



# 24X7 POWER FOR ALL PUDUCHERRY

A Joint Initiative of Government of India and UT  
Administration of Puducherry





सत्यमेव जयते

Government of India



**Piyush Goyal**

**Union Minister of State (IC)  
Power, Coal, New & Renewable Energy**

## **Foreword**

Electricity consumption is one of the most important indices that decide 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 UT Administration of Puducherry 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 UT in primary, secondary & tertiary sectors resulting in inclusive development.

I compliment the UT Administration of Puducherry and wish them all the best for implementation of this programme. The Government of India will complement the efforts of UT Administration of Puducherry in bringing uninterrupted quality power to each household, farmer, small & medium enterprises and establishment in the UT.



Government of Puducherry



## Shri. V. Narayanasamy Hon'ble Chief Minister of Puducherry

### Foreword

Power sector is a critical infrastructure element required for the smooth functioning of the economy. An efficient, resilient and financially sustainable power sector is essential to stimulate growth and prosperity in the state. The availability of reliable, quality and affordable power can ensure growth of all sectors of economy including agricultural, industrial and others.

Puducherry is a prosperous Union Territory with 100% electrification. However, there is need for strengthening the system and enhance the average hours of power supply to consumers coupled with the need to control the cost of power and keep the power companies also in pink of financial health. AT & C loss reduction and application of energy efficiency measures would go a long way in achieving these objectives.

It is at this juncture that "24x7 Power for all" programme play a pivotal role. Conceived with the objective of providing 24x7 quality, reliable and affordable power for all, this programme takes a holistic approach for addressing the concerns across the value chain in Power sector.

On behalf of Government of Puducherry, I would like to thank Government of India, Hon'ble Prime Minister and Hon'ble Minister of Power for implementation of this programme.



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Government of Puducherry

Government of Puducherry

## Joint Statement

24x7 Power for All' (PFA) programme will be implemented by UT Administration of Puducherry with active support from Government of India with the objective to connect the unconnected in phased manner by FY 19, ensure 24x7 quality, reliable and affordable power supply to all Domestic, Commercial Agriculture and Industrial consumers within a fixed time frame.

UT Administration of Puducherry is attaching highest priority to power sector and power supply position is constantly reviewed. The UT is committed to provide full support to all utilities for ensuring quality power supply.

UT Administration of Puducherry would ensure that all the necessary steps outlined in the PFA document are taken up in terms of capacity addition, power purchase planning, strengthening the required transmission, implementation of Smart Grid and distribution network, encouraging renewables, undertaking customer centric initiatives, reduction of AT&C losses, bridging the gap between ACS & ARR, and following good governance practices in implementation of all

central and UT Administration schemes.

Government of India (GoI) would continue to support the efforts of UT Administration of Puducherry by fast tracking resolution of key issues pertaining to generation and ensuring optimum fund allocations in various distribution schemes (as per provisions of applicable policies).

It is envisaged to cover the entire UT under PFA programme in a phased manner and provide 24x7 power supply to all consumers from FY 17 itself and to all un-connected households by FY 18.

UT Administration of Puducherry would endeavor to implement the programme much earlier than the above targeted dates with the support of Government of India on scheme allocations.

The central and UT Administration would meet regularly to review the progress of the programme over the 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)

**Dr. S. Sundaravadivelu, I.A.S.**

Secretary, Power Department,

Government of Puducherry

## EXECUTIVE SUMMARY

24x7- Power for All (24x7 PFA) is a Joint Initiative of Government of India (GoI) and State Governments/UT Administrations with the objective to provide 24x7 power available to all households, industry, commercial businesses, public needs, any other electricity consuming entity and adequate power to agriculture farm holdings by FY 19. This roadmap document aims to meet the above objectives for the UT of Puducherry.

As per 2011 census, the population of UT of Puducherry was 12.48 lakhs. The power department of UT is the sole distribution licensee in the UT. The UT has per capita annual consumption of 1,850 units (FY 11) in the country which is way higher than national average of 1010 units during the same year (CEA) as there is about 37% industrial consumption in the UT.

### CONNECTING THE UNCONNECTED

Based on 2011 Census, there were around 7,071 un-electrified households in the UT. However as of FY 15 as per EDP records the number of un-electrified households have increased to 7,948. These households have not applied for electrification due to various socio-economic reasons or there are litigations which prevent EDP to affect service connection. There is no household left un-electrified due to want of electricity infrastructure. All the unconnected households will be electrified within FY 17 itself.

### 24 X 7 SUPPLY

The UT is already supplying power to the extent of 24 hours in urban areas and rural areas except for maintenance and operational issues.

### GROWTH IN DEMAND

In order to achieve the objective of 24 x 7 supply in the state, the state would see an increase in

peak demand from 503 MW in FY 15 to 644 MW in FY 19 with corresponding increase in energy requirement from 2,777MU in FY 15 to 3,555 MU in FY 19.

In the present conditions, the peak demand of 503 MW in FY 15 was almost fully met owing to power allocation from central generating stations and Power supplied by TNEB to Karaikal and by KSEB to Mahe.

The future demands have been derived by estimating household consumption after taking into account the growth in number of electrified households on the one hand and the growth in average consumption per household on the other hand. It has also been assumed that un-electrified consumers arrived as per census projection who have not applied for electrification would be electrified by FY 17. Individual category-wise growth rate equivalent to the 5 year CAGR has been considered for other than domestic sectors. However in case of abnormal historical CAGR for any category (less than 1% or higher than 20%) sales have been projected at CAGR of 5%.

The daily household consumption has been computed for households for FY 15 and escalated by historical CAGR of previous 5 years to arrive at the daily household consumption up to FY 19.

### SUPPLY ADEQUACY

Puducherry has only one gas based generating plant of 32.5 MW capacity at Karaikal and meets the most of the demand through allocation from Central Generating Stations. The present long-term availability of the state is 437 MW from all sources including share from unallocated quota from Central Generating Stations.

In FY 15 about 36% of the power was sourced from NTPC stations and 28% power from NLC. The UT also drew 354 MU power from TNEB for Karaikal and 42 MU from KSEB for Mahe.

In order to meet the increasing demand, the UT has been allocated 96 MW from CGSs (tentative) and solar based plants in a phased manner by FY 19.

As Puducherry will be having projected energy availability of almost 100% through long-term share in FY 19, there is no requirement of purchase through short term power as of now.

Accordingly, UT needs to optimize its power purchases as per requirement on short term basis and should look forward for selling the surplus power to prospective deficit states.

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#### ADEQUACY OF TRANSMISSION NETWORK

Presently, Pondicherry district is getting power at 230 kV level and remaining three areas such as Karaikal, and Mahe are getting power at 110 kV and Yanam at 132 kV level. The existing ISTS transmission line capacity and transformation capacity is adequate for meeting the present demand requirement of Karaikal, Mahe and Yanam. However transmission capacity of Pondicherry district will need augmentation at 230 KV and 110 kV level to meet projected demand.

The UT has also planned 230 kV Sub-station in Karaikal so as to import power from Tamil Nadu and other CGS at 230 kV level.

The UT has also envisaged capex of Rs 249 Crore on its transmission network which will be partly funded by central government budget and funding from JICA.

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#### ADEQUACY OF DISTRIBUTION NETWORK

There are about 4,32,609 consumers in the UT with 418 MVA connected load. The DT capacity in the UT is about 566 MVA. Keeping in view the load incident at HT and EHT level, the existing transformation capacities are adequate to meet the demand at LT level. The UT also plans to add 123.95 MVA of DT capacity by FY 19. The total capacity would comfortably meet the demand at LT level in FY 19.

The UT has envisaged a requirement of Rs 275 Crores in strengthening of distribution infrastructure.

The existing distribution network with projected addition would be adequate under projected peak load conditions but the UT has to take necessary steps to complete the planned works within scheduled time period.

The trajectory for AT&C loss reduction has been taken as per discussion with MoP so as to reach 10% by FY 19. In order to achieve the same T&D loss of Puducherry has been reduced in equal trench so as to reach 9.09% by FY 19 and collection efficiency has been increased in equal trench so as to reach 99% by FY 19.

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#### FINANCIAL TURNAROUND

EDP clocked net profit of Rs 104.95 Crore, however the department still has accumulated loss of Rs 442.81 Crores. If the UT follows roadmap as laid in this document regarding losses and capex, its accumulated loss will increase to Rs 759 Crores in FY 19. Further the UT needs tariff escalation of around 9% per year to wipe-off its accumulated loss. However if UT is unable to decrease its T&D losses as per target laid out in this document, it will need tariff escalation of around 10.5% to wipe-off accumulated losses.

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# 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. For this 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 contained in 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 also monitors the performance of distribution companies (Licensees) on the basis of 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 UT Administration of Puducherry with the objective to make 24x7 power available to all households, industry, commercial businesses, public needs, any other electricity consuming entity and adequate power to agriculture farm holdings.

Towards this goal the 24x7 PFA initiative seeks to:

- i. Ensure reliable 24x7 supply to consumers within a period of three years of commencement of the program. The hours of supply for agriculture consumers will be decided by the UT Administration as per requirement.
- ii. 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 19.
- iii. Ensure adequate capacity addition planning and tie ups for power from various sources at affordable price to meet the projected power demand in future.
- iv. Strengthen the transmission and distribution network to cater to the expected growth in demand of existing as well as future consumers.
- v. Assess the financial measures including optimizing investments and undertaking necessary balance sheet restructuring measures to ensure liquidity in the finances of the utility.
- vi. Put in place a strategy to ensure reduction of AT&C losses as per the agreed loss reduction trajectory and methodology and steps required to be taken at every level of distribution.
- vii. Identify steps for implementation and adoption of modern technologies to monitor reliability of supply.
- viii. Identify steps for monitoring timely commissioning of various generating plants and transmission and distribution infrastructure to meet the expected growth in demand.
- ix. To take measures for meeting the

performance standards as laid down by the SERC.

**This document is an action plan has been drawn to achieve the above aims and objectives. The plan will be executed by the UT Administration of Puducherry with the support of Government of India, 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 already identified/registered consumers and other consuming entities,
- (2) Connecting the unconnected households and unconnected farm holdings.

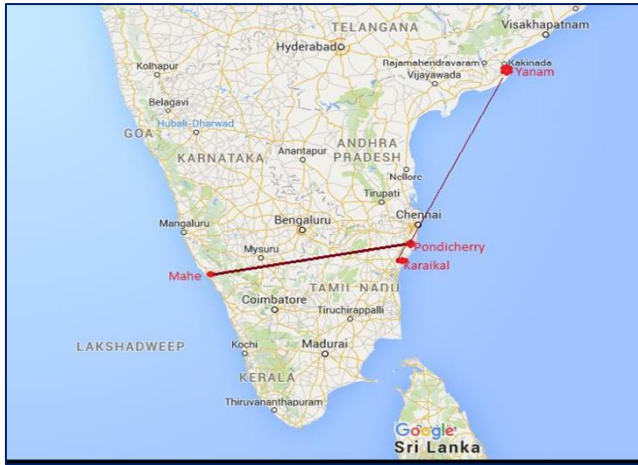
Accordingly the methodology adopted to prepare the 'Action Plan' for 24x7 PFA includes inter-alia:

- 1) Projection of average per day consumption of rural and urban households based on respective historical compounded annual growth rates (CAGR) during the past five years.
- 2) Projection of demand of commercial, industrial and agriculture consumers based again on past data and historical CAGR recorded during the past five years.
- 3) Assess the power requirement of un-electrified households and draw up a time bound plan for electrification of all households.
- 4) Project the annual energy requirement and maximum demand by aggregating

the requirement of all consumer categories and applying an appropriate load factor.

- 5) Draw up a broad plan to meet power demand in future through
  - ✓ UT's own upcoming generation resources.
  - ✓ Allocation from upcoming central sector power plants
  - ✓ Quantum for additional procurement required.
- 6) Assess the additional energy requirement for providing 24x7 power supply to all households in the UT as well as to other consumer categories and determine financial implications on utilities for procuring additional energy and its implication on tariff.
- 7) Assess the adequacy of the network - both inter-state and intra state transmission as well as distribution so as to meet the increased / expected / projected power requirement of all consumer categories of the UT.
- 8) To incorporate futuristic initiatives like smart grid, energy efficiency measures etc.
- 9) 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.
- 10) Set monitor able targets to achieve the goal of 24x7 Power for All in a cost effective manner to the consumers of the UT.

## CHAPTER 2: FACTS ABOUT PUDUCHERRY



Key Facts	
Constituted on	01 <sup>st</sup> November 1954
<b>As per 2011 Census</b>	
<b>Total Area</b>	<b>490 Sq. Km</b>
- Rural Areas	- 335.44 Sq. Km
- Urban Areas	(68.46%) - 154.56 Sq. Km (31.54%)
<b>Population</b>	<b>12,47,953</b>
- Rural	- 3,95,200
- Urban	- 8,52,753

The Union Territory of Puducherry comprises of four regions namely Puducherry, Karaikal, Mahe and Yanam, which are not geographically contiguous and is spread over an area of 490 Sq. km with the total population of 12.48 Lakhs as per provisional results of Census 2011. The basic profiles of four regions are as follows:

- Puducherry is the largest among the four regions and consists of 12 scattered areas interspersed with enclaves of Villupuram and Cuddalore Districts of Tamil Nadu.
- Karaikal is about 150 kms South of Puducherry and is bounded by Nagapattinam and Thiruvarur Districts of Tamil Nadu State.
- Mahe lies almost parallel to Puducherry 653 kms away on the west coast near Kannur District of Kerala State.
- Yanam is located about 840 kms north-east of Puducherry and it is located in the East Godhavari District of Andhra Pradesh State.

The Territory of Puducherry was merged with the Indian Union on 01<sup>st</sup> November 1954 and is administered under the provisions of Government of Union Territories Act, 1963.

Puducherry Electricity Department being a deemed distribution licensee as per section 14 of the Electricity Act 2003, performs the functions of transmission and distribution of electric power to the Union Territory. The sole generating station in Puducherry is a 32.5 MW combined cycle gas power plant in Karaikal owned by the Puducherry Power Corporation Limited. The entire power requirement of Puducherry is met from the power allocated from the Central Generating Stations, Tamil Nadu Electricity Board, Kerala State Electricity Board and from the Puducherry Power Corporation Limited

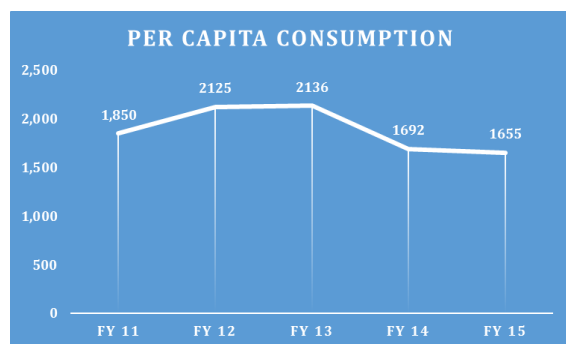
The Union Territory of Puducherry has an extensive network of Power Transmission and Distribution Systems spread along the breadth and width of all the four regions of the Union Territory. EDP operates a transmission network of 230 kV & 110 kV and distribution network at 33 kV, 22 kV, 11 kV and at LT levels. The power sector of UT is regulated by Joint Electricity Regulatory Commission (JERC) for the State of Goa and UTs.

## CHAPTER 3: CONSUMPTION PATTERN AND ELECTRIFICATION STATUS

### ELECTRIFICATION STATUS AND PER-CAPITA CONSUMPTION

The population of UT Puducherry has grown from 9,74,345 in 2001 to 12,47,953 in 2011. Based on the annual energy availability from FY 11 to FY 15, the per-capita consumption of electricity in the period has been as shown below:

**Figure 1: Per-Capita Consumption of Electricity (kWh per person) in recent years**



- The per-capita consumption has shown a decreasing trend from FY 14 onwards which is primarily due to decrease in industrial sales over the years.

### STATUS OF ELECTRIFICATION AND PROJECTION OF HOUSEHOLDS FOR FY 15

The summary of electrified and un-electrified households in UT as per 2001 and 2011 census and projections for FY 15 based on CAGR for past 10 years is tabulated below:

**Table 1: Projection of households based on Census 2001 and 2011**

Particulars	Electrified Households	Un-Electrified Households	Total Households
<b>Total Puducherry</b>			
2001	1,83,217	25,438	2,08,655
in %	87.81%	12.19%	100.00%
2011	2,94,205	7,071	3,01,276
in %	97.65%	2.35%	100.00%
CAGR	4.85%	-12.02%	3.74%
<b>FY 15 (Projected Households)</b>	<b>3,56,432</b>	<b>-6,855</b>	<b>3,49,577</b>
<b>Pondicherry</b>			
2001	1,41,563	16,842	1,58,405
in %	89.37%	10.63%	75.92%
2011	2,26,316	4,387	2,30,703
in %	98.10%	1.90%	76.58%
CAGR	4.80%	-12.59%	3.83%
<b>FY 15 (Projected Households)</b>	<b>2,73,037</b>	<b>(4,894)</b>	<b>2,68,143</b>
<b>Karaikal</b>			
2001	30,673	6,992	37,655
in %	81.46%	18.57%	18.05%
2011	47,880	2,188	50,068
in %	95.63%	4.37%	16.62%
CAGR	4.55%	-10.97%	2.89%
<b>FY 15 (Projected Households)</b>	<b>57,215</b>	<b>(1,104)</b>	<b>56,112</b>
<b>Mahe</b>			
2001	5,693	211	5,904
in %	96.43%	3.57%	2.83%
2011	7,150	47	7,197
in %	99.35%	0.65%	2.39%
CAGR	2.30%	-13.94%	2.00%
<b>FY 15 (Projected Households)</b>	<b>7,832</b>	<b>(42)</b>	<b>7,790</b>
<b>Yanam</b>			
2001	5,288	1,393	6,681
in %	79.15%	20.85%	3.20%
2011	12,859	449	13,308
in %	96.63%	3.37%	4.42%
CAGR	9.29%	-10.70%	7.13%
<b>FY 15 (Projected Households)</b>	<b>18,347</b>	<b>(816)</b>	<b>17,532</b>

From above it is inferred that:

- *In 2011, Pondicherry has highest 76.58% of total households in the UT followed by Karaikal having 16.62% households*
- *Mahe has highest number of electrified households at 99.35% followed by Pondicherry having 98.10% electrified households*
- *Overall number of households has grown at a CAGR of 3.74% with Yanam showing highest decadal growth rate of 7.13% as compared to 3.83% in Pondicherry.*

The above projected figures, derived by extrapolating Census 2011 data, do not match with the records of the UT (EDP) for FY 15 which shows a very different position. The following table compares the projected number of electrified and un-electrified households based on Census 2011 and as per EDP records.

**Table 2: Census 2011 vs. EDP's Household Data for Puducherry (Numbers)**

Particulars	Electrified HHs	Un-Electrified Consumers	Total HHs
<b>Total</b>			
FY 15 (Based on Census)	3,56,432	(6,855)	3,49,577
FY 15 (as per EDP)	3,22,034	7,948	3,29,982

Following variations were observed in figures submitted by EDP and census projections:

- Against the projections of 3,56,432 electrified households in FY 15, there are 3,22,034 electrified consumers as per records of EDP.

- Considering EDP submissions there are 7,948 households which are un-electrified i.e. 7000 households in Pondicherry and 948 in Karaikal. These households have not applied for electrification due to various socio-economical reasons or there are litigations which prevent EDP to affect service connection. There is no household left un-electrified due to want of electricity infrastructure. All the unconnected households will be electrified within FY 17 itself.

This anomaly/discrepancy in figures was discussed with EDP.

The issue of demand projections for future years was discussed with the UT. For the projection of daily household consumption (for the estimation of demand) of both rural and urban consumers in future years, electrified and un-electrified households as per record of EDP has been considered

Area-wise breakup of electrified, un-electrified and total households as per EDP is given in below table:

**Table 3: Area-wise Considered Household data for Puducherry**

Area	Electrified Consumers	Un-Electrified HHs	Total HHs
Pondicherry	2,42,793	7,000	2,49,793
Karaikal	59,156	948	60,104
Mahe	9,985	0	9,985
Yanam	10,100	0	10,100
<b>Total</b>	<b>3,22,034</b>	<b>7,948</b>	<b>3,29,982</b>

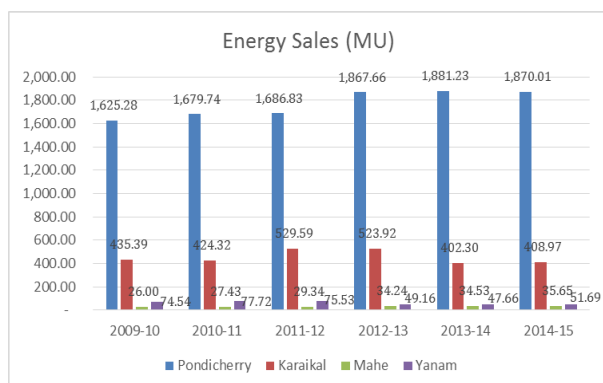
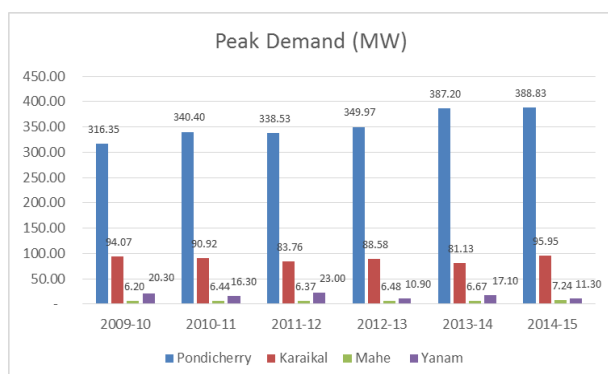
Accordingly, the demand projections for the UT have been worked out in the next chapter

## CHAPTER 4: DEMAND AND SUPPLY SCENARIO

### PRESENT POSITION

The actual demand scenario and total sales during the past 6 years is shown below:

**Figure 2: Peak Demand (in MW)**



- *EDP has met both maximum demand and energy requirement in FY 15*

The demand has increased substantially over the years owing to fact domestic demand has increased due to proper metering and increase in consumption pattern in both rural and urban.

As per the UT, in FY 15, barring a few operational issues, the supply was generally of the order of around almost 24 hours only.

### DEMAND PROJECTIONS

The present energy requirement of Puducherry during FY 15 was 2777 MU. With 24x7 supply to be provided across the UT, the demand is likely to increase. 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.

### APPROACH FOR ASSESSMENT OF ADEQUACY

As the four areas (Pondicherry, Karaikal, Mahe and Yanam) are not interconnected, area-wise estimation of demand and assessment of network adequacy has been done. The broad approach for assessment is highlighted below:

- The daily household consumption has been computed separately to arrive at the daily household consumption up to FY 19.
- The annual sales in domestic category has been arrived on consideration that the projected households would be consuming electricity at their projected daily household consumptions.
- Sales in categories other than household have been considered to increase at the respective CAGRs of past 5 years.

The area wise assessment power supply scenario is summarized in subsequent chapters.

## CHAPTER 5: POWER SECTOR SCENARIO- PONDICHERRY

### DEMAND PROJECTIONS

#### DETERMINATION OF CONSUMPTION OF DOMESTIC CONSUMERS

The present energy requirement of Pondicherry during FY 15 was 2183 MU. With 24x7 supply to be provided across the area, the demand is likely to increase.

The average daily household consumption of existing electrified households in FY 15 has been arrived at by dividing the actual sales by the actual number of electrified domestic consumers in FY 15 respectively.

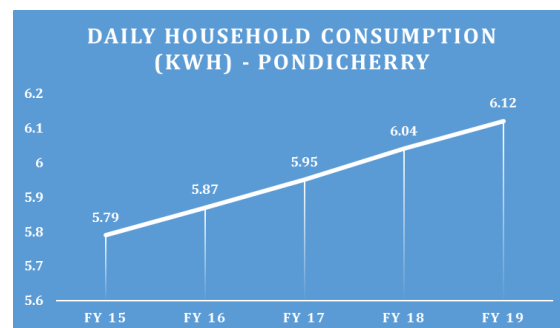
The actual daily household consumption of registered domestic consumers has increased to 5.79 kWh in FY 15 at CAGR of 1.40% in last 5 years. Daily household consumption till FY 19 has been projected by escalation daily household consumption by same CAGR.

Pondicherry also has 7000 un-electrified households. These households have not applied for electrification due to various socio-economic reasons or there are litigations which prevent EDP to affect service connection. There is no household left un-electrified due to want of electricity infrastructure. Out of 7000 un-electrified

households, it is expected 30% of these households will be electrified in FY 16 and remaining in FY 17.

The projected daily household consumption in Pondicherry is shown below:

**Figure 3: Projected Daily Household Consumption Electricity (kWh per person) for future years**



However, it may also be kept in view that the geographical features of the area (i.e. the location, accessibility, weather) along with current tariff levels play a significant role in determining the current and future demands.

The number of electrified households is expected to grow at the overall decadal CAGR of 4.53%.

Accordingly, the annual consumption of the domestic households is tabulated below:

**Table 4: Projected Sales from Existing and Newly Electrified Households in Pondicherry**

S. N.	Particulars	FY 15	FY 16	FY 17	FY 18	FY 19
<b>A</b>	<b>Electrified Consumers (Existing + Projected Growth)</b>					
	Electrified Consumers (in Nos.)	2,42,793	2,53,796	2,65,298	2,77,321	2,89,889
	Daily Household Consumption (in kWh)	5.79	5.87	5.95	6.04	6.12
	Projected Annual Consumption (in MU)	-	545.46	576.60	611.18	647.84
<b>B</b>	<b>Electrification of Un-Electrified Consumers</b>					
	Targeted Annual Addition (in Nos.)	-	2,100	4,900	-	-
	Cumulative Annual Addition (In Nos.)	-	2,100	7,000	7,000	7,000
	Projected Annual Consumption (in MU)	-	2.25	9.89	15.43	15.64
<b>C=A+B</b>	<b>Total Projected household Consumption (MU)</b>	-	<b>547.71</b>	<b>586.49</b>	<b>626.61</b>	<b>663.48</b>

## DETERMINATION OF CONSUMPTION OF OTHER CONSUMERS

For projection of sales for FY 16 to FY 19, the CAGR of previous 5 years has been considered for all categories. However for categories where growth is less than 1% or more than 20% the growth in consumption has been considered at normative 5%. Based on this, the category-wise sales is as per table below:

**Table 5: Projected Sales from Other Consumers in Pondicherry**

: Categories	CAGR Considered	FY 16	FY 17	FY 18	FY 19
Domestic		538.99	577.15	616.63	652.92
Hut Services		8.72	9.34	9.98	10.56
Commercial	3.50%	158.84	164.41	170.17	176.13
Agriculture (HP)	5.00%	55.71	58.50	61.42	64.49
Street Lighting	13.97%	24.83	28.30	32.26	36.77
LT Industrial	5.79%	158.76	167.95	177.67	187.95
Water Tanks	6.13%	30.72	32.61	34.61	36.73
Temporary	5.00%	5.39	5.66	5.94	6.24
<b>Total LT</b>		<b>981.98</b>	<b>1043.91</b>	<b>1108.67</b>	<b>1171.78</b>
HT Industrial	5.00%	604.86	635.10	666.86	700.20
HT Govt. Estates	11.27%	56.39	62.75	69.83	77.70
HT EHT Industrial	13.54%	360.60	409.42	464.85	527.79
<b>Total HT</b>		<b>1021.85</b>	<b>1107.28</b>	<b>1201.54</b>	<b>1305.68</b>
<b>Total</b>		<b>2003.83</b>	<b>2151.18</b>	<b>2310.20</b>	<b>2477.46</b>

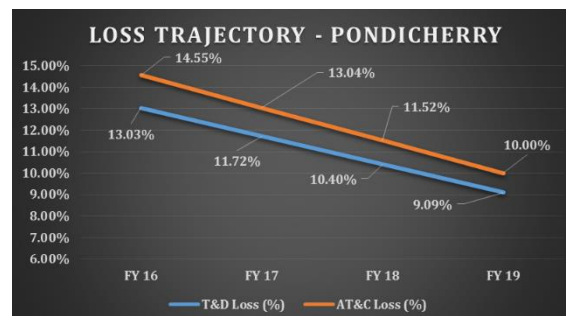
## ENERGY AND DEMAND REQUIREMENT

The trajectory for AT&C loss reduction has been taken as per discussion with MoP so as to reach 10% by FY 19. In order to achieve the same T&D loss of Pondicherry has been reduced in equal trench so as to reach 9.09% by FY 19 and collection efficiency has been increased in equal trench so as to reach 99% by FY 19.

The UT is undertaking a number of steps such as energy audit and assessment of base level loss, Intensification of Vigilance, Metering of Consumers, online payment mechanism, tie-up with Common Service Centre for collection of revenue, defective meter replacement, replacement of mechanical meters, metering of unmetered connections and introduction of prepaid meters etc.

The T&D and AT&C Loss trajectory is shown below:

**Figure 4: Projected Loss Reduction Trajectory**



Based on the loss reduction trajectory as shown above, energy and demand requirement for the future years is tabulated in Table 6 below:

The actual load of open access consumers in FY 15 is nil and the same is projected to remain constant and the peak demand of the Pondicherry has been accordingly calculated.

The load factor has been taken as 64.09% as per actual recorded in Pondicherry in FY 15.

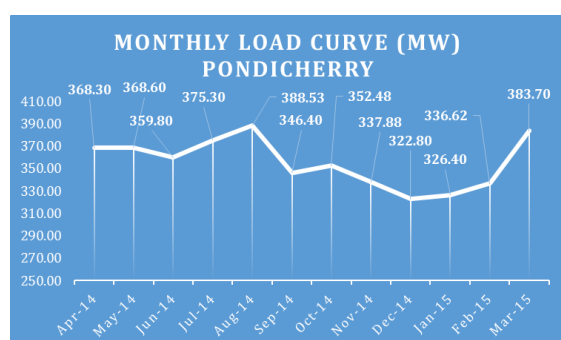
**Table 6: Energy Requirement (In MU) and Peak Demand (in MW)**

Particulars	Energy and Demand Scenario			
	FY 16	FY 17	FY 18	FY 19
Energy Requirement	2,400	2,538	2,686	2,839
Sale within UT	2,004	2,151	2,310	2,477
T&D Losses	13.03%	11.72%	10.40%	9.09%
Intrastate transmission losses	4.00%	4.00%	4.00%	4.00%
Load Factor	64.09%	64.09%	64.09%	64.09%
<b>Maximum Demand (EDP)</b>	<b>427.46</b>	<b>452.07</b>	<b>478.38</b>	<b>505.60</b>

As seen from the above, the maximum demand requirement of Pondicherry is projected to increase from 388.83 MW in FY 15 to **505.60 MW in FY 19** assuming an unchanged annual load factor of 64.09%.

## LOAD CURVE

**Figure 5: Load Curves Pondicherry (FY 15)**

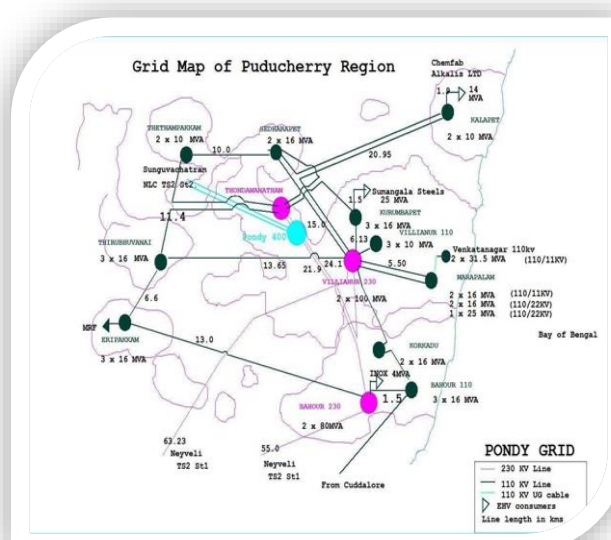


As seen from above, there is consistently a huge variation in minimum and maximum demand across the year i.e. from about 323 MW to more than 388 MW whereas the average demand is about 355 MW only.

Adoption of various energy efficiency measures like energy efficient irrigation pump-sets, energy efficient lighting (use of LEDs), adopting demand side management initiatives like introduction of Time of Day (TOD) tariff etc., would also help in reducing the peak demand of the UT.

## POWER MAP OF PONDICHERRY

**Figure 6: Power Transmission Map of Pondicherry**



## EXISTING INTER-STATE TRANSMISSION SYSTEM (ISTS)

Following inter-state transmission substations serve Pondicherry

- Pondicherry: 400/230 kV 2 x 315 MVA*
- Villianur: 230/110kV : 2x100MVA*
- Bahour: 230/110kV : 2x80MVA*
- Thondamanatham: 230/110kV : 2x100MVA*

The area has existing ISTS Transmission lines of 116.89 Ckt Kms at 230 kV is detailed in cells A1, A2 and B1 of Table 49 in Annexure-1

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

An additional 500 MVA Transformer is planned to be added to existing 400 kV Pondicherry Sub-station (2 x 315 MVA). Hence the capacity at 400 kV level would be suffice for envisaged 562 MVA maximum demand in FY 19. No new sub-station or transmission line is planned at 230 kV level. Against 560 MVA existing capacity available at 230 kV level, maximum import as per envisaged demand scenario will be 506 MW or 562 MVA. Hence the available transmission system needs to be augmented at 230 kV level to meet the power supply requirement of Pondicherry in FY 19.

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

The aggregate capacity in the area at 110/22 kV is 462 MVA. The above capacity is generally adequate to meet the present peak requirements of 388 MW or 432 MVA. The area has Intra-State transmission line of 187.48 Ckt Kms at 110 kV and 52.77 Ckt Kms at 230 kV. The intra state sub-station and transmission line of the area is detailed in Table 50 and Table 51 in Annexure-1.

#### INTRA-STATE TRANSMISSION SYSTEM PLANNED UP TO FY 19

EDP has planned to install 2 InSTS Sub-stations in the area having aggregate capacity of 100 MVA. EDP has also planned laying of 110 KV cable from Kurumbapet SS to 110kV proposed Lawspet substation and Venkatanagar 110kV SS totalling 5 Ckt. Km.

Table 46 and Table 48 in Annexure – 1 detail new sub-stations and transmission lines planned for system strengthening.

The total capacity of intra-state sub-station in the area would reach 562 MVA in FY 19. The total demand of the area is slated to reach 562 MVA out of which there is a substantial demand at EHT level (110 kV and above). Hence the intra-state sub-station capacity is adequate for envisage demand.

#### SYSTEM ANALYSIS UNDER PEAK DEMAND OF 506 MW IN FY 19

##### GENERAL

Results of load flow study will be required to assess the adequacy of the power drawl by the UT corresponding to FY 19 condition.

#### EXISTING DISTRIBUTION SYSTEM

A snapshot of the existing distribution system serving Pondicherry is given below.

**Table 7: Existing Distribution System as on March 2015**

Particulars	Qty.
Domestic Consumers	2,42,793
Connected Load	832 MVA
Peak Demand	389 MW
HT Lines & Cables (CKT Km.)	1016.89
LT Lines & Cables (CKT Km.)	3775.54

#### ASSESSMENT OF ADEQUACY OF DISTRIBUTION SYSTEM

##### AT 22/.04 KV LEVEL

The existing aggregate 22/0.4 KV distribution transformer capacity is about 453.66 MVA in FY 15.

Further, an additional transformer capacity of 75.50 MVA is planned to be added by FY 19 under various initiatives which will result

in overall distribution transformation capacity of 529.16 MVA by FY 19.

Given that the billed maximum demand of consumers at 22 kV and higher level totals around 196.02 MW (apportioning demand in ratio of total sales). This leaves a demand of 192.81 MW ( $=388.83-196.02$ ) to be met at LT (415V) level which corresponds to 214.23 MVA considering a power factor of 0.9.

Against this peak demand, the aggregate installed capacity of DT transformers in the UT is 453.66 MVA. This translates to an average loading of 47.22% on distribution transformers under peak demand conditions which is very comfortable.

Following the same logic and taking the projected peak demand of 505.60 MW in FY 19 and assuming the proportion of demand met at 22 kV in relation to the total sales, the contribution of consumers at 22 kV and above level to the peak demand of the UT comes to 266.46 MW.

Correspondingly, the demand met below 22 kV comes to around 239.14 MW ( $=505.60-266.46$ ) which corresponds to 265.71 MVA. This peak requirement, the installed capacity of distribution transformers in FY 19 is projected at 529.16MVA. This translates to an average loading of 50.21% on distribution transformers under peak demand conditions which is again very comfortable.

## CHAPTER 6: POWER SECTOR SCENARIO-KARAIKAL

### DEMAND PROJECTIONS

#### DETERMINATION OF CONSUMPTION OF DOMESTIC CONSUMERS

The present energy requirement of Karaikal during FY 15 was 491.85 MU. With 24x7 supply to be provided across the island, the demand is likely to increase.

The average daily household consumption of existing electrified households in FY 15 has been arrived at by dividing the actual sales by the actual number of electrified domestic consumers in FY 15 respectively.

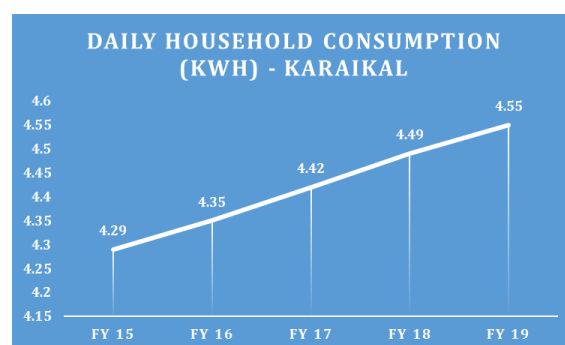
The actual daily household consumption of registered domestic consumers has increased to 4.29 kWh in FY 15 at CAGR of 1.53% in last 2 years. Daily household consumption till FY 19 has been projected by escalation daily household consumption by same CAGR.

Karaikal also has 948 un-electrified households. These households have not applied for electrification due to various socio-economic reasons or there are litigations which prevent EDP to affect service connection. There is no household left un-electrified due to want of electricity infrastructure. Out of 948 un-electrified

households, it is expected 30% of these households will be electrified in FY 16 and remaining in FY 17.

The projected daily household consumption in Karaikal is shown below:

**Figure 7: Projected Daily Household Consumption Electricity (kWh per person) for future years**



However, it may also be kept in view that the geographical features of the area (i.e. the location, accessibility, weather) along with current tariff levels play a significant role in determining the current and future demands.

The number of electrified households is expected to grow at the overall decadal CAGR of 4.53%.

Accordingly, the annual consumption of the domestic households is tabulated below:

**Table 8: Projected Sales from Existing and Newly Electrified Households in Karaikal**

S. N.	Particulars	FY 15	FY 16	FY 17	FY 18	FY 19
<b>A</b>	<b>Electrified Consumers (Existing + Projected Growth)</b>					
	Electrified Consumers (in Nos.)	59,156	61,837	64,639	67,569	70,631
	Daily Household Consumption (in kWh)	4.29	4.35	4.42	4.49	4.55
	Projected Annual Consumption (in MU)	-	98.47	104.23	110.62	117.40
<b>B</b>	<b>Electrification of Un-Electrified Consumers</b>					
	Targeted Annual Addition (in Nos.)	-	284	664	-	-
	Cumulative Annual Addition (In Nos.)	-	284	948	948	948
	Projected Annual Consumption (in MU)	-	0.23	0.99	1.55	1.58
<b>C=A+B</b>	<b>Total Projected household Consumption (MU)</b>	-	<b>98.70</b>	<b>105.22</b>	<b>112.17</b>	<b>118.98</b>

## DETERMINATION OF CONSUMPTION OF OTHER CONSUMERS

For projection of sales for FY 16 to FY 19, the CAGR of previous 5 years has been considered for all categories. However for

categories where growth is less than 1% or more than 20% the growth in consumption has been considered at normative 5%.

Based on this, the category-wise sales is as per table below:

**Table 9: Projected Category-wise Sales for Karaikal (In MU)**

Category	Considered	FY 16	FY 17	FY 18	FY 19
Domestic		96.78	103.17	109.99	116.66
Hut Services		1.92	2.05	2.18	2.31
Commercial	6.49%	19.65	20.92	22.28	23.73
Agriculture (HP)	5.00%	3.97	4.17	4.38	4.59
Street Lighting	5.00%	2.67	2.8	2.94	3.09
LT Industrial	5.00%	9	9.45	9.92	10.42
Water Tanks	7.87%	4.13	4.46	4.81	5.19
Temporary	5.00%	0.74	0.77	0.81	0.85
<b>Total LT</b>		<b>138.85</b>	<b>147.79</b>	<b>157.31</b>	<b>166.85</b>
HT Industrial	5.00%	285.15	299.41	314.38	330.1
HT Govt. Estates	14.33%	5.72	6.54	7.47	8.54
HT EHT Industrial	5.00%	2.1	2.21	2.32	2.43
<b>Total HT</b>		<b>292.96</b>	<b>308.15</b>	<b>324.16</b>	<b>341.07</b>
<b>Total</b>		<b>431.81</b>	<b>455.94</b>	<b>481.47</b>	<b>507.91</b>

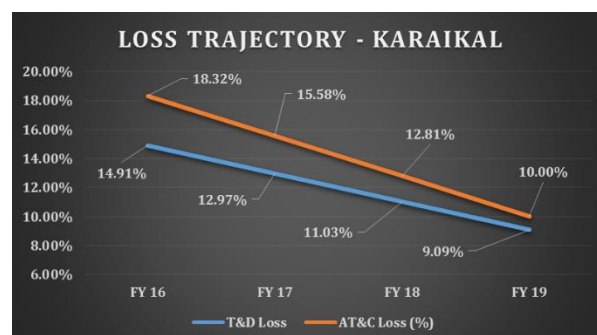
## ENERGY AND DEMAND REQUIREMENT

The trajectory for AT&C loss reduction has been taken as per discussion with MoP so as to reach 10% by FY 19. In order to achieve the same T&D loss of Karaikal has been reduced in equal trench so as to reach 9.09% by FY 19 and collection efficiency has been increased in equal trench so as to reach 99% by FY 19.

The UT is undertaking a number of steps such as energy audit and assessment of base level loss, Intensification of Vigilance, Metering of Consumers, online payment mechanism, tie-up with Common Service Centre for collection of revenue, defective meter replacement, replacement of mechanical meters, metering of unmetered connections and introduction of prepaid meters etc.

The T&D and AT&C Loss trajectory is shown below:

**Figure 8: Projected Loss Reduction Trajectory**



Based on the loss reduction trajectory approved as above, energy and demand requirement for the future years is tabulated in Table 10 below:

The actual load of open access consumers in FY 15 is nil and the same is projected to remain constant and the peak demand of the Karaikal has been accordingly calculated.

The load factor has been taken as 58.52% as per actual recorded in Karaikal in FY 15.

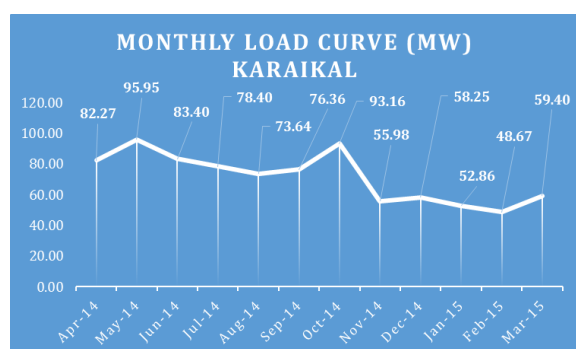
**Table 10: Energy Requirement (In MU) and Peak Demand (in MW)**

Particulars	Energy and Demand Scenario			
	FY 16	FY 17	FY 18	FY 19
Energy Requirement	529	546	564	582
Sale within UT	432	456	481	508
T&D Losses	14.91%	12.97%	11.03%	9.09%
Intrastate transmission losses	4.00%	4.00%	4.00%	4.00%
Load Factor	58.52%	58.52%	58.52%	58.52%
Maximum Demand (Karaikal)	103	106	110	114

As seen from the above, the maximum demand requirement of Karaikal is projected to increase from 95.95 MW in FY 15 to **114MW in FY 19** assuming an unchanged annual load factor of 58.52%.

### LOAD CURVE

**Figure 9: Load Curves EDP (FY 15)**

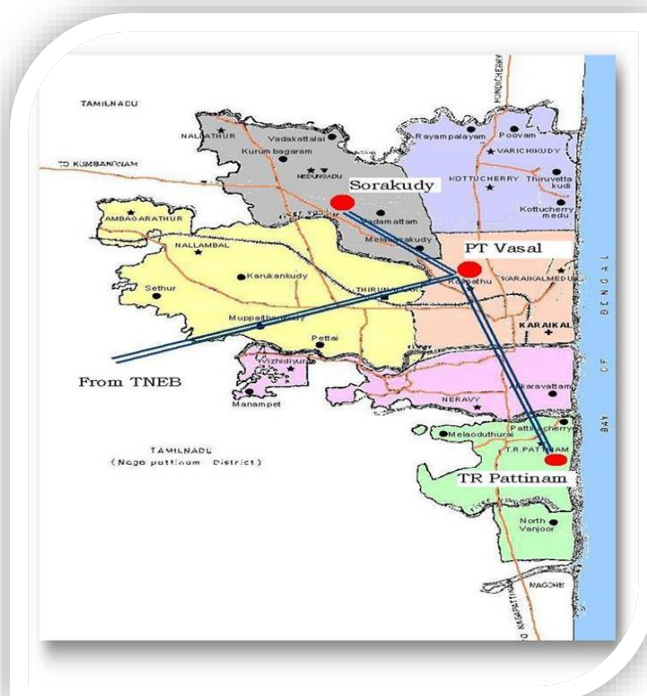


As seen from above, there is consistently a huge variation in minimum and maximum demand across the year i.e. from about 48 MW to more than 96 MW whereas the average demand is about 72 MW only.

Adoption of various energy efficiency measures like energy efficient irrigation pump-sets, energy efficient lighting (use of LEDs), adopting demand side management initiatives like introduction of Time of Day (TOD) tariff etc., would also help in reducing the peak demand of the UT.

### POWER MAP OF KARAIKAL

**Figure 10: Power Transmission Map of Karaikal**



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

Karaikal has no Inter-State Sub-station on its territory, however it has Inter-state transmission line between Thiruvavoor S/s in Kerala and Sorakudi S/s in Karaikal as detailed in cells B2 of Table 49 in Annexure-1.

## PLANNED INTER-STATE TRANSMISSION SYSTEM (ISTS)

A new 200 MVA sub-station has been planned by EDP in Karaikal area to import power from southern grid as well as to evacuate power from generating stations. The new sub-station will be fed by 230 kV NLC-Karaikal Transmission line. The details of the same is given in Table 45 and Table 47 in Annexure-1.

## EXISTING POWER EVACUATION & INTRA STATE TRANSMISSION SYSTEM

The aggregate capacity at 110/11 kV level in the area is 110 MVA. The above capacity is generally adequate to meet the present peak requirements of 95.95 MW or 106.61 MVA. The area has Intra-State transmission line of 63.48 Ckt Kms at 110 kV level. The intra state sub-station and transmission line of the area is detailed in Table 51 and Table 50 in Annexure-1.

## INTRA-STATE TRANSMISSION SYSTEM PLANNED UP TO FY 19

EDP has planned to install 1 InSTS Sub-station in the area having aggregate capacity of 32 MVA.

Table 46 in Annexure – 1 detail new sub-station planned for system strengthening.

The total capacity of intra-state sub-station in the area would reach 142 MVA in FY 19. The total demand of the area is slated to reach 126.67 MVA (114 MW). Hence the intra-state sub-station capacity is adequate for envisage demand.

## SYSTEM ANALYSIS UNDER PEAK DEMAND OF 114 MW IN FY 19

Results of load flow study will be required to assess the adequacy of the power drawl by the UT corresponding to FY 19 condition.

## EXISTING DISTRIBUTION SYSTEM

A snapshot of the existing distribution system serving Karaikal is given below.

**Table 11: Existing Distribution System as on March 2015**

Particulars	Qty.
Domestic Consumers	59,156
Connected Load	185 MVA
Peak Demand	96 MW
HT Lines & Cables (CKT Km.)	250.68
LT Lines & Cables (CKT Km.)	1281.63

## ASSESSMENT OF ADEQUACY OF DISTRIBUTION SYSTEM

### AT 11/.04 KV LEVEL

The existing aggregate 11/ 0.4 KV distribution transformer capacity is about 72.02 MVA in FY 15.

Further, an additional transformer capacity of 41.06 MVA is planned to be added by FY 19 under various initiatives which will result in overall distribution transformation capacity of 113.08 MVA by FY 19.

Given that the billed maximum demand of consumers at 11 kV and higher level totals around 65.60 MW (apportioning demand in ratio of total sales). This leaves a demand of 30.35 MW (=95.95-65.60) to be met at LT (415V) level which corresponds to 33.72 MVA considering a power factor of 0.9.

Against this peak demand, the aggregate installed capacity of DT transformers in the UT is 72.02 MVA. This translates to an average loading of 46.83% on distribution transformers under peak demand conditions which is very comfortable.

Following the same logic and taking the projected peak demand of 114 MW in FY 19 and assuming the proportion of demand met at 11 kV in relation to the total sales, the contribution of consumers at 11 kV and

above level to the peak demand of the UT comes to 76.71 MW.

Correspondingly, the demand met below 11 kV comes to around 37.29 MW ( $=114-76.71$ ) which corresponds to 44.27 MVA considering a power factor of 0.9. Against

this peak requirement, the installed capacity of distribution transformers in FY 19 is projected at 113.08 MVA. This translates to an average loading of 36.65% on distribution transformers under peak demand conditions which is again very comfortable.

## CHAPTER 7: POWER SECTOR SCENARIO-MAHE

### DEMAND PROJECTIONS

#### DETERMINATION OF CONSUMPTION OF DOMESTIC CONSUMERS

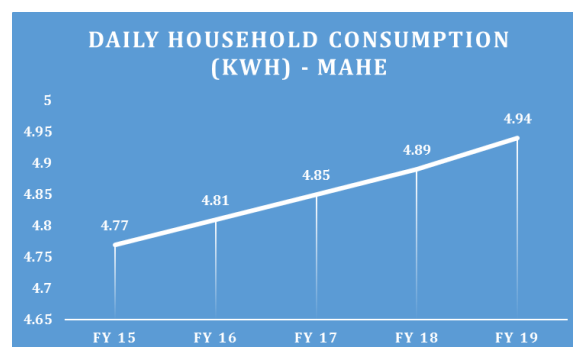
The present energy requirement of Mahe during FY 15 was 41.91 MU. With 24x7 supply to be provided across the island, the demand is likely to increase.

The average daily household consumption of existing electrified households in FY 15 has been arrived at by dividing the actual sales by the actual number of electrified domestic consumers in FY 15 respectively.

The actual daily household consumption of registered domestic consumers has increased to 4.77 kWh in FY 15 at CAGR of 0.85% in last 5 years. Daily household consumption till FY 19 has been projected by escalation daily household consumption by same CAGR.

The projected daily household consumption in Mahe is shown below:

**Figure 11: Projected Daily Household Consumption Electricity (kWh per person) for future years**



However, it may also be kept in view that the geographical features of the area (i.e. the location, accessibility, weather) along with current tariff levels play a significant role in determining the current and future demands.

The number of electrified households is expected to grow at the overall decadal CAGR of 4.53%.

Accordingly, the annual consumption of the domestic households is tabulated below:

**Table 12: Projected Sales from Existing and Newly Electrified Households in Mahe**

S. N.	Particulars	FY 15	FY 16	FY 17	FY 18	FY 19
<b>A</b>	<b>Electrified Consumers (Existing + Projected Growth)</b>					
	Electrified Consumers (in Nos.)	9,985	10,438	10,911	11,405	11,922
	Daily Household Consumption (in kWh)	4.77	4.81	4.85	4.89	4.94
	Projected Annual Consumption (in MU)	-	18.38	19.32	20.37	21.48
<b>B</b>	<b>Electrification of Un-Electrified Consumers</b>					
	Targeted Annual Addition (in Nos.)	-	-	-	-	-
	Cumulative Annual Addition (In Nos.)	-	-	-	-	-
	Projected Annual Consumption (in MU)	-	-	-	-	-
<b>C=A+B</b>	<b>Total Projected household Consumption (MU)</b>	-	<b>18.38</b>	<b>19.32</b>	<b>20.37</b>	<b>21.48</b>

#### DETERMINATION OF CONSUMPTION OF OTHER CONSUMERS

For projection of sales for FY 16 to FY 19, the CAGR of previous 5 years has been considered for all categories. However for categories where growth is less than 1% or more than 20% the growth in consumption has been considered at normative 5%.

Based on this, the category-wise sales is as per table below:

**Table 13: Projected Category-wise Sales for Mahe (In MU)**

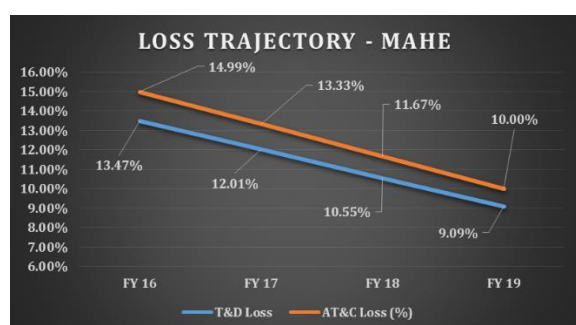
Categories	CAGR Considered	Projections			
		FY 16	FY 17	FY 18	FY 19
Domestic		18.36	19.3	20.35	21.45
Hut Services		0.02	0.02	0.02	0.02
Commercial	5.01%	5.67	5.95	6.25	6.57
Agriculture (HP)	5.00%	0.13	0.13	0.14	0.15
Street Lighting	5.00%	0.47	0.5	0.52	0.55
LT Industrial	1.80%	0.62	0.63	0.64	0.66
Water Tanks	2.36%	0.1	0.1	0.11	0.11
Temporary	5.00%	0			
<b>Total LT</b>		<b>25.37</b>	<b>26.64</b>	<b>28.03</b>	<b>29.5</b>
HT Industrial	11.37%	12.9	14.36	15.99	17.81
HT Govt. Estates					
HT EHT Industrial					
<b>Total HT</b>		<b>12.9</b>	<b>14.36</b>	<b>15.99</b>	<b>17.81</b>
<b>Total</b>		<b>38.27</b>	<b>41.01</b>	<b>44.03</b>	<b>47.31</b>

## ENERGY AND DEMAND REQUIREMENT

The trajectory for AT&C loss reduction has been taken as per discussion with MoP so as to reach 10% by FY 19. In order to achieve the same T&D loss of Mahe has been reduced in equal trench so as to reach 9.09% by FY 19 and collection efficiency has been increased in equal trench so as to reach 99% by FY 19.

The T&D and AT&C Loss trajectory is shown below:

**Figure 12: Projected Loss Reduction Trajectory**



Based on the loss reduction trajectory approved as above, energy and demand requirement for the future years is tabulated in Table 14 below:

The actual load of open access consumers in FY 15 is nil and the same is projected to remain constant and the peak demand of the Pondicherry has been accordingly calculated.

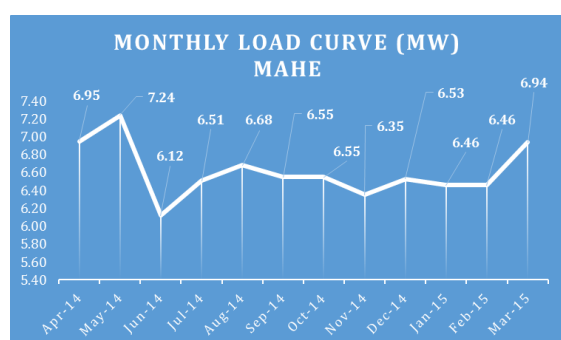
The load factor has been taken as 66.08% as per actual recorded in Mahe in FY 15.

**Table 14: Energy Requirement (In MU) and Peak Demand (in MW)**

Particulars	Energy and Demand Scenario			
	FY 16	FY 17	FY 18	FY 19
Energy Requirement	46	49	51	54
Sale within UT	38	41	44	47
T&D Losses	13.47%	12.01%	10.55%	9.09%
Intrastate transmission losses	4.00%	4.00%	4.00%	4.00%
Load Factor	66.08%	66.08%	66.08%	66.08%
<b>Maximum Demand (Mahe)</b>	<b>8</b>	<b>8</b>	<b>9</b>	<b>9.36</b>

As seen from the above, the maximum demand requirement of Pondicherry is projected to increase from 7.24 MW in FY 15 to **9.36 MW in FY 19** assuming an unchanged annual load factor of 66.08%. Load Curve

**Figure 13: Load Curves Mahe (FY 15)**

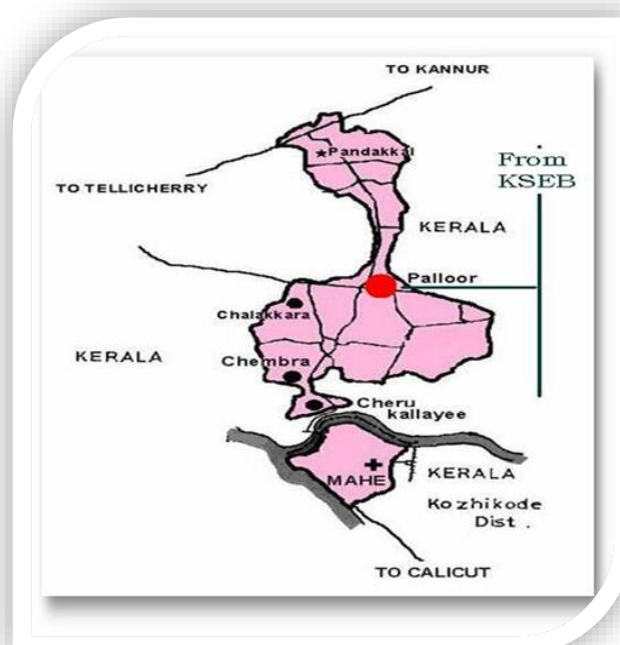


As seen from above, there is consistently a small variation in minimum and maximum demand across the year i.e. from about 6.12MW to 7.24 MW whereas the average demand is about 6.60MW only.

Adoption of various energy efficiency measures like energy efficient irrigation pump-sets, energy efficient lighting (use of LEDs), adopting demand side management initiatives like introduction of Time of Day (TOD) tariff etc., would also help in reducing the peak demand of the UT.

## POWER MAP OF MAHE

**Figure 14: Power Transmission Map of Mahe**



## EXISTING INTER-STATE TRANSMISSION SYSTEM (ISTS)

Mahe has no Inter-State Sub-station on its territory, however it has Inter-state transmission line between Kozhikodu S/s in Kerala and Pallur S/s in Mahe as detailed in cells B3 of Table 49 in Annexure-1.

## EXISTING POWER EVACUATION & INTRA STATE TRANSMISSION SYSTEM

The aggregate capacity at 110/11 kV level in the area is 20 MVA. The above capacity is generally adequate to meet the present peak requirements of 7.24 MW or 8.04 MVA.

## INTRA-STATE TRANSMISSION SYSTEM PLANNED UP TO FY 19

EDP has not planned any new Intra-state sub-station or transmission line in the area.

The total capacity of intra-state sub-station in the area would remain constant at 20 MVA in FY 19. The total demand of the area is slated to reach 9.36 MW or 10.40 MVA in FY 19. Hence the intra-state sub-station capacity is adequate for envisage demand.

## SYSTEM ANALYSIS UNDER PEAK DEMAND OF 9.36 MW IN FY 19

### GENERAL

Results of load flow study will be required to assess the adequacy of the power drawl by the UT corresponding to FY 19 condition.

## EXISTING DISTRIBUTION SYSTEM

A snapshot of the existing distribution system serving Mahe is given below.

**Table 15: Existing Distribution System as on March 2015**

Particulars	Qty.
Electricity Consumers	9,985
Connected Load	28 MVA
Peak Demand	7.24 MW
HT Lines & Cables (CKT Km.)	39.13
LT Lines & Cables (CKT Km.)	157.95

## ASSESSMENT OF ADEQUACY OF DISTRIBUTION SYSTEM

### AT 11/.04 KV LEVEL

The existing aggregate 11/ 0.4 KV distribution transformer capacity is about 25 MVA in FY 15.

Further, an additional transformer capacity of 3.70 MVA is planned to be added by FY 19 under various initiatives which will result in overall distribution transformation capacity of 28.70 MVA by FY 19.

Given that the billed maximum demand of consumers at 11 kV and higher level totals around 2.35 MW (apportioning demand in ratio of total sales). This leaves a demand of 4.89 MW (=7.24-2.35) to be met at LT (415V) level which corresponds to 5.43 MVA considering a power factor of 0.9.

Against this peak demand, the aggregate installed capacity of DT transformers in the UT is 25 MVA. This translates to an average loading of 21.73% on distribution transformers under peak demand conditions which is very comfortable.

Following the same logic and taking the projected peak demand of 9.36 MW in FY 19 and assuming the proportion of demand met at 11 kV in relation to the total sales, the contribution of consumers at 11 kV and above level to the peak demand of the UT comes to 3.52 MW.

Correspondingly, the demand met below 11 kV comes to around 5.84 MW (=9.36-3.52) which corresponds to 6.49 MVA considering a power factor of 0.9. Against this peak requirement, the installed capacity of distribution transformers in FY 19 is projected at 28.70 MVA. This translates to an average loading of 22.61% on distribution transformers under peak demand conditions which is again very comfortable.

## CHAPTER 8: POWER SECTOR SCENARIO-YANAM

### DEMAND PROJECTIONS

#### DETERMINATION OF CONSUMPTION OF DOMESTIC CONSUMERS

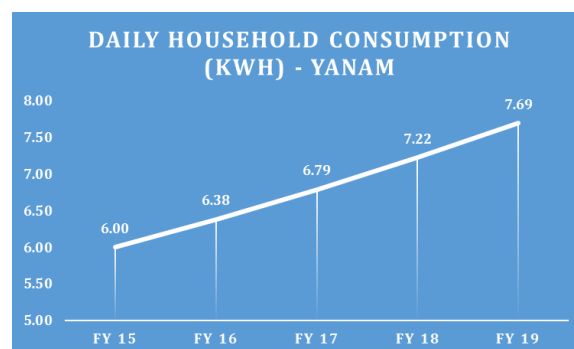
The present energy requirement of Yanam during FY 15 was 60.11 MU. With 24x7 supply to be provided across the island, the demand is likely to increase.

The average daily household consumption of existing electrified households in FY 15 has been arrived at by dividing the actual sales by the actual number of electrified domestic consumers in FY 15 respectively.

The actual daily household consumption of registered domestic consumers has increased to 6.00 kWh in FY 15 at CAGR of 6.40% in last 5 years. Daily household consumption till FY 19 has been projected by escalation daily household consumption by same CAGR.

The projected daily household consumption in Yanam is shown below:

**Figure 15: Projected Daily Household Consumption Electricity (kWh per person) for future years**



However, it may also be kept in view that the geographical features of the area (i.e. the location, accessibility, weather) along with current tariff levels play a significant role in determining the current and future demands.

The number of electrified households is expected to grow at the overall decadal CAGR of 4.53%.

Accordingly, the annual consumption of the domestic households is tabulated below:

**Table 16: Projected Sales from Existing and Newly Electrified Households in Yanam**

S. N.	Particulars	FY 15	FY 16	FY 17	FY 18	FY 19
<b>A</b>	<b>Electrified Consumers (Existing + Projected Growth)</b>					
	Electrified Consumers (in Nos.)	10,100	10,558	11,036	11,536	12,059
	Daily Household Consumption (in kWh)	6.00	6.38	6.79	7.22	7.69
	Projected Annual Consumption (in MU)	-	24.66	27.35	30.42	33.83
<b>B</b>	<b>Electrification of Un-Electrified Consumers</b>					
	Targeted Annual Addition (in Nos.)	-	-	-	-	-
	Cumulative Annual Addition (In Nos.)	-	-	-	-	-
	Projected Annual Consumption (in MU)	-	-	-	-	-
<b>C=A+B</b>	<b>Total Projected household Consumption (MU)</b>	-	24.66	27.35	30.42	33.83

#### DETERMINATION OF CONSUMPTION OF OTHER CONSUMERS

For projection of sales for FY 16 to FY 19, the CAGR of previous 5 years has been considered for all categories. However for categories where growth is less than 1% or more than 20% the growth in consumption has been considered at normative 5%. Based on this, the category-wise sales is as per table below:

**Table 17: Projected Category-wise Sales for Yanam (In MU)**

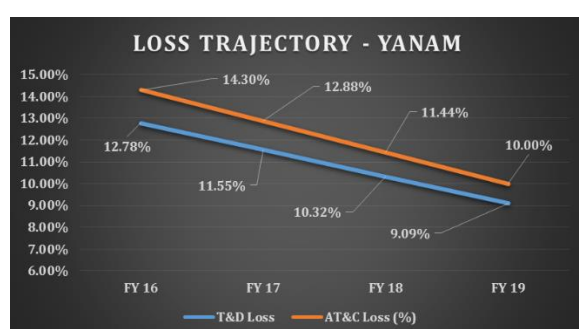
Categories	CAGR Considered	Projections			
		FY 16	FY 17	FY 18	FY 19
Domestic		24.65	27.34	30.41	33.82
Hut Services		0.01	0.01	0.01	0.02
Commercial	11.03%	5.44	6.04	6.71	7.45
Agriculture (HP)	5.00%	0.04	0.04	0.05	0.05
Street Lighting	5.00%	1.28	1.35	1.41	1.48
LT Industrial	1.61%	4.87	4.95	5.02	5.11
Water Tanks	1.95%	2.01	2.05	2.09	2.13
Temporary	5.00%	0.30	0.32	0.34	0.35
<b>Total LT</b>		<b>38.60</b>	<b>42.09</b>	<b>46.03</b>	<b>50.40</b>
HT Industrial	5.00%	16.89	17.74	18.63	19.56
HT Govt. Estates	5.00%	0.29	0.31	0.32	0.34
HT EHT Industrial	5.00%	0.00	0.00	0.00	0.00
<b>Total HT</b>		<b>17.19</b>	<b>18.05</b>	<b>18.95</b>	<b>19.90</b>
<b>Total</b>		<b>55.79</b>	<b>60.14</b>	<b>64.98</b>	<b>70.29</b>

## ENERGY AND DEMAND REQUIREMENT

The trajectory for AT&C loss reduction has been taken as per discussion with MoP so as to reach 10% by FY 19. In order to achieve the same T&D loss of Yanam has been reduced in equal trench so as to reach 9.09% by FY 19 and collection efficiency has been increased in equal trench so as to reach 99% by FY 19.

The T&D and AT&C Loss trajectory is shown below:

**Figure 16: Projected Loss Reduction Trajectory**



Based on the loss reduction trajectory approved as above, energy and demand requirement for the future years is tabulated in Table 18 below:

The actual load of open access consumers in FY 15 is nil and the same is projected to remain constant and the peak demand of the Pondicherry has been accordingly calculated.

The load factor has been taken as 60.72% as per actual recorded in Yanam in FY 15. .

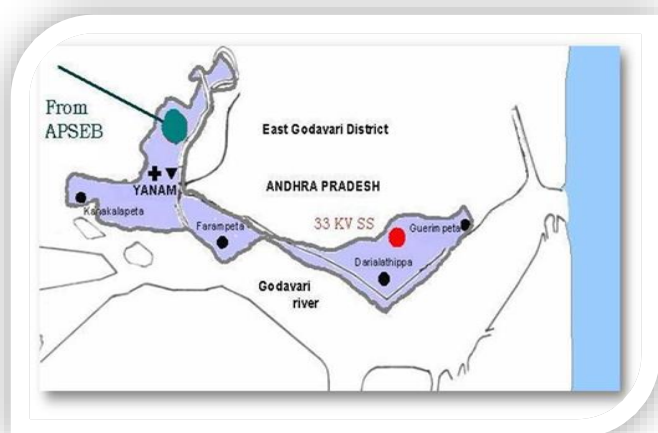
**Table 18: Energy Requirement (In MU) and Peak Demand (in MW)**

Particulars	Energy and Demand Scenario			
	FY 16	FY 17	FY 18	FY 19
<b>Energy Requirement</b>	67	71	75	81
<b>Sale within UT</b>	56	60	65	70
<b>T&amp;D Losses</b>	12.78%	11.55%	10.32%	9.09%
<b>Intrastate transmission losses</b>	4.00%	4.00%	4.00%	4.00%
<b>Load Factor</b>	60.72%	60.72%	60.72%	60.72%
<b>Maximum Demand (Yanam)</b>	13	13	14	15.14

As seen from the above, the maximum demand requirement of Pondicherry is projected to increase from 11.30 MW in FY 15 to **15.14 MW in FY 19** assuming an unchanged annual load factor of 60.72%.

#### POWER MAP OF YANAM

**Figure 17: Power Transmission Map of Yanam**



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

Yanam has no Inter-State Sub-station or transmission line on its territory.

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

The aggregate capacity at 132/11 kV and 132/33 kV level in the area is 36 MVA. The

above capacity is generally adequate to meet the present peak requirements of 11.30 MW or 12.56 MVA.

#### INTRA-STATE TRANSMISSION SYSTEM PLANNED UP TO FY 19

EDP has not planned any new Intra-state sub-station or transmission line in the area.

The total capacity of intra-state sub-station in the area would remain constant at 36 MVA in FY 19. The total demand of the area is slated to reach 15.14 MW or 16.80 MVA in FY 19. Hence the intra-state sub-station capacity is adequate for envisage demand.

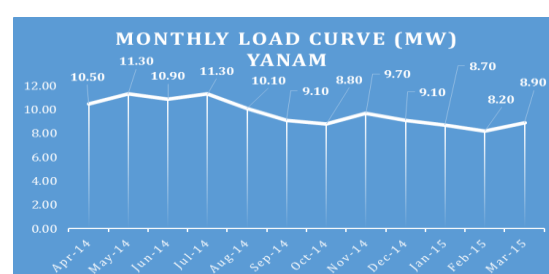
#### SYSTEM ANALYSIS UNDER PEAK DEMAND OF 15.14 MW IN FY 19

##### GENERAL

Results of load flow study will be required to assess the adequacy of the power drawl by the UT corresponding to FY 19 condition.

##### LOAD CURVE

**Figure 18: Load Curves Yanam (FY 15)**



As seen from above, there is consistently a small variation in minimum and maximum demand across the year i.e. from about 8.20 MW to 11.30 MW whereas the average demand is about 9.72MW only.

Adoption of various energy efficiency measures like energy efficient irrigation pump-sets, energy efficient lighting (use of LEDs), adopting demand side management initiatives like introduction of Time of Day (TOD) tariff etc., would also help in reducing the peak demand of the UT.

### EXISTING DISTRIBUTION SYSTEM

A snapshot of the existing distribution system serving Yanam is given below.

**Table 19: Existing Distribution System as on March 2015**

Particulars	Qty.
Domestic Consumers	10,100
Connected Load	52 MVA
Peak Demand	11.30 MW
HT Lines & Cables (CKT Km.)	36.00
LT Lines & Cables (CKT Km.)	199.55

### ASSESSMENT OF ADEQUACY OF DISTRIBUTION SYSTEM

#### AT 11/.04 KV LEVEL

The existing aggregate 11/ 0.4 KV distribution transformer capacity is about 15.32 MVA in FY 15.

Further, an additional transformer capacity of 3.69 MVA is planned to be added by FY 19

under various initiatives which will result in overall distribution transformation capacity of 19.01 MVA by FY 19.

Given that the billed maximum demand of consumers at 11 kV and higher level totals around 3.58 MW (apportioning demand in ratio of total sales). This leaves a demand of 7.72 MW (=11.30-3.58) to be met at LT (415V) level which corresponds to 8.58 MVA considering a power factor of 0.9.

Against this peak demand, the aggregate installed capacity of DT transformers in the UT is 15.32 MVA. This translates to an average loading of 56.00% on distribution transformers under peak demand conditions which is very comfortable.

Following the same logic and taking the projected peak demand of 15.14 MW in FY 19 and assuming the proportion of demand met at 11 kV and above in relation to the total sales, the contribution of consumers at 11 kV and above level to the peak demand of the UT comes to 4.28 MW.

Correspondingly, the demand met below 11 kV comes to around 10.86 MW (=15.14-4.28) which corresponds to 12.06 MVA considering a power factor of 0.9. Against this peak requirement, the installed capacity of distribution transformers in FY 19 is projected at 19.00 MVA. This translates to an average loading of 63.48% on distribution transformers under peak demand conditions which is near optimum.

## CHAPTER 9: OVERALL SCENARIO

### OVERALL DEMAND SCENARIO

Summing area-wise sales projection, sales for entire Puducherry is tabulated below

**Table 20: Projected Category-wise Sales for Pondicherry (In MU)**

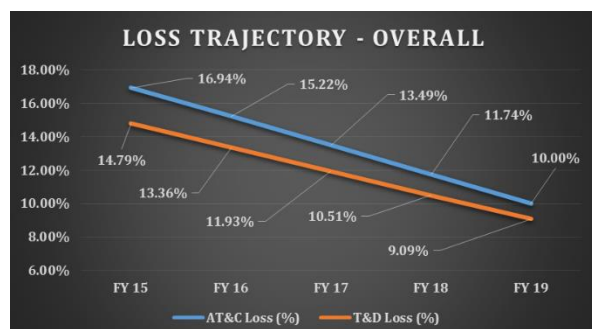
Categories	Projections			
	FY 16	FY 17	FY 18	FY 19
Domestic	678.78	726.96	777.38	824.85
Hut Services	10.67	11.42	12.19	12.92
Commercial	189.60	197.32	205.41	213.87
Agriculture (HP)	59.85	62.84	65.98	69.28
Street Lighting	29.25	32.95	37.13	41.88
LT Industrial	173.25	182.98	193.26	204.13
Water Tanks	36.97	39.22	41.61	44.15
Temporary	6.43	6.75	7.08	7.44
<b>LT Total</b>	<b>1184.80</b>	<b>1260.44</b>	<b>1340.04</b>	<b>1418.52</b>
HT Industrial	919.80	966.61	1015.85	1067.66
HT Govt. Estates	62.40	69.60	77.62	86.58
HT EHT Industrial	362.70	411.63	467.17	530.22
<b>HT Total</b>	<b>1344.90</b>	<b>1447.83</b>	<b>1560.64</b>	<b>1684.46</b>
<b>Total</b>	<b>2529.71</b>	<b>2708.27</b>	<b>2900.69</b>	<b>3102.98</b>

- As seen from above, the share of Industrial sales will increase from the 57.43% to 58.07% of overall consumption of the UT of Puducherry whereas the share of domestic sales will almost remain constant (27.27% to 27.25%.)

### ENERGY AND DEMAND REQUIREMENT

On the basis of area-wise demand assessment discussed in previous chapters, the overall trajectory for T&D Losses for total Puducherry UT is shown in figure below:

**Figure 19: Projected Loss Reduction Trajectory- Puducherry**



Based on the loss reduction trajectory arrived as above, energy and demand requirement for the future years is tabulated in table 5 below:

The actual load of open access consumers in FY 15 is nil and the same is projected to remain constant. Peak demand of whole Puducherry has been arrived at by summing total peak demand of all its areas without considering any diversity factor because load curves across all the areas are similar in nature. Load factor has been back calculated as ratio of average demand and peak demand.

**Table 21: Energy Requirement (In MU) and Peak Demand (in MW)**

Particulars	Energy and Demand Scenario			
	FY 16	FY 17	FY 18	FY 19
Energy Requirement within UT	3,041	3,203	3,376	3,555
<i>Sale within UT</i>	2,530	2,708	2,901	3,103
<i>T&amp;D Losses</i>	13.36%	11.93%	10.51%	9.09%
<i>Intrastate transmission losses</i>	4.00%	4.00%	4.00%	4.00%
<i>Load Factor</i>	63.00%	63.02%	63.04%	63.06%
<b>Maximum Demand (EDP)</b>	<b>551</b>	<b>580</b>	<b>611</b>	<b>644</b>

As seen from the above, the maximum demand requirement of Puducherry is projected to increase from 503.32 MW in FY 15 to **644 MW in FY 19** assuming an annual load factor of around 63.00%.

## CHAPTER 10: GENERATION PLAN

### CUMULATIVE GENERATION AVAILABILITY

The total installed capacity in UT Puducherry as on 31<sup>st</sup> March 2015 (PPCL and CGS) is 436.99 MW as detailed in table below. Station wise details are at **Table 52** in Annexure – 3. Thermal based capacity constitutes about 74.85% of total capacity followed by Nuclear based at 18.04% and gas based 7.11%.

**Table 22: Availability Mix in FY 15 (in MW)**

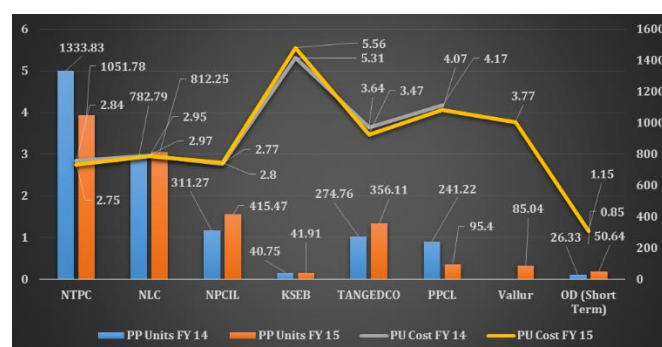
Source	Latest Entitlement in MW	In %age
<b>Availability Fully for UT</b>		
<b>Central Generating Stations (UT Fully Allocated)</b>		
Gas	32.50	7.44%
<b>Total</b>	<b>32.50</b>	<b>7.44%</b>
<b>Availability Partially</b>		
<b>Central Generating Stations</b>		
Nuclear	76.36	17.47%
Thermal	328.13	75.09%
<b>Total</b>	<b>404.49</b>	<b>92.46%</b>
<b>Grand Total</b>	<b>446.99</b>	

Mahe district is fed by energy from KSEB and Karaikal district is fed from power generated at PPCL and power imported from TNEB (TANGEDCO). Pondicherry and Yanam districts are fed from various CGSs having PPA with the UT. Sum of Individual maximum demand of districts of UT comes at 503.32 MW in FY 15 and the present annual energy requirement of the UT is of the order of 2,777 MU as per MoP.

The maximum demand is expected to increase to 650 MW in FY 19 and the energy requirement is projected to rise to 3,598 MU in FY 19, taking into account additional energy requirement for providing 24x7 power supply to the UT over the normal load growth.

The actual energy availability from various sources in FY 14 and FY 15 is summarized below:

**Figure 20: Availability Mix from Various Sources in FY 14 and FY 15 (in MU)**



- During FY 15, average power purchase cost has reduced from FY 14 except from KSEB and Short Term.
- Power from KSEB is the most costly one with an average rate of Rs 5.56/unit in FY 15.

### PLANNED CAPACITY ADDITION

In period FY 16 to FY 19 additional 101.40 MW is envisaged from upcoming CGS. The additional capacity available from various sources (along with the expected year of commissioning) is summarized below:

**Table 23: Summary of Additional Firm Availability from Various Sources**

Sr. No.	Source	Type	Capacity (MW)	Latest Firm Entitlement		Availability
				%	MW	
A	Tuticorin	Thermal	1000	0.95%	9.50	FY 16 (June)
B	Neyveli -2 Expansion	Thermal	500	3.0	15.0	FY 16 (Sep)
C	Solar NLC	Solar	20	100%	20.0	FY 17
D	Kudankulam-II	Nuclear	1000	3.35%	33.50	FY 17
E	Kalpakkam	Nuclear	500	0.60%	3.0	FY 18
F	Solat MNRE	Solar	15	100%	15.0	FY 18
<b>Total</b>			<b>3035</b>		<b>96.00</b>	

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

**Table 24: Projected Firm Share Allocations from Various Sources (in MW)**

Sr. No.	Source	Capacity Available in MW			
		FY 16	FY 17	FY 18	FY 19
	<b>Availability 100% for UT</b>				
A	PPCL	32.50	32.50	32.50	32.50
<b>Subtotal</b>	<b>Availability Within UT</b>	<b>32.50</b>	<b>32.50</b>	<b>32.50</b>	<b>32.50</b>
	<b>Availability Outside UT</b>				
B	Central Generating Stations including Others	404.49	404.49	404.49	404.49
C	CGS – New and Solar Plants	24.50	78.00	96.00	96.00
<b>Subtotal</b>	<b>Availability Outside UT</b>	<b>428.99</b>	<b>482.49</b>	<b>500.49</b>	<b>500.49</b>
<b>Total Availability from firm sources</b>		<b>461.49</b>	<b>514.99</b>	<b>532.99</b>	<b>532.99</b>

As seen from above, there is a considerable capacity addition from FY 15 to FY 19 from outside UT based on solar, nuclear and thermal plants (based on the latest expected dates of commercial operation as available with Central Electricity Authority/Latest Allocation Statement).

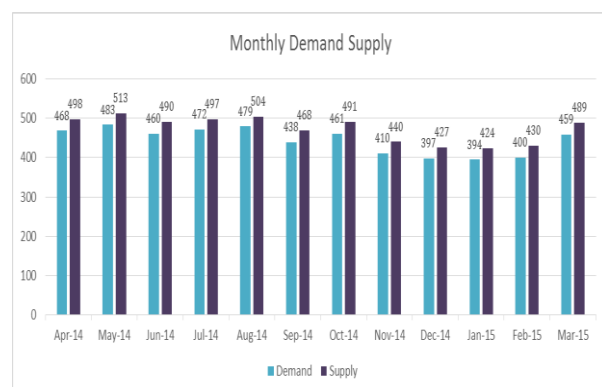
Accordingly, the projected energy availability from the above mentioned sources for future years is summarized in table below.

**Table 25: 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 within UT</b>	<b>3,041</b>	<b>3,203</b>	<b>3,376</b>	<b>3,555</b>
Energy Availability from Long Term Firm Tie-ups	3,219	3,558	3,601	3,601
<i>Energy Availability from Long Term Firm Tie-ups (In %age)</i>	105.84%	111.06%	106.65%	101.27%
<i>Targeted Energy Availability from Long Term Firm Tie-ups (In %age)</i>	2,737	2,883	3,039	3,200
Targeted Energy Availability from Long Term Firm Tie-ups (In MU)	90.00%	90.00%	90.00%	90.00%
<b>Adequacy of Power Supply</b>	<b>Adequate</b>	<b>Adequate</b>	<b>Adequate</b>	<b>Adequate</b>
Additional Energy Required on Long Term Basis (in MU)	-	-	-	-
Additional Firm Tie-up Required (80% PLF) on RTC Basis (in MW)	-	-	-	-
Additional Energy Required on Short Term Basis (in MU)	-	-	-	-

It is seen from above table that the availability from already tied-up firm share will remain more than 101-111% of the energy requirement.

**Figure 21: Demand Supply Curve (FY 15)**



As can be seen due to all allocation from firm sources there is little variation in power supply and due to adequacy, power availability exceeds demands through-out the year. As Puducherry will be having projected energy availability of more than 100% till FY 19, the UT has to just optimize the power purchase and sale planning.

There is no requirement of purchase through short term power as of now.

## FUND REQUIREMENT

As discussed above UT Puducherry energy requirement would be met through the CGS and PPCL and EDP is not planning to set up any power plant (Thermal, Hydro, Renewables, Gas etc.), so fund requirement for Generation is nil.

## ACTION POINTS FOR THE UT

### OPTIMIZED POWER PURCHASE AND SALE PLANNING

As seen from previous sections, there is considerable surplus (5%-20%) available with the UT. The UT needs to optimize its power purchase and should look forward for selling the surplus power to prospective deficit UT so as to earn revenue for the UT.

### GOVERNMENT OF INDIA INTERVENTION

Central Government should assist UT Administration of Puducherry to set its own generating plant so as to overcome its excessive reliance on external sources.

## CHAPTER 11: TRANSMISSION AND DISTRIBUTION: FUND REQUIREMENT AND ACTION PLAN

### FUND REQUIREMENT: TRANSMISSION

Puducherry has planned various capital expenditure works relating to transmission sub-stations and transmission lines in order to augment capacity, increase reliability and modernize the network. The said capital works will be majorly financed by Central

government budget which for purpose of this document has been treated as equity. EDP has also tied-up debt arrangement with Japanese funding agency (JICA). Capacity addition to be achieved by means of these works have already been described in previous chapters regarding individual areas. Funding required for various capital expenditure works is detailed in below table:

**Table 26: Fund Requirement for State Transmission Projects (in Rs Crores)**

Sl. No.	Category	Fund Requirement (in Rs Crores)				
		FY 16	FY 17	FY 18	FY 19	Total
1	Establishment of New Substations	12.29	-	71.20	43.47	114.67
2	Augmentation of System Capacity	0.65	-	15.48	3.96	19.44
3	Renovation and Modernization Works of Existing Capacity	-	1.65	17.79	8.41	27.85
4	Replacement of Capacitor Banks	0.35	-	4.00	1.50	5.50
5	Erection/ establishment/ upgradation of 230kV and 110kV Substations	-	20.00	40.40	20.81	81.21
	<b>Total Fund Requirement (Transmission)</b>	<b>13.29</b>	<b>21.65</b>	<b>148.87</b>	<b>78.15</b>	<b>261.96</b>

### ACTION POINTS FOR THE UT: TRANSMISSION

UT will implement the projects as listed on time to ensure availability of transmission system for 24 x 7 supply and will monitor the loading of lines and substations on periodic basis keeping in view the actual growth in loading of the load centers along with changes in consumer mix.

- The UT will procure and deploy one Emergency Restoration System (ERS) to

effectively restore transmission lines in case of emergency.

- The UT will look for options for construction of new lines through tariff based competitive bidding (TBCB) route.

### FUND REQUIREMENT: DISTRIBUTION

The fund requirement for capital works related to distribution undertaken by EDP is detailed in below Table:

**Table 27: Fund Requirement for Distribution Projects (in Rs Crores)**

Sl. No.	Category	Fund Requirement (in Rs Crores)				
		FY 16	FY 17	FY 18	FY 19	Total
1	R-APDRP Part-A Works	-	1.72	-	-	1.72
2	R-APDRP Part-B Works	8.00	30.00	30.00	-	68.00
3	System Improvement Schemes	12.00	7.80	7.96	8.12	35.88
4	Development Schemes	13.27	10.35	10.56	10.77	44.95
5	Rural Electrification (BNP)	14.45	0.75	0.77	0.78	16.75
6	100% Metering Programme	1.20	4.19	4.19	-	9.58
7	Conversion of HT Overhead lines into UG cables	6.26	4.10	4.18	4.27	18.81
8	IPDS	5.97	10.89			16.86
9	DDUGJY	24.95	37.43			62.38
10	<b>Total Distribution</b>	<b>86.10</b>	<b>107.23</b>	<b>57.66</b>	<b>23.94</b>	<b>274.93</b>

### IT INITIATIVES TAKEN BY EDP

In Puducherry, IT adoption on a massive scale is being pursued in the following areas:

- ✓ The RAPDRP Part-A implemented by EDP covers the following:
  - (1) Consumer Indexing.
  - (2) GIS Mapping
  - (3) Metering of DT and Feeders
  - (4) Automatic Data logging for all the DT and Feeders
  - (5) SCADA/DMS System
  - (6) AMR for all HT Consumers
- ✓ Integration of provision of online bill payment.
- ✓ Computerization of billing of rural consumers has been completed.
- ✓ Payment of electricity bills at Common Service Centers
- ✓ Introduction of prepaid meters.

### SMART GRID

The Government of India, Ministry of Power has taken up the process of establishment of smart-grids in India with an objective of achieving most efficient management of Distribution system and to deliver best possible service to consumers.

A Memorandum of understanding was signed with M/s Power Grid Corporation of India Ltd. wherein M/s POWERGRID along with their associates /collaborators jointly with Electricity Department, Puducherry would be responsible to establish a pilot smart Grid in the Electricity Distribution area of Puducherry City. The Detailed Project Report (DPR) prepared by M/s Power Grid and Electricity Department Puducherry was submitted to Ministry of Power at an estimated cost of Rs. 52.45 Crs. The Ministry of Power after scrutinizing the project report, approved the implementation of project at a cost of Rs. 46.11 Crores. The proposal has also been approved by the Cabinet Committee on Economic Affairs. The Government of India, Ministry of Power shall finance 50% of cost i.e. Rs.23.055Crs and the remaining 50%, is to be arranged by the department. As per the MOU entered into with M/S Power Grid, the utility portion of the project cost was to be met by M/s Power Grid & its associates/ Collaborators.

It was planned to develop a Consumer-Utility interactive Pilot Smart Grid which will cover Smart metering & control through Advanced Metering Infrastructure (AMI), Power Quality Management (PQM), Peak Load Management, Outage Management System (OMS), integration of multiple forms

of renewable energy sources, Micro-grid, Storage technology, Electric vehicle etc. in the Pondicherry Urban Distribution Division of the Electricity Department .

The original Project Area for implementation of Smart Grid Pilot Project is for 87000 consumers covering 300 Nos of Distribution transformers. The Pilot Project was launched on 9th October, 2012 with inauguration of Control Center. The details of Progress made with the collaborators in the original project area are as follows:

- ✓ 1600+ nos. of smart meters covering 6 Transformers installed.
- ✓ CT operated DT meters installed at the above transformers.
- ✓ Distribution Transformer Monitoring Solution (DTMS) in 2 transformers.
- ✓ Fault Passage Indicators (FPIs), 2 sets, along with communication Gateways
- ✓ Smart Street Lighting system with capacity of 12.5 KVA and two more sets are ready for installation
- ✓ One no of 140 Kvar APFC panel installed
- ✓ 3 nos. of smart meters installed for Roof top solar for Net-metering for study purpose
- ✓ One no of Power Transformer online monitoring system for 25MVA transformer at Marapalam SS installed.

M/s Power Grid Corporation of India Ltd., contrary to the provisions of MOU has expressed its inability to fund the pilot project and has made a request to Government of Puducherry to fund the Utility Share of Rs.23.05 Crs, in order to complete the pilot project.

Due to financial constraints the Government of Puducherry was not in position to allocate fund from its budget to the Project and given approval to proceed in an Investor model to complete the Smart Grid Pilot Project. Due to spiraling cost of the smart meter and associated hardware and software the

project has been scaled down from 87000 consumers to 35460 Consumers, in the core town area. This include 34000 nos. of consumers of all categories in the core Town area which includes 1460 Nos. of LT - CT operated High end user services existing in all the four regions of Puducherry .

Due tender process has been initiated to find a suitable investor for the project. On finalization, the lowest bidder Dong Fong Electronics, China has been selected on merit basis and the Letter of Intent (LOI) has been issued on 04/03/2016.

**Figure 22 Funding of Smart Grid Pilot Project**

Sl. No.	Description	Amount Rs Crores
1	Project Cost approved by the Ministry of Power	46.11
2	Total Project Cost as per the Tendering Proceedings	43.91
3	Capital Cost	41.16
4	Maintenance Cost	2.74
	<b>Total (3+4)</b>	<b>43.91</b>
5	MoP Share (50% of sl. No. 3 above)	20.58
6	Consultancy Charges @ 2.225% of the Project Cost (PGCIL)	1.04
7	UT administration share of project cost	20.58
8	Maintenance Charge for 5 years payable to the	2.74

## ACTION POINTS FOR UT

The UT **may revisit the overall plan for augmentation of distribution network** keeping in view of the increased load projections with overall system peak load of 644 MW and would take necessary steps to meet the Performance of standards specified by JERC.

The UT will also expand the scope of ongoing smart grid project so as to cover each and every consumer in the UT. EDP will also try to integrate features of pre-paid meter in smart-grid architecture.

**The UT will formulate a plan of conversion of roll out of prepaid metering by August 2016 so as to ensure 100% prepaid metering by March 2018.**

#### **GOVERNMENT OF INDIA INTERVENTION**

In order to ensure reliable and secure 24x7 quality power supply to all, the UT requests

that the investment sought under IPDS and DDUGJY needs to be sanctioned expediently by PFC/REC.

**The request of UT Puducherry would be considered by Government of India as per its policies/ frameworks or otherwise UT Puducherry would make arrangements for funding from other sources.**

## CHAPTER 12: RENEWABLE ENERGY INITIATIVES

### RENEWABLE ENERGY PLAN

Administration of Puducherry is in the process of signing of MOU for the Purchase of 20MW from 130MW Solar Project to be setup by Neyveli Lignite Corporation under VGF Scheme of Batch-V, phase-II of MNRE. The cost of power would be at the rate determined by CERC. The Government has already made request to MNRE to allocate 35 MW of solar project (including previous 20 MW) under state specific tendering process, to the U.T of Puducherry under VGF scheme of batch III & phase –II. The cost of Power would be at Rs. 4.50/unit.

Under Roof top system, the existing capacity is 140KW. It is programmed to add another 160kw in near future. EDP has programmed to install 500kw roof top solar system in government buildings under IPDS. Number of Commercial buildings and Hotels are having solar Water heating systems in the roof top of the building. Under Group net metering which is connected to the Grid. The excess energy exported to the grid is being adjusted with the other service connections of the same consumer existing in other places

### RPO AND REC STATUS IN UT OF PUDUCHERRY

As per Joint Electricity Regulatory Commission for State of Goa & Union Territories (Procurement of Renewable Energy) Regulations, 2010 and as amended on 19th February 2013, quantum of Renewable Purchase Obligations has been specified for each year whereby each distribution licensee needs to purchase electricity (in kWh) from renewable energy sources, at a defined minimum percentage of the total consumption of all the consumers in

its area during a year. EDP envisaged to comply with the Renewable Purchase Obligation and therefore has projected the RPO cost for FY 16 to FY 19 through REC certificates. The RPO cost is based on the percentage of solar and non-solar RPO specified by JERC is tabulated below considering the floor price of solar and non-solar REC. Prevailing floor price of solar RECs is Rs. 3500/REC and for non-solar Rs. 1500/REC.

**Table 28: RPO Obligation for FY 17 to FY 19 as determined by JERC**

FY	Solar	Non Solar
2017	1.15%	2.80%
2018	1.50%	2.80%
2019	1.85%	2.80%

Further, the Central Government notified the National Tariff Policy, 2016 in January 2016. Clause 6.4 of NTP, 2016 has directed the respective Commission and Distribution licensee that **Renewable sources of energy generation including Co-generation from renewable energy sources:**

*1) Pursuant to provisions of section 86(1)(e) of the Act, the Appropriate Commission shall fix a minimum percentage of the total consumption of electricity in the area of a distribution licensee for purchase of energy from renewable energy sources, taking into account availability of such resources and its impact on retail tariffs. Cost of purchase of renewable energy shall be taken into account while determining tariff by SERCs. Long term growth trajectory of Renewable Purchase Obligations (RPOs) will be prescribed by the Ministry of Power in consultation with MNRE.*

*Provided that cogeneration from sources other than renewable sources shall not be excluded from the applicability of RPOs.*

*(i) Within the percentage so made applicable, to start with, the SERCs shall also **reserve a minimum percentage for purchase of solar energy from the date of notification of this policy which shall be such that it reaches 8% of total consumption of energy**, excluding Hydro Power, by March 2022 or as notified by the Central Government from time to time.*

*(ii) Distribution Licensee(s) shall compulsorily procure 100% power produced from all the Waste-to-Energy plants in the*

*State, in the ratio of their procurement of power from all sources including their own, at the tariff determined by the Appropriate Commission under Section 62 of the Act.*

As per the suggestion of JERC and in Compliance of NTP, 2016, EDP would make arrangements to purchase physical solar power instead of REC to meet its solar obligations and the same would be envisaged in the subsequent years, once the plants commission and start supplying power to EDP.

## CHAPTER 13: ENERGY CONSERVATION AND ENERGY EFFICIENCY PROGRAM

### PRESENT STATUS OF ENERGY CONSERVATION ACTIVITIES

Renewable Energy Agency of Pondicherry (REAP) is the State Designated Agency (SDA) of Bureau of Energy Efficiency (BEE), Government of India for carrying out various energy conservation activities and programme in the UT of Puducherry.

EDP is implementing DSM based energy efficient lighting programme (DELP) under demand side management programme in the UT of Puducherry along with Energy Efficiency Services Limited (EESL). JERC has approved the implementation of the scheme vide petition no. 128/2014 order dated 25.04.2014. Bureau of Energy Efficiency (BEE) has carried out Monitoring and Verification of DELP scheme by appointing Energo Engineering Projects Limited (EEPL) and the final report has been submitted to BEE. The extract of the said report is as under:

"The following are the survey deliverables from the survey. The estimates given below are of 95% confidence level and a 5% margin of error.

*Number of LED bulbs installed and operating = 545730*

*Number of LED bulbs which were defective/fused = 32188*

*Number of LED bulbs which are broken = 9576*

*Number of LED bulbs kept as reserve = 21757*

*Estimated energy savings = 36.95 Million Units/ annum*

*Net electricity savings = 40.11 Million Units/ annum*

*Avoided generation capacity = 6.16 MW*

*Reduction in GHG emission in ton of CO<sub>2</sub> = 39314.8 Ton of CO<sub>2</sub>"*

The DSM based energy efficient lighting program (DELP) was very effectively implemented in the union territory of Puducherry where almost 80% of the population was covered under this programme. Households located in the most remote areas also participated in the programme. This programme proved most beneficial to end users especially, in rural areas where lightening bulbs contribute substantially to the power consumption and electricity bill. They were also satisfied with the bulb lighting.

There were a few concerns with people, where the bulbs were in a defective condition and were not operating. The lamp failure rate is 5.54% and as per the programme the failed LED bulbs can be exchanged for new ones. It was observed that very few failed bulbs were exchanged and the reason for this is that the people were not aware of this process. Households who have more than 1 service connection were given more than 3 bulbs. These households did not install all the LED bulbs and part of them were in reserve. These reserve bulbs would not contribute to any energy savings. It was observed that 3.5% of the bulbs were in reserve.

**EDP has considered an annual saving of 40.11 MUs from FY 17 to FY 19 under the DELP Scheme. EDP is required to prepare an actionable plan based on the above recommendations of the report by the end of FY 16 and implement same from FY 17 onwards.**

## CHAPTER 14: FINANCIAL VIABILITY OF INTEGRATED UTILITY – PUDUCHERRY

### FINANCIAL POSITION OF INTEGRATED UTILITY - PUDUCHERRY

In FY 15 EDP clocked net profit of Rs 104.95 Crores, however it still has an accumulated loss of Rs 442.81 Crores.

A detailed scenario analysis has been done to measure the financial performance in coming 4 years.

This analysis provided hereafter decipher that with improvement in performance to the required levels, the utility will be able to recover its accumulated losses while targeting to provide 24x7 Power to all in the UT. The calculations have been based on the assumption that utilities should function without any subsidy from government.

The existing Profit and Loss statement of the EDP for FY 15 is given below:

**Table 29: Profit and Loss Statement of the EDP – FY 15 (In Rs Crores)**

Particulars	FY 15
<b>Opening Accumulated Profit/ (Loss)</b>	<b>(547.76)</b>
<b>Income</b>	<b>1181.05</b>
Income from Retail Sale of Power	1,178.52
Income from Sale of Surplus Power	-
Other Income	2.54
<b>Expenditure</b>	<b>1034.15</b>
Transmission Charges	72.80
Power & Fuel Cost	867.66
Employee Cost	75.46
R&M cost	7.71
A&G Expenses	10.52
<b>Operating Profit</b>	<b>146.90</b>
<b>PBDIT</b>	<b>146.90</b>
Interest	16.04
<b>PBDT</b>	<b>130.87</b>
Depreciation	25.92
Net Prior Period Credits / (Charges)	104.95
<b>Profit Before Tax</b>	<b>104.95</b>
Provision for bad and doubtful debts	-
<b>PBT (Post Extra-ord Items)</b>	<b>104.95</b>

Particulars	FY 15
<b>Tax</b>	<b>-</b>
<b>Reported Net + Profit /- Loss</b>	<b>104.95</b>
<b>Closing Accumulated Profit/ (Loss)</b>	<b>(442.81)</b>

Based on the road map discussed in the previous chapters, various scenarios have been prepared to understand the sensitivity analysis of targeted parameters. However, the impact analysis on financial position has been restricted up to FY 19 as the projections of key drivers of expense and revenue items as power purchase mix and sales mix has not been projected beyond FY 19.

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.
- At targeted growth rate as per “24x7 Power for All” Road Map with funding of proposed investments in distribution through state funds and financial institutions.
- Better Loss Reduction Trajectory and subsequent dependence on Lower Tariff Hike.
- Non-Adherence to Loss Reduction Trajectory (higher AT&C Losses) and subsequent dependence on Higher Tariff hike.
- Scenario A plus no impact of accumulated losses plus financial turnaround.

## COMMON ASSUMPTIONS

- ✓ Any change in the power purchase cost will be taken care by the Fuel and Power Purchase Cost Adjustment mechanism.
- ✓ Sale of surplus power has been considered at the average rate of Rs. 3 per unit (including wheeling charges) as there is less offtake of power by nearby states.
- ✓ Year wise cost break-up is given in Annexure 3.
- ✓ No revenue subsidy.
- ✓ Escalation towards Employees Costs has been considered at 10% based on year on year increase in CPI inflation index in FY 14.
- ✓ Escalation towards A&G expenses has been considered at 6% based on year on year increase in WPI inflation index respectively in FY 14.
- ✓ R&M Expenses has been considered at 1.4% of opening GFA.
- ✓ Phasing of capital expenditure in IPDS and DDUGJY schemes has been considered as 39.02% in FY 16 and 60.98% in FY 17.
- ✓ Asset Additions has been considered as 50% in same year of capital expenditure. Interest is calculated on assets capitalized only and no IDC has been considered.
- ✓ Interest computations have been done as per the existing loan profile of EDP and addition of new loans on the prevailing market rates (i.e. at 11.75% p.a.)
- ✓ Category-wise average billing rate for computation of revenue for FY 16 and onwards has been taken as per the latest tariff order dated 10<sup>th</sup> April, 2015. Energy sales and Revenue from Temporary category assumed as same as actual for FY 2014-15
- ✓ Actual transmission charges of FY 14 have been escalated in proportion to the increase in power purchase quantum and allocation.
- ✓ For new assets, depreciation has been calculated @ 5.28% and for the existing assets the depreciation has been calculated @ 4.62% (the actual average depreciation rate of FY 14).
- ✓ Non-Tariff Income has been escalated by 10% Y-o-Y based on provisional actuals for FY 15.
- ✓ The average cost of supply has been computed after deducting non-tariff income from the expenses.
- ✓ Transmission Schemes are mostly funded through JICA loan and Distribution Schemes based on loan and internal equity.
- ✓ 100% under loan for R-APDRP (Part A&B) as conversion of 90% funding into grant will be applicable only when the targets laid down in the guidelines are achieved.
- ✓ For IPDS capex of Rs 21.74 as Crores approved by screening committee approval has been envisaged to be incurred. Under DDUGJY proposal to the tune of Rs 62.38 Crores sent to GoI for approval however the same has not been approved and hence not considered for this document. Grant: Loan ratio for other centrally sponsored schemes is as per the provisions of the respective schemes for UT (**except scenario C where no grant has been considered against IPDS and DDUGJY**).

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

### ASSUMPTIONS

- ✓ No tariff hike
- ✓ T&D losses as per targeted trajectory.

**Table 30: Assumptions for Scenario A**

Particulars	Units	FY 16	FY 17	FY 18	FY 19
<b>Energy Related Assumptions</b>					
Energy Demand	MU	3,041.38	3,203.31	3,376.37	3,555.50
Sales	MU	2,526.60	2,708.27	2,900.69	3,102.98
Power purchase	MU	3,219.05	3,557.69	3,600.74	3,600.74
AT&C losses	%	15.22%	13.49%	11.74%	10.00%
Distribution Losses	%	13.36%	11.93%	10.51%	9.09%
Collection Efficiency	%	97.85%	98.23%	98.62%	99.00%
Power purchase cost	Rs Crores	1,093.43	1,217.55	1,240.93	1,245.51
Power purchase cost per unit sold	Rs /kWh	4.33	4.50	4.28	4.01
Power purchase cost per unit purchased	Rs /kWh	3.40	3.42	3.45	3.46
<b>Revenue Related Parameters</b>					
Revenue from retail sale of power	Rs crores	1,275.52	1,266.20	1,357.76	1,455.79
Tariff Increase	%	4.35%	0.00%	0.00%	0.00%
Average Billing Rate	Rs /kWh	5.05	4.68	4.68	4.69
<b>Escalations</b>					
Employee Costs	%	10.00%	10.00%	10.00%	10.00%
Administrative and General Costs	%	6.00%	6.00%	6.00%	6.00%
Non-Tariff Income	%	10.00%	10.00%	10.00%	10.00%

**Table 31: Impact (in per unit terms) of key financial components (Scenario A)**

Particulars	UoM	FY 16	FY 17	FY 18	FY 19
Total Revenue from all sources	Rs. Crores	1,331.61	1,375.58	1,428.45	1,473.08
Total Expense	Rs. Crores	1,328.74	1,470.48	1,516.17	1,546.31
PBT	Rs. Crores	2.87	(94.90)	(87.72)	(73.23)
ABR	Rs. per unit	4.71	4.68	4.68	4.69
ACS	Rs. per unit	4.91	5.43	5.23	4.98
Interest Cost	Rs. Crores	16.09	18.33	26.76	39.24
Tariff Increase	In %age	4.35%	0.00%	0.00%	0.00%
O&M cost	Rs. per unit	0.38	0.42	0.43	0.44
R&M cost per unit	Rs. per unit	0.03	0.03	0.04	0.04
Employee cost per unit	Rs. per unit	0.31	0.34	0.35	0.36
Interest cost per unit	Rs. per unit	0.06	0.07	0.09	0.13
A&G cost per unit	Rs. per unit	0.04	0.04	0.04	0.04

**Table 32: Financial Position of the Utility (Scenario A)**

Particulars	FY 15	FY 16	FY 17	FY 18	FY 19
Income	1181.05	1,268.38	1,375.58	1,428.45	1,473.08
<i>Income from Retail Sale of Power</i>	<i>1,178.52</i>	<i>1,179.09</i>	<i>1,266.20</i>	<i>1,357.76</i>	<i>1,455.79</i>
<i>Income from Sale of Surplus Power</i>	<i>-</i>	<i>53.30</i>	<i>106.32</i>	<i>67.31</i>	<i>13.57</i>
<i>Other Income</i>	<i>2.54</i>	<i>2.79</i>	<i>3.07</i>	<i>3.37</i>	<i>3.71</i>
Expenditure	1034.15	1,281.52	1,424.06	1,459.51	1,476.93
<i>Transmission Charges</i>	<i>72.80</i>	<i>85.07</i>	<i>94.02</i>	<i>95.15</i>	<i>95.15</i>
<i>Power &amp; Fuel Cost</i>	<i>867.66</i>	<i>1,093.43</i>	<i>1,217.55</i>	<i>1,240.93</i>	<i>1,245.51</i>
<i>Employee Cost</i>	<i>75.46</i>	<i>83.00</i>	<i>91.30</i>	<i>100.43</i>	<i>110.48</i>
<i>R&amp;M cost</i>	<i>7.71</i>	<i>8.88</i>	<i>9.37</i>	<i>10.46</i>	<i>12.51</i>
<i>A&amp;G Expenses</i>	<i>10.52</i>	<i>11.15</i>	<i>11.82</i>	<i>12.53</i>	<i>13.28</i>
Operating Profit	146.90	(13.14)	(48.48)	(31.05)	(3.85)
PBDIT	146.90	(13.14)	(48.48)	(31.05)	(3.85)
<i>Interest</i>	<i>16.04</i>	<i>16.09</i>	<i>18.33</i>	<i>26.76</i>	<i>39.24</i>
PBDT	130.87	(29.23)	(66.81)	(57.82)	(43.09)
<i>Depreciation</i>	<i>25.92</i>	<i>31.13</i>	<i>28.09</i>	<i>29.90</i>	<i>30.14</i>
<i>Net Prior Period Credits / (Charges)</i>	<i>104.95</i>	<i>-</i>	<i>-</i>	<i>-</i>	<i>-</i>
Profit Before Tax	104.95	(60.36)	(94.90)	(87.72)	(73.23)
<i>Provision for bad and doubtful debts</i>	<i>-</i>	<i>-</i>	<i>-</i>	<i>-</i>	<i>-</i>
PBT (Post Extra-ord Items)	104.95	(60.36)	(94.90)	(87.72)	(73.23)
<i>Tax</i>	<i>-</i>	<i>-</i>	<i>-</i>	<i>-</i>	<i>-</i>
Reported Net + Profit /- Loss	104.95	(60.36)	(94.90)	(87.72)	(73.23)
Closing Accumulated Profit/ (Loss)	(442.81)	(503.16)	(598.06)	(685.78)	(759.01)

Based on the above assumptions, it is evident that if EDP adheres to the PFA Roadmap targets and reduction of T&D losses, then in case of no tariff increase the department will have yearly loss. The accumulated financial losses will increase to Rs. 759.01 Crores in the FY 19 from Rs 442.81 Crores in FY 15. Earlier, JERC had allowed a tariff increase of 4.35% for FY 16 on average tariff of FY 15. Therefore it is imperative that EDP should be given annual tariff increase to wipe-off losses.

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

### ASSUMPTIONS

- ✓ Tariff Hike of 9% every year from FY 17 to FY 19 on latest category-wise average billing rates approved by the Commission for FY 16.
- ✓ T&D losses as per targeted trajectory.

**Table 33: Assumptions for Scenario B**

Particulars	Units	FY 16	FY 17	FY 18	FY 19
<b>Energy Related Assumptions</b>					
Energy Demand	MU	3,041.38	3,203.31	3,376.37	3,555.50
Sales	MU	2,526.60	2,708.27	2,900.69	3,102.98
Power purchase	MU	3,219.05	3,557.69	3,600.74	3,600.74
AT&C losses	%	15.22%	13.49%	11.74%	10.00%
Distribution Losses	%	13.36%	11.93%	10.51%	9.09%
Collection Efficiency	%	97.85%	98.23%	98.62%	99.00%
Power purchase cost	Rs Crores	1,093.43	1,217.55	1,240.93	1,245.51
Power purchase cost per unit sold	Rs /kWh	4.33	4.50	4.28	4.01
Power purchase cost per unit purchased	Rs /kWh	3.40	3.42	3.45	3.46
<b>Revenue Related Parameters</b>					
Revenue from retail sale of power	Rs Crores	1,275.52	1,380.16	1,613.16	1,885.29
Tariff Increase	%	4.35%	9.00%	9.00%	9.00%
Average Billing Rate	Rs /kWh	5.05	5.10	5.56	6.08
<b>Escalations</b>					
Employee Costs	%	10.00%	10.00%	10.00%	10.00%
Administrative and General Costs	%	6.00%	6.00%	6.00%	6.00%

**Table 34: Impact (in per unit terms) of key financial components (Scenario B)**

Particulars	UoM	FY 16	FY 17	FY 18	FY 19
Total Revenue from all sources	Rs. Crores	1,331.61	1,489.54	1,683.85	1,902.58
Total Expense	Rs. Crores	1,328.74	1,470.48	1,516.17	1,546.31
PBT	Rs. Crores	2.87	19.06	167.68	356.27
ABR	Rs. per unit	4.71	5.10	5.56	6.08
ACS	Rs. per unit	4.91	5.43	5.23	4.98
Interest Cost	Rs. Crores	16.09	18.33	26.76	39.24
Tariff Increase	In %age	4.35%	9.00%	9.00%	9.00%
O&M cost	Rs. per unit	0.38	0.42	0.43	0.44
R&M cost per unit	Rs. per unit	0.03	0.03	0.04	0.04
Employee cost per unit	Rs. per unit	0.31	0.34	0.35	0.36
Interest cost per unit	Rs. per unit	0.06	0.07	0.09	0.13
A&G cost per unit	Rs. per unit	0.04	0.04	0.04	0.04

**Table 35: Financial Position of the Utility (Scenario B)**

Particulars	FY 15	FY 16	FY 17	FY 18	FY 19
Income	1181.05	1,268.38	1,489.54	1,683.85	1,902.58
Income from Retail Sale of Power	1,178.52	1,179.09	1,380.16	1,613.16	1,885.29
Income from Sale of Surplus Power	-	53.30	106.32	67.31	13.57
Other Income	2.54	2.79	3.07	3.37	3.71
Expenditure	1034.15	1,281.52	1,424.06	1,459.51	1,476.93
Transmission Charges	72.80	85.07	94.02	95.15	95.15
Power & Fuel Cost	867.66	1,093.43	1,217.55	1,240.93	1,245.51
Employee Cost	75.46	83.00	91.30	100.43	110.48
R&M cost	7.71	8.88	9.37	10.46	12.51
A&G Expenses	10.52	11.15	11.82	12.53	13.28
Operating Profit	146.90	(13.14)	65.48	224.34	425.65
PBDIT	146.90	(13.14)	65.48	224.34	425.65
Interest	16.04	16.09	18.33	26.76	39.24
PBDT	130.87	(29.23)	47.15	197.58	386.41
Depreciation	25.92	31.13	28.09	29.90	30.14
Net Prior Period Credits / (Charges)	104.95	-	-	-	-
Profit Before Tax	104.95	(60.36)	19.06	167.68	356.27
Provision for bad and doubtful debts	-	-	-	-	-
PBT (Post Extra-ord Items)	104.95	(60.36)	19.06	167.68	356.27
Tax	-	-	-	-	-
Reported Net + Profit /- Loss	104.95	(60.36)	19.06	167.68	356.27
<b>Closing Accumulated Profit/ (Loss)</b>	<b>(442.81)</b>	<b>(503.16)</b>	<b>(484.10)</b>	<b>(316.43)</b>	<b>39.84</b>

Based on the above assumptions, it is evident that if EDP adheres to the PFA Roadmap targets, tariff increase of 9% each FY and reduction of T&D losses, the accumulated financial losses will decrease to accumulated profit of Rs. 39.84 Crores in FY 19 from Rs 442.81 Crores in FY 15. Earlier, JERC had allowed a tariff increase of 4.35% for FY 16 on average tariff of FY 15.

## SCENARIO C: AT TARGETED GROWTH RATE AS PER 24X7 ROAD MAP PLUS FINANCIAL TURNAROUND-PROPOSED INVESTMENTS FUNDED THROUGH LOAN ONLY

### ASSUMPTIONS

- ✓ The proposed investments under IPDS and DDUGJY are funded through debt and equity in ratio 70:30.
- ✓ Same Tariff Hike of 9% each in FY 17 to FY 19 on latest category-wise average billing rates approved by the Commission for FY 16.
- ✓ T&D losses as per targeted trajectory.

**Table 36: Assumptions for Scenario C**

Particulars	Units	FY 16	FY 17	FY 18	FY 19
<b>Energy Related Assumptions</b>					
Energy Demand	MU	3,041.38	3,203.31	3,376.37	3,555.50
Sales	MU	2,526.60	2,708.27	2,900.69	3,102.98
Power purchase	MU	3,219.05	3,557.69	3,600.74	3,600.74
AT&C losses	%	15.22%	13.49%	11.74%	10.00%
Distribution Losses	%	13.36%	11.93%	10.51%	9.09%
Collection Efficiency	%	97.85%	98.23%	98.62%	99.00%
Power purchase cost	Rs Crores	1,093.43	1,217.55	1,240.93	1,245.51
Power purchase cost per unit sold	Rs /kWh	4.33	4.50	4.28	4.01
Power purchase cost per unit purchased	Rs /kWh	3.40	3.42	3.45	3.46
<b>Revenue Related Parameters</b>					
Revenue from retail sale of power	Rs Crores				
Tariff Increase	%	1,275.52	1,380.16	1,613.16	1,885.29
Average Billing Rate	Rs /kWh	4.35%	9.00%	9.00%	9.00%
<b>Escalations</b>					
Employee Costs	%	10.00%	10.00%	10.00%	10.00%
Administrative and General Costs	%	6.00%	6.00%	6.00%	6.00%

**Table 37: Impact (in per unit terms) of key financial components (Scenario C)**

Particulars	UoM	FY 16	FY 17	FY 18	FY 19
Total Revenue from all sources	Rs. Crores	1,331.61	1,489.54	1,683.85	1,902.58
Total Expense	Rs. Crores	1,328.86	1,470.97	1,517.02	1,547.29
PBT	Rs. Crores	2.75	18.57	166.82	355.28
ABR	Rs. per unit	4.71	5.10	5.56	6.08
ACS	Rs. per unit	4.91	5.43	5.23	4.99
Interest Cost	Rs. Crores	16.16	18.66	27.42	40.04
Tariff Increase	In %age	4.35%	9.00%	9.00%	9.00%
O&M cost	Rs. per unit	0.38	0.42	0.43	0.44
R&M cost per unit	Rs. per unit	0.03	0.03	0.04	0.04
Employee cost per unit	Rs. per unit	0.31	0.34	0.35	0.36
Interest cost per unit	Rs. per unit	0.06	0.07	0.09	0.13
A&G cost per unit	Rs. per unit	0.04	0.04	0.04	0.04

**Table 38: Financial Position of the Utility (Scenario C)**

Particulars	FY 15	FY 16	FY 17	FY 18	FY 19
Income	1181.05	1,268.38	1,489.54	1,683.85	1,902.58
Income from Retail Sale of Power	1,178.52	1,179.09	1,380.16	1,613.16	1,885.29
Income from Sale of Surplus Power	-	53.30	106.32	67.31	13.57
Other Income	2.54	2.79	3.07	3.37	3.71
Expenditure	1034.15	1,281.52	1,424.08	1,459.60	1,477.08
Transmission Charges	72.80	85.07	94.02	95.15	95.15
Power & Fuel Cost	867.66	1,093.43	1,217.55	1,240.93	1,245.51
Employee Cost	75.46	83.00	91.30	100.43	110.48
R&M cost	7.71	8.88	9.40	10.56	12.66
A&G Expenses	10.52	11.15	11.82	12.53	13.28
Operating Profit	146.90	(13.14)	65.46	224.24	425.50
PBDIT	146.90	(13.14)	65.46	224.24	425.50
Interest	16.04	16.16	18.66	27.42	40.04
PBDT	130.87	(29.30)	46.79	196.83	385.46
Depreciation	25.92	31.17	28.23	30.00	30.18
Net Prior Period Credits / (Charges)	104.95	-	-	-	-
Profit Before Tax	104.95	(60.48)	18.57	166.82	355.28
Provision for bad and doubtful debts	-	-	-	-	-
PBT (Post Extra-ord Items)	104.95	(60.48)	18.57	166.82	355.28
Tax	-	-	-	-	-
Reported Net + Profit /- Loss	104.95	(60.48)	18.57	166.82	355.28
Closing Accumulated Profit/ (Loss)	(442.81)	(503.28)	(484.71)	(317.89)	37.40

Based on the above assumptions, it is evident that if EDP adheres to the PFA Roadmap targets, tariff increase of 9% each FY and reduction of T&D losses and funds the entire capital expenditure proposed under IPDS and DDUGJY through combination of State Government equity, loans from FI/Multilateral/Bilateral agencies etc. the accumulated financial losses from Rs 442.81 Crores in FY 15 will decrease to accumulated profit of Rs. 37.40 Crores in FY 19. Hence it is evident that finances of EDP is not considerably impacted if grant portion of central funded scheme are converted to debt and equity.

However since successful completion of IPDS and DDUGJY will lead to reduction in losses, hence UT should target to complete these schemes successfully.

## SCENARIO D: NON ADHERANCE TO LOSS REDUCTION TRAJECTORY (HIGHER LOSS REDUCTION TRAJECTORY) AND SUBSEQUENT DEPENDENCE ON HIGHER TARIFF HIKE

### ASSUMPTIONS

- ✓ **T&D losses as per actual of FY 15.**
- ✓ Tariff Hike of 10.5% each year from FY 17 to FY 19 on latest category-wise average billing rates approved by the Commission for FY 16.

**Table 39: Assumptions for Scenario D**

Particulars	Units	FY 16	FY 17	FY 18	FY 19
<b>Energy Related Assumptions</b>					
Energy Demand	MU	3,092.24	3,310.28	3,545.22	3,792.20
Sales	MU	2,526.60	2,708.27	2,900.69	3,102.98
Power purchase	MU	3,219.05	3,557.69	3,600.74	3,600.74
AT&C losses	%	16.62%	16.28%	15.95%	15.62%
Distribution Losses	%	14.78%	14.78%	14.77%	14.77%
Collection Efficiency	%	97.85%	98.23%	98.62%	99.00%
Power purchase cost	Rs Crores	1,093.43	1,217.55	1,240.93	1,245.51
Power purchase cost per unit sold	Rs /kWh	4.33	4.50	4.28	4.01
Power purchase cost per unit purchased	Rs /kWh	3.40	3.42	3.45	3.46
<b>Revenue Related Parameters</b>					
Revenue from retail sale of power	Rs Crores	1,275.52	1,399.15	1,657.86	1,964.20
Tariff Increase	%	4.35%	10.50%	10.50%	10.50%
Average Billing Rate	Rs /kWh	5.05	5.17	5.72	6.33
<b>Escalations</b>					
Employee Costs	%	2,526.60	2,708.27	2,900.69	3,102.98
Administrative and General Costs	%	3,219.05	3,557.69	3,600.74	3,600.74

**Table 40: Impact (in per unit terms) of key financial components (Scenario D)**

Particulars	UoM	FY 16	FY 17	FY 18	FY 19
Total Revenue from all sources	Rs. Crores	1,316.35	1,476.44	1,677.90	1,967.91
Total Expense	Rs. Crores	1,328.74	1,470.48	1,516.17	1,603.74
PBT	Rs. Crores	(12.39)	5.96	161.73	364.17
ABR	Rs. per unit	4.71	5.17	5.72	6.33
ACS	Rs. per unit	4.91	5.43	5.23	5.17
Interest Cost	Rs. Crores	16.09	18.33	26.76	39.24
Tariff Increase	In %age	4.35%	10.50%	10.50%	10.50%
O&M cost	Rs. per unit	0.38	0.42	0.43	0.44
R&M cost per unit	Rs. per unit	0.03	0.03	0.04	0.04
Employee cost per unit	Rs. per unit	0.31	0.34	0.35	0.36
Interest cost per unit	Rs. per unit	0.06	0.07	0.09	0.13
A&G cost per unit	Rs. per unit	0.04	0.04	0.04	0.04

**Table 41: Financial Position of the Utility (Scenario D)**

Particulars	FY 15	FY 16	FY 17	FY 18	FY 19
Income	1,196.19	1,253.12	1,476.44	1,677.90	1,967.91
<i>Income from Retail Sale of Power</i>	1,181.00	1,179.09	1,399.15	1,657.86	1,964.20
<i>Income from Sale of Surplus Power</i>	10.59	38.04	74.22	16.66	-
<i>Other Income</i>	4.60	2.79	3.07	3.37	3.71
Expenditure	1,036.24	1,281.52	1,424.06	1,459.51	1,534.36
<i>Transmission Charges</i>	72.80	85.07	94.02	95.15	95.15
<i>Power &amp; Fuel Cost</i>	865.21	1,093.43	1,217.55	1,240.93	1,302.94
<i>Employee Cost</i>	75.93	83.00	91.30	100.43	110.48
<i>R&amp;M cost</i>	7.71	8.88	9.37	10.46	12.51
<i>A&amp;G Expenses</i>	14.59	11.15	11.82	12.53	13.28
Operating Profit	159.94	(28.40)	52.38	218.39	433.55
PBDIT	159.94	(28.40)	52.38	218.39	433.55
<i>Interest</i>	18.81	16.09	18.33	26.76	39.24
PBDT	141.13	(44.49)	34.05	191.63	394.31
<i>Depreciation</i>	25.92	31.13	28.09	29.90	30.14
<i>Net Prior Period Credits / (Charges)</i>	-	-	-	-	-
Profit Before Tax	115.21	(75.62)	5.96	161.73	364.17
<i>Provision for bad and doubtful debts</i>	2.60	-	-	-	-
PBT (Post Extra-ord Items)	112.61	(75.62)	5.96	161.73	364.17
<i>Tax</i>	-	-	-	-	-
Reported Net + Profit /- Loss	112.61	(75.62)	5.96	161.73	364.17
Closing Accumulated Profit/ (Loss)	(438.57)	(518.42)	(512.46)	(350.73)	13.44

Based on the above assumptions, it is evident that if EDP doesn't adheres to the target reduction of losses and the same remain equal to value achieved in FY 15, EDP has to depend on higher tariff hike of 10.5% each year from FY 17 to FY 19, to wipe off accumulated losses.

Thus, it can be inferred from above that improvement of efficiency and better power purchase/sale planning will reduce the dependence on tariff hike.

## CHAPTER 15: 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 EDP for looking at activities of overall communication strategy.

The financial situation in Puducherry 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 UT Puducherry will also be required:

**Table 42: 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>	Energy Secretary	Quarterly
Inter-State Transmission Projects <i>Physical Progress, Achievements and Other Relates Issues</i>	SE (Planning) - Circle I	Monthly
Intra-State Transmission Projects	SE (Planning) - Circle I	Monthly

Communication Objective	Responsibility	Frequency
<i>Physical Progress, Achievements and Other Relates Issues</i>		
Distribution <i>Progress, Achievements, Losses, Consumer Initiatives etc.</i>	SE - Circle III	Monthly
Renewable Power	SE - Circle II	Quarterly

### INFORMATION TECHNOLOGY

The need to adopt IT in every sphere of utility operation is self-evident. Power is a complex product that must be consumed on a real time basis. The overall value involved in the process is very high. Even more importantly it touches all citizens. Yet, the information systems that drive the operations of the sector are generally very basic and information transparency and consistency is poor.

While sporadic efforts have been made in the past to improve this, quantum changes are required to increase IT adoption in all spheres of power sector operation.

- ✓ Power procurement planning and optimization tools will be implemented to reduce the power procurement costs and improve supply reliability. This will be achieved through the institution of technically robust forecasting, scheduling and dispatch (Unit Commitment) and settlement tools. The tools shall be used to ensure that the control room operators have the ability to take real time decisions to ensure cost reduction.
- ✓ Implementation of Enterprise Resource Planning Systems (ERP) which would cover critical aspects like Finance and Accounts, Asset Management, Inventory Management, Human Resource Management, Project Management,

Personal information System (PIS). ERP will help in timely capitalization of asset, deriving better business value of investment etc.

- ✓ In order to curb the malpractices being done at the level of meter readers while entering the meter reading of the consumers, “**Mobile Based Photo Meter Reading & Billing System**” may be adopted.
- ✓ Centralized Information & Monitoring System for operational, enforcement & litigation, vigilance activities and analysis have to be operationalized.
- ✓ Power management would require tools like SCADA and Distribution Management Systems (DMS) that allow for adequate visualization of the networks and response capabilities. Technologies for sub-station automation, GIS, SCADA, DMS, OMS, etc., shall be adopted. For the urban areas SCADA is very useful for improving reliability and reduction of network downtime.
- ✓ Requirement of Regional Distribution Control Centres (RDCC) within the UT will be identified in view of upcoming projected load. These will initially cater to the principal load centres, but would thereafter be expanded to all load centres of the UT. This will be a key initiative, not only for effectively managing 24x7 supply, but also thereafter for other functions like forecasting.
- ✓ Project monitoring tools shall be incorporated in the PMU to ensure that progress on the investments in the UT are monitored rigorously and bottlenecks identified.
- ✓ Standards of service specified under Section 57 of the Electricity Act 2003 will be monitored. The utilities shall use IT tools to gather the information with

regard to service standards with minimal manual.

The above measures, need to be implemented on priority basis by UPCL and also to be integrated with each other to ensure that the systems are inter-operable (i.e., they can talk to each other). For this the utilities shall evolve a detailed IT plan to implement the above in a well-coordinated manner.

## 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.
- **UT Level Committee:** It is proposed that a UT 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.

- **Circle Level Committee** – It is proposed to constitute a Circle 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 UT, 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 UT 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.

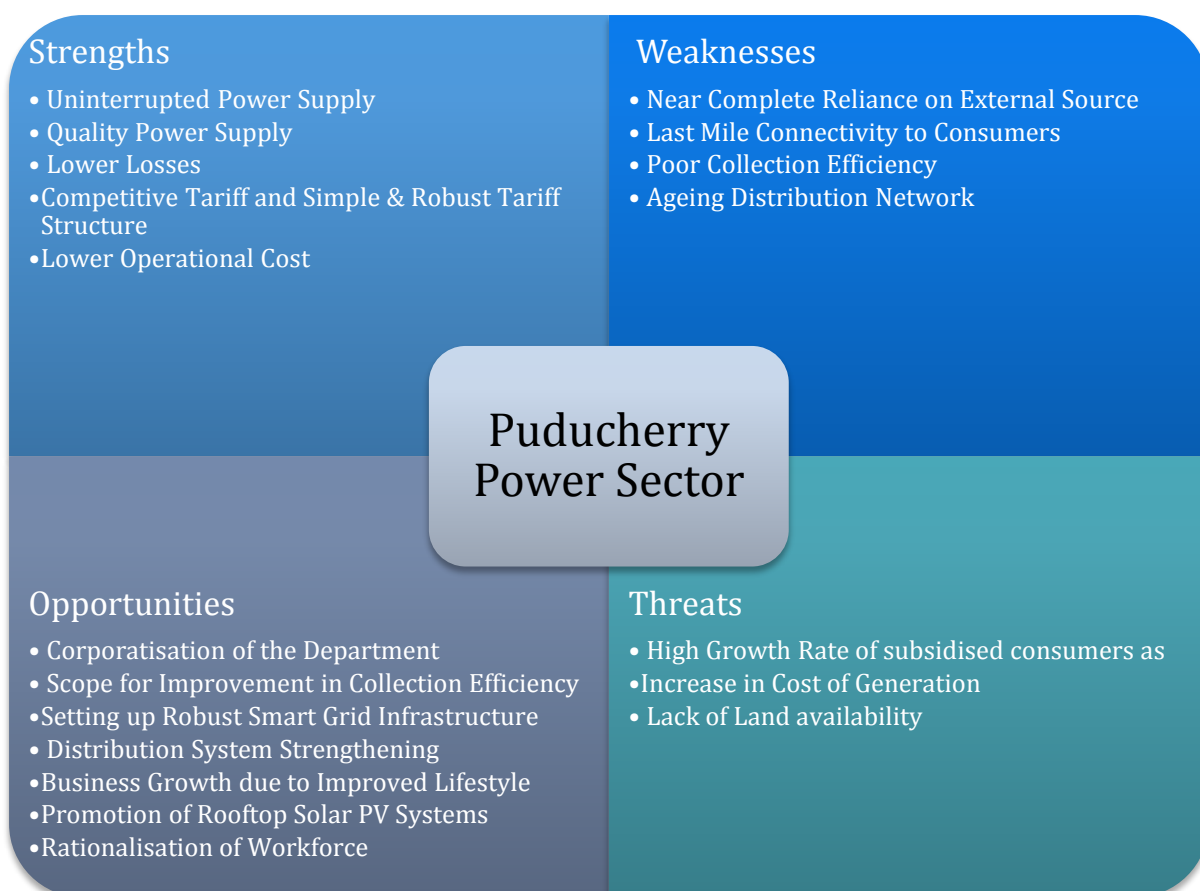
A UT level officers training institute may be required to be opened in the UT to fulfil the ongoing training requirement for employees of Electricity Department Puducherry. This also helps in training of subordinate technical staff. Following training programmes are proposed to be implemented for the 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 circle.

## CHAPTER 16: YEAR WISE ROLL OUT PLAN

### SWOT ANALYSIS

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



From the above analysis it is quite evident that most of the threats are external factors which would need continuous efforts from Puducherry to mitigate them as soon as possible. Further, from the weaknesses tabulated it is seen that, with some strong and bold measures Puducherry will be able to attain the target.

Based on the above observations, a road map for Puducherry has been developed to mitigate the above weaknesses and threats.

## ROAD MAP FOR POWER FOR ALL

**Table 43: Roll Out Plan**

Table 15: Roll Out Plan								
Sl. No.	Category	Base year scenario (FY 15)	Rollout Plan				Total	Total expected capacity FY 19
			FY 16	FY 17	FY 18	FY 19		
GENERATION								
A	Availability (MW):							
1	Thermal-Gas	32.50	0.00	0.00	0.00	0.00	0.00	32.50
2	Thermal-Coal	328.13	24.50	0.00	0.00	0.00	24.5	352.63
3	Nuclear	76.36	0.00	33.50	3.00	0.00	36.5	112.86
4	Renewable (Solar)	0.00	0.00	20.00	15.00	0.00	35.0	35.00
Total Availability (MW)		436.99	24.50	53.50	18.00	0.0	96.0	532.99
B	Peak Demand (MW):							
1	Peak Demand (MW)	503	551	580	611	644		644
2	Per Capita Consumption							
TRANSMISSION								
C	Transmission Lines (CKM):							
1	Inter State							
	400 kV	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	230 kV	115.33	0.00	0.00	190.00	0.00	107.00	305.33
	110 kV	80.45	0.00	0.00	0.00	0.00	0.00	80.45
2	Intra State							
	230 kV	52.77	0.00	0.00	0.00	0.00	0.00	52.77
	110 kV	268.36	0.00	5.00	0.00	0.00	0.00	268.36
Total Transmission Line		516.91	0.00	5.00	0.00	0.00	0.00	516.91
D	Transformation Capacity (MVA):							
1	Inter State							
	400/230 kV	630.00	0.00	0.00	0.00	0.00	500.00	1130.00
	230/110 kV	560	0.00	200	0.00	0.00	0.00	760.00
2	Intra State							
	220/132 kV	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	110/22 kV	628	0.00	132	0.00	0.00	0.00	760.00
Total Transformation Capacity		1188	0.00	332	0.00	0.00	0.00	1520.00
DISTRIBUTION								
E	Connecting the Unconnected							
1	Village Electrification (Grid)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	Village Electrification (Off Grid)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	Target Electrification –	7,948	2,384	5,564	0	0	7,948	-
F	Efficiency Improvement							
1	T&D Losses	14.79%	13.36%	11.93%	10.51%	9.09%		9.09%
2	AT&C Losses	16.94%	15.22%	13.49%	11.74%	10.00%		10.00%
G	Capacity Addition/Augmentation							
1	HT Lines & Cables (CKT Km.)	1342.70	19.75	16.03	18.67	17.64	72.09	1414.79
2	LT Lines & Cables (CKT Km.)	5414.67	30.10	29.34	30.13	28.38	117.95	5532.62
3	DTs (MVA Capacity)	566.00	34.50	33.20	25.06	31.19	123.95	689.75

## CHAPTER 17: FUND REQUIREMENT

The fund requirement for various schemes (ongoing and proposed) for Generation, Transmission, Distribution and Renewable energy plan as discussed in previous chapters is tabulated below:

**Table 44: Fund Requirement**

Sl. No.	Category	Fund Requirement (in Rs Crores)				
		FY 16	FY 17	FY 18	FY 19	Total
<b>A</b>	<b>Generation</b>					
1	Own Generation (to be Commissioned up to FY 19)	0.00	0.00	0.00	0.00	0.00
2	R&M of Existing Stations	0.00	0.00	0.00	0.00	0.00
	<b>Total Fund Requirement (Generation)</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
<b>B</b>	<b>Transmission</b>					
1	Establishment of New Substations	12.29	-	71.20	43.47	126.96
2	Augmentation of System Capacity	0.65	-	15.48	3.96	20.09
3	Renovation and Modernization Works of Existing Capacity	-	1.65	17.79	8.41	27.85
4	Replacement of Capacitor Banks	0.35	-	4.00	1.50	5.85
5	Erection/ establishment/ upgradation of 230kV and 110kV Substations	-	20.00	40.40	20.81	81.21
	<b>Total Fund Requirement (Transmission)</b>	<b>13.29</b>	<b>21.65</b>	<b>148.9</b>	<b>78.15</b>	<b>261.96</b>
<b>C</b>	<b>Distribution</b>					
1	R-APDRP Part-A Works	-	1.72	-	-	1.72
2	R-APDRP Part-B Works	8.00	30.00	30.00	-	68.00
3	System Improvement Schemes	12.00	7.80	7.96	8.12	35.88
4	Development Schemes	13.27	10.35	10.56	10.77	44.95
5	Rural Electrification (BNP)	14.45	0.75	0.77	0.78	16.75
6	100% Metering Programme	1.20	4.19	4.19	-	9.58
7	Conversion of HT Overhead lines into UG cables	6.26	4.10	4.18	4.27	18.81
8	IPDS	5.97	10.89			16.86
9	DDUGJY	24.95	37.43			62.38
	<b>Total Fund Requirement (Distribution)</b>	<b>86.10</b>	<b>107.23</b>	<b>57.66</b>	<b>23.94</b>	<b>274.93</b>

The request of UT Puducherry for funds under IPDS and DDUGJY would be considered by Government of India as per its policies/ frameworks or otherwise UT Puducherry would make arrangements for funding from FIs/Banks/Multilateral funding agencies.

# ANNEXURES

## ANNEXURE – 1

**Table 45: Planned ISTS Substations**

Sl. No.	Name of the Project	Project Cost (in Crores)	Voltage level (KV)	No. of ICTs x MVA Capacity	Total MVA	Target Date
<b>230/110 kV Transformers</b>						
1	Establishment of 230/110 KV Auto SS at Karaikal	28.00	230/110KV	2 x 100	200	Mar'2017
2	Additional Transformer in 400/230 kV Puducherry SS	40.00	400/230 kV	1 x 500	500	Mar' 2019

**Table 46: Planned Intra-state Substations**

Sl. No.	Name of the Project	Project Cost (in Crores)	Voltage level (KV)	No. of ICTs x MVA Capacity	Total MVA	Target Date
<b>110/22kV Transformers</b>						
1	Establishment of Thondamanatham 110/22 KV SS with 2x25 MVA Power Transformer capacity.	11.60	110/22	2x25	50	Mar-17
2	Establishment of 110/22 SS with 2x25 MVA Power Transformer near Thavalakuppam including Land acquisition and associated line portion	25.10	110/22	2x25	50	
3	Establishment of 110/22 SS with 2x16 MVA Power Transformer at Kottucherry (Karaikal) including Land acquisition and associated line portion	25.54	110/22	2x16	32	Mar'2017
<b>Total: 132/33kV Transformers</b>		<b>62.24</b>			<b>132</b>	

**Table 47: Planned ISTS Transmission Lines**

Sl. No.	Line Name	Project Cpst (Rs. Cr)	Ckts.	Line Length (Ckt. km)
<b>230 kV Lines</b>				
1	Laying of 230 KV Transmission line from NLC to 230 kV Karaikal SS	110.00	D/c	190

**Table 48: Planned InSTS Transmission Lines**

Sl. No.	Line Name	Ckts.	Line Length (Ckt. km)	Conductor
<b>110 kV Lines</b>				
1	Laying of 110 KV cable from kurumbapet SS to 110kV proposed Lawspet SS and Venkatanagar 110kV SS	S/c	5	

**Table 49: Existing Inter-State Transmission Lines (in CKT. KM)**

Existing ISTS Lines				
Sr. No.	Line Name	Ckts.	Line Length (Ckt. km)	Conductor
<b>A</b>	<b>230 kV</b>			
<b>1</b>	Neyveli T.S-II - Villianur	Single circuit	63.23	KUNDAH
<b>2</b>	Neyveli T.S.II - Bahour	Single circuit	52.10	ZEBRA
<b>B</b>	<b>110 kV</b>			
<b>1</b>	Panruti - Bahour	Single circuit	1.45	Leopard
<b>2</b>	Thiruvaroor-Sorakudi	Single circuit	30	Panther
<b>3</b>	Kozhikodu-Pallur	Double circuit	7	Panther
<b>4</b>	Khakinada-Metakur	Single Circuit	42	AAAC

**Table 50: Existing Intrastate Transmission Lines (in CKT. KM)**

Sl. No.	Name of the Project	Ckts.	Total Ckt-km
<b>1</b>	<b>230 kV</b>		
<b>2</b>	Ramanathapuram-Villianur	Single	24.09
<b>3</b>	Ramanathapuram-Bahour	Single	21
<b>4</b>	Ramanathapuram-Thondamanatham-I	Single	4.19
<b>5</b>	Ramanathapuram-Thondamanatham-II	Single	3.49
<b>6</b>	<b>110 kV</b>		
<b>7</b>	Thondamanatham-Kurumbapet	Single circuit	8.705
<b>8</b>	Thondamanatham-Sedarapet	Single circuit	5.575
<b>9</b>	Thondamanatham-Thirubuvanai	Single circuit	16.89
<b>10</b>	Thondamanatham-Thethapakkam	Single circuit	7.66
<b>11</b>	Sedarapet-Tethampakkam	Single circuit	9.96
<b>12</b>	Villianur-Sedarapet	Single circuit	15
<b>13</b>	Villianur-Kurumampet	Single circuit	6.13
<b>14</b>	Villianur-Thirubuvanai	Single circuit	13.65
<b>15</b>	Thirubuvanai-Eripakkam	Single circuit	9.62
<b>16</b>	Bahour-Eripakkam	Single circuit	17.16
<b>17</b>	Eripakkam-MRF.Ltd	Single circuit	0.15
<b>18</b>	Bahour-Bahour	Single circuit	2.273
<b>19</b>	Bahour-Korkadu	Single circuit	14
<b>20</b>	Bahour-Villianur	Single circuit	6.65
<b>21</b>	Villianur-Marapalam	Double circuit	5.5
<b>22</b>	Villianur-Kalapet	Single circuit	20.95
<b>23</b>	110KV BASS-VASS	Single circuit	17.27
<b>24</b>	Kurumampet-M/s. Sumangala	Single circuit	1.5
<b>25</b>	Kalapet-Chemfab	Single circuit	1.9
<b>26</b>	Bahour-Inox	Single circuit	0.381
<b>27</b>	Marapalam-Venkattanagar(UG cable)	4Rx630sqmm copper S/C	6.556
<b>28</b>	Sorakudi-Pillaitheruvasal	Single circuit	6.14
<b>29</b>	Pillaitheruvasal-TR Patinam	Single circuit	24.34
<b>30</b>	TR Patinam-Sorakudi	Single circuit	30.5
<b>31</b>	TR Patinam-Chemplast	Single circuit	2.5
<b>32</b>	Matakur-Adavaipolam(Ckt.-1)	Single Circuit	8.9
<b>33</b>	Matakur-Adavaipolam(Ckt.-2)	Single Circuit	8.5
<b>TOTAL</b>			<b>321.13</b>

**Table 51: Existing Intrastate Substation Capacity (In MVA)**

Sl. No.	Name of the station	Voltage level (in kV)	No. x Rating (in MVA)	Capacity (in MVA)
1	Marapalam	110/22	2 x 16	32
		110/22	1 x 25	25
		110/11	2 x 16	32
2	Villianur	110/22	3 x 10	30
3	Kalapet	110/22	2 x 10	20
4	V.Nagar	110/11	2 x 31.5	63
5	Bahour	110/22	2 x 16	32
6	Korkadu	110/22	2 x 16	32
7	Eripakkam	110/22	3 x 16	48
8	Sedarapet	110/22	2 x 16	32
9	Kurumbapet	110/22	3 x 16	48
10	Thirubuvanai	110/22	3 x 16	48
11	Thethampakkam	110/22	2 x 10	20
12	Sorakudy	110/11	3 x 16	48
13	Pillaitheruvasal	110/11	2 x 16	32
14	T.R.Pattinam (PPCL)	110/11	2 x 15	30
15	Palloor( Mahe)	110/11	2 x 10	20
16	Mettacur(Yanam)	132/11	2 x 10	20
		132/33	1 x 16	16
Total Capacity Available (in MVA)				628

## ANNEXURE – 2

**Table 52: Power entitlement in FY 16 (in MW)**

Source	Type	Entitlement in MW
<b>Availability from Outside UT</b>		<b>439.47</b>
<b>Central Generating Stations</b>		
<b>NTPC</b>		
RSTPS Stage I & II	Thermal	88.83
RSTPS Stage III	Thermal	22.50
Talcher Stage II	Thermal	65.60
Simahdri Stage II	Thermal	16.30
<b>NLC</b>		
NLC TPS II Stage I	Thermal	82.34
NLC TPS II Stage II	Thermal	31.00
NLC TPS I Expn	Thermal	17.09
NLC TPS II Expn	Thermal	15.00
Tuticorn	Thermal	9.50
<b>NPCIL</b>		
MAPS	Nuclear	7.88
KAPS Stage I U1&U2	Nuclear	18.48
KAPS Stage II U3&U4	Nuclear	16.50
Kundakulum	Nuclear	33.50
<b>Others</b>		
Vallur Thermal Project	Thermal	4.47
Availability from Inside UT		
PPCL	Gas	32.50
<b>Total Availability from firm sources</b>		<b>436.99</b>

**Table 53: Year-wise Projection of Power Purchase/Availability (in MU)**

Source	Average Per Units Charges (Rs/kWh)	Energy Availability in MU				Power Purchase Cost (in Rs Crores)			
		FY 16	FY 17	FY 18	FY 19	FY 16	FY 17	FY 18	FY 19
<b>Availability from Outside UT</b>		<b>3,061</b>	<b>3,382</b>	<b>3,399</b>	<b>3,399</b>	<b>943</b>	<b>1,067</b>	<b>1,074</b>	<b>1,074</b>
<b>Central Generating Stations</b>									
<b>NTPC</b>									
RSTPS Stage I & II	2.96	657	657	657	657	194	194	194	194
RSTPS Stage III	3.09	167	167	167	167	52	52	52	52
Talcher Stage II	2.24	447	447	447	447	100	100	100	100
Simahdri Stage II	3.63	111	111	111	111	40	40	40	40
<b>NLC</b>									

Source	Average Per Units Charges (Rs/kWh)	Energy Availability in MU				Power Purchase Cost (in Rs Crores)			
		FY 16	FY 17	FY 18	FY 19	FY 16	FY 17	FY 18	FY 19
NLC TPS II Stage I	2.99	551	551	551	551	165	165	165	165
NLC TPS II Stage II	2.94	212	212	212	212	62	62	62	62
NLC TPS I Expn	3.74	121	121	121	121	45	45	45	45
NLC TPS II Expn Unit-1	4.81	39	50	50	50	19	24	24	24
NLC TPS II Expn Unit-2	4.81	39	50	50	50	19	24	24	24
Tuticorn	4.09	38	65	65	65	16	27	27	27
<b>NPCIL</b>									
MAPS	2.08	40	40	40	40	8	8	8	8
KAPS Stage I U1&U2	3.17	110	110	110	110	35	35	35	35
KAPS Stage II U3&U4	3.04	95	95	95	95	29	29	29	29
Kundakulum-1	3.89	169	169	169	169	66	66	66	66
Kundakulum-2	3.89	-	198	198	198	-	77	77	77
Kalpakkam	3.89			18	18			7	7
<b>Others</b>									
TNEB (Karaikal)	3.47	238	309	309	309	82	107	107	107
Vallur Thermal Project	3.76	29	29	29	29	11	11	11	11
<b>Availability from Inside UT</b>		<b>276.63</b>	<b>311.32</b>	<b>337.34</b>	<b>337.34</b>	<b>126.28</b>	<b>145.36</b>	<b>157.07</b>	<b>157.07</b>
Solar NLC	5.50	-	35	35	35	-	19	19	19
Solar MNRE	4.50	-	-	26	26	-	-	12	12
KSEB	5.82	43	43	43	43	25	25	25	25
PPCL	4.34	234	234	234	234	101	101	101	101
REC		-	-	-	-	33	22	28	34
Interstate Losses on CGS		119	135	136	136				
Rebate						9	17	18	19
<b>Gross Total Availability from Firm Sources</b>		<b>3,219</b>	<b>3,558</b>	<b>3,601</b>	<b>3,601</b>	<b>1,093</b>	<b>1,218</b>	<b>1,241</b>	<b>1,246</b>
Sale of Surplus Power if any		169	335	194	3	51	101	58	1
<b>Net Total Availability from Firm Sources</b>		<b>3,050</b>	<b>3,222</b>	<b>3,407</b>	<b>3,598</b>	<b>1,043</b>	<b>1,117</b>	<b>1,183</b>	<b>1,245</b>

**Table 54: Year-wise Projection of Category-wise Revenue (In Rs Crores) – Base Case**

Categories	ABR		Projections				
	FY 15	FY 16	FY 15	FY 16	FY 17	FY 18	FY 19
Domestic	3.00	3.13	191	213	228	244	259
Hut Services	1.66	1.73	2	2	2	2	2
Commercial	5.55	5.79	101	110	114	119	124
Agriculture (HP)	0.90	0.94	5	6	6	6	7
Street Lighting	6.14	6.40	16	19	21	24	27
LT Industrial	5.76	6.02	83	104	110	116	123
Water Tanks	3.43	3.58	19	13	14	15	16
Temporary	9.59	10.01	6	6	7	7	7
HT Industrial	6.06	6.32	530	581	611	642	675
HT Govt. Estates	6.29	6.57	35	41	46	51	57
HT EHT Industrial	6.04	6.31	193	229	260	295	334
Grand Total	4.99	5.18	1,181	1,324	1,418	1,521	1,630