128	-107	-82	50
Depreciation	12	22	36	45
<b>Profit Before Tax</b>	<b>-140</b>	<b>-130</b>	<b>-118</b>	<b>5</b>

The hike of 25% is required in case the funding is sourced from FIs / Banks since the interest cost will increase the required ARR. Therefore, it is evident that MSPDCL will require support from center or state to fund its capex for controlling the tariff.

**Table 42: Cash flow Statement (Rs Crores)**

Cash Flow (Rs crores)	31-Mar-16	31-Mar-17	31-Mar-18	31-Mar-19
<b>Cash flow arising from Operating Activities</b>	<b>(114)</b>	<b>(63)</b>	<b>(15)</b>	<b>126</b>
Depreciation and Amortisation expenses	12	22	36	45
Operating profit	(102)	(40)	21	170
Subsidy	-	-	-	-
Increase / (Decrease) in current liability	123	127	123	(2)
(Increase) in current Asset	-	-	-	-
Cash Flow from Operation	21	86	144	168
Cash from Investment Activities	-	-	-	-
<b>Capex</b>	<b>(353)</b>	<b>(662)</b>	<b>(248)</b>	<b>(32)</b>
<b>Net Cash from Investment Activities</b>	<b>(353)</b>	<b>(662)</b>	<b>(248)</b>	<b>(32)</b>
<b>Cash from Financing Activities</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>
Equity Investments	62	88	49	10
Debt Drawn	157	231	117	22
Loan Repayment	(4)	(19)	(41)	(48)
WC loan	(123)	(127)	(123)	2
Interest cost	(26)	(67)	(104)	(120)
Grant	134	343	83	-
Net Cash from Financing Activities	199	449	(19)	(134)
<b>Net Cash Balances</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>
Cash BF	9	(123)	(250)	(373)
Cash Flow during the year	(132)	(127)	(123)	2
Cash	(123)	(250)	(373)	(371)
Cash CF to balance sheet - post deficit loan	-	-	0	0
<b>Cash deficit Loan</b>		-	-	-
Opening loan	-	123	250	373
Additions	123	250	373	371
Repayment	-	123	250	373
Closing	123	250	373	371
	14%	14%	14%	14%
Interest on cash deficit loan	8.32	25.19	42.04	50.20

## CHAPTER 10: OTHER INITIATIVES

### COMMUNICATION

Successful implementation of 24x7 Power Supply Scheme requires clear communication among all the stakeholders across the value chain, including the consumers. In order to avoid potential roadblocks in implementation due to poor communication and flow of information, the following table lists the primary responsibility of each stakeholder and the corresponding method in which it will be carried out.

A centralized corporate communication team can be formed at headquarters of the MSPDCL for looking at activities of overall communication strategy.

The financial situation in Manipur makes it imperative to raise tariffs while other initiatives including 24x7 supply are implemented. Such tariff increases would inevitably impact consumers and meet with resistance. To address this, the utilities should clearly communicate their plans on implementing the reliable 24x7 supply scheme along with the other reliability and efficiency improvement measures that they are implementing. A high level of involvement of the Government of Manipur will also be required:

**Table 43: Proposed Communication Responsibilities**

Communication Objective	Responsibility	Frequency
"Power for All" - Roll Out Plan	Secretary, Energy	Quarterly
Status update on Deliverables	Secretary, Energy	Quarterly
Generation Projects <i>Physical Progress, Achievements and Other Relates Issues</i>	Managing Director, MSPCL	Quarterly

Communication Objective	Responsibility	Frequency
Inter-State Transmission Projects <i>Physical Progress, Achievements and Other Relates Issues</i>	Director (Projects), PGCIL	Monthly
Intra-State Transmission Projects (till 33 kV level) <i>Physical Progress, Achievements and Other Relates Issues</i>	Managing Director, MSPCL	Monthly
Distribution <i>Progress, Achievements, Losses, Consumer Initiatives etc.</i>	Managing Director, MSPDCL	Monthly
Renewable Power	MANIREDA	Quarterly

### INSTITUTIONAL ARRANGEMENT

A strong monitoring framework is essential to ensure the success of the "Power for All" scheme. The following structure is being proposed to undertake regular monitoring of the progress of all initiatives being undertaken in this scheme.

- Government of India (GOI) Level Committee:** It is proposed that this committee will review the overall progress of the scheme on a quarterly basis and provide necessary support to ensure a coordinated response from the Central Government - where necessary. The committee may be constituted with the following members – PFC, REC, CEA, SECI, EESL, BEE, Ministry of Power, MoEF and MNRE.
- State Government Level Committee:** It is proposed that a State level committee headed by the Secretary (Power) will be formed to review the progress of the scheme on a quarterly basis. This committee will monitor the

progress of the works undertaken as part of the scheme and issue directions to enable faster execution.

- **Department Level Committee:** It is proposed that a Department level committee headed by the Nodal Officer will be formed which shall undertake steps required to ensure the projects are progressing as per the action plan. This committee will undertake progress reviews on a monthly basis.
- **District Level Committee** – It is proposed to constitute a district level committee headed by the S.E. to take action that is necessary to ensure the projects are completed in a timely manner and address any issues pertaining to land or other relevant approvals.
- **Project Monitoring Unit (PMU)** – A project monitoring unit shall be set up for monitoring the progress of the works being undertaken under this scheme. The PMU will operate under the Secretary, Energy and shall be operated by an external independent agency.

The PMU shall be responsible for undertaking coordination, preparing the action plans and monitoring progress of all works under the “Power for all” scheme. The PMU would also help facilitate in tracking the action steps and providing feedback to the various committee that are proposed to be set up under the scheme. Government of India shall provide grants for the PMU operations.

The committees that are being proposed above are required to be set up at the earliest to kick start the whole scheme. It is important that the committees keep meeting on a regular basis as per the frequency/timelines mentioned above – to ensure that

the objectives set out under the “Power for all” scheme are achieved.

## CAPACITY BUILDING

With the increase of IT applications in the Transmission & Distribution system and to meet the expectations of 24x7 power supply for the consumers in the state, it is important to focus on capacity building of the employees for enhancement of technical know-how and keeping abreast with latest technological developments. The capacity building may also include consumer grievance system, awareness regarding importance of working with safety, outage management system, demand side management etc. It is also imperative that for transforming the distribution utility into a customer friendly one, change of mind-set of the employees would be required. It is critical that Change Management initiatives are rolled out and institutionalized for achieving better results.

In view of the importance of training on new technologies, there is a requirement for development and implementation of a well-structured Human Resource Training Programme to help realize the dream of 24x7 power supply system in the state in its true sense.

There is already a provision for Demand Side Management (DMS) training under various programmes of Bureau of energy Efficiency (BEE) and the same should be implemented to achieve the goal of 24 x 7 power. The training for the class C & D employees is also being provided under RAPDRP Part C scheme.

A state level officers training institute may be required to be opened in the state to fulfil the ongoing training requirement for employees of Manipur Power Utilities. This also helps in training of subordinate technical staff. Following training

programmes are proposed to be implemented for the utility:

- ✓ Two Weeks trainings for technical staff including officers & engineers once in every two years.
- ✓ One week training for non-technical officers every two years.
- ✓ One week training for subordinate technical staff at each district headquarters every year.

## CHAPTER 11: ROLL OUT PLAN

### SWOT ANALYSIS

In the above sections, we have discussed in detail the existing status and future needs. We have also provided some actionable targets, which will help Manipur in achieving the set goal. Before structuring the above targets, SWOT analysis of existing power sector in Manipur have been discussed. An exercise has been done to bring out some of the key risk indicators which affect the overall power sector in Manipur along with advantages present.





## ROAD MAP FOR POWER FOR ALL

Sl. No.	Category	Base year scenario (FY 15)	FY 16	FY 17	FY 18	FY 19	Cumulative total by FY19	Total expected capacity FY 19
<b>GENERATION</b>								
<b>A</b>	<b>Availability (MW):</b>							
<b>1</b>	Central and other sources	182	0	41	23	20	84	<b>266</b>
<b>B</b>	<b>Peak Demand (MW):</b>							
<b>1</b>	<b>Peak Demand (MW)</b>	<b>150</b>	<b>254</b>	<b>242</b>	<b>292</b>	<b>357</b>		<b>357</b>
<b>TRANSMISSION</b>								
<b>C</b>	<b>Transmission Lines (CKM):</b>							
	132kV Lines	475	85	54	132	170	441	915
	33 kV lines	1250	154	98	105	190	546	1796
	400kV Lines	0	0	0	45	0	45	45
	<b>Total Length :</b>	<b>1724</b>	<b>239</b>	<b>152</b>	<b>282</b>	<b>359</b>	<b>1032</b>	<b>2757</b>
<b>D</b>	<b>Transformation Capacity (MVA):</b>							
<b>1</b>	400/132				315	630	945	945.0
<b>2</b>	132/33 kV	469	48	25	130	160	363	832.0
<b>3</b>	33/11 kV	434	57.8	35	41	572	706	1140.4
	<b>Total Transformation Capacity</b>	<b>903</b>	<b>106</b>	<b>60</b>	<b>486</b>	<b>1362</b>	<b>2014</b>	<b>2917</b>
<b>DISTRIBUTION</b>								
<b>E</b>	<b>Connecting the Unconnected</b>							
<b>1</b>	Target Electrification – Rural	3,16,191	32,000	50,174	21,000	5,500	1,08,674	4,24,865
<b>2</b>	Target Electrification – Urban	1,65,142	9,277	18,554	18,554	-	46,386	2,11,528
<b>F</b>	<b>Efficiency Improvement</b>							
<b>1</b>	T&D Losses	43.92%	38.00%	21.21%	17.04%	14.14%		9%
<b>2</b>	AT&C Losses	52.33%	44.20%	25.15%	18.70%	15.0%		15%
<b>G</b>	<b>Capacity Addition/Augmentation</b>							
<b>1</b>	11 kV Lines (CKT Km.)	6,310	394	1,275	245	-	1,914	8,223
<b>2</b>	LT Lines (CKT Km.)	7,498	972	1,177	674	-	2,823	10,322
<b>3</b>	DT Capacity	469	27	21	11	-	58	527

# ANNEXURES

## ANNEXURE – 1

Area Name	Total households			Electrified household		
	Rural	Total	Urban	Rural	Total	Urban
Bishnupur	28147	44891	16744	19969	34364	14395
Chandel	25860	29097	3237	15653	18764	3111
Churachandpur	46647	49916	3269	26685	29894	3209
Imphal East	54014	91806	37792	43389	78663	35274
Imphal West	41512	111393	69881	30795	87078	56283
Senapati	80529	82048	1519	59188	60696	1508
Thoubal	54653	85295	30642	28157	49507	21350
Ukhrul	30882	35790	4908	10836	14026	3190
Tamenglong	21069	24477	3408	8670	11541	2871
<b>Grand Total</b>	<b>383313</b>	<b>554713</b>	<b>171400</b>	<b>243342</b>	<b>384533</b>	<b>141191</b>

## ANNEXURE – 2

**Table 44: Category wise sales (MU)**

Categories	FY 09	FY 10	FY 11	FY 12	FY 13	FY 14	FY 15
Domestic							
Rural	48	63	70	76	76	82	116
Urban	72	65	82	96	127	133	141
Commercial							
Rural	5	4	8	9	10	10	9
Urban	10	12	15	18	21	24	27
General Purpose							
Irrigation/ Pumping							
Rural	-	1	0	0	1	3	2
Urban	0	0	0	0	0	0	0
Allied Agricultural Activities							
Public Lighting							
Rural	1	2	2	2	1	3	3
Urban	3	2	4	4	4	2	2
LT Industrial (Low & Medium)							
Rural	2	2	3	5	4	4	3
Urban	6	5	9	15	16	13	15
Specified Public Purpose							
Public water works							
Rural	3	7	8	9	7	7	5
Urban	7	11	10	15	17	22	12
General Purpose (>110KVA)							
Temporary Supply							
Rural	0	0	0	0	1	0	0
Urban	0	0	0	5	0	-	-
HT Bulk Supply (Domestic)							
Rural	13	20	29	33	32	37	40
Urban	28	24	30	34	48	61	56
HT & EHV Large Industries							
Rural	0	0	1	2	12	13	7
Urban	1	1	1	2	2	2	4
<b>Total</b>	<b>197</b>	<b>221</b>	<b>271</b>	<b>325</b>	<b>379</b>	<b>415</b>	<b>443</b>

**Table 45: Projected Sales (MU)**

Categories	FY 16	FY 17	FY 18	FY 19
Domestic	314	421	532	613
Commercial	42	49	57	85
Irrigation/ Pumping	3	3	3	3
Allied Agricultural Activities				
Public Lighting	5	6	7	9
LT Industrial (Low & Medium)	21	25	29	34
Specified Public Purpose				
Public water works	19	21	23	25
Temporary Supply	0	0	0	0
HT Bulk Supply (Domestic)	112	131	152	177
HT & EHV Large Industries	17	25	40	156
<b>Total</b>	<b>532</b>	<b>680</b>	<b>843</b>	<b>1,101</b>

## ANNEXURE – 3

**Table 46: Inter-State Transmission Lines: Existing & Planned**

Sl. No.	Line Name	Ckts	Length (Ckt-km)	Conductor	Project Cost (Rs. In Cr.)	Tentative Scheduled Commissioning (Year)
1	2	3	4	5	6	7
<b>400kV Lines Charged at 132 kV</b>						
1	Imphal(PGCI) - Silchar	D/C	166	Twin Moose	Existing	Existing
2	Imphal(PGCI) - New Kohima 400 kV	D/C	240		297 (Under NERSS-VI)	2019
<b>132 kV lines</b>						
1	Leimatak - Jiribam (PGCI)	S/C	82.4	Panther	Existing	Existing
2	Leimatak - Imphal (PGCI)	S/C	35	Panther	Existing	Existing
3	Imphal (PGCI)- Dimapur	S/C	168.9	Panther	Existing	Existing
4	Jiribam (PGCI) - Aizawl (PGCI) via Tipaimukh	S/C	172.3	Panther	Existing	Existing
5	Imphal (PGCI) - Imphal (Yurembam)	S/C	0.8	Panther	Existing	Existing
6	Upgradation of existing inter-state 132 kV link between Imphal (PG) and Imphal (State)	S/C	0.8		20	2018

**Table 47: Substations under Inter-State Transmission Substation (ISTS): Existing & Planned**

Sl. No.	Name of the Substation	Voltage level (kV/kV)	MVA Capacity	Total MVA	Project Cost (in Crores)	Tentative Scheduled Commissioning (Year)
1	Yurembam PGCIL	400/132	6x105	630		2019
2	Yurembam PGCIL	132/33	2x50	100	Existing	Existing
3	Jiribam (Switching substation)	132			Existing	Existing

**Table 48: Intra-State Transmission Lines: Existing & Planned**

Sl. No.	Line Name	Ckts	Length (Ckt- km)	Conductor	Project Cost (in Crores)	Tentative Scheduled Commissioning (Year)
<b>400kV Lines</b>						
1	Yurembam (PGCI) to Thoubal via Nambol	DC	45.1	Moose	180.98	2018
<b>132kV Lines</b>						
1	Link line from Thoubal 400 kV S/S to Kongba 132 kV S/S	DC	7	Panther	7.47	2019
2	Link line from Thoubal 400 kV S/S to Kakching 132 kV S/S	DC	7	Panther	7.47	2019
3	Link line from Thoubal 400 kV S/S to Moreh 132 kV S/S	SC	25	Panther	20.76	2019
4	Leimatak -Ningthoukhong	SC	10.5	Panther	Existing	Existing
5	Ningthoukhong - Yurembam	SC	27.5	Panther	Existing	Existing
6	Yurembam - Mao	SC	91.375	Panther	Existing	Existing
7	Yurembam - Yaingangpokpi	DC	41.386	Panther	Existing	Existing
8	Yaingangpokpi - Kakching via Kongba (1st Circuit)	SC	78	Panther	Existing	Existing
9	Leimatak - Jiribam	SC	88.4	Panther	Existing	Existing
10	LILO on Jiribam -Aizawl at Tipaimukh	SC	13		14.76	2018
11	LILO at Karong	SC	1.155	Panther	Existing	Existing
12	Ningthoukhong - Churachandpur	DC	46.032	Panther	Existing	Existing
13	Kakching - Churchandpur	SC	37.858	Panther	Existing	Existing
14	Loktak-Jiri-Circuit No. -I to Rengpang(LILO)	SC	2.5	Panther	Existing	Existing
15	LILO at Jiribam.	SC	0.637	Panther	Existing	Existing
16	LILO at Kongba	SC	22.737	Panther	Existing	Existing
17	Heikakpokpi (Kakching)- Chandel	SC	20	Panther	Existing	Existing
18	Yaingangpokpi - Hundung	SC	25	Panther	Existing	Existing
19	Churchandpur - Thanlon	SC	53.925	Panther	85.5	2017
20	Rengpang - Tamenglong	SC	35	Panther	Under WB	2018
21	LILO on Kakching -Kongba at Thoubal	SC	16	Panther	16.29	2018
22	Kakching - Moreh	SC	55	Panther	52.78	2018
23	Leimatal Power House (NHPC) - Ningthoukhong (2nd Circuit)	SC	10.5	Panther	19.44	2018
24	LILO on Kakching - Churchandpur at Elangkhangpokpi	SC	10	Panther	11.34	2017
25	Yurembam S/S (State) - Yurembam S/S (PGCI) (3rd Curcuit)	SC	1	Panther	10.25	2018
26	Kakching - Churchandpur (2nd Circuit)	SC	37.858	Panther	17.92	2017
27	Yaingangpokpi - Kakching via Kongba (2nd Circuit)	SC	78	Panther	Under WB	2018
28	LILO on Yurembam -Karong at Gamphazol	SC	6	Panther	Under WB	2018

Sl. No.	Line Name	Ckts	Length (Ckt- km)	Conductor	Project Cost (in Crores)	Tentative Scheduled Commissioning (Year)
29	Yurembam - Yaingangpokpi (S/c on D/C tower)	SC	47.5	Panther	Existing	Existing
<b>33 kV Lines</b>						
1	Bishenpur-Utlou	SC	5.8	Racoon	Existing	Existing
2	Chakpikarong-Joupi	SC	5.8	Racoon	Under RGGVY	2018
3	Churachandpur-New Lamka	SC	15	Racoon	Existing	Existing
4	Churachandpur-Sangaikot	SC	28	Racoon	Existing	Existing
5	Churachandpur-Thinkew	SC	38	Racoon	Existing	Existing
6	Hundung-Gumnom	SC	20	Racoon	2.88	2018
7	Hundung-Kamjong	SC	55	Racoon	Existing	Existing
8	Hundung-Nungbi Khullen	SC	35	Racoon	3.23	2017
9	Hundung-Phungyar	SC	42	Racoon	3.66	2018
10	Hundung-Tolloi	SC	28	Racoon	Existing	Existing
11	Hundung-Ukhrul Khunjao	SC	16	Racoon	Existing	Existing
12	Iroisemba-Lamphel	SC	5.2	Racoon	Existing	Existing
13	Iroisemba-Leimakhong	DC	18	Panther	Existing	Existing
14	Jiribam-Rengpang	SC	75	Racoon	Existing	Existing
15	Jiribam-Shivapurikhal	SC	40	Racoon	Existing	Existing
16	Kakching-Machi	SC	15	Racoon	Existing	Existing
17	Kakching-New Chayang	SC	19	Racoon	Existing	Existing
18	Kakching-Tegnoupal	SC	27	Racoon	Existing	Existing
19	Kakching-Wangjing	SC	22	Racoon	Existing	Existing
20	Kangpoki-Tamei	SC	25	Racoon	Existing	Existing
21	Kangpokpi -Leimakhong	SC	35	Racoon	Existing	Existing
22	Karong-Kangpokpi	SC	25	Racoon	Existing	Existing
23	Karong-Tadubi	SC	34	Racoon	Existing	Existing
24	Khuman Lampak -Keishampat	SC	3.5	Racoon	Existing	Existing
25	Khuman Lampak -Kongba	DC	14	Panther	Existing	Existing
26	Khuman Lampak-Iroisemba	DC	8.15	Panther	Existing	Existing
27	Khuman Lampak-Nilakuthi	SC	8.5	Racoon	Existing	Existing
28	Kongba - Thoubal	SC	16	Racoon	Existing	Existing
29	Kongba -Urup	SC	6	Racoon	Existing	Existing
30	Kongba-Mongsangei	DC	14	Panther	Existing	Existing
31	Kongba-Sangaipat	SC	3.2	Racoon	Existing	Existing
32	Leimakhong - Nilakuthi	SC	9.5	Racoon	Existing	Existing
33	LILO on Iroisemba-Khuman Lampak at Capitol Project	SC	6	Racoon	0.75	2019
34	LILO on Iroisemba- Leimakhong at Mayang Langjing	SC	5	Racoon	Existing	Existing
35	LILO on Kakching-Wangjing at Khongjom	SC	12	Racoon	Existing	Existing
36	LILO on Kangpokpi- Leimakhong at Sekmai	SC	10	Racoon	Existing	Existing
37	LILO on Kangpokpi-Tamei at Gelnel	SC	6	Racoon	0.98	2017
38	LILO on Karong -Tadubi at Maram	SC	2	Racoon	Existing	Existing
39	LILO on Karong-Kangpokpi at Mayangkhang	SC	8	Racoon	1.25	2018
40	LILO on Keishampat-Khuman Lampak at Kangla	SC	0.1	Racoon	Existing	Existing



Sl. No.	Line Name	Ckts	Length (Ckt-km)	Conductor	Project Cost (in Crores)	Tentative Scheduled Commissioning (Year)
41	LILO on Khuman Lampak-Leimakhong at Mantripukhri	SC	4.88	Racoon	Existing	Existing
42	LILO on Leimakhong-Kangpokpi at Gamphazol	SC	2	Racoon	Existing	Existing
43	LILO on Mayang Imphal-Kakching at Sekmaijin	SC	0.5	Racoon	Existing	Existing
44	LILO on Napetpali-Khuman Lampak at Chingarel	SC	1.6	Racoon	Existing	Existing
45	LILO on Rengpang-Jiribam at Oinamlong	SC	3	Racoon	0.48	2019
46	LILO on Saikul-Napet Palli at Sagolmang	SC	8	Racoon	Existing	Existing
47	LILO on Tolloi-Namrei at Paoyi	SC	12	Racoon	1.68	2019
48	LILO on Yurembam-Mongsangei at Sangaiprou	SC	0.2	Racoon	Existing	Existing
49	Maram-Lakhamai	SC	40	Racoon	Existing	Existing
50	Maram-Willong	SC	37	Racoon	Existing	Existing
51	Mayang Imphal-Kakching	SC	19	Racoon	Existing	Existing
52	Moirang Khunou-Wangoo	SC	13.5	Racoon	Under RGGVY	2018
53	Moirang-Moirang Khunou	SC	6.5	Racoon	Existing	Existing
54	Mongsangei - Wangoi	SC	10	Racoon	1.92	2018
55	Mongsangei-Kakwa	SC	3	Racoon	Existing	Existing
56	Namarei-Jessami	SC	50	Racoon	Existing	Existing
57	Napetpali-Khuman Lampak	SC	28.4	Racoon	Existing	Existing
58	Napetpali-Saikul	SC	35.5	Racoon	Existing	Existing
59	New Chayang-Chakpikarong	SC	18.4	Racoon	Existing	Existing
60	New Chayang-Sugunu	SC	20	Racoon	3.21	2017
61	New Lamka-Singhat	SC	36.5	Racoon	Existing	Existing
62	Nilakuthi -Leimakhong	SC	9.5	Racoon	Existing	Existing
63	Ningthoukhong-Bishenpur	SC	5	Racoon	Existing	Existing
64	Ningthoukhong-Moirang	SC	6.5	Racoon	Existing	Existing
65	Rengpang-Khoupum	SC	20	Racoon	Existing	Existing
66	Rengpang-Tamenglong	SC	35	Racoon	Existing	Existing
67	Sangaipat-JNIMS	SC	3	Racoon	Existing	Existing
68	Sangaiprou-Sagolband	SC	6	Racoon	0.79	2018
69	Tadubi-Mao	SC	10	Racoon	1.97	2018
70	Tamenglong-Tousem	SC	42	Racoon	Existing	Existing
71	Tengnoupal-Moreh	SC	35	Racoon	Existing	Existing
72	Thanlon - Maulnaum	SC	29	Racoon	4.02	2019
73	Thanlon-Parbung	SC	45	Racoon	Existing	Existing
74	Thanlon-Pherzawl	SC	48	Racoon	Existing	Existing
75	Thanlon-Sinjawl	SC	25	Racoon	Existing	Existing
76	Thinkew-Henglep	SC	25	Racoon	3.26	2019
77	Thinkew-Thanlon	SC	75	Racoon	Existing	Existing
78	Thoubal - Ushoipokpi	SC	9	Racoon	Existing	Existing
79	Thoubal 132 kV S/S to Thoubal 33 kV Substation	DC	6	Racoon	4.04	2019
80	Thoubal-Kasom khullen	SC	25	Racoon	3.28	2018
81	Thoubal-Wangjing (Moirang Palli)	SC	10	Racoon	1.92	2019
82	Thoubal-Yairipok	SC	10	Racoon	1.92	2019
83	Tolloi-Namarei	SC	43	Racoon	Existing	Existing

Sl. No.	Line Name	Ckts	Length (Ckt-km)	Conductor	Project Cost (in Crores)	Tentative Scheduled Commissioning (Year)
84	Wangjing-Heirok	SC	8	Racoon	1.54	2019
85	Wangjing-Thoubal	SC	7	Racoon	Existing	Existing
86	Willong-Thuyeng	SC	45	Racoon	6.31	2019
87	Yaingangpokpi-Litan	SC	12	Racoon	Existing	Existing
88	Yaingangpokpi-Napetpali	SC	10	Racoon	Existing	Existing
89	Yurembam-Airport	SC	4.5	Racoon	Existing	Existing
90	Yurembam-Iroisemba	DC	4.49	Panther	Existing	Existing
91	Yurembam-Leimakhong	SC	35	Racoon	Existing	Existing
92	Yurembam-Mayang Imphal	SC	23.8	Racoon	Existing	Existing
93	Yurembam-Mongsangei	DC	10.4	Panther	Existing	Existing
94	Yurembam-Noney	SC	35	Racoon	Existing	Existing
95	Noniy to LDSHEP	SC	37	Racoon	6.34	2017

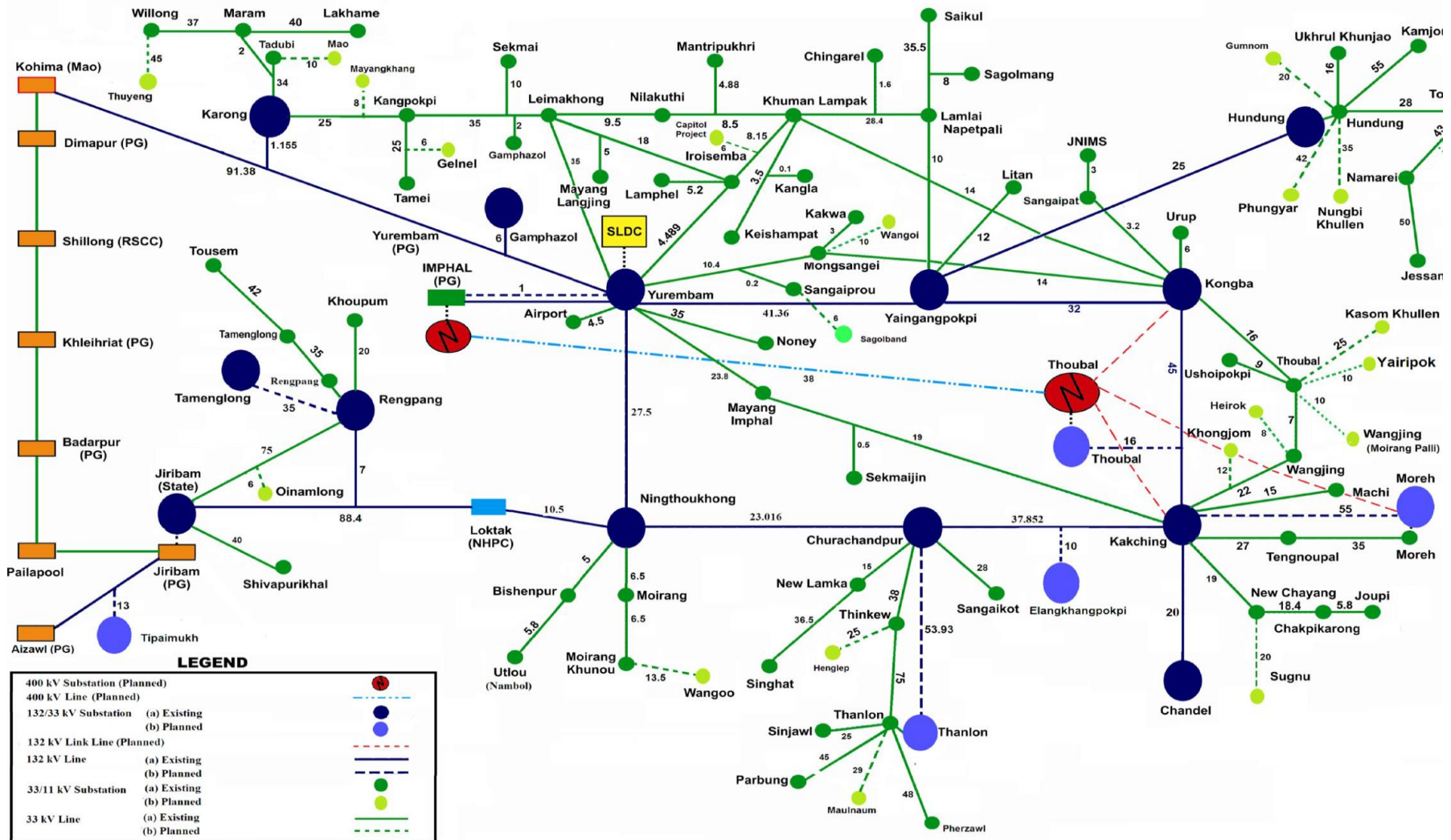
**Table 49: Intra- State Substations under ISTS: Existing & Planned**

Sl. No.	Name of the Sub station	Voltage level (kV/kV)	MVA Capacity	Total MVA	Load at Sub station	Project Cost (in Crores)	Tentative Scheduled Commissioning (Year)
1	Thoubal	400/132	3x105	315		160.76	2018
2	Karong	132/33	2x20	40	17.08	Existing	Existing
3	Yaingangpokpi	132/33	2x20	40	13.38	Existing	Existing
4	Gamphazol	132/33	2x20	40		Under WB	2018
5	Ningthoukhong	132/33	1x20	20	10.38	Existing	Existing
6	Yurembam State	132/33	3x31.5	94.5	41.56	Existing	Existing
7	Churachandpur	132/33	2x20	40	24.52	Existing	Existing
8	Thanlon	132/33	2x12.5	25		19.9	2017
9	Tipaimukh	132/33	2x12.5	25		31.57	2018
10	Jiribam	132/33	1x20	20	2.66	Existing	Existing
11	Kongba	132/33	2x20	40	20.22	Existing	Existing
12	Hundung	132/33	2x12.5	25		Existing	Existing
13	Kakching	132/33	2x20	40	34.36	Existing	Existing
14	Thoubal	132/33	2x20	40		30.32	2018
15	Elangkhangpokpi	132/33	2x20	40		35.59	2018
16	Rengpang	132/33	1x12.5	12.5	0.2	Existing	Existing
17	Tamenglong	132/33	2x20	40		Under WB	2018
18	Chandel	132/33	2x12.5	25		Existing	Existing
19	Moreh	132/33	2x12.5	25		24.35	2018
20	Leimakhong	33/11	1x3	3	2.42	Existing	Existing
21	Kangpokpi	33/11	1x3.15	3.15	2.59	Existing	Existing
22	Yaingangpokpi	33/11	1x3.15	3.15	1.5	Existing	Existing
23	Tadubi	33/11	1x3.15	3.15	0.31	Existing	Existing
24	Karong	33/11	1x5	5	4.09	Existing	Existing
25	Saikul	33/11	1x3.15	3.15	0.69	Existing	Existing
26	Maram	33/11	1x3.15	3.15	1.31	Existing	Existing
27	Lakhamai	33/11	2x1	2	0.6	Existing	Existing
28	Willong	33/11	2x2.5	5	1.2	Existing	Existing
29	Gamphazol	33/11	2x2.5	5	2.1	Existing	Existing
30	Mayangkhang	33/11	2x5	10		5.37	2018
31	Mao	33/11	2x5	10		4.83	2018
32	Thuyeng	33/11	2x2.5	5		4.22	2019

Sl. No.	Name of the Sub station	Voltage level (kV/kV)	MVA Capacity	Total MVA	Load at Sub station	Project Cost (in Crores)	Tentative Scheduled Commissioning (Year)
33	Gelnel	33/11	2x2.5	5		4.99	2017
34	Senapati (HQ)	33/11	2x5	10		6.3	2019
35	Keithelmanbi(New)	33/11	2x5	10		Under WB	2018
36	Ningthoukhong	33/11	2x3.15	6.3	4	Existing	Existing
37	Moirang	33/11	2x3.15	6.3	3.6	Existing	Existing
38	Nambol	33/11	1x5	5	3.79	Existing	Existing
39	Bishnupur	33/11	1x3.15	3.15	2.95	Existing	Existing
40	Moirang khunou	33/11	1x3.15	3.15	3.5	Existing	Existing
41	Wangoo	33/11	2x1	2		Under RGGVY	2018
42	Kwakta	33/11	2x3.15	6.3		Under WB	2018
43	Leimapokpam	33/11	2x5	10		Under WB	2018
44	Iroisemba	33/11	3x5	15	4.27	Existing	Existing
45	Yurembam	33/11	3x5	15	8.61	Existing	Existing
46	Mongsangei	33/11	2x10	20	12.81	Existing	Existing
47	Mayang Imphal	33/11	2x3.15	6.3	4.11	Existing	Existing
48	Imphal P/H	33/11	3x5	15	10.72	Existing	Existing
49	Lamphel	33/11	2x10	20	7.97	Existing	Existing
50	Airport	33/11	2x1	2	0.309	Existing	Existing
51	Kangla	33/11	2x5	10	7.35	Existing	Existing
52	Kakwa	33/11	2x5	10	4.73	Existing	Existing
53	Sangaiprou	33/11	2x10	20	4.8	Existing	Existing
54	Mayang Langjing	33/11	1x3.15	3.15		Existing	Existing
55	Wangoi	33/11	1x3.15	3.15		7.1	2019
56	Sekmai	33/11	2x2.5	5	1.8	Existing	Existing
57	Capitol Project(GIS)	33/11	2x5	10		16.08	2019
58	Sagolband	33/11	2x5	10		5.06	2019
59	Hiyangthang	33/11	2x3.15	6.3		Under WB	2018
60	Pisum (GIS)	33/11	2x10	20		Under WB	2018
61	Takyl	33/11	2x5	10		Under WB	2018
62	Lamphel (NIT)	33/11	2x10	20		Under WB	2018
63	Thanlon	33/11	2x1	2	0.23	Existing	Existing
64	Shivapurikhan	33/11	1x3.15	3.15	1.5	Existing	Existing
65	Thinkew	33/11	2x1	2	0.19	Existing	Existing
66	New Lamka	33/11	2x5	10	6.7	Existing	Existing
67	Singhat	33/11	1x3.15	3.15	0.7	Existing	Existing
68	Churachandpur	33/11	3x5	15	9.6	Existing	Existing
69	Pherzawl	33/11	2x1	2	0.4	Existing	Existing
70	Sinjawl	33/11	2x1	2	0.6	Existing	Existing
71	Henglep	33/11	2x1	2		2.85	2019
72	Sangaikot	33/11	2x1	2	0.87	Existing	Existing
73	Maulnuam	33/11	2x2.5	5		5.02	2019
74	Tuliphai	33/11	2x3.15	6.3		Under WB	2018
75	Kongba	33/11	2x10	20	11.37	Existing	Existing
76	Khuman Lampak	33/11	4x5	20	9.64	Existing	Existing
77	Jiribam	33/11	2x5	10	2.66	Existing	Existing
78	Nilakuthi	33/11	2x10	20	5.25	Existing	Existing
79	Napetpalli (Lamlai)	33/11	1x5	5	3.48	Existing	Existing
80	Sagolmang	33/11	2x3.15	6.3	1.5	Existing	Existing
81	Sangaipat	33/11	2x10	20	3.5	Existing	Existing
82	JNIMS	33/11	2x5	10		Existing	Existing
83	Mantripukhri	33/11	2x5	10	1.4	Existing	Existing

Sl. No.	Name of the Sub station	Voltage level (kV/kV)	MVA Capacity	Total MVA	Load at Sub station	Project Cost (in Crores)	Tentative Scheduled Commissioning (Year)
84	Chingarel	33/11	2x5	10	1.98	Existing	Existing
85	Urup (Langdum)	33/11	1x3.15	3.15		Existing	Existing
86	Top Khongnangkhang	33/11	2x5	10		Under WB	2018
87	Andro	33/11	2x3.15	6.3		Under WB	2018
88	Porompat	33/11	2x5	10		Under WB	2018
89	Sanjenbam	33/11	2x5	10		Under WB	2018
90	Litan	33/11	1x3.15	3.15	0.93	Existing	Existing
91	Hundung	33/11	2x3.15	6.3	3.53	Existing	Existing
92	Tolloi	33/11	1x1	1	0.67	Existing	Existing
93	Kamjong	33/11	1x1	1	0.31	Existing	Existing
94	Namrei	33/11	2x1	2	0.36	Existing	Existing
95	Jessami	33/11	2x2.5	5	1.9	Existing	Existing
96	Kasom Khullen	33/11	2x2.5	5		4.06	2018
97	Phungyar	33/11	2x2.5	5		4.29	2018
98	Paoyi	33/11	2x2.5	5		4.67	2019
99	Ukhrul Khunjao	33/11	2x5	10		Existing	Existing
100	Nungbi Khullen	33/11	2x2.5	5		5.39	2017
101	Gumnom	33/11	2x2.5	5		4.86	2018
102	Kakching	33/11	2x5	10	6.52	Existing	Existing
103	Thoubal	33/11	2x5	10	7.42	Existing	Existing
104	New Chayang	33/11	1x3.15	3.15	4.52	Existing	Existing
105	Wangjing	33/11	1x3.15+ 1x5	8.15	5.82	Existing	Existing
106	Sekmaijing	33/11	2x5	10	1.93	Existing	Existing
107	Thoubal Leisangthem	33/11	2x5	10		Existing	Existing
108	Khongjom	33/11	2x2.5	5		Existing	Existing
109	Sugnu	33/11	2x2.5	5		5.30	2017
110	Wangjing (Moirang Palli)	33/11	1x3.15	3.15		7.1	2019
111	Yairipok	33/11	1x3.15	3.15		7.1	2019
112	Heirok	33/11	1x3.15	3.15		7.1	2019
113	Usoipokpi	33/11	1x3.15	3.15		Existing	Existing
114	Rengpang	33/11	1x3.15	3.15	1.28	Existing	Existing
115	Tamenglong	33/11	1x3.15	3.15	1.2	Existing	Existing
116	Khoupum	33/11	1x3.15	3.15	0.21	Existing	Existing
117	Noney	33/11	1x3.15	3.15	2.53	Existing	Existing
118	Tamei	33/11	1x3.15	3.15	2.36	Existing	Existing
119	Tousem	33/11	1x3.15	3.15	0.82	Existing	Existing
120	Oinamlong	33/11	2x2.5	5		4.79	2019
121	Loktak Downstream HEP	33/11	2x5	10		5.86	2017
122	Thangal	33/11	2x3.15	6.3		Under WB	2018
123	Tengnoupal	33/11	1x1	1	0.45	Existing	Existing
124	Moreh	33/11	1x5	5	3.6	Existing	Existing
125	Chakpikarong	33/11	2x1	2		Existing	Existing
126	Chandel	33/11	2x5	10		4.47	2017
127	Joupi	33/11	2x1	2		Under RGGVY	2018
128	Machi	33/11	2x1	2	0.8	Under RGGVY	2018

## Power Network Map of Manipur





## ANNEXURE – 4

### MNRE Schemes/options for electrification of remote households

#### SCHEMES FOR INDIVIDUAL HOUSEHOLDS

OPTION I	
System Proposed	100 Wp Solar system
Solar PV Module	100 Wp
Battery Storage (Tubular type)	12V, 75 AH
Estimated Project Cost	<b>Rs. 25,000/</b>

The above system is adequate to meet consumer demand with autonomy for two(2) non-sunshine days for consumption profile of estimated 0.3 units per day considering following inclusions in the scheme:

Inclusions	Nos.	Unit Load (W) [DC]	Total Load (W)	Hours of use per day	Energy Consumption (kWh/day)
D.C. operated LED Lights	3	8	24	4	0.096
D.C. operated LED Lights	2	5	10	4	0.040
D.C. Fan	1	12	12	10	0.120
D.C. B&W TV	1	12	12	4	0.048
Mobile Charger	1	5	5	3	0.015
<b>Total</b>					<b>0.319</b>

OPTION 2	
System Proposed	200 Wp Solar system
Solar PV Module	200 Wp
Battery Storage (Tubular type)	12V, 75 AH
Estimated Project Cost	<b>Rs. 50,000/</b>

The above system is adequate to meet consumer demand with autonomy for two (2) non-sunshine days for consumption profile of estimated 0.6 units per day considering following inclusions in the scheme:

Inclusions	Nos.	Unit Load (W) [DC]	Total Load (W)	Hours of use per day	Energy Consumption (kWh/day)
D.C. operated LED Lights	3	8	24	6	0.144
D.C. operated LED Lights	2	5	10	6	0.060
D.C. Fan (1*24W or 2*12W)	2	12	24	12	0.288
D.C. Color TV	1	30	30	4	0.120
Mobile Charger	1	5	5	3	0.015
<b>Total</b>					<b>0.627</b>



## SCHEMES FOR VILLAGE WITH A CLUSTER OF “HOUSEHOLDS” – OFF GRID

OPTION III	
Target Cluster of Households	15
Total Load (500 Whrs/ Household)	7500 Whrs
System Proposed	Solar PV Mini Grid And Central Control Room
Solar PV Panel	2.5 KWp
Battery Storage	48V, 600AH
Off Grid PCU (Inverter and Charge controller)	48 V, 2.5 KW
Other balance of System Components	As per actual
Estimated Project Cost	<b>Rs. 7,50,000/</b>

Inclusions	Nos.	Unit Load (W) [DC]	Total Load (W)	Hours of use per day	Energy Consumption (kWh/day)
A.C. operated LED Lights	3	8	24	6	0.144
A.C. operated LED Lights	2	5	10	6	0.060
Power for A.C. Fan and or Power for A.C. Loads like Color TV, Set top/ PC and Mobile Charger etc.	1	50	50	6	0.300
<b>Total</b>					<b>0.504</b>

OPTION IV	
Target Cluster of Households	50
Total Load (700 Whrs/ Household)	35,000 Whrs
System Proposed	Solar PV Mini Grid And Central Control Room
Solar PV Panel	12.5 KWp
Battery Storage	240V, 600AH
Off Grid PCU (Inverter and Charge controller)	240V, 12.5 KW
Other balance of System Components	As per actual
Estimated Project Cost	<b>Rs. 30,00,000/</b>

Inclusions	Nos.	Unit Load (W) [DC]	Total Load (W)	Hours of use per day	Energy Consumption (kWh/day)
A.C. operated LED Lights	3	8	24	6	0.144
A.C. operated LED Lights	2	5	10	6	0.060
Power for A.C. Fan and or Power for A.C. Loads like Color TV, Set top/ PC and Mobile Charger etc.	1	50	50	10	0.500
<b>Total</b>					<b>0.704</b>

### **PROPOSED SCHEME:**

- MNRE may provide subsidy at the rate of 40%.through NCEFA network of local technicians will have to be created for service and repair.
- Some local agencies / NGO's will have to be involved to ensure upkeep and proper use through awareness and training of users.
- The beneficiary may be asked to keep some fixed amount as “Reserves” like for battery replacement in future.